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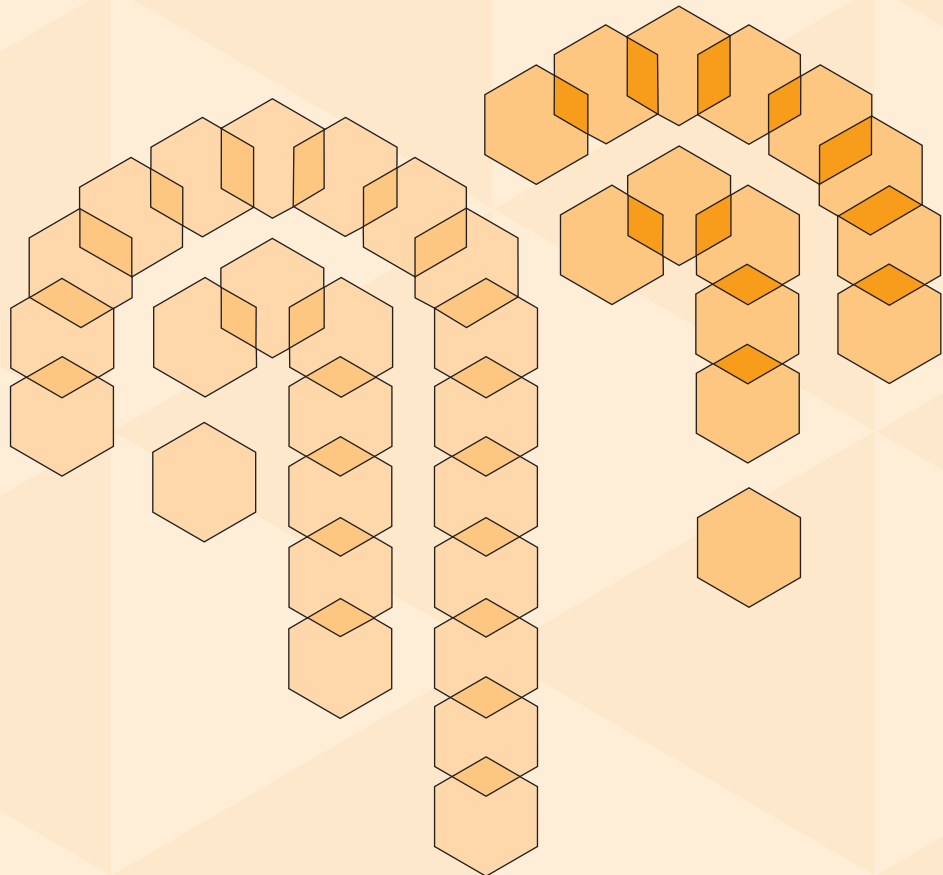


**Munich Re  
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From Knowledge  
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# Megacities

## Resilience and Social Vulnerability

Edited by Hans-Georg Bohle and Koko Warner



# SOURCE

'Studies Of the University: Research, Counsel,  
Education' - Publication Series of UNU-EHS

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# **SOURCE**

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# **Megacities: Resilience and Social Vulnerability**

Edited by Hans-Georg Bohle and Koko Warner

Outcomes of the 2nd UNU-EHS Summer Academy  
of the Munich Re Chair on Social Vulnerability  
22–28 July 2007, Hohenkammer, Germany

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We also would like to express our appreciation to the Munich Re Foundation in helping to prepare and execute the Summer Academy. Our thanks goes especially to Angelika Boos, who strongly supported organizational and logistical arrangements for the academy, and Anne Wolf, who contributed to the working sessions of the academy.

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## Foreword

Megacities simultaneously offer the best of humanity and challenge us with the worst of human security problems. Cities are today the home to about half of all humanity and serve as uneasy hosts to a variety of less desirable facets. Cities bursting with millions of people battle crime, unemployment or underemployment, insufficient infrastructure including housing and sanitation, and exposure to natural disasters.

Megacities also represent the pinnacle of human ingenuity and creativity. The world's superlative structures – the tallest, largest, strongest buildings – are almost all found in megacities. Culture and expression through the arts finds its most refined expression in these fertile meeting grounds. Education, advances in public health and advanced science all take place in the mega-crossroads of urban agglomerations.

In this volume, authors explore some of these dynamics related to megacities, resilience, and social vulnerability. The *Megacity Resilience Framework* addresses questions of how tensions between social and ecological, local and global, and formal and informal processes work out within large-scale urban environments. Case studies from slums in India – some of the world's best known and most densely populated slums – explore whether megacities drain resources and contribute to environmental fragility, and how that affects social vulnerability of particular groups. Some of the articles also highlight that megacities offer unparalleled economies of scale that no rural area could afford.

Human security is intrinsically linked to the individual, but also to the characteristics of different demographic groups living together in urban areas. To achieve human security requires an understanding of how threats to that security interact with these characteristics. Megacities bring people of diverse backgrounds, knowledge, and cultural heritage together and engage these people in ongoing social discourse. Within this context, megacities offer great opportunities for groups of people to discuss the risks they face and develop collective actions to manage these risks. This collective action can be seen across the world in grassroots level citizen efforts to combat crime, environmental degradation such as desertification and environmental shocks like floods. The greatest potential and capital of megacities are the people inhabiting them, and these people have the ability to (at least in part) shape the risks they face together.

The focus of this SOURCE brings out this unique perspective and extends the understanding of how environmental, infrastructural, and institutional risk factors interact with social and economic factors to create particular patterns of social vulnerability and resilience in megacities.



Janos J. Bogardi  
Director UNU-EHS

## Foreword

The Munich Re Foundation strives to serve people at risk and to move “from knowledge to action”. It is a catalyst for knowledge accumulation and implementation. In 2005, the Foundation entered a partnership with the United Nations University Institute for Environment and Human Security (UNU-EHS) to foment policy-relevant research on social vulnerability. Together, we established a Chair on Social Vulnerability at UNU-EHS. This SOURCE publication represents the combined work of young professionals and international experts who contributed to the 2007 Summer Academy on Social Vulnerability. The academy is one of our major activities within the Chair network on Social Vulnerability. The theme of the 2007 academy at Schloss Hohenkammer, Germany, focused on megacities, resilience, and social vulnerability. Participants included 12 experts and 26 selected PhD candidates from twelve countries on four continents; nine of the students came from developing countries. The cross-disciplinary character of social vulnerability issues was mirrored by the participants’ backgrounds in urban planning, ecology, epidemiology, geography, hydrology, economics, engineering, sociology, and political science.

This volume explores issues of resilience and vulnerability in megacities, the largest settlements on earth and a source of constant fascination – and risk. Today, the world contains more than 20 cities with more than 10 million inhabitants. Only a handful of these are in industrialized countries. Urban giants in developing countries host some of the poorest groups of people, often living in the highest risk areas or crowded into slums at the edges of booming urban areas. Experts forecast massive urbanization processes in developing countries, with millions of people moving to metropolitan areas.

New arrivals and established inhabitants alike face risks and opportunities in the vast complexity of the cultural, economic, and political dimensions in conurbations. Participants of the 2007 Summer Academy discussed these dimensions and presented original research on megacity resilience and vulnerability. Yet even international experts were surprised to hear the appraisal of a special academy guest, the Mayor of Calcutta, Dr. Bikash Ranjan Bhattacharya. The Mayor observed the participants as they worked to create a “Megacity Resilience Framework” – a theoretical framework to understand vulnerability and resilience in the intricate context of a megalopolis. Yet, in one sentence – “almost everything in a megacity is local” – the Mayor reminded us of the human scale of the issues. It is that human scale of megacities – the appreciation of social capital and social vulnerability – that papers in this volume explore. We must learn and understand much more about other customs and cultural perceptions, and the needs and abilities of communities to reduce risk in these areas. Only such an understanding will help identify the true Achilles’ heel of megacities and the communities within them.

The Summer Academy represents only one small step among many others towards better understanding of the labyrinthine relationships of people, nature, institutions, and urban environments. Only with more knowledge of and action in megacities can we overcome the major challenges of our time.



Thomas Loster  
Chairman of the Munich Re Foundation

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# The Megacity Resilience Framework

*Sakdapolrak, P., Butsch, C., Carter, R. L., Cojocar, M.-D., Etzold, B., Kishor, N., Lacambra, C., Reyes, M. L., Sagala, S.*

## Abstract

In 2007, for the first time in history, more than half of the world's population lived in an urban area. Megacities are an extreme product of the global urbanisation process. Therefore, they hold a key position in efforts to understand this process and in the development of strategies for managing these new urban dimensions. A group of young scientists and experts gathered at the UNU Summer Academy 2007 and drafted the Megacity Resilience Framework. This Framework serves as an explanatory model for the interdependency of megaurban resilience and vulnerability. This paper elaborates on the state of the art in resilience and vulnerability research with particular regard to the three fields of tension (global-local, socio-ecological, formal-informal) that shape a megacity.

## Background

The United Nation University's Summer Academy on Social Vulnerability, which focused on 'Megacities: Social Vulnerability and Resilience Building,' was held in Hohenkammer, Germany, in July 2007. A group of young scientists and experts gathered from various countries and multiple disciplines to identify the factors of, and analyse the interrelationship between, vulnerability and resilience that characterises complex urban agglomerations called megacities. The outcome of this process is the Megacity Resilience Framework (MRF), which is introduced in this paper.

## Vulnerability and Resilience

Holling (1973:14) defined resilience as an intrinsic characteristic of ecosystems; 'a measure of the persistence of systems and their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables'. Recent definitions of resilience have expanded with particular application to social systems (Adger 2000, Norris et. al., 2007); the natural and built environment, for example coastal regions, urban areas, and megacities (Alberti et al., 2003); and emerging understandings of social-ecological systems (Walker et. al., 2006). Recent theories of resilience emphasize recovery, flexibility, and learning as key components. The Resilience Alliance, for example, defines resilience as 'the amount of change the system can undergo and still retain the same controls on function and structure; the degree to which the system is capable of self-organization; and the ability to build and increase the capacity for learning and adaptation' (Resilience Alliance 2007).

Vulnerability is defined as an individual, group, or system's capacity to 'anticipate, cope with, resist, and recover from' the impact of a disruption or adverse event (Blaikie et.al., 1994:9). Recent theory includes consideration of physical vulnerability, the (in)capacities linked to particular environmental, geographic and other conditions (Alcantara-Ayala 2002, USGS 2001), social vulnerability, the historic, sociocultural, economic, political, and other conditions that structure adaptive and coping (in)capacity for individuals and societies (Chambers 1989, Kreimer 1992, Bohle 2001, Cardona 2003).

Vulnerability and resilience are closely related concepts, and there is a dialectic relation between the two. Resilience refers generally to persistence and sustainability, while vulnerability refers overall to the capacity to withstand and adapt. However, when conditions of vulnerability are addressed and decreased, the capacity to respond and adapt improves and the persistence and sustainability (resilience) of the system is supported. This relationship is important for the development of resilient social-ecological systems as well as for the promotion of human security. Vulnerability 'points to the need for systems to change. When these changes include preparedness, recovery and mitigation geared to alleviate the ef-

fects of specific hazards, resilience increases, which in turn results in the reduction of vulnerability. As a consequence, the reconstitution of the social system occurs, making it safer for individuals, communities, and organizations that are part of it' (Aguirre 2006:2).

## **Megacities: Arenas of Vulnerability and Resilience**

Megacities<sup>1</sup> are the most excessive products of global urbanisation. The new urban dimensions and scale, and the global connectedness in combination with a local disconnectedness, make megacities a 'new urban form' (Castells 1996: 404). It is against this background that the vulnerabilities of megaurban populations and the resilience of megacities as an entity become visible.

Megaurban life offers various advantages: improved economic opportunities, better quality of life, easier access to basic services, and a rich cultural life. However, with increasing social polarisation induced by globalisation, the percentage of the marginalised population that is excluded from these benefits is growing within megacities.<sup>2</sup> These people are vulnerable to the effects of economic, social and political insecurity, exploitation, environmental pollution, natural hazards, health crises, and food insecurity.<sup>3</sup> Their livelihoods are jeopardised by their informal legal status, which impedes their labour, tenure and political rights (formal-informal-nexus); their poor living environment affecting particularly their health (social-ecological-nexus); and their dependence on the cash economy, making them extremely susceptible to price rises and financial crises (global-local-nexus) (Meikle 2002: 38).

In contrast, megacities also offer unique opportunities for increasing human security and enabling communities to buffer various types of shocks without the loss of livelihoods – a new quality of social resilience. This is a new and increasingly accepted perspective on megacities (Cohen 2004, Gurjar and Lelieveld, 2005, Kraas 2007a or Barnett and Xumei, 2007). While currently these are "Mega-problem-cities", they also hold the keys for meeting the challenges of the new urban millennium. Kraas (2007a) refers to megacities as 'laboratories', in which solutions for these challenges can and must be developed. Among them, strategies to reduce vulnerability and to increase resilience are required. In this way, the perception of megacities can shift from 'global risk areas' (Kraas 2003) towards 'engines of global change' (Kraas and Nitschke, 2006) and – possibly – resilient socio-ecological systems with a sustainable future (Barnett and Xumei, 2007).

## **Three Approaches Towards Megacity Resilience**

The MRF, introduced in the next section, is an attempt to capture the complexity of a megacity vis-a-vis its vulnerability to varying disasters, disruptions, and stresses, as well as its capacity to be resilient because of and in spite of its complexity. To describe this complexity, in this section we discuss the megacity as shaping and shaped by processes on the global and the local scale, in formal-informal spheres, and within the socio-ecological system.

### **Global-Local**

The issues associated with megacities exist at several levels: the community, district, city, the megacity itself, and beyond. For example, in the case of Jakarta, a metropolis consisting of Jabodetabek, Jakarta

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1 Megacities are defined as urban agglomerations with either more than 5 million (Bronger 1996), 8 million (Fuchs et. al., 1994) or 10 million (Mertins 1992) inhabitants. See Kraas (2007a) for a detailed definition.

2 See Ehlers (2006) and Kraas (2007b) for the ecological, economic, political and social dimensions of problems, risks and disadvantages of megaurbanization, but also its benefits, chances and advantages. See also UNFPA (2007: 14-33).

3 The vulnerabilities of urban livelihoods have not been studied yet to the same extent as the multiple vulnerabilities in rural contexts. Recently, this gap seems to become filled successively: See for instance Moser (1998), Bohle and Adhikari (2002), Rakodi and Lloyd-Jones (2002) or Pryer (2003).

Bogor, Depok, Tangerang and Bekasi (Firman 2004), if there is rain in Bogor at the local level, then it causes flooding in some areas of Jakarta that are topographically much lower than Bogor. Global-local issues also impact inter-institutional relations. For example, local institutions, like community-based organizations of the poor, have historically had little influence beyond the neighborhood scale on the agenda of the megacity (Parnell et. al., 2007). Bangalore City is also a useful example for understanding the complexity of global-local issues. Bangalore is a focal point for software development in the Asian region and globally, but the city is still overwhelmed with local problems of civic deficiencies, poverty, and income inequality (Madon and Sahay, 2001).

In addition, a megacity is part of a much larger network of global cities with both positive and negative effect. Many present megacities are the nodes within the global economic system; but, given the high intensity of industrial and human activities, the air quality in megacities is extremely poor and air pollution is at the highest level, particularly in fast growing metropolises like Shanghai, Jakarta, Bangkok, Sao Paulo and Mexico City (Simon 2007).

Even situations that appear to have a primarily local relevance can have impact also at the global level. For example, when there is flooding in Mumbai, almost all other cities in India become vulnerable. Even though there are several localities that have good drainage systems and are well maintained, when there is a heavy downpour, the inadequate drainage in impoverished areas affects other regions as well. Such conditions impact all aspects of life, including the business and commercial networks in Mumbai, the finance capital of India. The overall resilience of the city is, therefore, decreased.

## **Formal – Informal**

In most publications about the informal sector<sup>4</sup>, a clear distinction is drawn between formal and informal economic activities: regularity, controllability, predictability, legality and measurability stand against irregularity, uncontrollability, unpredictability, illegality and immeasurability.

In contrast, we understand the formality-informality-nexus as a continuum of economic, social, and political processes at different stages and spatial levels of legal security, official recognition and record, formal control, tax-paying practices and governmental regulatory power.<sup>5</sup> As a consequence, there are different and often limited ways in which these actions can be planned, channelled and managed by state, city or municipal authorities. However, it is most often the formal regulations ('official' permissions, rules, restrictions, etc.) that frame the space of action for people involved in the informal sector.

In megacities of developing countries, the informal sector is growing and is securing the livelihoods of millions of people (Moser 1998: 4; Meikle 2002: 39; Nurul Amin 2002: iii; Chen 2005: 12) In particular, for the urban poor, informality and insecurity – and thereby vulnerability – are closely related (Daniels 2004: 503; Kraas 2007b: 20). On the one hand, the informality of these populations makes them more vulnerable to exploitation, suppression, state arbitrariness, and exposure to environmental hazards. On the other hand, they are not forced to rely primarily on the formal elements of megaurban governance. Informal activities are often more dynamic, flexible and better capable to cope with disturbances. This rapid adaptive capacity opens space for greater resilience in megacities.

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4 The International Labour Organisation introduced the concept of the 'informal sector' in 1972. See Chen (2005: 4) for a summary of differing positions since then; she distinguishes three main schools of thought: the dualist school (ILO 1972), the structuralist school (Moser 1978), and the legalist school (de Soto 1989). One might want to add a fourth perspective: the livelihood school (Moser 1998, Meikle 2002).

5 Adopting Lee's (2000: 390) working definition, the informal sector comprises 'those parts of economic geographies beyond official recognition and record through which people engage in social reproduction outside formal systems of control and remuneration but often in close relationship with formal economic geographies'. But as Chen (2005: 8) rightly notes: 'production, distribution and employment relations tend to fall at some point on a continuum between pure "formal" relations (i.e., regulated and protected) at one pole and pure "informal" relations (i.e., unregulated and unprotected) at the other, with many categories in between.'



The following aspects are central to the understanding of the formality-informality-nexus in megacities. First, formal and informal activities are closely intertwined and in a symbiotic relation, each having its legitimacy. Second, there are specific types of linkages of formal and informal processes in specific socio-economic spheres. Third, the degree of informality depends largely on the density of formal regulations. However, informal decision making processes and arrangements often determine the scale and scope of both formal and informal activities.<sup>6</sup> Fourth, there are different kinds of arenas, where formal and informal processes co-exist, overlap, interplay or interfere, for instance, employment, settlement, institutions, etc. Fifth, the mode of governance – whether more formal or informal – of these arenas is subject to contestation. Actors in these arenas compete for the kind of linkages and the density of formal regulation. However, one could assert that megacities of the Global South are governed to a large extent by informal means. Sixth, the specific interplay between formal and informal processes determines specific vulnerabilities of megaurban populations and the resilience of a megacity as an entity.

Any analysis of vulnerabilities and resilience in megacities cannot treat (more) formal and (more) informal elements/processes as separate categories; there are always multiple linkages (Chen 2005: 8; Daniels 2004: 505). How these linkages can be strengthened in order to reduce vulnerability and increase resilience (e.g. through participatory governance, improved labour rights, etc.) should be a focus of future megacity research.

## Socio-Ecological

The Millennium Ecosystem Assessment Board (2005) states: ‘Everyone in the world depends on nature and ecosystem services to provide the conditions for a decent, healthy, and secure life’. As obvious as this may sound, this dependency is made concrete in its meaning for a megacity. Every community of living organisms needs resources and energy to survive. Megacities are systems in continuous change and require these same conditions to meet the needs of its population.

The interrelation between the natural environment and the population is not as clear in a megacity as it is in a smaller city, because ecosystems in megacities are not that visible. But simple questions as ‘Where does the air comes from? Where does the water comes from?’ remind us how dependent we are upon the natural environment. A megacity, thus, is not autopoietic. It is not self-contained; rather, it needs to be served by its surrounding ecosystem. Environmental Services have been clearly conceptualised by the Ecosystem Services Project (2007) as ‘the transformation of a set of natural assets (soil, plants and animals, air and water) into things that we value’. Value is to be understood anthropocentrically, as cities have to destroy nature in order to enable human life and security (Krebs 2005)<sup>7</sup>. But for its contribution to the well being of its inhabitants and for its fostering of sustainability, nature must not be seen as a resource for urgent needs. Long-term and quality-of-life considerations have to be taken into account (ibid.). Taking into consideration current trends of urbanisation and population growth, the analysis of the historical change of land use is becoming indicative not only of the growing urbanisation and the inherent loss of ecosystems, but also of urbanisation taking place in or towards areas at risk. Pielke and Landsea (1998) normalised the quantitative losses caused by hurricanes between 1925 and 1995 in the USA and concluded that changes in wealth and in coastal population, rather than the increase of hurricanes or their intensity, caused an increase in reported damages (economic loss).

6 It needs mentioning that informality is not a residual category of the poor: informal arrangements between members of economic and political elites often decide about formal investments, business co-operations, legal measures and or the use of executive powers. In this sense, one could assert that megacities are governed to a large extent by informal means.

7 The fact that within urban areas, nature is not solely valued in an instrumental way is also shown by Bolund and Hunhammar (1999), Andersson (2006), Elmqvist et al. (2004), Braga *et al.* (2004), and Savage (2007), among others, who, at the global and local scale in the developing and developed world, have described different ecosystems within urban areas: street trees, urban forests, lawns, gardens, parks, cultivated land, wetlands, lakes, sea, and streams. These systems filter air, regulate micro-climate, reduce noise, drain rainwater, treat sewage, and provide possibilities for recreational activities and cultural values in the cities.

This highlights the manmade nature of some risks and shows that resilience building as such has to take human desire into account.



**Figure 1: The slum Karail opposite the rich business quarter Gulshan in Dhaka**

Source: B. Etzold, 2007

## The Megacity Resilience Framework

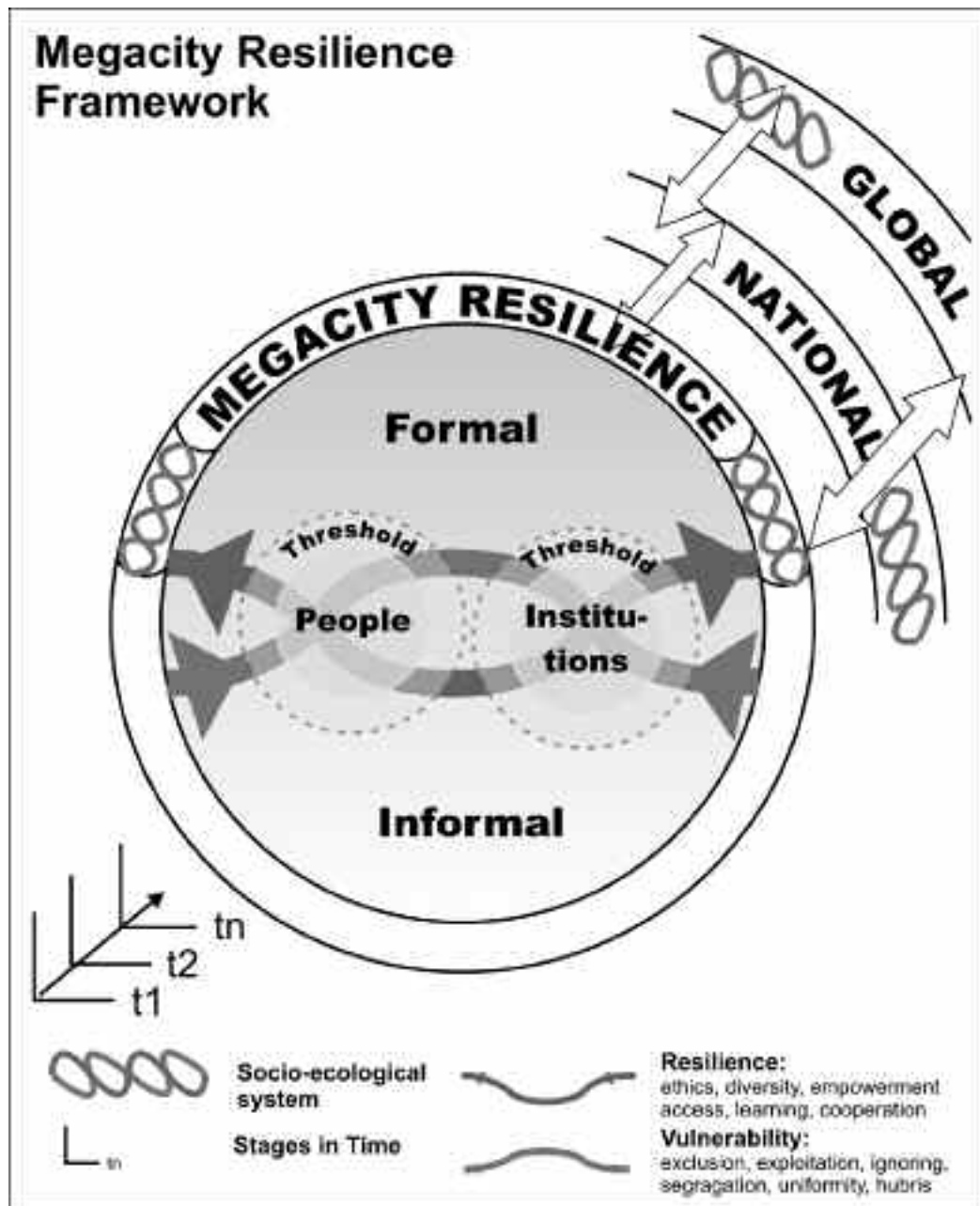
For this framework, megacity resilience is understood as the combined resiliences of all systemic components of a megacity. The concept is based on the following assumptions:

- megacities are influenced by manifold interwoven processes (economical, political, ecological, social etc.) on different scales, having at the same time and impact on other scales themselves.
- the functioning of megacities is influenced by the interplay of formal and informal processes, as well as various hybrid states in between.
- megacities must be conceived as coupled socio-ecological systems.
- socio-economic groups, due to their capacities, networks and linkages, are differently vulnerable to multiple stressors. Specific groups may be more sensitive to shocks and stress events of varying magnitudes and frequencies.
- resilience and vulnerability are interconnected in dialectic relationship.

The central statement of the framework is that the interaction of people and institutions takes place within the various intermediate stages between purely formal and informal spheres, embedded in the coupled social-ecological system, influenced by and influencing processes on different spatial scales. Thus, the resilience of a megacity is changing due to these ongoing interacting processes. In the framework, the abstract entity megacity resilience is illustrated by using a sphere as a model. This sphere is either expanding (more resilience) or contracting (less resilience) in time. The framework, thereby, emphasizes the dynamic notion of resilience.

The central regulatory mechanism for the megacity resilience sphere consists of two elements: people and institutions and their interaction. People are, in this context, understood to be acting individuals with a specific endowment of resources and capabilities. Institutions, on the other hand, are defined in their broadest sense, including the common notion of constituencies, codified laws etc., as well as rules, norms, habitualised behaviour, etc. People and institutions each have specific vulnerabilities and resiliences determining their ability to withstand to perturbations, addressed here as critical 'thresholds'. These define the extent to which the single components of the elements are able to absorb disturbances without being threatened in their existence. The interaction of the two elements of this regu-





**Figure 2: Megacity Resilience Framework**  
(draft based on the group work Summer Academy 2007)

latory mechanism either increase the vulnerability (red arrow = contraction) or the resilience (green arrow = expansion), changing the sphere's size in time. Vulnerability is increased by processes like exclusion (e.g. from decision making), exploitation (e.g. of workforce), ignoring (e.g. unsustainable processes), segregation (esp. social segregation processes), uniformity (e.g. of planned artificial environment), hubris (e.g. faith in technical solutions), etc. Resilience is increased by ethics (e.g. in good governance), diversity (e.g. valuing cultural diversity), empowerment (e.g. in decision making), access (e.g. to basic services), learning (e.g. social learning), cooperation (e.g. public-private-partnerships), etc.

The MRF as a framework seeks not only to explain the interrelation of different influencing forces on resilience, but also to highlight questions for future research. These questions can be summarised under three broader thematic labels: conceptual, on the edge of 'fields of tension', and within the 'fields of tension'.

Conceptual issues mainly address the concept of resilience itself: is the dialectic understanding of the relation between vulnerability and resilience helpful for research? Can the resilience of a megacity as such be measured. If so, by which indicators? Questions relating to more than one of the addressed 'fields of tension' would include how can formal, as well as informal, institutions within a megacity be utilised to build a more balanced socio-ecological system? Which effects, either political or economical, from the global or national sphere affect the socio-ecological system or the interrelation of formal and informal institutions? Several issues could be researched within each 'field of tension', only one shall be mentioned as an example: how can formal and informal networks be linked in order to keep the strengths of both types of networks while at the same time eliminating the weaknesses?

The newly introduced notion of megacity resilience, including the three fields of tension and the focus on interactions of people and institutions, highlights promising areas for future research. Results from this research could provide a valuable basis for evidence based decision-making.

## Summary and Conclusion

The task was to work out a conceptual understanding of a megacity as a complex system that is suitable for application in different cities all exhibiting the three fields of tensions mentioned. While megacities pose high long- and short-term risks to their populations, to the fragile system of a globalised world and to the environment, they possess also a certain self-healing potential. This potential can be realized if the concepts of vulnerability and resilience are understood as being in a dialectical relation. The examination of critical thresholds of coping capacities and the analysis of adequate adaptation possibilities is crucial.

Each analysis has to bear in mind: (1) the interdependence of the spatial scales in cities that are home to their people, as well as crystallization points of a globalised society; (2) the importance of activating the links between the formal and the informal sectors in order to profit from the dynamics, the flexibility, and the site-specific dimensions of this symbiosis; (3) the pivotal intertwined nature of the social and the ecological. To fit this holistic, general, and variable approach, the model tried to clarify the dynamics, which are inherent to these relations, rather than to the actual size or scale of a megacity. A megacity, thus, is not about numbers, but about qualities.

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# Mega-Ubanization and Social Vulnerability

*Bernd Hansjürgens, Dirk Heinrichs, Christian Kuhlicke*

## Introduction: Megacities as Risk Habitat

Urbanization is one of the most dramatic processes of global change. Particularly in mega-urban regions, it anticipates trends with both regional and global consequences that are not yet well understood. Mega-urbanization involves unprecedented growth, high population density, and a concentration of economic and political power, turning the urban habitat into both a space of opportunity and a space of risk. What is more, megacities generate a highly complex variety of simultaneous and interacting processes that produce and reinforce risks and dangers.

Whether and to what extent these risks turn into disasters depends on the vulnerability of the exposed system and population. The analysis of past events shows that the capacity to anticipate or cope with risks, i.e. to resist and recover from the impact of hazards, is determined not only as a direct function of the event but also in the context of increasing social inequality and poverty (Blaikie et al., 1994). Megacities are particularly critical in this respect. The World Bank estimates that by 2035, cities will become the predominant site of poverty (Ravallion 2001). Even today, poverty levels in the megacities of Latin America and the Caribbean are higher than in rural areas. There is a growing concentration of poverty in specific neighbourhoods, with racial minorities in some structures and international immigrants in others (UN Habitat 2004). Hence, vulnerability to not only the dangers associated with natural hazards, but also environmental degradation, poor housing and sanitation or the lack of access to basic services differs significantly across locations (Munich Re Group 2004), as well as across social groups (Wisner 1999).

This article focuses on two questions that are of relevance to research and policy on megacities. (1) How do mega-urbanization and concepts of vulnerability relate? (2) What are particular and distinct challenges for addressing vulnerability of megacities and to support strategies for enhancing resilience? The article is structured as follows. The following section addresses mega-urbanization as the phenomenon of the 21st century. Later, we consider definitions and concepts of social vulnerability together with their application and discuss their adequacy for describing mega-urban conditions. Finally, we derive conclusions regarding mega-urbanization and social vulnerability.

In summary, we first suggest that current definitions of megacities might fail to make explicit the specific conditions that would permit an analysis of social vulnerability. Instead, we propose that the vulnerability of megacities is due to a set of phenomenological conditions, which we describe as the sheer size, the speed at which megacities experience change, and complexity of megacities. Second, we question the adequacy of established concepts of social vulnerability to reflect these specific conditions within megacities. Third, we propose a research framework that employs an analysis of critical processes. Fourth, we highlight the critical role of governance and propose entry points for strategies to enhance the resilience of megacities.

## Mega-Urbanization and Risks: Scale, Speed and Complexity

Urbanization is the phenomenon of the 21st century. The world's urban population, which has quadrupled since 1950, is predicted to reach 3.17 billion in 2005 out of a total population of 6.45 billion (UN Population Division 2004). The figures for urban dwellers are expected to rise to five billion by 2030. Cities in the developing world will absorb 95 % of urban growth in the next two decades; by 2030, cities will be home to almost four billion people, or 80 % of the world's urban population. As approximately 60 % of urban growth is due to an excess of urban fertility over urban mortality, the population of the world's megacities is rising dramatically – and will continue to do so in the future. It is surely no exaggeration to assume that some cities will reach currently inconceivable dimensions.

How do we define a megacity? The most common approach is the use of population size, whereby thresholds vary from 5 million to 10 million people. In its recent report *The State of the World's Cities*, the UN system adds the category of megacities with 20 million inhabitants. Another approach combines a definition based on population and functional primacy: the shares of the respective national total regarding megacities' populations, their economic wealth, and their services (Bronger 1996). A third approach relates to the 'global city' or world city hypothesis (Sassen 1991; Beaverstock et.al., 1998). Here, the focus is on the role and prominence of a city as a 'node' in the global economic network in terms of the presence of advanced producer services or corporate services such as legal advice or banking institutions; as population size is not a measure, this global hierarchy of cities does not exclusively contain megacities.

While each of these definitions concentrates on relevant aspects underlining the outstanding role of megacities, they provide neither a comprehensive nor an exclusive characterization of a megacity. What is more important in the context of social vulnerability? They fail to make explicit the conditions of a megacity with respect to the production of and exposure to risks. But what are the elements that turn a megacity into a distinct 'place of risk'? A more adequate definition for this purpose would build on the three elements of size/scale, speed, and complexity. To outline briefly some of the characteristic features of these elements:

- *Size/scale* highlights the outstanding nature of megacities, not only in terms of population, but also with regard to the use of resources. Sao Paulo, for example, is home to 10 % of Brazil's population and creates 1/3 of the national economic wealth for which it requires about 70% of the national energy consumption.
- The second element, *speed*, refers to the velocity of change. The population of Dhaka expanded from 6.6 million in 1990 to 12.3 million in 2000 and expected to reach 18.4 million in 2010. However, not just the change in population but also the associated rapid changes in lifestyle have wide-ranging effects. In Beijing, the current 1.3 million cars reflect an increase of 140% since 1997 (UN Habitat 2006). Preferences for housing lead to a dramatic increase in land consumption and an unprecedented expansion of the largest cities.
- Together, speed and scale combine into a third characteristic: complexity. The growth and spread of megacities has impacts on complex natural ecosystems and resources-regimes at a global scale, as documented, for instance, in the case of greenhouse gas emissions (Hardoy et.al., 2001). Likewise, complexity refers to the simultaneous functioning and interconnection of socio-technical systems over an expanding area.

We assume that this combination of size/ scale, speed and complexity shapes vulnerabilities specific to megacities. In the following we outline a set of assumptions that describes this relationship and that we use to suggest a heuristic framework, which could serve as a starting point to refocus vulnerability research for megacities. We choose three examples: (1) a single hazardous event, (2) chronic long-term damaging processes and (3) events related to global change, and outline how these three dimensions could relate to the vulnerability of megacities.

(1) Single hazardous events include earthquakes, windstorms, volcanism or tsunamis. At the global scale, such events are increasing in frequency. Of course, megacities do not have a monopoly on being affected by single hazardous events. Indeed, as Cross (2001) points out, losses in terms of affected lives have been greater in rural areas. However, given their disproportionate location in coastal and/or seismic and volcanic hazard zones, some argue that disasters in megacities have the potential to overwhelm local and national response capacities with serious effects on the global economy (Uitto 1998, Mitchel 1999). This may be explained by the very size of such cities; the sheer number of people exposed to single hazards is greater than in less densely settled areas. Furthermore, the speed of change characterizing megacities may lead to an inadequacy of both formally and informally institutionalized

patterns of disaster mitigation and response mechanisms with regard to the increasing number of exposed people. Vulnerability may further increase through the complexity of megacities and cascading effects of an event.

(2) People in the large cities face not only single events, but also critical, chronic and long-term damaging processes that pose a threat to their lives and health. These risks are associated with their outstanding consumption of resources and the discharge of waste in the form of air pollution or sewage. Again, scale is a decisive factor: in Jakarta, less than 3% of the daily 1.3 million cubic meter wastewater reaches one of the few treatment plants (UN Habitat 2006). In Bombay, about 2 million out of the total 17 million people have no access to sanitary facilities, such as toilets or areas for washing. The consequences are primarily suffered by the most vulnerable groups of the urban poor (in particular, children and their mothers, together with the elderly). They are particularly extreme in informal settlements/slums. Cities with a high proportion of informal settlements display large differences in child mortality rates between various urban quarters. In the poor households of a favela in Rio de Janeiro, the mortality rate is three times that of an area with adequate sanitation, drinking water and building standards (UN Habitat 2006). Such conditions are, above all, a result of the rapid growth of the cities and the lagging-behind of the allocation of the water infrastructure. This has led to a critical state of both human and environmental health, as water-borne diseases are the most common sources of illness and death. Certainly, the vulnerability is also closely related to other factors that reflect manifest inequality, such as tenure insecurity, social exclusion and crime; however, we believe that these factors have to be considered in close relation with complex and highly dynamic processes.

(3) A third group of risks are those relating to *Global Environmental Change* (GEC). On the one hand, megacities contribute to GEC by their massive use of environmental resources. On the other hand, they are affected by the consequences of GEC. The *Low Elevation Coastal Zone* (LECZ) is less than 10 meters above sea level and will bear the consequences of sea level rise. The LECZ represents 2% of the world's land area but contains 13% of its urban population (Huq et al., 2007). Almost 2/3 of the world's large cities with more than 5 million inhabitants fall at least partly into this zone. With regard to this dimension, the interplay between the complexity, speed and scale of megacities is even more difficult to grasp. In particular, southern megacities lack infrastructure, resources and institutional capacity to cope with these trends. What is more, local effects of global environmental change are adding greater uncertainty to the tasks of anticipating or coping with risks and resisting and recovering from the impact of disasters.

## **Social Vulnerability: Definitions, Concepts and Their Application**

The concept of vulnerability has become widespread in the scientific community as an analytical approach to explain the occurrence of disasters and crises. Despite its diverse interpretation (Weichselgartner 2001), some key parameters are considered important in the definition of vulnerability: the exposure to perturbation or external stresses, the sensitivity to perturbation, and the capacity to adapt to and/or cope with perturbation and external stresses (Adger 2006).

In a general sense, vulnerability emphasizes that disasters and crisis are never the simple result of natural processes, but rather are social products (O'Keefe et al., 1976). Its central endeavour is thus to refute 'taken-for-granted beliefs about the essential nature of things', and to show how particular concepts and categorizations of the material world have been produced and maintained over time (Demeritt 2002). As White stated already some sixty years ago: 'Floods are "acts of God", but flood losses are largely acts of man' (White 1945: 2).

The concept of vulnerability has its origin primarily in two different areas of research: (a) hazard research, and (b) poverty and development research. Despite certain differences, both fields largely overlap and inspire each other.



(a) White and his students conducted geographical hazard research already in the 1950s and 60s (White 1945; Kates 1962), whereby it came to be considered as the dominant paradigm (Hewitt 1983). However, geographers conducting research in developing countries at that time quickly figured out that the existing mode of explanation – the hazard paradigm – was not appropriate for explaining the origins of hazards in the southern hemisphere (O'Keefe et al., 1976; Waddell 1977). They concluded that the political-economic context must be acknowledged more rigorously in order to explain the 'conditions that reduce the ability of people and places to respond to environmental threats' (Cutter 2003: 6). The concept of vulnerability results from this critique and marks a turning-point in hazard research: it is no longer the hazard, but the production of vulnerable conditions that stands at the centre of attention. In their often cited work *At Risk*, Blaikie et al. (1994) conceptualizes this view by distinguishing between root causes, dynamic pressure and unsafe conditions that put pressure on individuals and households.

(b) Development research offers a quite distinct concept that rejects poverty as too simplistic of an explanation of vulnerability and argues that, for example, the economic situation of actors alone would not satisfactorily explain collective and mostly creeping crises such as famines (Sakdapolrak 2007). Chambers (1989) offers an approach that views crises from two different angles; whereas the 'internal perspective' of vulnerability captures the means by which groups or individuals try to cope with and adapt to radical changes in the social or natural environment, the 'external' side captures the exposure of individuals and groups to such radical changes. Watts and Bohle (1993) take up this view. They outline a pyramidal 'Space of Vulnerability', which is constituted of complex interactive processes of human ecology, entitlements and political economy, which in turn define individual and collective vulnerabilities. This concept thus focuses above all on societal structures and a resulting lack of entitlements that limits the abilities of individuals and groups to handle threatening situations such as food insecurity, civil strife and social upheaval (Adger 2006: 270). As a result, the so-called 'livelihood approach' develops a more application-oriented perspective (Carney et al., 1999). It focuses on the resources (physical, natural, political, social, and financial) of individuals and households that can be applied in order to deal with and adapt to a wide range of risks.

We want to raise two concerns with respect to the applicability of the above concepts to the vulnerability of megacities:

First, in a general sense, the concept of vulnerability was designed to fit primarily rural contexts and it mostly focused on individuals/households (Carr 2005). Related approaches might reach their limits when considering the increasing complexity of current global developments in general, the higher commodification of urban life, the complexity of exposure to risks and greater social fragmentation, as well as the informality in the definition of megacities. Other theoretical approaches, which try to overcome the gap between the levels of individuals/households and generally established societal structures, may offer a way of avoiding the artificial reification of the separation of actions and structures (Bohle 2001; van Dillen 2002). In this view, societal structures and individual actions refer dialectically to each other (Berger and Luckmann, 1967; Giddens 1986). Recently, the usefulness of this concept has been tested in empirical case studies (Bohle 2002). It may also prove helpful in explaining the differing vulnerabilities of actors living in megacities, since it allows their respective 'life worlds' and the broader societal contexts to be taken into account.

Second, using the phenomenological elements 'size/scale', 'speed', and 'complexity' requires us to take a more systematic view of the dynamic interaction between the material and social in large-scale urban areas. The recent debate among scholars involved in this field takes up this argument with to the aim of bridging the gap between the natural and social sphere. Instead of having a nearly exclusive focus on the societal side of the production of vulnerable conditions, it rediscovers the mutuality and the coupled character of the human-environment system (Hilhorst 2004: 53). This argument considers society and nature not as opposing entities, but as interconnected spheres and adopts a system-oriented perspective that tries to understand vulnerability as a holistic concept which is rooted in both

natural and social systems (McCarthy et al., 2003; Turner II et al., 2003). By no longer focusing simply on one physical trigger or the social production of vulnerable conditions, but rather by analysing the vulnerability of the entire system at a specific scale (e.g. a megacity or a specific part of a megacity), it may be possible to develop a more systematic view of the dynamics of large-scale urban areas.

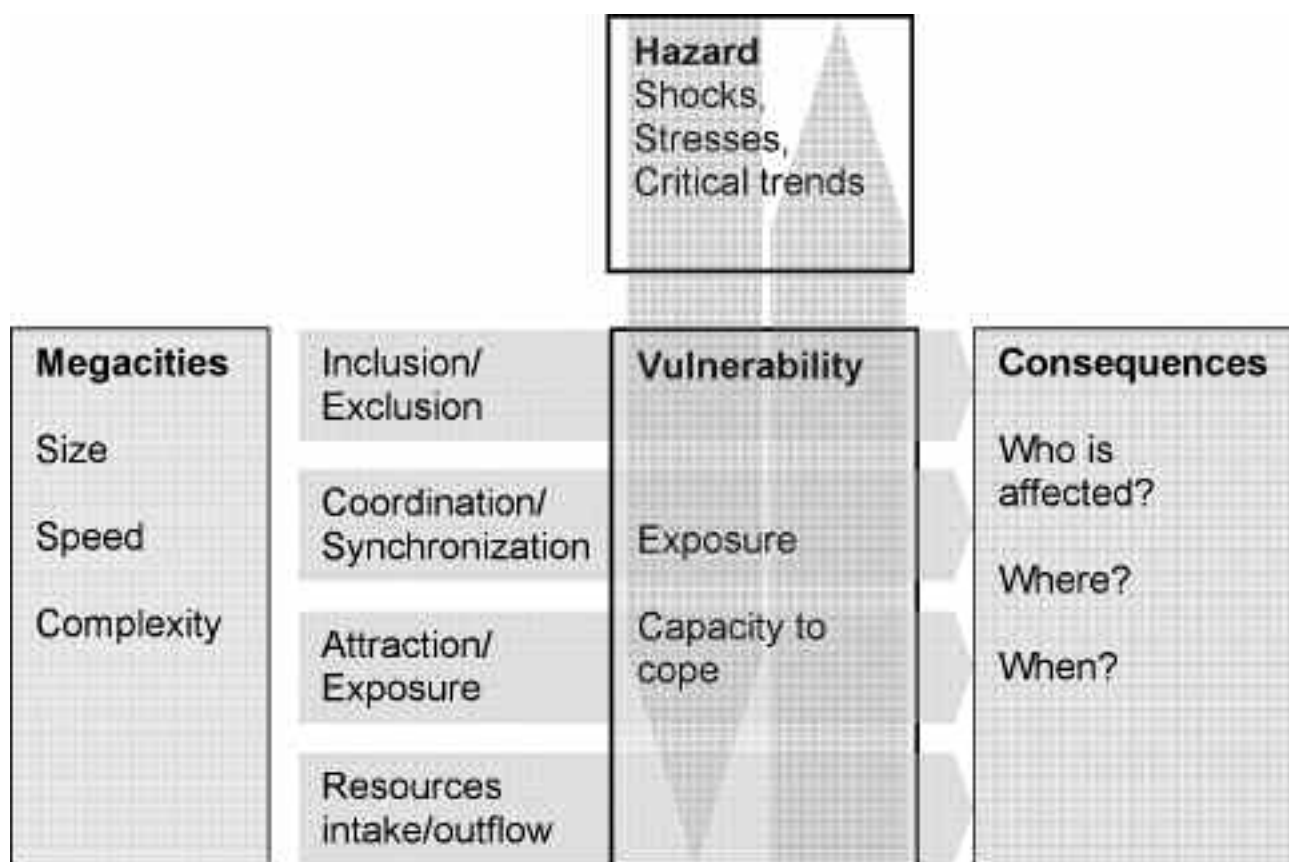
In the following section, we take up these concerns and outline a framework (rather than a full-blown model), which can be seen as a starting point to refocus vulnerability research for megacities.

## Vulnerability Analysis of Megacities

How can we link social vulnerability concepts and their application to mega-urban vulnerability? We have determined in the previous sections that there exists a relationship between hazards (shocks, stresses, and critical trends) and social vulnerability. In megacities, this relationship between vulnerability and hazards occurs under specific conditions, which we have summarized as size/scale, speed of change and complexity.

These rather abstract categories (size/scale, speed, complexity) emerge in critical processes that have influence on the social vulnerability of the population in a megacity. We have discerned four types of critical processes:

- (1) *Inclusion/exclusion* of citizens relates to entitlement to resources (e.g., health care or public infrastructure, legal rights, security), as well as access to information. Both are crucial elements for coping with a natural or man-made hazard. Examples of exclusion are the marginalization of people in social housing estates at the urban fringe, informal settlements/slums, or 'permanentalized' emergency shelters after previous disasters.



**Figure: Framework for Vulnerability Analysis in Megacities**

- (2) *Coordination/synchronization* refers to the increasing fragmentation of political and administrative units. In many mega-urban areas there is a lack of (vertical) coordination between the various governmental levels (federal level, metropolitan area, districts) – there are problems of insufficient institutional fit. In addition, the mitigation and rescue/recovery plans are (horizontally) disintegrated. The lack of a coherent concept can worsen the situation in case of hazards.
- (3) *Attraction/exposure* refers to in-migration or expansion of existing endangered settlements, e.g. in flood-prone areas or on slopes. This is often the result of politically and economically created land shortage. The incoming people are particularly vulnerable.
- (4) *Resources intake/outflow* is related to the resource flows such as the discharge of contaminated water or sewage downstream of the city.

The analysis of these processes against particular hazards under the perspective of social vulnerability would focus on who are the most affected, where they are located, and when vulnerability is most apparent with regard to not only sudden shocks and disasters, but also more slowly deteriorating conditions. By revealing the spatial, temporal and social dimensions of vulnerability for a (limited) number of the most pertinent hazards in a given megacity, we can achieve much in deepening our understanding and in ‘urbanizing’ the vulnerability agenda.

## **Building More Resilient Megacities**

Deeper understanding of social vulnerability and its distribution across time, space and social status would be a first step in tackling the question of what are appropriate actions leading towards more resilient megacities. In our understanding, a central role is played by urban governance, i.e. the mechanisms of how decisions on publicly relevant affairs are made within and between the spheres of the state and the private sector. As pointed out above, urban governance is crucial in determining vulnerability, both as problem and solution:

There was a ‘worldwide’ consensus achieved during the *International Decade for Natural Disaster Reduction* (IDNDR) (ISDR 2004) that important principles of risk reduction are:

- mainstreaming disaster prevention and mitigation into a wide range of ‘normal’ policies affecting social welfare, infrastructure, livelihood and planning;
- orienting these actions towards multiple hazards, rather than just a single kind of event.

Two further aspects must be considered here. First, such policies should be directed towards the three dimensions of ‘who is affected, where and when’. Second, whereas current disaster management measures have tended to focus on ‘engineering solutions’ (e.g. flood barriers), such measures may prove inadequate or insufficient to cope with vulnerabilities. Responses to disasters need to include the design and enforcement of appropriately developed environmental and public health standards and the institutionalization of a range of social safety nets, including food security programmes with a longer term perspective.

Governance plays a central role in mitigating or adapting to risks (Pelling 2003). ‘Poor’ or ‘bad’ governance performance can amplify vulnerability. For example, the failure to manage basic urban services, such as regulation of pollution-generating industries, provision of safe transport systems, adequate water supply and sanitation, creates a hazardous situation for the citizens. The governance deficits are particularly revealed when inadequate response to risk events turns them into disasters. Thus, ‘good’ or ‘adequate’ governance and well-designed strategies both for mitigation and adaptation are indispensable in the effort to limit vulnerability.

However, how can we design better governance structures? What recommendations can be given? Here we can only outline some elements. The key components of an agenda for strengthening resilience

are (1) information, (2) improving the capacities to cope of affected people in general and (3) improving their social capital in particular.

(1) Information is a prerequisite for adaptation activities. People can only adapt to hazards or stress if they have the relevant knowledge. However, the distribution of knowledge is highly selective. The content of information (including local and stakeholder knowledge) has to be tailored to the conditions of the vulnerable groups (their ethnic backgrounds, degrees of integration, 'accessibility' etc.).

(2) The possibilities for mitigating and adapting to hazards on the basis of private resources are rather limited. Therefore, access to services and facilities, especially in crisis situations, plays a central role in enhancing the capacity to cope of vulnerable groups. However, in many cases, public services and facilities are not available. Therefore, mitigation and adaptation activities of the vulnerable groups themselves are decisive and have to be strengthened.

(3) Social capital is, according to the livelihood asset framework, one of the elements of the asset portfolio. Since in a mega-urban setting the most vulnerable inhabitants tend to have very limited access to natural, human, financial, and physical capital, the only capital which is left to respond to hazards is the social capital. This makes local community-based organizations so critical in reducing vulnerability, and it sheds light on the actors and stakeholders within a megacity implementing such an agenda.

What are the roles of the various actors and stakeholders? Arguably, actions to anticipate, mitigate and reduce effects of disaster events, shocks and long-term environmental change must be the responsibility of all relevant stakeholders: international financing institutions (IFIs), national and local governments, international and southern-based non-governmental organisations (NGOs) and local neighbourhoods. IFIs have access to capital. National governments have to provide strategic leadership and coordination in case of a disaster, so long as the threat remains perhaps more remote; this represents a classic role of the state. Local governments can oversee provision of basic services, regulating when necessary. Grassroots actors in NGOs or local neighbourhoods have local knowledge and energies that can be applied to strengthen local mitigation interventions. The precise balance between local, regional and national institutions and the questions of whether sectoral departments and specialized disaster/civil defence agencies should take a lead needs to be determined in a city/country-specific manner.

However, above and beyond considering actors individually, collaboration and partnership is the key to building local resilience. Without this, vulnerability reduction is unlikely to happen.

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## **1. SECTION**

### **MEGACITIES AS FORMAL AND INFORMAL SPACES**

## 1.1 Street Food in the Megacity Dhaka: How Can We Conceptualize Its Role Within the Megaurban Food System?

*Benjamin Etzold*

### Abstract

This paper examines the role of street food within the megaurban food system of the megacity Dhaka. It is based on a joint research project by the Universities of Bonn and Heidelberg, which is currently being undertaken. The project aims to explain megaurban food systems: what they are, how food system activities are interrelated and what food system interactions result in. A research framework is laid out to assess vulnerabilities of the megaurban population to food insecurity. The overall aim is to foster the resilience of the megacity Dhaka in terms of overall food security.

### Introduction

The sheer size of the megacity Dhaka and its rapid population and economic growth shape the daily lives of its inhabitants, both in terms of material and immaterial, 'Lebenswelten'. Recent research efforts worldwide show that megacities, especially in the global south, face enormous challenges (Kraas 2003; Kraas 2007): living space, physical infrastructures, health services, education facilities and employment opportunities are required and political participation, accountable decision-making and justice need implementation. Although, the basic needs of poor city dwellers are discussed extensively in this context, less attention is being paid to food and nutrition. A lack of food is a fundamental aspect of social vulnerability in megacities that is often overlooked.

Presently, more than 14 million people are believed to live in the capital of Bangladesh (United Nations (UN) 2004). All Dhakais need to eat food every day. All depend primarily on purchasing food for their consumption. Hundreds of thousands are involved in the businesses of producing food in Dhaka's peri-urban hinterland, transporting food and fuel, preparing food for the city and the markets, trading with and selling it, processing and preparing it, and transporting it again. Given the rapid growth of the megacity and the many economic, social, political and environmental difficulties the people of Dhaka have to master, it is nothing less than astonishing that the megaurban food system works – although with shortcomings.

### Food (In)Security in Bangladesh

Bangladesh has suffered from a severe famine that affected the majority of its population in 1974. Food shortages caused by natural hazards, such as the floods in 1974, 1988, 1998 and 2007 or the cyclones in 1991 and 2007, can lead to acute food insecurity of great parts of the population. However, research has shown that food insecurity in Bangladesh and elsewhere does not necessarily correlate with a decline in overall food availability (food supply crises), but is rather due to a decline in exchange entitlements. Such entitlement crises are caused by rapid increases in food prices, in particular of the main staples rice and wheat, in combination with a relative decrease in incomes (Sen 1981; Bohle 1992; Watts, Bohle 1992; del Ninno et.al., 2004; Osmani 1991; Zingel 2006).

Despite frequent disturbances that have led to extraordinary hunger and even to the death of many Bangladeshi in the past, it is 'ordinary' hunger that still is a sad reality in Bangladesh:

Today, though people are not dying, they are going hungry and becoming stunted with reduced mental and physical capacity. They are suffering. The hungry population of over 60 million people is larger than most other global cases – the third largest poor population in any country after China and India. Nearly half of Bangladesh's children are underweight, making it one of the most severe cases of malnutrition in the world. While



Bangladesh has definitely got more food than it had thirty years back, yet almost half of Bangladesh is still far from being food secure (Mishra, Hossain 2005: 1).

Whereas chronic food insecurity was often highlighted as a phenomenon of rural regions, it is increasingly becoming a concern in cities in developing countries. In particular, children and women are vulnerable to malnutrition (Harris 1990; Pryer, Crook 1988). The same holds true for the megacity Dhaka, where over fifty percent of the slum population is believed to be malnourished, with women-headed households suffering worst (Pryer 2003).

## **Megaurban Food Systems**

### **Megaurban Food System Research**

Food security research (not only in Bangladesh) has been primarily interested in rural populations (Gill 2003). On the other hand, research on urbanization hardly touches questions of food systems, taking urban food supply for granted (UN 2004; United Nations Human Settlements Programme (UN-HABITAT) 2006; United Nations Population Fund (UNFPA) 2007). It is only in times of crisis, when the importance of this issue becomes sudden (Guyer 1987). Only a small number of case studies address the functioning of metropolitan food systems in developing countries (Gertel 1995; Bohle, Adhikari 2002). But increasingly, flows of food in and out of cities and inner-urban food distribution are studied; in particular by the United Nations *Food and Agricultural Organisation* (FAO) (Aragrande, Argenti 2001; Yasmeen 2001) and scholars of the sustainability science community (Koc et.al., 1999; Ingram et.al., 2005). In megacities, the specific vulnerabilities and resiliencies of city dwellers can be analysed through interdisciplinary studies of food systems (Bohle, Adhikari 2002; Bohle, Zingel 2006).

### **What Are Food Systems?**

Different conceptions exist of the processes and activities revolving around food. Polly Ericksen (2006: 3), summarizing the position of the *Global Environmental Change and Food Systems Programme* (GECAFS), defines food systems as including 'the interactions between and within bio-geophysical and human environments which determine a set of activities; the activities themselves (from production through to consumption); outcomes of the activities (contributions to food security, environmental security, and other securities); and other determinants of food security (stemming in part from the interactions)'.

According to Terry Cannon (2002: 354) 'a food system can be defined as the specific combination of social (including economic and political) and natural (climate, resources) components that leads to the potential satisfaction of nutrition for a given individual or household through their combination of livelihood activities based on assets and incomes. A food system includes four sub-systems: Production, Exchange, Distribution, and Consumption.'

Thus, it is necessary to distinguish these four dimensions of a food system.

Production (P) comprises all activities around the provision of inputs for producing food (land, labour, financial capital, technology), the preparation and caring of land, breeding and planting, weeding, harvesting and slaughtering, as well as the processing of primary products and packaging of food.

The term exchange (E) describes all activities that relate to the material transport, storage, barter, sale and (foreign) trade, marketing and advertising of food products and other food-related transactions, as well as flows of finances and people.

Consumption (C) depicts all activities involving everything from the selection and preparation of food to eating and digestion, and, hence, the provision of nutrition.

All regulatory activities of the food system, including regulation of P-, E- and C-activities through governmental bodies of the city, the nation-state or global institutions, macro-economic price mechanisms, as well as informal networks of information, knowledge and power can be subsumed by the term distribution (D).

These sub-systems are dynamically linked across spatial levels and multiple scales; cutting through social, economic, political, cultural and ecological dimensions on the way from 'plough to fork'. A food system is structured by internal processes as well as by external driving forces leading to different outcomes for different actors. A food system can be conceptualized as a network of actors with unequal power to influence the flows of food commodities, money and information between its nodes – and, thereby, its functionality.

### **Food Security as Food System Outcome**

Food security can be considered as the overarching goal of food systems (Ericksen 2006). Food security has been defined by the FAO at the World Food Summit (FAO 1996) as the condition of food systems when 'all people, at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy life.'

According to the GECAFS Programme (Ingram et al., 2005), the determinants of food security relate directly to the elements of the food system. Food security encompasses food availability, food accessibility and food utilization (Ericksen 2006: 27).

Food availability refers to the amount, type and quality of food a given population has at its disposal to consume. Availability is directly linked to production, exchange and distribution, i.e. agricultural productivity, efficiency of markets and food policies at a specific location.

Food accessibility refers to the ability to access the type, quality and quantity of food a household requires. Affordability (purchasing power), allocation (food distribution or regulation) and preference (social and cultural norms) are elements of what Amartya Sen (1981) calls (food) entitlements.

Utilization refers to individual or household capacity to consume and benefit from food. This component includes the nutritional value of the food, the implications for the consumer's health (food safety) and the social and cultural value attached to it (for instance, the appreciation of home-made food as opposed to street food).

Megacity dwellers usually have neither the means nor the space to produce food themselves. As a consequence, megaurban food security depends mostly on whether a household can afford to buy enough food in quantity and quality (Bohle, Adhikari 2002; Bohle, Zingel 2006). Thereby, the mechanisms of the distribution system are at the core of the megaurban food system: it mediates between the production and exchange of food and its consumption. And most importantly, as this project assumes, it determines the vulnerabilities or resiliencies of the megaurban population in terms of food security.

### **A Vulnerability-Approach to Megaurban Food Systems**

By using an actor-orientated vulnerability approach, the functioning of a megaurban food system can be understood and the specific exposures, sensitivities and adaptive capacities of megaurban livelihoods, which face multiple stresses that jeopardize their food security, can be detected.

According to Turner and colleagues, vulnerability is 'the degree to which a system, a subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation or stress/stressor' (Turner et al., 2003: 8074).

Social vulnerability is a dynamic, multilayered and multidimensional social condition, which is structured by social, political, economic or ecological forces, and rooted in actors' attributes, capacities and strategies in specific places at specific times. Acknowledging the contributions of many authors (Bohle 1998; Bohle 2001; Birkmann 2006; Downing et al., 2005; Krüger 2003; Prowse 2003; Sakdapolrak 2007; Turner et al., 2003; Van Dillen 2004; Watts, Bohle 1992), five main components of vulnerability can be identified: drivers, exposures, sensitivities, adaptive capacities and outcomes. The following deductions of these terms serve as the author's working definitions.

Drivers can be either slow-onset processes, which put stress on social-ecological systems or actors (major trends such as global environmental change, globalization, megaurbanization, degradation, etc.), or sudden disturbances that challenge the functionality of a system or the livelihood of an actor (shocks such as natural hazards, social, economic or political crises). More often than not, various stresses and disturbances affect actors simultaneously or repeatedly on multiple functional scales.

Exposures can be defined as the systemic (common, generalized) risks to encounter environmental and social stresses or to suffer from sudden disturbances. A differential exposure is a spatial and socio-economic category relating to specific geographical locations (exposed places), exposed activities and social groups.

Sensitivities mean the individual (ideosyncratic) risks of being susceptible to these stresses and perturbations, or the risks of not being able to face these challenges with adequate coping strategies. For clarification, this also applies to small homogenous groups, which face quite specific risks. Sensitivity is a social category that generally refers to inequities, social networks, power relations and interdependencies and, in particular, the specific socio-economic position of sensitive actors.

Adaptive capacities are social and individual abilities to anticipate and adapt to changes, cope with disturbances and mitigate their adverse effects adequately. Generally speaking, adaptive strategies aim at the reduction of losses and risks. In order to sustain a system's functionality or an actor's livelihood in the future, pro-active actions (ex-ante) try to reduce the exposure and sensitivity to perturbations before a possible stress event, whereas re-active strategies (ex-post) are either short-term responses (coping) or long-term changes in behaviour (adaptation) after a specific impact.

Sensitivities and adaptive capacities address people's 'agency' (Giddens 1984) or 'habitus' (Bourdieu 1998). These strongly depend on the set of assets (natural, physical, human, financial and social capital) and entitlements that individuals, households or communities possess and whether they can mobilise them in times of crisis (Moser 1998). In particular, the position in social networks plays a pivotal role and often determines the sensitivity, adaptive capacity and outcomes – and thus the vulnerability or resilience – of exposed actors (Bohle 2006; Bohle 2007; Downing et al., 2005).

Outcomes are the potentials and results stemming from socio-economic situations and ecological conditions, external impacts and the adaptive capacities of exposed/sensitive actors. In our case, food security or food insecurity are the consequences of a complex and dynamic interplay of these closely interdependent vulnerability components.

Most often in vulnerability analyses, the drivers are conceptualized as negative stresses, exposure and sensitivity related to natural hazards, and the adaptive capacity is seen as a 'survival' strategy aiming at buffering adverse outcomes. The drivers might, however, also reveal new opportunities for livelihoods, or could be seen as 'normal' dynamic changes in a cyclical sense. Exposure and sensitivity could be framed, in turn, as spatial closeness to and openness towards innovations. From the perspective of resilience-science, the adaptive strategies should not only enable the system/the actor to withstand disturbances, but also to re-organise after perturbations and learn from dynamic changes. Thus, the outcomes strongly depend on how 'learning, recovery and flexibility open eyes to novelty and new worlds of opportunity' (Resilience Alliance 2007).

## Resilient Food Systems

Resilience is another way of looking at how external and internal stresses are absorbed, mitigated and averted. Whereas vulnerability is most often regarded as a concept focusing on individual actors, households and communities, the resilience – science from an ecosystem science perspective – shifts the attention to complex and coupled social-ecological systems. Social-ecological systems are ‘multi-scale pattern[s] of resource use around which humans have organized themselves in a particular social structure (distribution of people, resource management, consumption patterns, and associated norms and rules)’ (Resilience Alliance 2007).

Food systems are complex social-ecological systems par excellence. Thereby, vulnerability and resilience perspectives can be merged in their study.

Resilience has been defined by the Resilience Alliance (2007) as ‘the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure and feedbacks – and therefore the same identity’.

Ecological resilience focuses on the magnitude of disturbances an ecosystem can experience before shifting into a different state. In contrast, social resilience refers to ‘the ability of human communities to withstand external shocks to their social infrastructure, such as environmental variability or social, economic, and political upheaval’ (Adger, cited in Colding, Folke, Berkes, 2003: 354).

As a specific form of resilience, Alberti and colleagues describe urban resilience as ‘the degree to which cities tolerate alteration before reorganizing around a new set of structures and processes’ (Alberti et al., 2003: 1170). Urban resilience largely depends on how well a city can simultaneously maintain or balance ecosystems and human functions. Thus, the resilience of a megaurban food system is mainly determined by the magnitude of both ecological and social perturbations that it can absorb and still retain its overall function – providing food security for the population in megacities. As mentioned before, this relates, in particular, to the functioning and effectiveness of the modes of regulation (distribution) in the food system.

## Research Framework: Vulnerability and Resilience of Megaurban Food Systems

It is against this background that a joint research project of the Universities of Bonn and Heidelberg was put forward.<sup>9</sup> Through the analysis of the ‘Megaurban Food System of Dhaka’ the project aims to reveal the discontinuities, fragmentations and conflicts, which global processes generate in local arenas (Bohle, Zingel 2006), and, thereby, contribute to an improved understanding of ‘the geography of vulnerable food systems’ (Bohle 1993; Bohle 2002).

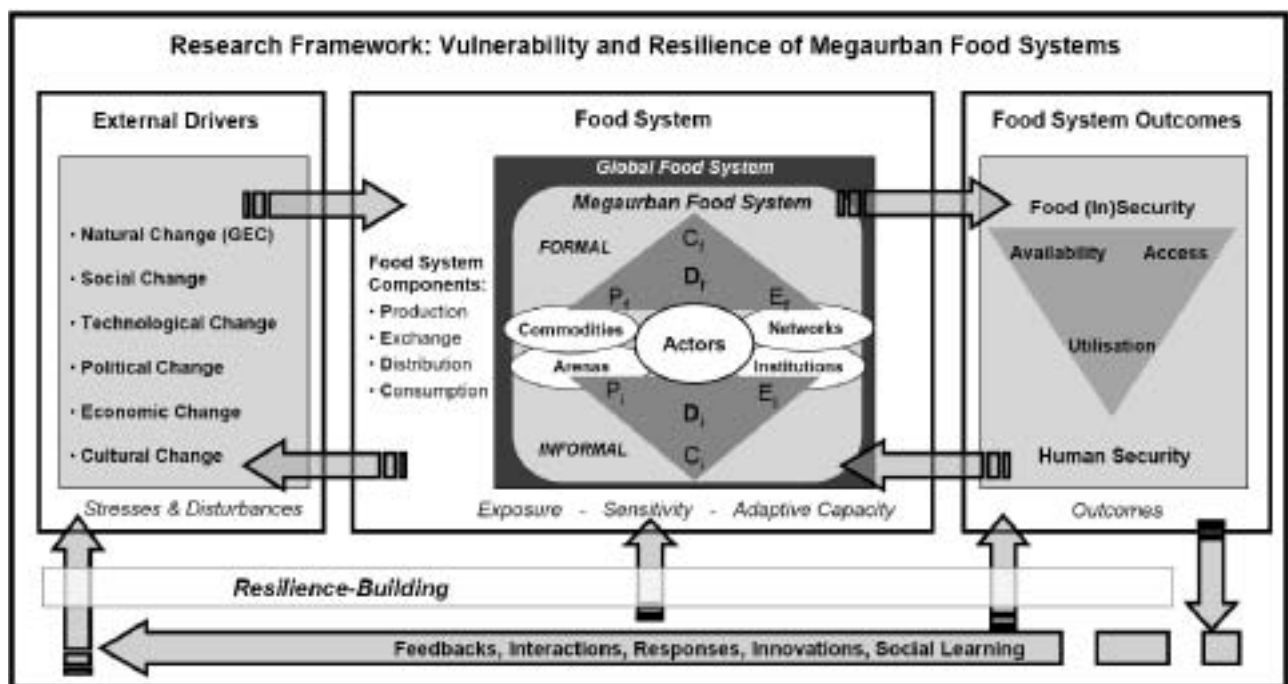
How is a megaurban food system working? Which driving processes of global change have a significant impact on the functionality of Dhaka’s food system? Who are the major actors of the food system? How effective are the formal and informal institutions in terms of a resilient food system? How do different sections of the urban population cope with and adapt to challenges to their livelihoods, such as a flood or a cyclone, the loss of the prime income earner, economic or political crises – revealing their vulnerability or resilience in terms of food security? Are challenges to megaurban food security directly related to Dhaka’s growing population figure and spatial expansion (bio-physical axis), or can they be assigned to economic or political factors (socio-institutional axis)?

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<sup>9</sup> The project has two subprojects. The first is conducted by Markus Keck (South Asia Institute, University of Heidelberg, Germany) and supervised by Hans-Georg Bohle (Geography Department, University of Bonn, Germany) and Wolfgang-Peter Zingel (South Asia Institute, University of Heidelberg, Germany). It is starting from the entry points of food into Dhaka and tries to dismantle its supply, exchange and distribution networks. In contrast, the street food study, which is conducted by the author and supervised by Hans-Georg Bohle, is looking at Dhaka’s food system from an inside perspective by focusing on food consumption.

In order to answer these vital questions, a conceptual research framework serves as the guideline to assess the vulnerabilities and resiliencies in Dhaka's food system (Figure 1). It looks at particular activities and actors involved in production, exchange, distribution and consumption of food. The megaurban food system is structured by internal processes, such as formal governmental legislation and informal arrangements, as well as by demographic, economic and ecological factors that are mainly determined by megacity-characteristics. In order to detect vulnerabilities to food insecurity, the complex and dynamic interactions between producers, traders, distributors and consumers in Dhaka's food system need to be recognized and understood. Organised in networks, these actors struggle over access to food resources in different arenas, and compete over the regulation of the food system.

Furthermore, the effects of external drivers, such as global environmental change, megaurbanization, socio-economic globalization on the flows of commodities, money, information and people, on exchange and consumption patterns, as well as on the functioning of institutions, need identification.



**Figure 1: Research Framework: Vulnerability and Resilience of Megaurban Food Systems**

Source: Benjamin Etzold and Markus Keck

The capabilities of food system actors depend on their assets and specific livelihood strategies. They draw on 'formal' aspects of the food system, for instance, officially authorised and controlled imports into the megacity, state-regulated markets or licensed restaurants. However, in megacities in developing countries, 'informal' food system activities, such as uncontrolled urban agriculture, not-state-regulated markets and non-licensed street food vending, are essential for the functioning of food supply and markets, and for the food security of megaurban consumers. In absence of efficient formal regulations, the urban poor (those with fewer assets and impeded access to resources and supporting institutions) rely primarily on the 'informal' part of the food system.

The relative position of megaurban food system actors in both formal and informal distributive and supportive networks is highly dynamic – decreasing or increasing their vulnerability to food insecurity. It is a goal of the project to develop an improved understanding of those complex social processes and strategies that lead to megaurban food security (Bohle, Zingel 2006). Thereby, a small contribution can be made to enhancing the human security, i.e. food security, of marginalized people in Dhaka in the future and foster the resilience of the megaurban food system.



## Street Food in Megaurban Food Systems

Street food plays a pivotal role for the megaurban food system of developing countries. And its importance will increase even further in this urban 21st century (Tinker 1999). Small tea and food stalls, vendors selling snacks, drinks and fruits from push-carts, baskets or just from a mat on the ground, and rickshaw-drivers, balance-pole carriers and children carrying metal containers (tiffins) with food are a common sight in South Asia. These street food vendors, the distributors, the 'invisible' women preparing street foods at home, children and helpers who assist with the purchasing of the ingredients at local markets and the processing of food items are all part of the 'informal prepared food system' (Tinker 1998: 4) in megacities.

### What Is Street Food?

Street food includes 'any food that can be eaten without further processing and is sold on the street, from pushcarts or baskets or balance poles, or from stalls or shops having fewer than four permanent walls' (Tinker 1987: 52). This definition is based on extensive studies undertaken by the Equity Policy Centre (EPOC) in nine countries in the 1980s and 1990s. The FAO (1997: 4) speaks of street foods as 'ready-to-eat foods and beverages prepared and/or sold by vendors and hawkers, especially in streets and other similar public places'.

Worldwide, there is a great variety of street food for sale depending on food preferences, cultural and religious practices, climatic conditions, socio-economic situations of vendors and consumers as well as on governmental regulations regarding street food products and food safety. A study in the rural town of Manikganj in Bangladesh, for instance, identified 128 different street foods within a year (Tinker 1997: 84). To grasp this multitude, it is important to distinguish street food according to its specific characteristics, cooking methods, the state of preparedness or religious and cultural factors.



Picture 1: A mobile street food vendor selling Jhal Muri, a popular snack with puffed rice, onions and spices, on Dhaka University campus. His main customers are students.  
Source: B. Etzold, November 2007

**Table 1: Types of Street Food** (based on Nirathron,2006: 26;Tinker 1987: 52;Tinker 1997: 84)

Classification Method	Types / categories
Site of Preparation	ready-to-eat-food sold in the street but prepared elsewhere (i.e. at vendor's home) [served cold or warm] – ready-to-eat-food prepared and sold in the street [served cold/warm/hot]
Cooking method	Grilled; roasted; deep fried; steamed; boiled; cooked
Dishes	Main dishes; light meals; snacks; desserts & sweets; drinks
Kind of meal in which taken	Breakfast; lunch; supper; snacks in between; night food
Cultural & religious aspects	Vegetarian vs. non-vegetarian food; kosher vs. non-kosher food; etc.
Cultural perspective	‘Traditional’ indigenous food snacks vs. ‘modern’/western fast food
Type of food (study in Thailand; Nirathron, 2006)	Fresh food; cooked food; food prepared on the street; packaged food; fruits; others
Type of food (study in Bangladesh; Tinker, 1997)	‘wet meals’ like rice meals, some sweets & meal substitutes; dry snacks; ice cream and other dairy products; drinks like tea & juices

### Street Food Vending

The most important locations for street food vending are places, where people assemble in great numbers, in particular markets, bus and train terminals, harbours, university campuses, in front of school grounds and hospitals, and nearby clusters of working places. Furthermore, street food plays a particular role in densely populated living quarters (Nirathron 2006: 27). These public places, thereby, become nodes of informal food distribution networks.

Regarding the ‘visible’ street food trade, an important criterion for distinguishing different vending patterns is mobility. The permanent, static or fixed street food vendors are permanently located at the same site, most often at a tolerated site in public space (Nirathron 2006: 27). Their advantage is a greater stability regarding the time and place of their business and, usually, a higher volume of operation, both in terms of customers and in capital. Mobile street food vendors do not have fixed premises, but move from one location to another (Nirathron 2006: 27). Their advantage is their flexibility, whereby they can access customers at various places at particular times. Importantly, they can often also circumvent problems with authorities. However, there is a limit to the amount of food they can carry due to its weight.

There is a continuum between mobile and fixed vendors (Tinker 1987: 55).



Picture 2: A married couple selling tea, bakery products and cigarettes from a pushcart, which remains permanently in front of Dhaka's Kamalapur Railway Station. Their main customers are rickshaw-pullers and travellers.

Source: B. Etzold, October 2007

Semi-mobile vending units are mobile carts with a stationary place for sale, or semi-static vending units that operate according to specific circumstances, such as the season, Ramadan or special festivities. Moreover, many mobile vendors follow a regular route or push their carts or carry their basket to the same locations everyday.

‘Ready-to-eat food that was carried through the streets by the preparer rather than the purchaser, for eating at home or office, and was not for sale on the street’ (Tinker 1997: 15) is important as well. These ‘invisible street foods’ include contract-catered meals, which are supplied regularly to workers at their workplace or the home of the cook. Home-prepared meals that are cooked by women of businessmen, factory workers or shop owners, are often brought to their respective workplaces by rickshaw-drivers, balance-pole- or basket-carriers in metal containers (tiffins). Although, this kind of food is neither prepared, sold nor consumed ‘in the street’, they play an important role in the informal food system (Tinker 1997: 15; Tinker 1999: 330).

Street food vending is an essential self-employment opportunity for the urban poor. Often run as family businesses, visible and ‘invisible’ street food activities constitute a large section of the so called ‘informal sector’ in megacities, providing the vendors’ households with a meagre income to sustain their livelihoods. While the success of these informal activities largely depends on the webs of social relations that actors have spun and their positions in these informal networks, modes of formal regulation (‘official’ permissions, rules, restrictions, etc.) must not be neglected. Authorities often impede the street food business with the aim of improving food safety and ‘clearing’ public space. Thus, vendors are repeatedly subject to harassments and exploitation by both the police and local muscle men (mastans) (Siddiqui, Ahmed 2004: 363). Facing multiple challenges, from weather conditions and environmental pollution, to rapid economic changes, like food price inflation, and political insecurity, such as police raids, vendors use well thought-out strategies to reduce their exposure and sensitivity. Their own families’ food security depends on their adaptive capacities in times of crises.

### Street Food Consumption

Street food is cheap, tasty and readily available in the megacities of developing countries, making it an important component of megaurban food security. The consumption of street food can either serve as a supplement to the daily diet or as a substitution of home-prepared food. Thereby, the dependency on street food is quite different for various consumer groups: while students and middle-class businessmen



Picture 3: A young worker at the Sadar Ghat ferry terminal eats home-prepared food that was brought to him in a food-tiffin.

Source: B. Etzold, February 2007



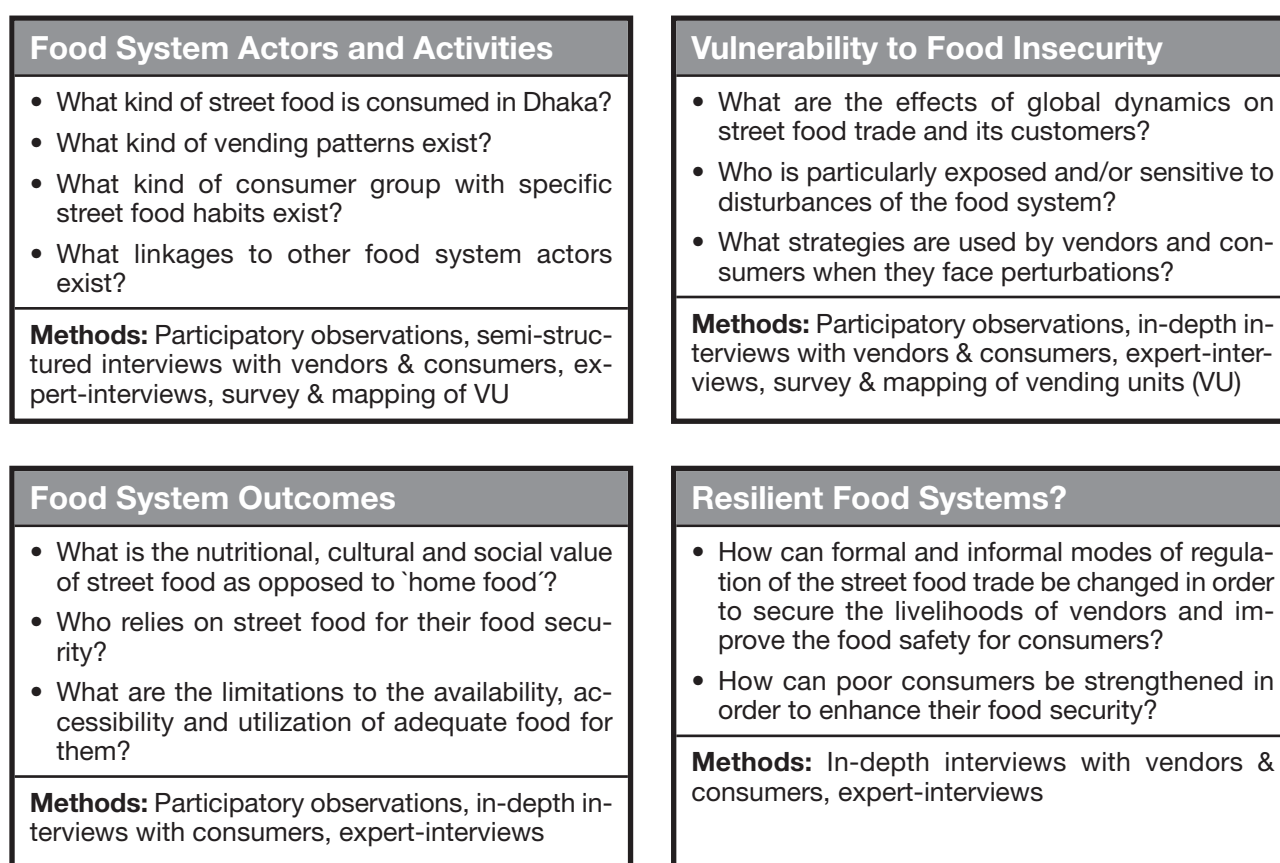
might have similar street food consumption patterns, factory workers, day labourers and rickshaw-pullers not only have other nutritional needs and food preferences, but also, and more importantly, a smaller budget for their food expenditure. Many people in developing countries' cities have no access to adequate food in terms of quantity and quality on a daily basis.

Street dwellers, for instance, often do not even have the assets to prepare their own meals. For them, street food substitutes self-prepared meals. Thus, its consumption becomes their sole provider of nutrients and 'backbone' of their food security. However, due to the often unhygienic conditions of the street food trade, health challenges can arise for its costumers.

## Assessing the Role of Street Food in the Megaurban Food System of Dhaka

While an extensive study about street food was conducted by EPOC in the rural town Manikganj in Bangladesh in the mid-1980s (Tinker 1997: 84), only little secondary data sources exist regarding the topic in the megacity Dhaka. There have been two pilot studies on street food (Consumers Association of Bangladesh 2004; Naheed et al., 2002), which looked at vending practices with a particular focus on public health concerns. However, no study about the role of street food in Dhaka, which draws on a large sample size and gives in detail information on the functioning of the street food trade, as well as on the importance of street food for the food security of the urban poor, exists yet.

In line with the conceptual research framework outlined above and following an actor-oriented perspective, this ongoing study focuses on the following four pillars of enquiry into the role of street food in Dhaka's food system (Fig. 2).



**Figure 2: Four Pillars of Enquiry into the Role of Street Food in Dhaka's Food System**

Source: Benjamin Etzold

Street food relates clearly to a food system's consumption-component. Actors and activities involved in Dhaka's street food trade as well as the related flows of food, money and information within the food

system are examined in a first step. A combination of quantitative and mainly qualitative methods is applied in four selected sites in Dhaka. Then, the exposures and sensitivities of vendors and consumers to external stresses and disturbances, as well as the adaptive capacities of both groups, are analysed. How do they (re)act in times of economic and political uncertainty? At selected sites, food system outcomes under specific sets of economic, political, social and ecological conditions are assessed. The foci lie on the implications for the food security of Dhaka's marginalized consumers and the cultural meanings of street food as opposed to home-prepared food. In a last step, scenarios to secure the livelihoods of street food vendors, to enhance the food security of the urban poor and, thereby, to foster the resilience of Dhaka's food system will be explored.

## Conclusions

Street food has multiple roles in the megaurban food system of Dhaka. Megaurban consumers are connected to food supplies and exchange networks through their consumption of home-prepared food and street food. Street food vendors are important and flexible nodes within these urban food distribution networks. However, as street food vending is a food system activity on the consumer-side of food-supply chains, it is highly dependent on the regulatory mechanisms, such as prizes, governmental legislation, informal arrangements, etc., which are in place in the spheres of production and exchange. Additionally, street food cuts across different spatial scales; rural-urban, national-regional and global-local interactions become visible through this trade.

By utilizing street food vending as a self-employment opportunity, the vendors can secure their families' livelihoods under 'normal' circumstances. In order to do so, flexibility and mobility are vital attributes for their resilience against socio-ecological perturbations.

While almost all sections of the society consume different kinds of street food at different times, less affluent and mobile customers rely more on street food for their food security than others. Therefore, these latter groups are subject to public health risks, which revolve around the hygiene of food processed and sold on the street, to a larger extent.

The integration of aspects of vulnerability and resilience research is valuable in the analysis of megaurban food systems. Thereby, the specific challenges to food security for all Dhakaiyas and opportunities for a resilient food system can be identified. Whether these challenges and opportunities are mainly determined by external driving forces, such as globalization, that are localized in Dhaka, or whether they depend on the internal modes of food system regulation in the context of wider struggles over the governance of megacities, remains to be seen.

## Acknowledgements

I am grateful for the financial support of the German Research Foundation (DFG) within their priority program 'Megacities – Megachallenge: Informal Dynamics of Global Change', and the intellectual stimulus by my supervisors, Hans-Georg Bohle and Wolfgang-Peter Zingel, as well as by my colleague Markus Keck. With their Summer School, the United Nations University's Institute for Environment and Human Security (UNU-EHS) and the Munich-Re Foundation provided a great platform for young scholars to exchange their ideas on vulnerability, resilience and megacity research. I highly appreciate being part of this network.

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## 1.2 Constructing Safety: Unauthorized Housing and Earthquake Vulnerability in Istanbul, Turkey

*Rebekah A. Green*

### Abstract

Many cities in developing nations have experienced an influx of poor migrants in search of work. This population influx has often been accommodated through land squatting, irregular construction and unauthorised housing. For the urban poor, this has resulted in immediate affordable housing; however, this housing frequently has long-term vulnerability to natural hazards. This article examines the ways in which squatters in Istanbul, Turkey, understand the seismic vulnerability of their unauthorised housing. Distrust of professional engineers and contractors has led Istanbul squatters to believe that self-built housing will not only be less costly, but also safer than commercially built housing. This study of squatters' risk perceptions highlights the need for innovative risk reduction strategies in the unauthorised neighbourhoods of mega-cities – strategies that seek to address short-term social vulnerabilities and long-term exposure to natural hazards.

### Introduction

Unauthorised housing – a solution to exorbitant housing costs in urban centres – extracts high costs both from the individual and society. Unauthorised housing often concentrates population growth in marginal areas that have high exposure to natural hazards (Neuwirth 2005; Pelling 2003; Quarantelli 2003; UNDP 2004a). Buildings constructed without formal inspections and designs are also likely to experience extensive damage from natural hazards due to the low quality of their designs and constructions (Coburn, Spence 1992).

This article examines how one population vulnerable to seismic hazard – squatters of Istanbul, Turkey – perceives their seismic risk and acts upon these perceptions. It is based on engineering and anthropological field research in Istanbul's squatter settlements from 2001 to 2002 following the devastating 1999 Marmara earthquakes. It first looks on how rapid development in the second half of the 20th century led to natural hazard vulnerability in many urban centres of developing countries, and Istanbul in particular. This is followed by a discussion of how Istanbul residents' distrust in the formal building market has led many squatters to practice self-building as a means of reducing vulnerability to seismic hazard and housing costs. By assessing the structures in which people actually live, the article juxtaposes squatters' beliefs that they have built earthquake resistant housing with the heightened physical vulnerabilities that have been created.

### Unauthorised Housing in Istanbul, Turkey

The second half of the 20th century witnessed the largest growth of urban populations in the world's history. Population growth in urban centres of rapidly industrializing countries has characteristically been among the urban poor. As Ravallion (2001) finds, the poor urbanise at faster rates than the general population. Drawn by the rise of the industrial and service sectors, these newly arrived urban residents' primary sources of income has been from low-paying jobs with wages that are close to basic food security. This often necessitates cost savings in the area of housing (Neuwirth 2005; Shatkin 2004; Turner 1977). One prominent method of reducing housing costs has been to reduce dramatically or eliminate costs associated with obtaining land and permission to build upon it. Squatters often further reduce housing costs by engaging in self-construction outside the formal housing sector. Self-construction eliminates the costs associated with for-profit building contractors, municipal building permits, professional engineering and architectural design. Because of these considerable cost savings,



unauthorised building channels, once considered a transitional form of construction, appear to be more permanent than the state controlled channels they evade.

Istanbul, Turkey, serves as an example of a city with heightened vulnerability to natural hazards due to sustained rapid unauthorised growth. Between the years 1930 and 2000, Istanbul grew from 800,000 residents, to a teeming modern metropolis of ten million – a growth brought on by waves of urban migration from Turkey's rural peripheries (Merkezi 1997). As housing shortages increased, migrants began to build shanty towns. During the 1950s and 1960s, the inner core of middle and high income districts along the Marmara Sea and the Bosphorus coast were surrounded by a proliferation of unauthorised housing – structures made out of tin, plastic, discarded construction material and adobe that had been built by new migrants and other low-income residents (Keles 1990).

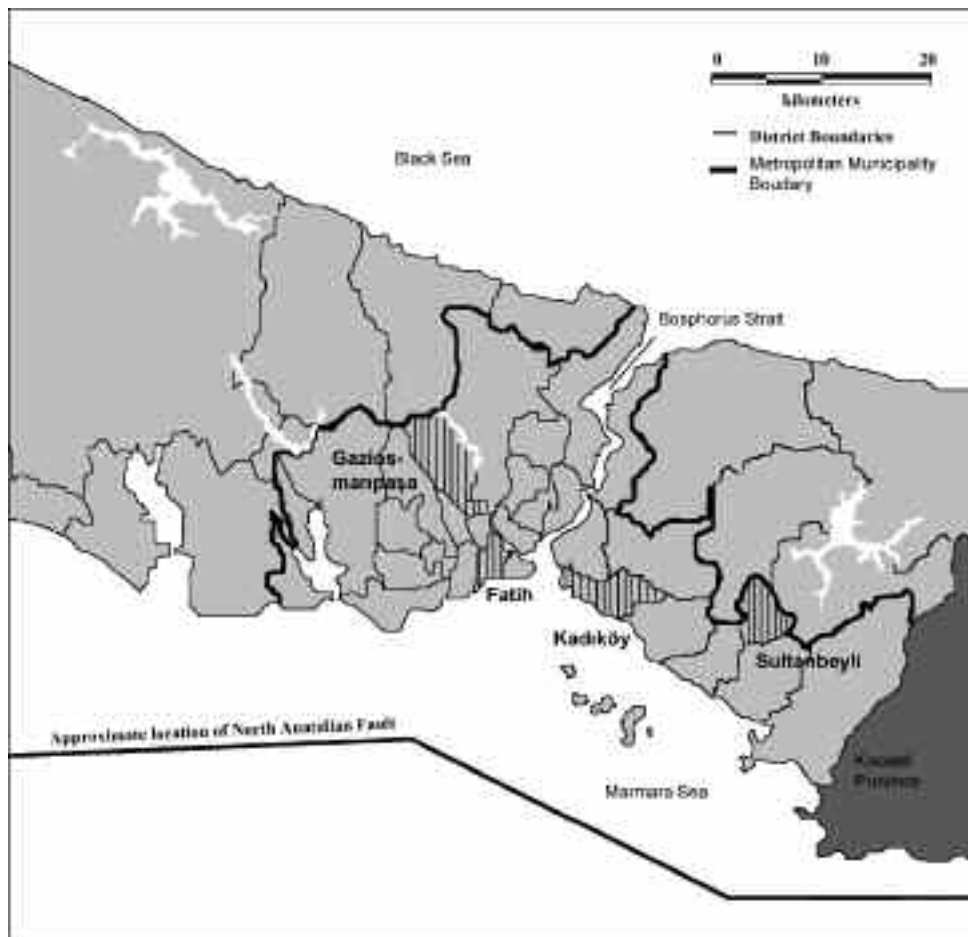
Early attempts to demolish these shanty towns did little to curb the growth of Istanbul's unauthorised housing market (Gulati 1985). Unclear land tenure rights following the fall of the Ottoman Empire encouraged illicit sale and unauthorised development of land (Heper 1982). Moreover, skyrocketing inflation, an uninsured banking structure that was unable to finance home mortgages, and an ineffective or non-existent social safety net turned residents of Istanbul to land speculation that fuelled construction in the unauthorised sector (Baharoglu 1996; Oncu 1988). By the 1970s, the rising land value in unauthorised shanty towns facilitated a transformation of the urban landscape. Shanties were demolished by the squatters themselves and replaced by mid-rise, reinforced concrete apartment blocks (Merkezi 1998), built primarily by small, one-man construction companies and self-builders on the contested land of unauthorised settlements (Oncu 1988).

The issue of building stock vulnerability came into sharp focus when the 1999 Marmara earthquakes struck provinces just to the east of Istanbul. These two earthquakes led to a region-wide disaster that resulted in close to 20,000 deaths and more than 54,000 damaged buildings (Erdik 1999). Documented under-strength concrete, inadequate reinforcement detailing, land use violations, and substantial post-construction modifications of buildings contributed to this unexpected level of damage (Gulkan 2000; Sezen et al., 2000). The high damage levels and loss of life vividly illustrated how Turkish building practices during years of heavy urban growth resulted in cities that were vulnerable to earthquake-induced disasters (Gulkan 2001).

Reconnaissance reports like the ones following the 1999 earthquakes have helped to document the fact that housing built during a period of rapid development poses a great threat to human life during earthquakes. Yet, Istanbul residents have continued to live in vulnerable, unauthorised housing and even continued to construct unauthorised housing following these earthquakes. To understand the continued production and use of vulnerable housing, careful attention must be paid to the ways in which residents perceive the threat of earthquakes and the safety of their homes.

## **Methodology and Research Sites**

This article draws on two years of field research undertaken from 2001 to 2003 that examined how perceptions of earthquake risk shape the strategies people use to reduce their vulnerability to this natural hazard. The research consisted of eight semi-structured interviews with professional engineers followed by 45 semi-structured interviews with residents of four Istanbul districts shown in Figure 1. Residents were asked to participate through door-to-door solicitation using a purposeful random sampling technique; each interview lasted approximately 45 minutes. When an interview was conducted in a respondent's home, the interview was followed by a visual screening of the home for physical vulnerability to seismic hazard based upon an adaptation of Rapid Visual Screening of Seismically Hazardous Buildings (Applied Technology Council 1988) and a locally produced Earthquake Structure Risk Test (Istanbul Technical University 2000). Further details on methodology can be found elsewhere (Green 2008).



**Figure 1 Districts Selected for Survey**

Source: Author, based upon Erdik et al. (2003) and Metropolitan Municipality of Istanbul (2004)

The neighbourhoods studied were selected because they had similar estimates of seismic intensity (European Macroseismic Scale VII-VIII) in a probable future earthquake (Erdik et al., 2003), but varied in terms of building stock legality. Structures in two of the districts, Fatih and Kadikoy, were built predominantly during the 1970s through the formal housing market. The remaining two districts, Gaziosmanpasa and Sultanbeyli, were considered sites of primarily unauthorised squatting and construction.

### **Risk Perception and Unauthorised Construction in Istanbul**

An analysis of the 45 resident interviews clearly documented widespread distrust of the construction process. Residents across all four districts uniformly believed that construction in the formal housing market was dominated by contractors who were considered ignorant and apt to steal. Respondents assumed that outward appearance and the reputation of the contractor or engineer were not reliable indicators of a building's earthquake resistance, reflecting the belief that those involved in the design and construction trades could not (or would not) use their positions to construct seismic resistant housing impartially for everyone. Many of the respondents assumed that most buildings had not been constructed according to building codes, inspection procedures, and construction standards that would ensure their safety. Some further assumed that even well qualified and experienced contractors and engineers would produce buildings of widely varying quality, including buildings that did not conform to Turkish earthquake design and construction standards. These perceptions are not without reason. The provincial government estimates that over 80 per cent of all buildings in Istanbul have been pardoned for not conforming to city plans and close to half of all buildings were constructed without permits (Sonmez 1996).

In the unauthorised districts of Gaziosmanpasa and Sultanbeyli, distrust of professional builders and professional designers was at its most extreme. Residents in these districts had turned to self-construction as a means of reducing their involvement in what they perceived as a corrupt formal housing market filled with profiteering contractors, engineers and municipal building departments.

Table 1 tabulates the level of participation in construction reported by residents who were surveyed. Respondents were categorized as participating in the construction of their homes when they or their families had acted as labourers or construction overseers during the construction process. Both types – builder-occupied and commercially built housing – are present in all districts. However, instances of construction participation were highest in the rapidly expanding squatter district of Sultanbeyli, where 80 per cent of the residents interviewed lived in a building in which they had actively participated in the construction process.

**Table 1: Percentage of Respondents Participating in the Construction of their Home**

District	N	Participated in construction	Did not participate in construction	Average monthly household income in US\$ (1987)*
Kadikoy	11	8 %	92 %	450
Fatih	11	18 %	82 %	340
Gaziosmanpasa	12	55 %	45 %	240
Sultanbeyli	10	80 %	20 %	230
AVERAGE	44	40 %	60 %	320

Source: Author and Sonmez (1996)

\* Sultanbeyli was not a legal municipality at the time; income for a similar neighbouring municipality (Kartal) is included as reference. The last line indicates average monthly income for all legally recognized municipalities of Metropolitan Istanbul in 1987.

Many self-constructors in Gaziosmanpasa and Sultanbeyli reported purchasing materials and physically performing the construction themselves with the help of family members. This process was most appealing to families that had low financial resources, but many strong members who were able to and experienced with carrying out the demanding physical tasks associated with reinforced concrete construction. When one man was asked how he determined material type and sizing for his unauthorised home, he replied, 'We do the building's calculation [ourselves]. I mean, we have graduated from primary school, so we understand and can do a few things'.

When financial resources permitted, families reported hiring extra help, typically day labourers able to assist in the tasks of steel detailing and concrete pouring. However, even when labourers were hired, self-builders often eliminated contractor overheads by acting as their own construction manager. Mocking the formal construction process, a Sultanbeyli herb seller explained, 'In general, the buildings around here are not done by saying, "Let me get an esteemed architect to draw something up; let me have this approved; let me call so and so and have them inspect it." It's not like that around here.' Rather, he explained, the choice of local construction workers and contractors was based on recommendation. 'If I'm going to do a house here, I go to the owner of this building here and ask him who did it, who was his foreman, who was his form worker, and who was his iron worker. He recommends them to me, and I go find the men. The foreman draws up the plans himself. He does a nice job' Self-building and self-management strategies reduced costs by eliminating architectural or engineering firms that would design the building to ensure that it met governmental standards of construction. For residents of unauthorised housing, this omission was seen as financially advantageous. A Sultanbeyli resident who had managed the construction of his own home and worked as a realtor of unauthorised housing units

spoke about new construction, explaining that 'engineers or professional contractors around here would increase the construction costs for an average guy one, two, maybe three times'. Many self-builders considered engineers external to the construction of their homes and believed they could well be cheated by them. Thus, by eliminating engineers from the construction process, residents in these informally constructed neighbourhoods believed that they were lowering construction costs.

Financial concerns were not the only justification residents gave for self-construction of their homes. Residents of the unauthorised settlements surveyed considered strength, especially earthquake resistance, a primary criterion for good housing. A squatter whose extended family had built their own three-story reinforced concrete building stated that strength was a primary concern 'because we were going to live here ourselves'. While many residents of unauthorised housing believed that earthquake resistant housing was important, they did not trust the professionalism of engineers.

In analyzing statements residents made regarding engineers, half of the negative statements made regarding engineers indicated that they believed an engineer's involvement in the construction process would not improve the robustness or seismic resistance of their homes. Some respondents were concerned that engineers did not have technical knowledge, or if they did, that they would not share it with residents. Others discounted the knowledge of technical design that engineers learn in universities, believing that engineering design and oversight would undermine the tacit knowledge of local construction workers and master builders. One Sultanbeyli resident stated, 'When [design] engineers are no longer part of the process, the building becomes a bit stronger. The other people started working with construction from childhood. They are the people who understand'. A Gaziosmanpasa resident who worked in the construction trade summed up his experience interacting with engineers on formal construction sites saying, 'When engineers and contractors do the work, they do it poorly in order to make it come out cheaper'. This view was held by many respondents who had not employed an engineer in the design or construction inspection of their buildings, but who based their views on stories they had heard or experiences they had as construction workers on formal construction sites.

Residents in unauthorised districts perceived that they were decreasing their risk by building their homes themselves. They believed that managing or eliminating design and construction professionals was an effective means of reducing the physical vulnerability of their homes and, thus, an effective means of reducing their exposure to seismic risk. The resulting construction was perceived as more, rather than less, earthquake resistant. In the formal housing districts of Istanbul, the local term 'gecekondu' was used to signify housing that was not only illegal, but of poor quality and undesirability. However, in the unauthorised housing districts this term was often used proudly to signify a house had been more carefully constructed. Indeed, unauthorised construction indicated a building of higher earthquake resistance because those who built the house would use it themselves. This perception was so strong that of the nine people in Sultanbeyli and Gaziosmanpasa who had moved since the 1999 earthquakes, five had moved into what they considered to be small-scale, earthquake resistant, unauthorised construction in order to protect themselves and their families. While residents in these districts disagreed on necessary construction details and the employment of design engineers, there was considerable agreement that owner-occupied gecekondu construction signified better housing. In both Sultanbeyli and Gaziosmanpasa, the oft repeated statement 'gecekondu is better' summed up both a low-cost home building technique and a seismic risk reduction strategy. A discussion of the physical vulnerability of unauthorised construction can be found elsewhere (Green 2005, 2008).

## **Earthquake Resistant Homes, Earthquake Resistant Cities**

In Istanbul, as elsewhere, self-built housing helps alleviate high living costs for the urban poor, but poses a serious challenge to the reduction of urban vulnerability to natural hazards. The drivers of illegal construction and squatting – poverty, macro-economic instability, urban migration, and hierarchical social relations – make it attractive, and in some instances, the only option for low-income urban residents (Ab-

bott 2002; Van der Linden 1997). Yet, in alleviating short-term social vulnerabilities associated with poverty, residents of unauthorised settlements also become vulnerable to long-term risks associated with natural hazards and environmental degradation. Addressing both the short and long-term, physical and social vulnerabilities pose a challenge to the development efforts in mega-cities across diverse social and physical settings.

While the root causes of unauthorised housing need to be identified and ameliorated (Garau et al., 2005; UN 2005), the physical vulnerability of urban unauthorised housing to future natural disasters must also be immediately addressed (Pelling 2003; UNDP 2004a). To do so, reduction of physical vulnerability must be framed within the reality of urban poverty and self-building practices. Urban poverty often limits the ability of residents to amass the capital necessary to construct formal housing. Building permits, bribes, and design and inspection payments add to construction costs, as do requirements to complete construction within limited time frames. Self-construction allows residents to engage in progressive construction as financial resources become available. It also allows them to act as construction managers, contractors, or even labourers, further reducing construction costs. As shown in this study, these financial realities are further reinforced by a perception that formally constructed housing is less earthquake resistant because it is constructed by someone interested in profit. Together, this promotes self-built, unauthorised construction as a primary solution to both the urban housing crisis and the threat of future disasters.

In this complex context of social vulnerability and risk perception, risk reduction efforts in poor urban districts can most readily be achieved by complementing self-builders' desires to build earthquake resistant housing for their families. In Latin America and the Middle East, seismic resistance demonstration projects, model blueprints, training programmes, and partnerships with local builders have been effective in improving the seismic resistance of traditional and rural construction (Coburn, Spence 1992; Petal et al, 2008; Dudley, Haaland 1993). Others have used participatory planning approaches to address urban vulnerability to meteorological hazards (Allen 2003). These strategies can also be used to help reduce urban vulnerability to geophysical hazards. Today, residents of unauthorised neighbourhoods are active agents in shaping the vulnerability of urban centres. By taking into account both the constraints on their lives and their perceptions of risk, efforts can be made to help self-builders become active agents in effectively reducing the vulnerability of cities, such as Istanbul, to natural disasters.

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## 1.3 Socio-Spatial Transformations and the Urban Fringe Landscape in Developing Countries

Adedayo Adesina

### Abstract

The recent upsurge in urban growth and decentralization of economic activities has made urban fringe a topical issue in both local and international debates; however, the problem, once visible in the city center, has moved to the suburbs due to globalization forces that culminated into megacity development. There have been lots of transformations in the urban fringe landscape in the last two decades that make it highly vulnerable to risks as much as expected of the city itself owing to large agglomeration of people and economic activities in this area. Lack of dependable institutions and absence of government have caused problems on jurisdictional administration of these urban hinterlands. The boarder line between urban and rural landscape is called the urban fringe. Often, conflict zones with neither rural nor urban features lie outside the corporate existence of the city. Because of proximity to the city, it experiences much of urbanization processes and serves as a buffer for urban development. One prominent force that shapes urban fringe landscape in the developing countries is the informal sector activities, and these constitute about 65% of the urban economy. Informal sector response to the failure of urban governance has various dimensions. Notable among them are the uncoordinated residential development, emergent transition in demographic re-agglomeration different from the hitherto initial population and restructuring of economic activities at the fringe areas. This paper is a part of a larger ongoing study on urban fringe structural characteristics in developing countries and Ibadan-Nigeria, in particular. It, therefore, espoused ways towards mainstreaming risk reduction and vulnerability in the area. It also examines the attendant role of informal sector activities in shaping the urban fringe environment and impact of globalization forces on the urban fringe local landscape with a view to fill the gaps in the areas of urban vulnerability, governance and planning in developing countries.

### Introduction

More than half of the world's population lives in areas that are classified as urban. In developing countries, a substantial and growing proportion lives in or around metropolitan areas and mega cities, including the zone termed the 'urban fringe', where their livelihoods depend to some extent on natural resources, such as land for food, water and fuel, and space for living (*Department of International Development* (DFID) 1999). The population pressure means that resources in such zones are often overexploited. Although heterogeneous in its social composition, the urban fringe constitutes the habitat of a diversity of populations, including lower income groups that are particularly vulnerable to negative externalities of both rural and urban systems. These include: risks to health, life and physical hazards related to the occupation of unsuitable sites; lack of access to clean water and basic sanitation; poor housing conditions. Environmental changes also impinge upon the livelihood strategies of these communities by decreasing or increasing their access to different types of capital. Meanwhile, growing environmental and social problems are also concentrated in urban suburbs with some of the highest population densities in the world. Concentrations of the economic, social, political and administrative organs of a nation or region in mega cities have made them magnets for rich, as well as poor, households.

Nigeria has been experiencing a great transition from rural to urban oriented economies. This has been accompanied by the increasing mobility of production factors such as capital, labour, technology and information, to the urban fringe near the megacities Ibadan, Lagos, Kano, Benin, Aba, Kaduna etc., following the wide spread beliefs that urban fringes are fashionable areas in urban literature, especially in developed countries. Empirical studies have revealed a contrary view regarding the fate of cities in

developing countries (Dupont 2005; Adesina 2004). The United Nation-Habitat report (2005) has indicated that in the year 2025, 61% of the 5 billion world population will be urban, and most megacities will stand in what we call the 'south clusters'. About 85% of these developments will occur at the urban hinterlands. Because of proximity to the city, and urban bias nature of development policies in Nigeria, the zone experiences much of urbanization processes and serves as buffer for future urban development. Their growth provides opportunities even as their spread 'eats' into farmland and open space. Thus, the area is highly vulnerable to various risks as expected of the city itself. Lack of dependable formal institutions and absence of governance have caused problems on jurisdictional administration of the urban hinterlands.

The following questions have been posed to address these issues: Is there any impact on structural characteristics of the urban fringe of a megacity? What is the risk potential associated with these transformations? What are the informal sector responses to the failures of urban governance? What are the socio-ecological impacts of these transformations on the urban fringe political economy? Although the effect of distance to the city center has been minimized by the advent of high technology development in information and transportation system, over 55% of urban dwellers in Ibadan still commute daily to the city center for various activities. Given the persistent spate of urbanization trends in most developing countries over the last two decades, urban fringe has begun to assert its influence on cities as a viable zone for regional economy and development. The vulnerability of the urban fringe to different risks is conceptualized within the context of man-environment interaction and the ability of individuals and social groups residing in this zone to respond, cope with, recover from and adapt to any external stress 'surprise' placed on their livelihoods and well-being as resulted from urbanization process. This paper places the socio-economic well being of the area at the center of the analysis by focusing on the socio-infrastructure and institutional constraints that limit the capacity of suburbanites to respond to the emerging transformations in the zone. It also highlights the role and nature of the informal sector with a view to fill the gap in the area of vulnerability and resilience building in the city.

## **Conceptualizing Urban Fringe Vulnerability Issues**

Most theoretical constructs on urban fringe and urban growth have evolved primarily in the context of American cities. Burgess (1925) suggests a concentric settlement pattern in Chicago, which was termed the urban classical model. Albeit this conceptualization, there are different forms of critics ranging from the static to dynamics urban theorists. In spite of the multitudes of generalization, there is no theory that addresses urban fringe issues hitherto. However, Wehrwein (1942) opined that urban fringe is a Twentieth Century phenomenon that needs to be conceptualized within the prevailing regime. The economics and human ecological analysis of urban structure provided a number of elements explaining the locational behaviour of household in the city. A model based on the theories of von Thunen and Losch (1966) defined neighborhood by distance showing how identical activities would emerge at similar locations due to market forces leading to hierarchies of activities both within and amongst regions. Ecological thought is evident in the concentric theory of Burgess (1925); the model initially analyzed the expansion of the city and then discussed the processes of urban metabolism and mobility, which are closely related to expansion and succession.

Hoyts' (1939) main argument was that different income groups tend to live in different areas, and instead of occupying entire rings around the Central Business District (CBD), they sectorized around it. Thus, there are well-defined, sector-shaped, high-income areas adjoining on one or both sides by middle-income areas. The theory is applicable to the urban fringe demographic structure if there are truly differences in city dwellers and the suburbanites. The concept of multiple nuclei was expanded by Harris and Ullman (1945). They observed that the nuclei are either pre-existing agglomerations, which later becomes a development node, such as location of industry in the suburb, or a transit village that serves as a bulk breaking point for merchandise. As the area between them becomes filled through urban growth, or

new centers emerge from the need for certain type of services, the size of the urban area increases forming what is known today as the megacity. Many cities in the developing world follow somewhat of a different pattern, particularly in the sub-Sahara, West Africa. This has, however, made a clear case for the reversal of the concentric model of Burgess (1925). Cities where this pattern exists are referred to as pre-industrial (i.e. they are primarily administrative or for religion centers as at their time of initial founding and growth). In such cases, the central area is the place of residence of the elite or upper class, usually kings, paramount rulers or religion leaders. The poor live on the periphery or city fringe zones. Unlike most cities in the developed countries, social class is invisibly related to distance from the center of the city. Hence, the fashionable suburb is evident at the urban fringe areas in contrast to what is applicable in the developing world.

Further studies on urban theories have identified the importance of the eclectic approach to urban issues. These developments have relevance in the conceptual understanding of urban fringe vulnerability, the integration of the global marketplace, deindustrialization, decentralization, counter-urbanization and the globalization effect. The concept of social vulnerability has been an important theoretical topic in global change research for more than a decade (Bohle, H.G & Dowing 1994); recent research in social theory have shown a link between resilience and vulnerability. If urban fringe development is conceptualized as an inherently dynamic process from both social and ecological systems, then the level of vulnerability in the area will increase in direct proportion to the reduced level of resilience from urbanization process. Geography's traditional concern with inter-relationships between people and the physical and social environments provide the basis for this concept in urban social geography. People create urban spaces, which draws its character from the people who inhabit them. As people work and live in urban space, they gradually impose themselves on the environment, modifying and adjusting it to suit their needs, explained by sociospatial dialectic. Indeed, an important aspect of urban fringe morphogenesis, which must be seen as more than the sum of detailed processes of urban expansion and reorganization, is the concept of vulnerability. Neighborhoods and communities are created, maintained and modified; the value, attitudes and behaviour of the inhabitant, meanwhile, cannot help but be influenced by their surroundings and the values, attitudes and behaviour around them.



**Figure. 1.1: Map of Ibadan Metropolitan Fringe Area**

Source: Field Report (Adesina 2003)

## Managing Transformations in Ibadan Metropolitan Fringe Area

The urban fringe in Nigeria has been undergoing substantial changes as housing and land markets develop and socioeconomic stratification rises. This zone, for instance, is experiencing a revitalization of employment and economic activities. Many residents have moved to this area from the central city even though density there remains much lower than the city core. Accompanying such moves is industrial suburbanization that characterized the global economy, aided by the development in *Information Communication Technology* (ICT) at the wake of Twenty-First Century. As a result of selective real estate development, the urban fringe is often an awkward juxtaposition of flashy commercial or residential high-rises mixed with aging neighborhoods and dilapidated rural dwellings. The recent influx of a large number of residents to the fringe zone added a new element of complexity to the ongoing spatial restructuring in the Nigerian urbanization processes. Increasingly, new immigrants and minorities are either starting out in suburbs or moving to suburbs.

This change in the settlement pattern of minority groups creates new social and political challenges for suburbs. In some cases, the suburban system is reflecting racial and income segregation mirroring urban socio-economic structures. In addition, a vast array of religious and cultural institutions are finding their ways into the suburban landscape. Beyond demographic work, descriptive work has been done on the dynamics of minority, immigrant and indigenous cultures, such as native and foreign nationals establishing themselves in the suburbs. There has been an increase in the number of non-natives in the fringe area as employment decentralization from the city center increases migration of labour forces. Anchoring on this is the building of resilience amongst suburbanites, which largely depends on local social networks mostly in informal settings. Ibadan, a traditional urban center in southwestern Nigeria, is a good example of megacity development in sub-Saharan Africa. The city, as the seat of western government in the 1960s, transformed from the administrative role to post colonial urban center. The demographic composition is heterogeneous; this is as a result of spate of developmental project and institutions present in the city. Amongst them are the premier University of Ibadan, *International Institution for Tropical Agriculture* (IITA) and a host of indigenous industries in and around its hinterland. Residential distribution appears to coincide with the trend of local population decentralization in the areas. This distribution pattern is not accidental, as migrants are attracted to different parts of fringe for different reasons. Recent analysis shows that the best predictor of resident concentration is employment opportunity, including the number of economic activities and land market systems in the fringe areas. A meaningful study of this area involved bringing people with different values, aspirations and place together; this may provide an in-depth searchlight to the science of social vulnerability and resilient building in the urban fringe.

## Informal Sector and Urban Fringe Landscape

The structural adjustment programmes and austerity measures instituted in the last two decades across most of the African continent had diverse and profound consequences for the countries concerned. One of the most significant developments – arising partially as a response to the diminished role of government's vis-à-vis employment and social services – has been the proliferation of economic activities, which are not incorporated within the formal market structure. These activities have come to be classified as those of the informal sector, giving rise to a conceptual dichotomy between formal and informal sectors of respective economies. Despite Nigeria's overall unprecedented record of urban growth during the last two decades of reform, social disparities between urban and rural areas, as well as regional imbalances, remain large. Such disparities are a key driving force behind the country's largest tide of suburbanization in most recent time. The definition of informal sector is too well known to delay the findings, as it can be seen in table 1.1. (Abumere 1998; Bromley 1978; Feige 1990). What are perhaps of greater relevance are the aspects of the informal sector that impact the urban fringe landscape and expose it to various risk. Meanwhile, it is important to point out that the level of the urban informal sector in most developing countries, especially Ibadan-Nigeria, is very large, usually weakly developed with



low level of investment (Abumere 1998). The large size can be explained mainly in terms of failure of socioeconomic policies of the Nigerian government. It is also probably a stage of development phenomenon since the level of the sector is inversely correlated with the level of development no matter how it is measured (Miller 1994; Abumere 1998).

**Table 1.1: Categorization of Informal Sector Activities in Urban Fringe**

S/No	Classes of Enterprises	Informal Sector Activities
I	Processing	grinding, milling, dyeing, leather works
II	Repairs	bicycle repairing, watch repairing, electronic and G.S.M phone repairing
III	Personal Services	laundry, cloth washing, barbing, shoe-shining, nail cutting hairdressing, photography
IV	Agricultural Services	butchery, animal feedmills, fish ponds, poultry
V	Trading and Other Services	trading, hotelling, potters, painting, art and design, video clubbing, game houses, building materials, stores
VI	Technical Services	mechanics, battery charging, panel battery, vulcanizing, electrical works, welding, carpentry, baking
VII	Artisan and Craft	furniture, tailoring, printing and publishing, music vendors, mirror making, knitting, goldsmith, embroidery

Sources: Mabogunje 2002 modified by the Author

As shown in table 1.1, urban fringes informal activities are to be found in a wide range of economic activities. There is heavy reliance on family or friends for capital to improve business and the relatively large proportion of low level education (mostly primary education or less) among informal sector workers. Elsewhere in many developing cities, informal settlements have been the principal features of the urban fringe landscape, many of which are never fully integrated and later become a nucleus to the shanty urban landscape. Congregation of migrants in urban fringes also aggravates existing socio-spatial segregation and is a major influence on urban spatial development. On the other hand, some new migrants choose to live in concentration of ethnic or economic groups to help maintain previously established social relations networks and assert their group identity. They bring with them informal channels for the flow of capital, skills, and social connections that can improve their economic opportunities and living experiences in cities. All these make the zone very susceptible to risk and call for urgent attention.

## Governance and Social Administration

Suburbs are mimicking the city in many ways, not the least of which is the formation of a new landscape of segregation and separation. In the central city, the use of price and zoning creates exclusivity. In the urban fringe zones, segregation had to be re-invented in a spatially less controllable frontier. The gated community is one form of new spatial arrangement of people by race, class and social orientations. This new formation and its many manifestations, from a new form of zoning and land use exclusions to new ways of attracting people within similar interests and discouraging others, make the area vulnerable to many social vices. A number of policy changes and social forces have played a significant role in this direction. For example, most Nigerian policies on the informal sector have not enhanced the access to urban opportunities by enabling participation in decision making. The policies, rather, improved access to credit, thereby increasing the number in a geometrical proportion. Reliable estimates put the record as of 2002 at 68% of people in the sector get credit and capital through an informal social security network, albeit the recent microfinance policy of the World Bank and recent market re-capitalization of Obasanjo's regime in Nigeria. Given the low level of investments in informal sector from

government, workers in the sector will for a long time remain at the margin of the urban society, unable to contribute meaningfully to urban development. Therefore, building resilience against disaster is a hideous task. As a result of these developments, there are informal arrangements of maintaining social relation in the urban fringe; this is enhanced by zero level of anomie as opposed to city center and also bridging the social gap through local actors, such as resident and landlord association in the area. What then, can be done towards mainstreaming risk and vulnerability in this area? This question is very relevant to many third world countries with large informal sectors and failure of state in urban governance. The gradual erosion of local social networks in the fringe areas needs to be tackled. Local actors (landlords, youth movements and residents association) help a lot in building resilience and reduction of risk. Side-by-side with the accelerating pace of suburbanization, the urban fringe has also experienced processes of socio-economic, cultural and political change, which bear directly as factor, arena and context on the challenges of governing the urban space and the urban experience.

The quest for broad-ranging political reform across Africa is among the most significant of processes shaping and defining the context of urbanisation and governance. The reform began in the late 1980s and around it the struggles continue to crystallize. Various experiments in decentralization, devolution and local-level administration impinge directly on the content, structure and quality of the city governance irrespective of the reasons for which they were undertaken. The examples are manifold. Taxation and representation in the city administration have been reformed and experiments in the creation of autonomous agencies, as part of new public sector management approaches, have been put in place. The emergence of non-governmental organizations, community-based organizations, and neighbourhood associations have become an active part of city life and play a role, either formally or informally, in the overall governance of the urban space. Serious problems of economic accumulation carry consequences for urban livelihoods. These problems are issues of employment, income distribution and equitable access to resources. The intensifying demographic shifts also make the urban fringe a site for the reproduction of youthful population. Other growing problems are those of environmental sustainability, which also bear on the quality of livelihoods, and the challenges of balancing urban policy and security of citizens with respect to civil liberties and human rights.

Institutionalizing local governance and the role-played by resident/ landlord association in producing urban spaces that are public, but not open to all, and private, but open to many co-residents, is a major task in this respect. The challenges of resilient building at the urban fringe in the face of massive population pressure has produced, across the continent, new poles of marginality and exclusion, side-by-side with new market niches and a sprawling informal sector. The crisis of agricultural production, arising partly from the flow of population from the rural to the peri-urban and urban areas, has also produced new problems of food security, which the emergence of urban fringe and city farming by individuals and households has not always been sufficient to overcome. Earlier settlers confront new populations settling in expanding urban settings with claims of indigeneity. This often carries implications for all aspects of their rights and often results in violent communal conflicts. With existing infrastructure either in a state of decay or not expanding quickly enough to accommodate growing populations, the pace and quality of life in most Ibadan urban fringe is called constantly into question (Adesina 2004). The weakened capacity and reach of the state means that whole swathes of the urban fringe are not covered (adequately) by the apparatuses and agencies of government at all levels, leaving such spaces to self-constituted local security guards and all sorts of informal administrative brigades that arrogate to themselves powers of 'taxation' and policing.

## **The Urban Fringe Environment and Informal Sector Activities**

Problems related to the growth of cities and the concentration of populations in large metropolitan areas represent huge challenges for modern societies. Economic growth drives urban expansion in the form of construction of businesses, dwellings, roads, leisure centers, etc., and the metropolitan regions

face the growing problems of urban sprawl, a decline in natural vegetation, wildlife habitats and agricultural land. The replacement of undeveloped land by residential and commercial development continues at an unprecedented rate. The urban fringe is subject to a wide range of ecological transformations and flows that originated within and outside its domain. Most of the changes are driven by the proximity of urban areas (land conversion and new developments, market opportunities, flows of people, waste, labour, goods, capital, etc.); nevertheless, the sustainability of the natural resource base and quality of life in the fringe areas, also affected by the linkages, are maintained within their rural hinterland and, in general, with the use and appropriation of natural resources and environmental services.

From an environmental perspective, urban fringe areas face two main challenges and the relationship between the two seems to be a key point for the design of strategic *Environmental Planning and Management* (EPM) that benefits the poor and enhances the quality of life for sustainable development of the particular area. The first set of challenges is related to the environmental conditions of the urban fringe as the living and working environment of a large number of people in developing countries. One prominent feature in the Ibadan urban fringe area is the impact of the informal sector activities on its landscape. Although heterogeneous in its composition, the area constitutes the habitat of lower income communities, which are particularly vulnerable to negative externalities of mixed land use systems. This includes risks to health and life and physical hazards related to the occupation of unsuitable sites, lack of access to basic infrastructure and poor housing conditions.

The second challenges are linked to the sustainability of the regional extraction patterns of renewable and non-renewable resources of urban fringe ecosystems, and to the minimization of the transfer of environmental costs from rural and urban systems to 'no man's land' the urban fringe. The area is subject to many competing interests without any adequate institutional framework to strike balances that might contribute to relieve poverty, protect the environment, maximize the productivity of human and natural resources, or draw synergy from urban and rural relationships. Therefore, the vulnerability of both urban and rural areas can be dramatically affected by the dynamic and changing flows of commodities, capital, natural resources, people and pollution taking place in the fringe area. For example, land is the main source of livelihood for many living in the area. Yet, as land prices rise, poor people are priced out of even the less desirable areas by middle-income earners. The poorest are often forced into temporary settlements as urban fringe land is lost to urban residential development. The same happens to subsistence farming and the cultivation of high value produce. Disputes over access to and control over land often give rise to social conflict and spiraling violence. In Africa, land conflicts are compounded by clashes between formal and informal land right titles. The urban fringe poor depend, to a greater extent, on access to natural resources than do wealthier, urban-based groups. Consequently, they are adversely affected when these resources are lost or degraded by influxes of people from expanding urban areas, solid waste disposal and untreated liquid waste from residential and industrial areas. This could also lead to environmental health risks.

## Conclusion

The challenge of increasing resilience building and vulnerability in urban centers is essentially a developmental question; disaster risk reduction policy is a wise investment. There is no gainsaying that urban fringe is highly vulnerable to various risks that could be anticipated from urban development processes and prevented through adequate planning. Since the informal sector constitutes the bulk of urban fringe economy, programmes, which ignored the sector, can hardly succeed. Summarily, there is need for a new thinking and paradigm shift in the conceptualization of urban vulnerability and resilience issues in developing countries. Within the context of urban sustainability, we need to realize that social vulnerability and resilience building in urban centers are not isolated events, but rather outcomes of the urbanization process, suburbanization and urbanism embedded in contemporary urban development

processes. In both spatial extent and demographic characteristics, the cities have continued to grow without form, order or organized direction. While mechanisms and consequences of growth are not well understood in most cases, city expansion is surreptitiously encroaching into immediate rural hinterlands, thereby overwhelming the natural environment with serious implications for the economic base, socio-demographic characteristics, health and well being of communities at the urban fringes and even further. The paper, therefore, concludes by articulating views on programmes aimed at empowering communities and suburbanites in building resilience to shock and surprises, and to ensure that urban informal activities do not unwittingly increase vulnerability to these hazards. Consequently, sustainable livelihoods need to be achieved in the context of reducing vulnerability and enhancing resilience as a new approach in urban development.

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## **2. SECTION**

### **ECOLOGICAL AND SOCIAL RELATIONS IN MEGACITIES**

## **2.1 Access to Healthcare in the Fragmented Setting of India's Fast Growing Agglomerations – a Case Study of Pune**

*Carsten Butsch*

### **Abstract**

The ability to cope with ill health in India varies significantly between socio-economic groups. Although India was a precursor of primary health care, its public health sector is in a poor condition. This holds especially true for cities expanding at a fast pace, which in most cases exceeds local governments' abilities to adequately provide public health care facilities. The concept of access provides a systematic categorisation of barriers and facilitators for health care utilisation. A framework for the analysis of access to the specific setting of socially polarised emerging megacities has to consider all these conditions. In this paper an analytical framework providing the methodology for identifying the most vulnerable groups regarding health within emerging megacities is introduced. The multi-method study design for testing the theoretic framework is also outlined in this paper. It includes a combination of methods from geography, qualitative and quantitative social research. Besides the research approach preliminary results from expert interviews and a pilot household survey already conducted are also presented.

### **Introduction**

This paper addresses the issue of access to health care under the specific conditions of emerging megacities. Megacities of medium- and low-income countries show increasing levels of social polarisation. The unequal distribution of income induces an unequal allocation of resources in the health care sector. At the same time, megacity inhabitants are exposed to severe environmental degradation, which affects different socio-economic groups unevenly with multiple effects on human health. Horton (1997) calls for immediate action in order to prevent megacities from becoming sick and diseased necropolises.

The health status of an individual clearly determines his capacity to cope with sudden changes or crisis. At the same time, the individual's ability to actively develop adapting strategies towards changes is strongly determined by his physical and mental health status (Bohle 2005). The provision of a framework for the analysis of access to health care in the specific setting of megacities is essential to understand access barriers. It will be the basis for evidence based counter-measures resulting in better health care provision, improved health status and, therefore, in reduced vulnerability.

This paper starts with an overview of current research from the different relevant disciplines, an introduction to the structures of the Indian health care sector and the research area. After that, the framework and the study design will be outlined. This is followed by preliminary results and a discussion of the preliminary results with respect to the ongoing research process.

### **Literature and Method Urban Health**

Since 2007, cities are the environment in which more than half of the world's population lives (Satterthwaite 2002). Cities and especially fast growing urban agglomerations addressed as (emerging) megacities – depending on their size – strongly influence the health status of their inhabitants in many ways. On the one hand, cities produce a local oversupply of medical services. This variety of supply can generally be assumed to be a positive factor regarding the population's health. Very often the negative impacts of urbanisation, which are strongly interlinked with environmental degradation, over-

crowding, changes in the societal structure and the overload of infrastructure, are in the focus of discussions on urban health. The urban populations in low- and lower-middle income countries suffer from the burden of infectious diseases, which is typical for the first stage of the epidemiological transition (Martens 2002) and exposure to chronic diseases, due to changes in the lifestyle and conditions of the urban environment, typical for later stages of the epidemiological transition. Some authors address this in combination with other factors, such as determinants from environmental via social to institutional factors, as a 'new urban penalty' (Krafft et al., 2003).

Galea and Vlahov (2005) call in this context for the set up of an interdisciplinary research on urban health focussing on the following issues: the influence of the physical environment; the social environment; and access to the health care services. The need for further research on measures to improve urban health was recently also subject of a working paper released by the World Bank (World Bank 2007). The authors also demand from science the shaping of evidence-based public health measures to improve the quality of health in urban environments. From their perspective, historic experiences from western countries can provide valuable guidelines and highlights the need for basic health care services (Galea and Vlahov, 2005).

In a mid term perspective, the improvement of health in cities through various effects will influence megaurban resilience and vulnerability. As a direct outcome, the health of individuals, and their ability to cope and adapt, will increase. As an indirect outcome, a more healthy society will also be economically more efficient, which might induce the construction of a social safety net again with strong effects on social vulnerability at various levels.

## **Megacities: New Urban Dimensions and Societal Challenges**

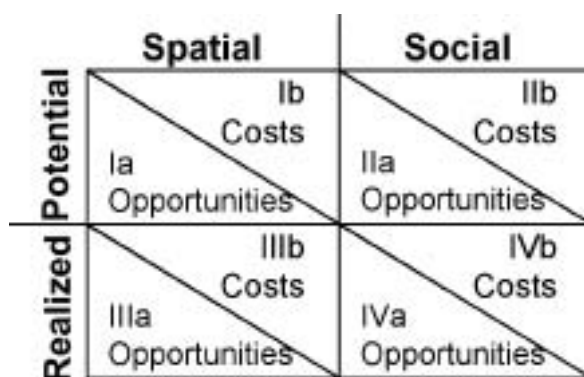
Within the megaurban landscape, various social and ethnical groups coexist with completely different lifestyles, very often in direct neighbourhoods. These contrasts usually also take manifestation in the physical environment. 'New' urban elites, who are affiliated with the global economy, live in gated communities or – relevant in the Indian context – housing societies, a kind of 'semi-gated' communities. The 'old' urban elites affiliated with the local or regional, sometimes maybe even national, economies would often follow a more traditional lifestyle (Dittrich 2003). They also have their own measures of self-segregation shaping the city's physical surface. In the direct neighbourhood to both of these groups, it is not unusual to find those who are excluded from even essential resources in slum areas. The slums as a whole again are very heterogeneous, while most times a single slum pocket is quite homogeneously structured. The slum population most times consists either of in-migrants from the rural areas, who only have a weak economic basis, or groups who have been (traditionally) excluded from access to education and middle class employment. Slum-dwellers are widely excluded from the benefits of the globalisation processes, but they still might be involved in the system of the global economy, for example, as cheap labour forces. The slum settlements vary in their size, structure, inner organisation and – especially relevant in the Indian context – their legal status (Sen et al., 2003). The latter also results in different levels of supply from the municipal authorities. Not only are essential supplies, such as electricity or water, not formally provided, but the access to health care can be influenced by the status of the settlements.

Even if one might not fully agree with Scholz' theory of the fragmented development (Scholz 2000), one cannot deny an increasing social polarisation and a disconnection of lifestyles. The social polarisation within today's urban (mega-)agglomerations in low and lower middle income countries influence strongly the everyday life by determining one's action space based on their social affiliation (Coy 2005). Among other sectors, the accessibility of certain healthcare services is clearly determined by this. In this way, the emerging megaurban societies form a new background posing questions related to access of healthcare and to measuring concepts, all of which to be reviewed. The development of new

approaches to access health services in megaurban areas will not only have an effect on megaurban dwellers' health statuses and vulnerabilities. The concepts developed here may also serve as a blueprint for areas less pressured than megaurban areas that can be viewed as laboratories of our urban future (Kraas 2007).

## Access to Health Care

The utilisation of curative, as well as preventive, healthcare and health promotion services allows for an individual to improve her or his personal health status. If the genetic disposition, risk taking behaviour, lifestyle and environmental factors are mostly viewed as negative influences on the health status, the consumption of preventive, as well as health services, has a positive effect. Equitable access to the resources of the healthcare sector does not exist due to certain barriers or facilitators (Waters 2000). Both can be of very different natures, but they all result in differences in the access to health care services (Ricketts and Goldsmith, 2005).



**Graph 1: Matrix of Access**

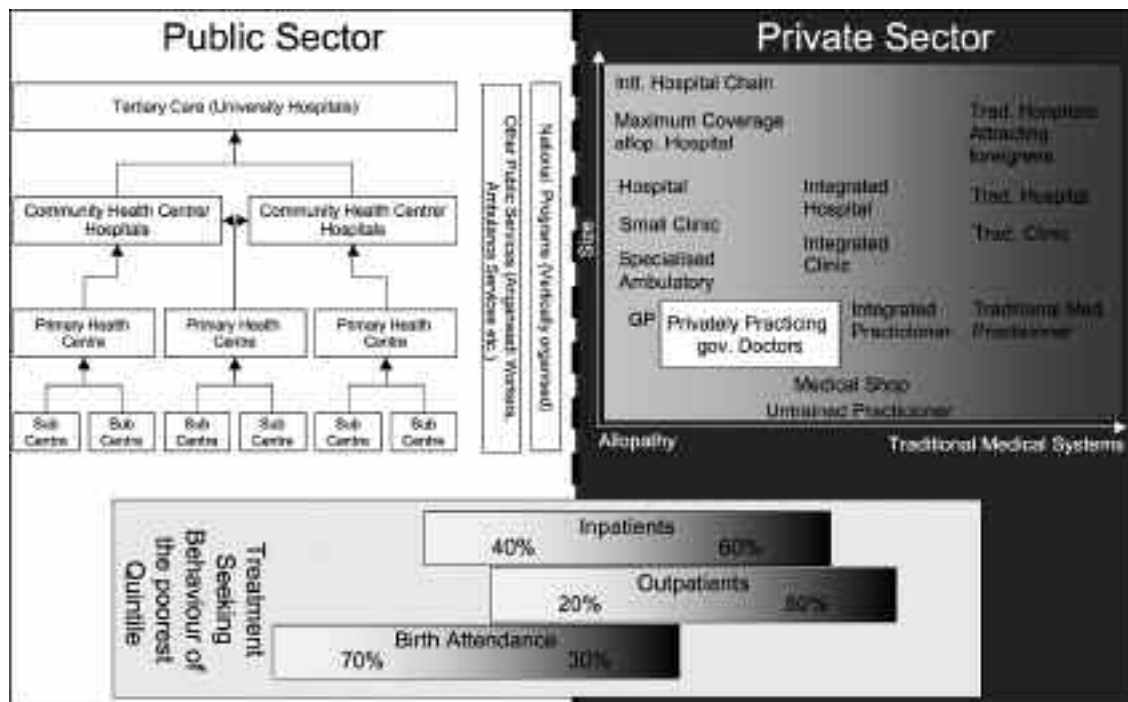
Source: own draft based on Khan and Bhardwaj 1994

As in most cases of geography, physical distances are subject of access-research. The minimisation of travel distances or travel times to certain specialised institutions or the identification of gaps in the basic supply are ideal questions to be worked on with geographical methods. However, the spatial aspects alone are not sufficient for an understanding of access to health care (Kumar 2004). For more than thirty years, there has been an intensive debate about different concepts of measuring access in the literature. Ricketts and Goldsmith (2005) summarise these discussions under the title 'the battle of frameworks'. While for one school (Andersen and Newman, 1973) understanding access means the identification of specific barriers and facilitators determining access, a second school (Penchansky and Thomas, 1981) focuses on the 'fit' between local demand and local supply, measured in the five categories: 1) availability 2) accessibility 3) accommodation 4) affordability 5) acceptability.

A categorisation by Khan and Bhardwaj (1994) seems to provide the possibility to combine the strengths of both approaches. They define as the two main categories for analysis spatial access and social access. These have to be analysed in the two horizons of potential and realised access. Each field of this two-by-two matrix is then separated into the two measurements of opportunities and costs, leading to the eight fields of the matrix in graph 1 (Khan and Bhardwaj, 1994).

A combination of this detailed categorisation and the five main categories by Penchansky and Thomas seems to offer a guideline for designing an analytical framework for understanding megaurban access. Availability and accessibility are clearly spatial factors, while the other three categories are aspatial or social factors. This combined matrix will serve as a frame for the activities of the fieldwork campaign (mapping, household survey and expert interviews) and a guideline for the information gathering.

## India's Health Care Sector



**Graph 2: Health Care Sector in India**

Source: own draft

India's health care sector is a highly complex structure consisting mainly of an overburdened public sector and an unregulated private sector. The latter is due to severe shortfalls in the public sector, which is, for most Indians, the main source for curative treatment (World Bank 2002, Gangolli et al., 2005).

Regarding preventive treatment, the public institution's outreach is much higher. Graph 2 gives an overview on the structure of India's health care sector. The public sector officially claims to provide health services for every Indian citizen, a guideline that was developed by the Bhole committee in 1947 and became part of the Indian constitution (Park 2005). This brilliant theoretical system has to face poor practical relevance, as is illustrated by the bars at the bottom of graph 2, which shows the treatment seeking behaviour of the poorest quintile of the population. Regarding the status of the public health care sector, the *Ministry of Health and Family Welfare* (MOHFW) wrote in its most recent National Health Policy that 'funding is generally insufficient; the presence of medical and para-medical personnel is often much less than that required by prescribed norms; the availability of consumables is frequently negligible; the equipment in many public hospitals is often obsolescent and unusable; and, the buildings are in a dilapidated state' (MOHFW 2002: no page number). On the social inequality of healthcare utilisation, the ministry comments that 'for vulnerable sections of society in several States, access to public health services is nominal and health standards are grossly inadequate' (MOHFW 2002: no page number).

World Bank (2001) addressed the following problem areas of the Indian health care sector as the most urgent ones: the unregulated private sector; the poor status of the governmental services; and the social inequalities.

In 2005, the health ministry designed the National Rural Health mission, a campaign to strengthen rural governmental health services. Some critics (Banerji 2005) point out that the focussing on the rural areas draws attention from the point that severe intraurban differences in the health status and the access to health care exist. Figures from the second round of the *National Family Health Survey* (NFHS) show that the percentage of those for whom the public sector is the primary source of care is significantly higher



in rural areas (International Institute for Population Sciences and ORC, Macro 2000). Although it is true that still more than 60% of the Indian population lives in rural areas, it has to be considered that the urban agglomerations grow at a much higher pace. Agarwal and Sangar (2005) describe the growth of India's population as a '2-3-4-5 Syndrom'. While India's population in total grows at 2% p.a., the annual growth of the urban population is 3%; the one of megacities is 4%; and, finally, the population in inner city marginal settlements grows with an annual rate of 5% (Agarwal and Sangar, 2006). That means that the demand for infrastructure also rises significantly faster in urban areas. Furthermore, within the cities, a group grows at an enormous pace, which actually has to rely on the governmental health services.

## **Pune Region**

The city of Pune forms together with the twin town Pimpri-Chinchwad the greater Pune agglomeration, which is the 'eastern end' of an agglomeration corridor, stretching from Mumbai to Pune. In the 1960s, the first industries (automobile) came to Pune, which gave a burst to the city's growth. Since 1967, both administrative bodies are joined under the roof of the Pune Metropolitan Planning Area, which is an additional administrative area to match the planning processes of the two independent municipal corporations.

One can distinguish three major phases in the history of the city's growth. The Peshwas made Pune in the 16th century their capital to govern large parts of the subcontinent and, by that, initiated the first phase of urbanisation. Today, the old centre, the Peths-area, forms the city's core. In the colonial times the British attached their own settlements to the city, staying separated from the Indian city. They built quarters for the administration – the civil lines – and also a separated military area – the cantonment (Diddee und Gupta, 2000). The third and still recent urbanisation phase started in the 1960s and the city's growth keeps accelerating. The city grew in terms of population from 730,000 inhabitants in 1960 to today's 4 million inhabitants (recent estimates from the *Pune Municipal Corporation* (PMC) 2005) while the surface area of the city grew from 138 km<sup>2</sup> to 244 km<sup>2</sup>. Out of these 4 million inhabitants – according to the same source – about 43% of the population lives in slum settlements. For 2015, it is expected that the number of citizens will grow up to 6 million.

Today, mainly the automobile industry and IT are the dominant branches of the industry. Education, especially higher education, is the third important employer and has a strong influence on the growth of the IT and automobile industries. Formerly known as Oxford of the east, Pune provides highly trained specialists for the economy, which surely was one of the reasons for the industries' decision to come to Pune. The city profited also from its closeness to Mumbai and the negative effects of the overcrowding in Mumbai. For Mumbai affiliated investors, Pune became an alternative, as it is close to Mumbai and the real estate prices are lower, offering a high quality of life at the same time. Diddee and Gupta (2000), though, already noticed a decline in the quality of life accompanying the rapid growth of the city: 'all planning exercises – be it Development Plans, Town Planning Schemes or Regional Plans – have only succeeded in making Pune a more chaotic place. But though it is no longer a great place to live in it still remains a great place to work in. Is this the price one has to pay in the name of development?' (Diddee und Gupta, 2000:15)

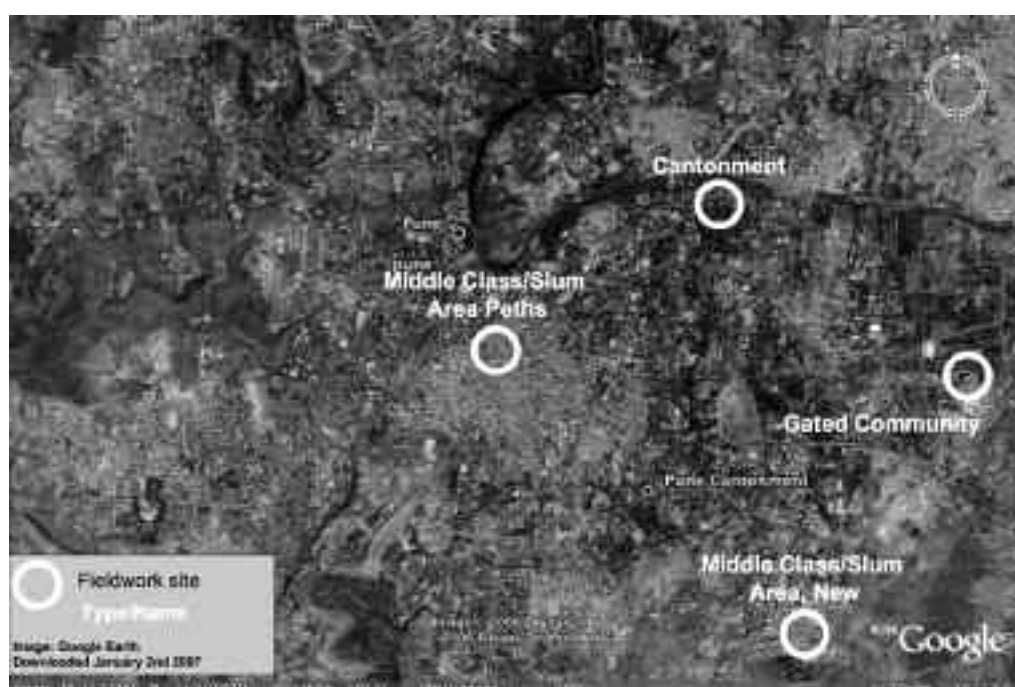
## **Methodology**

The main research question guiding the research process is: Why and how does the access to health care vary within the emerging megacity of Pune? How do the both sides of the market, demand and supply, perceive and react to these differences?

In order to follow this question, a two-phase research design was chosen. In the first phase, expert discussions and a pilot study were used to gather background information on health problems and struc-

ture of the health care services. On this basis, the research questions and the study design were developed for the main phase.

In the second phase, access to health care is analysed in six different areas of Pune using various methods to address the categories provided by Khan and Bhardwaj (1994). The six selected study areas (cf. graph 3) reflect, on the one hand, different stages of Pune's growth and, on the other hand, different neighbourhoods with specific income and lifestyle groups. In these areas it is planned to map all health facilities and to collect metadata on them (potential spatial access). The study is already completed in three areas. The main part of the whole study will be a representative household survey with a random-walk-sample (realised spatial and aspatial access). Out of this sample, individuals will be selected for in-depth interviews to learn more about the individual costs of access, as well as personal barriers and facilitators for accessing certain facilities (realised and potential aspatial and spatial access). Expert interviews, finally, will be the method to get a better understanding of the mechanisms of the health care sector, its organisation and the influence on social opportunities and social costs (potential aspatial and spatial access). This multi-method study design allows for several approaches towards the complex measure of access, covering, at the same time, all fields of the matrix in graph 1.



**Graph 3: Field Work Sites**

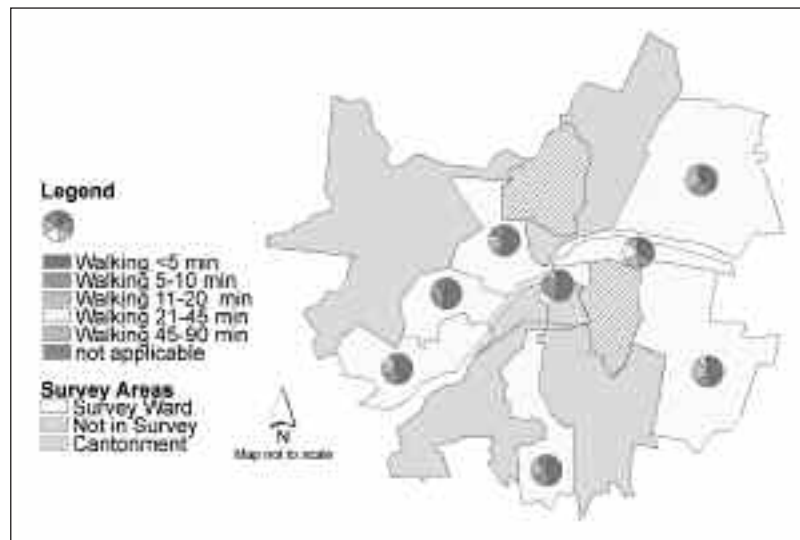
Source: Own draft based on Google Earth Image

## Results

### Results of the Pilot Study

An extensive household survey was conducted in Pune as a pilot study covering, besides health issues, questions on water supply and migrational status. Indian students from Bharati Vidyapeeth Institute for Environment Education and Research and German students from Cologne University Department of Geography jointly conducted the survey supervised by Indian and German academics. The survey was part of two field trips for students from Cologne University. The questionnaire was developed by University of Cologne beforehand and adjusted by the students and their supervisors during the survey. The thematic questions were supplemented by a set of socioeconomic variables in order to classify households according to their socioeconomic status. The sampling method was not representative, as

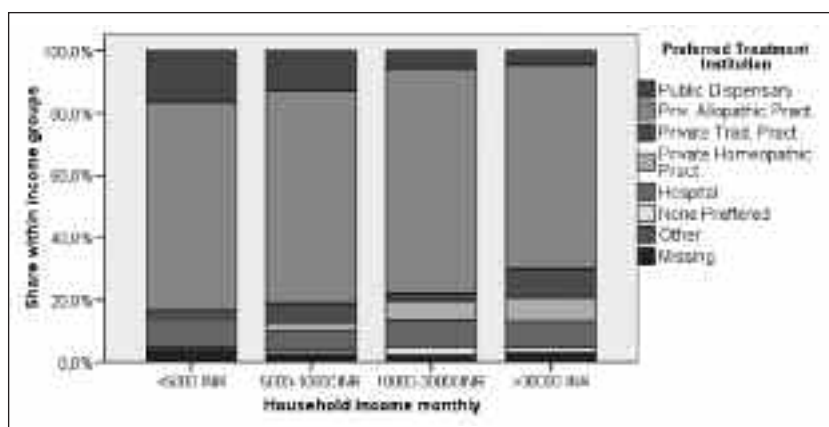
the survey only has the character of a pilot study. In total, 528 interviews were conducted, representing 2,955 persons living in the respective households, which is an average household size of 5.67 for the total sample.<sup>10</sup> The survey was undertaken in eight of the city's administrative wards, covering older and newer parts of the city (cf. map 1).



**Map 1: Survey Wards and Walking Distance to Closest Pub. Dispensary**

Source: Own draft, based on joint fieldwork

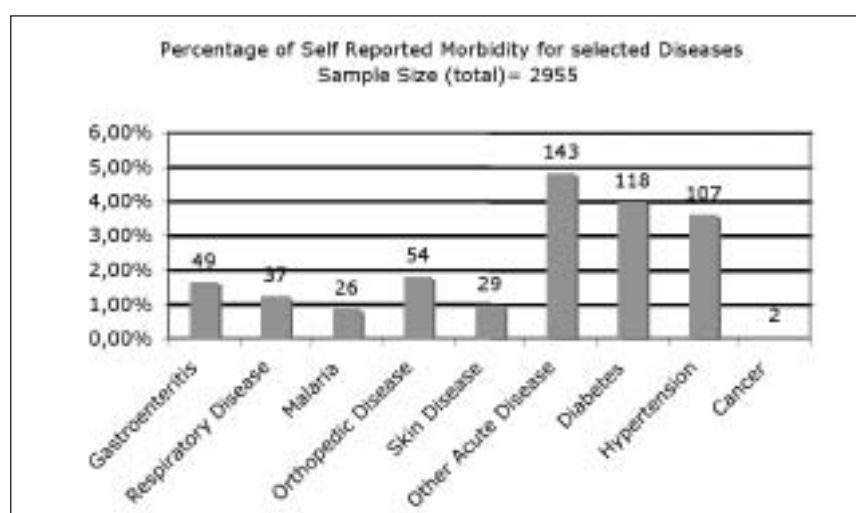
Theoretically, health care should, at least for the poorest, be offered by governmental services. In practice, either services are not available or people do not trust in governmental services. These circumstances result in a very low utilisation rates for governmental health services and high utilisation rates of private practitioners. This literature based assumption (Kamat 1995, World Bank 2002) was also reflected in the findings of the household survey (cf. chart 3). The utilisation rate for governmental services decreases with the income. Seeking service at private facilities can, especially for lower income groups, result in indebtedness or the need to sell assets to be able to pay for treatment. But the high utilisation rates of private practitioners can hardly be explained by the absence of public services in the case of Pune.



**Graph 4: Preferred Treatment Institution by Income Group**

Source: Own draft, based on joint fieldwork

<sup>10</sup> The first group, led for the German side by Prof. Dr. Frauke Kraas pre-tested and evaluated of the questionnaire and collected 62.3% (N=329) of the final data, 37.7% (N=199) of the data was collected by the second group led by Dr. Thomas Krafft and the author.



**Graph 5: Self-Reported Morbidity in Absolute Numbers and as Prevalence for the Whole Sample** Source: Own draft, based on joint fieldwork.

Map 1 shows the perceived walking distance to the closest public dispensaries. All over the city, spatial coverage seems to be no access barrier. Therefore, the investigation of aspatial dimensions, especially social barriers of access, will have to be studied in more detail in the main study phase. Graph 5 illustrates that Pune is struck by what has been introduced in the literature as the 'double burden of disease'. The data shows the self reported morbidity, understood as recalled treated and untreated episodes of disease within the whole family for the last six months. It can be assumed that the actual self-reported morbidity is much higher, as not always key household persons (like the spouse of the head of the household) were the respondents in the survey. Therefore, not all episodes within the family might be known to the actual responding person. Interestingly, there seems to be a variation in the treatment seeking behaviour depending on the nature of disease. While acute infectious diseases are still dominating the burden of disease, the figures of chronic, lifestyle associated diseases also represent a significant share. Interestingly, the treatment seeking behaviour seems to vary depending on the type of disease. Having been asked where they sought treatment for specific episodes in the past, only 4% reported having been treated in a public treatment facility in the case of gastroenteritis. In opposite to that, 9% of the diabetes cases were/are treated in public facilities. A possible explanation would be the need for cost-intensive long term treatment and medication for diabetes. The subsidised treatment in the public sector, in that case, seems to become an alternative, despite the obviously existing access barriers.

### Preliminary Results of the Main Research Phase:

As the second phase of the research process is currently ongoing, only some preliminary results from expert interviews can be presented. Four quotes, reflecting at glance the results from a first series of expert interviews on access to health care and the relation between health infrastructures and city growth, shall underline the need for further empirical investigation.

One of the interviewed private practitioners summarised his perception of the access to health care of different groups with the words: 'So access wise – I think if you have money you have access in the city; if you do not have money, you can still have access, but you are not very happy with the access' (Source: Own expert interview). For him, the issue of access is dominantly linked to the financial aspect. He also, draws the attention to the point that people are not satisfied with free of charge or subsidised services, although the quality is not necessarily worse as he states later in the interview. Most of the interviewed experts share his view on the peoples' perception of public and private health care services.

A ward medical officer, responsible for parts of the public health infrastructure on the local level, describes that, for most people, private health care institutions are the first access point:

Low income group, they first go to a near located private practitioner if minor problems are there, like cold, cough, diarrhoea. There they get treated, but not properly, because most of the practitioners are practicing ayurveda, homeopathy or unani medicine, so they give only symptomatic treatment, not curative. So they go there, they get relief. But if any complication happens, then they go to our government facilities, either government hospitals or maybe even sometimes to trusts, because there are some hospitals, private hospitals, that are giving treatment affordable to that class. (Source: Own expert interview)

Later in the interview she says that private health care is regarded by the population as the better treatment and, therefore, is preferred even if the costs for the treatment is relatively high, especially for poorer people. She, herself, does not trust in the Indian systems of medicine, as she points out implicitly. From her point of view, very often private practitioners do not treat the people correctly and the governmental health sector has to function as a safety net for those who were not treated well but cannot afford further private treatment.

On the ability of the health care sector to cope with the city's growth, one of the interviewees, an academic researcher on community medicine, said:

It's related to the development of the city. See what happens... it is particularly the way in which our city grows – mostly unplanned. Initially, when the city is small, all the service providers try to get located in the centre. Then the city is growing in the periphery that is not equipped with hospitals. (Source: Own expert interview)

For him, the periphery seems to lack health infrastructure. Interestingly, he relates the lack of infrastructure to the issue of city planning. The lack of health infrastructure is, for him, also a result of the missing governance in the process of city growth. The ward medical officer, already quoted above, commented on the problems of getting new personnel and setting up new infrastructure:

We're lacking behind, because whatever doctors or nurses or whatever workforces is needed, we have to get the sanction from the state government. And this is a very big process; if we plan or if we want to get new doctors, it takes two to three years to complete that process, so that is difficult for us, so we cannot cope with this. (Source: Own expert interview)

## Discussion

Although the findings from the pilot survey are not representative due to the sampling, some of the initial hypotheses were strengthened. For example, the lowest income groups have been asked which treatment institutions they generally prefer and they indicated, with a surprisingly low percentage, institutions from the public sector. Regarding the share of private allopathic doctors as the main access point to health care, the share is interestingly constant through the various income groups. With increasing income, the tendency to seek health at practitioners offering alternative systems of medicine seems to increase. The results also show a differentiated treatment seeking behaviour, which is influenced by the nature of disease (chronic vs. acute). What is obvious from a first spatial analysis is that the perceived distribution of treatment institutions in the public sector seems to be no access barrier. Clearly, Pune's population is in the midst of an epidemiological transition and is fully prone to what has been addressed in the literature as the 'double burden of disease'.

The experts who are familiar with the local health care system highlight the social aspects of access to health care as the relevant barriers. Although having different perspectives on the problem complexity (private sector, public sector and academics), their interpretations show generally the same tendency, though with differing undertones. These experts' views partially explain the findings of the household survey.



## Conclusion

The sobering results are that public health care institutions seem to be not trustworthy and unable to contribute to fulfilling India's vision of health for all. As the preliminary results show, access is highly complex in the specific case of Pune. As an emerging megacity, it is undergoing a massive societal transformation and the framework provided by India's health care system offers no fit instruments for ensuring equal access to health care. At the same time, the preliminary results indicate that it is especially socio-economic determinants that influence access to health care. These need to be addressed especially for the public health care sector as, otherwise, even the little investment in public health infrastructure cannot unfold activity.

Access to health care is a central issue in urban health. With respect to vulnerability it becomes an important issue as it is influencing the households' economic situations, as well as their ability to cope and adapt in the case of a crisis. The framework that is developed and tested will provide a blueprint for the analysis of access to health care in areas under similar conditions. The results of the main research phase will contribute to a better understanding of the treatment seeking behaviour and of barriers and facilitators for access to health care. In that way, it will provide evidence for proposing new strategies of resource allocation to improve access to health care. In a mid- or long-term perspective this will result in a decrease of vulnerability.

## Acknowledgement

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## 2.2 Understanding Resilience through Ritual and Religious Practice: An Expanded Theoretical and Ethnographic Framework

*Rebecca L. Carter*

### Abstract

This paper contributes to emerging analytical frameworks within the study of social vulnerability and resilience. It focuses in particular on an expanded view of resilience as a local, multi-dimensional, and fluid process of change and adaptation; a process inherent to all societies, yet one that also has an important degree of cultural and regional specificity. The paper argues that studies of resilience can be expanded through examination and comparison of everyday social and cultural practices and experiences of resilience building, considering in particular their role in the reduction of vulnerability and in the promotion and lived experience of human security and sustainability. Drawing from ethnographic research currently in progress in the U.S. city of New Orleans, the paper focuses on religious devotion as one culturally specific example of local resilience building. Although a great deal is understood about why resilience is important, there is comparatively less empirical research on how it develops within individuals and communities. The paper concludes with an analysis of initial research findings and their relevance, identifying directions for continued research, particularly in complex social-ecological settings, such as urban areas and megacities.

### Introduction

Theories and definitions of vulnerability and resilience have evolved over years of diverse and cross-disciplinary scholarship. In the social sciences, vulnerability has been primarily conceptualized in relation to a system's exposure and susceptibility to external stress and its capacity to recover (Blaikie et al., 1994; Adger 2006). Closely related theories of resilience developed from scientific and mathematic foundations gained prominence in the field of ecology for their focus on change, structure, and function in the displacement and return to equilibrium of materials and systems (Holling 1973).

More recently, studies of vulnerability and resilience have evolved with particular relevance to human social systems and their integration with the natural world. New social-ecological frameworks maintain the focus on stress, change, and recovery, but also emphasize human response and action, for example, through organization, learning, and increased adaptation (Walker et al., 2006; Resilience Alliance 2007). Such frameworks open space for investigations of the inseparability of human social, cultural, and environmental systems and give more attention to the reduction of vulnerability and the promotion of resilience, security, and sustainable development (Warner 2007). These emerging frameworks feature broadened definitions of vulnerability and resilience, which emphasize, in particular, the social groundings and means of these conditions.

Social vulnerability refers to 'the inability of people, organizations, and societies to withstand adverse impacts from multiple stressors to which they are exposed. These impacts are due in part to characteristics inherent in social interactions, institutions, and systems of cultural values' (Warner 2007: 14-15). Social vulnerability particularly affects marginalized populations in developing countries; it is most acute following a disruption, such as a disaster or other catastrophic event, and it persists because of the structural, social, political, and other conditions that reinforce it. Emerging conceptualizations of social vulnerability remain, however, in dialectic relationship with resilience. The degree of social vulnerability is dependent partly on the level of resilience and the capacity for resilience building among individuals, communities, and institutions. As resilience is built, through social and other means, vulnerability is reduced; similarly, the reduction of social vulnerability leads to social transformation and system change (Aguirre 2006).

Emerging perspectives on social vulnerability are distinct for their focus on people, complex social-ecological systems, and non-structural solutions to risk reduction. These concerns are particularly relevant within rapidly changing social/environmental and urban/rural landscapes, seen, for example, with the growth of urban areas and megacities. These are complex systems with diverse populations and multiple conditions of vulnerability. Given the close relationship between vulnerability and resilience, concern for the reduction of social vulnerability in these settings must exist alongside attention to resilience and resilience building. Emerging perspectives on resilience, therefore, must also focus on people, surrounding social-ecological systems and non-structural solutions. In this way, the challenges and vulnerabilities affecting human life are examined in relation to the opportunities for resilience building and social/environmental change.

While emerging theories and frameworks of vulnerability and resilience are valuable, the discipline lacks sufficient empirical research. Field projects should be innovative and sound, focusing on the collection of richly detailed local data in particular environments of social vulnerability, and including data on beliefs, behaviors, and social and cultural practices, along with assessments of their role in processes of vulnerability reduction and resilience building. In addition, research findings should be distributed and shared in ways that are relevant to the people within impacted communities, as well as to scholars and scientists across disciplines. Such research will contribute to a greater understanding of the social and cultural foundations of vulnerability and resilience, shedding light on the 'how' of local vulnerability reduction, resilience building, and the promotion and experience of human security and sustainability.

## **Expanding Theoretical frameworks**

Within the emerging frameworks on resilience, scholarly work has been primarily focused on the 'external' aspects of resilience building, i.e. structural characteristics and approaches to risk management. The more 'internal' aspects, such as human agency, stress management, and coping, remain comparatively under-explored (Bohle 2001). Investigations of the internal characteristics of resilience, however, are very much at the center of scholarly research in other fields, such as anthropology, philosophy, theology, and the humanities more broadly. These disciplines examine, for example, aspects of human being, agency, action, social fortitude, and the sociocultural and political groundings of resistance and change. Emerging frameworks of resilience can be further expanded, therefore, by drawing in the research and theoretical concepts that are developed in these fields. This paper explores three theoretical threads of inquiry as potentially informing for resilience research: 1) theory on kinship and relatedness to investigate the relations and bonds that make up and sustain social and cultural networks; 2) theoretical understandings of everyday processes of social transformation, change, and revitalization; and 3) cross-disciplinary explorations of the lived experience and meaning of security and sustainability.

In the social sciences, particularly in the field of anthropology, the study of kinship is at the foundation of investigations of human social life. The analytical category of kinship, however, has grown far beyond its roots in biology and its preoccupation with blood relations and affinity. An important concept that has recently emerged within this field is the idea of 'relatedness' (Carsten 2000: 4). Rather than remaining narrowly focused on biologically based lines of descent and relation, the concept of relatedness explores the bonds that form between seemingly unrelated people, things, and places. Theory on relatedness has the potential to inform studies of resilience, for example, by providing a new lens with which to view the way that people unite, exchange information, share resources, and build networks. In daily life and across diverse domains, many culturally specific practices exist by which such connections are formed, maintained, and also dismantled. These practices might include more formal rites, as well as 'small, seemingly trivial, or taken-for-granted acts like sharing a meal, giving a dish of cooked food to a neighbor, [or] dropping in to a nearby house for a quiet chat' (Carsten 2000: 18). By focusing on the sociality of life, new light is shed on the inner workings of resilience building.

The concept of relatedness is also open enough to allow for comparative work, considering for example the diverse types of relations that are formed by members of different groups who are impacted by certain local conditions and who have specific objectives and concerns to address. There are, thus, additional political and ecological dimensions to relatedness, evident, for example, in the unequal access to resources across populations and regions, and in the socioeconomic and associated geographic barriers that affect network building capacity. In sum, several important research questions about resilience building can be explored through an examination of relatedness. What are the social and other links between individuals, communities, and institutions? How is information communicated and how are resources shared? How are relationships maintained and/or repaired after a crisis, disaster, or other extreme event? And finally, how do these processes compare across populations, regions, and conditions of vulnerability?

Local processes of resilience building include the organization of social and other relations into collective processes of transformation, change, and revitalization. Useful in their examination is theory on revitalization and other social movements. Originally developed within the field of anthropology to describe individual and collective processes of cultural change in the face of devastation, a revitalization movement takes shape when people experience extreme stress and group together to change themselves and their culture and society. Revitalization movements are 'deliberate, organized, conscious efforts by members of a society to construct a more satisfying culture' (Wallace 1956: 265). Recent reassessments of revitalization are perhaps more relevant to resilience building in mega-urban areas; they give attention to current conditions and movements and focus on the particularities of events, conditions, and timing; the thriving of 'emergent nativisms...in revitalistic response' to neo-colonial situations; and revitalization at the center as well as the fringe of society (Wallace 2004: ix). Revitalization is, thus, more fruitfully considered within the larger context of social and political encounters, movements, and change. Such theory has the potential to expand knowledge on the conditions that motivate the building of resilience, the struggle for secure and sustainable conditions, and the mechanisms that people develop and use.

Finally, the study of resilience can be expanded through cross-disciplinary exploration of the lived experience and meaning of security and sustainability. This inquiry would focus on the long-term personal and social impacts of relatedness, network building, social transformation and revitalization, examining what these processes provide for people and how they might contribute to a personal or shared sense of human security and sustainability. Theories and understandings of security have broadened considerably from their historic focus on national/international political security to a recent conceptualization of human security. This framework envisions a world where individuals are free from fear, desire, the impact of hazard, and have equal opportunities to develop to their full potentials (Human Security Network 1999). The investigation of human security, however, can broaden to include a focus on the lived experience of the building of resilience and the promotion of security at the local level. This inquiry already has a long history in the humanities, particularly in fields such as philosophy and theology. There is a recent and especially relevant thread, however, which focuses on the frailties, capacities, and potentialities of human being given current conditions of instability and uncertainty. For example, within the emerging frame of existential anthropology, scholars identify 'The struggle for being...as a course steered between a variable environment and the equally variable capacities of persons' (Jackson 2005: xi). The development of human capacity, resilience and security involves 'being-in-the-world through our ever changing capacity to create the conditions of viable existence and coexistence in relation to the given potentialities of our environment' (Jackson, 2005: xv). There is a similar philosophical view, which examines human capacity, hope, resilience, and strength in the space of 'radical endings' concerned with, 'what we might legitimately hope at a time when the sense of purpose and meaning that has been bequeathed to us by our culture has collapsed' (Lear 2006: 104). This scholarship focuses also on the way in which new visions for a secure and sustainable future are developed and shared by people facing adverse conditions.



Despite the value of these theoretical considerations and expansions of resilience theory, empirical and ethnographic research is needed for further tests and modification of these frameworks. There are, however, unique challenges to research design and method, particularly within complex social-ecological systems where multiple variables and conditions of change make classical scientific research difficult. There are also challenges inherent in measuring the immeasurable, examining and usefully analyzing concepts, such as lived experience, belief, and practice. Although such concepts are difficult to study, scholars maintain that it is possible to focus on 'moments of being...glimpses into what is at stake for the actors, and how they experience the social field in which they find themselves' (Jackson 2005:xxv).

In the sections that follow, preliminary findings from an ethnographic research project, currently in progress in New Orleans, are presented and analyzed. The research focuses on ritual and religious practices, particularly the veneration of saints, compared within and across diverse local religious communities. The historical development and diversification of these practices, their natures and meanings, and their relation to conditions of vulnerability, resilience, and security is considered. As initial findings demonstrate, the examination of these local rituals and religious practices is also the examination of the local social and cultural groundings of resilience. It includes the everyday social-spiritual relations that make up and sustain social and cultural networks; the role of religion in vulnerability reduction and in the motivation of social organization, transformation, and revitalization; and the role of religion in the lived experience of human security and sustainability.

## **Expanding Ethnographic Frameworks**

### **Historical Background**

The research compares devotion to Our Lady of Prompt Succor (a local appellation of the Virgin Mary) and St. Joseph, two saints with important local and historical significance. Religion has been an important dimension of public and private life in the city of New Orleans since it was founded in 1718. Local practices of saint devotion began during the colonial period as Catholic missionaries traveled with early European settlers; they were further developed with the arrival of French Ursuline nuns in 1727. In thanksgiving to the Virgin Mary for her intercession and protection during their formative years in New Orleans, the Ursulines initiated devotion to the Virgin Mary as Our Lady of Prompt Succor (Secours). They built a convent and shrine and grew a community of devotees through their educational, charitable, and other activities. In 1928, the Holy See officially recognized the saint as the patroness of New Orleans and the state of Louisiana. Originating from the National Votive Shrine of Our Lady of Prompt Succor in New Orleans, devotion grew until it became customary for Catholics and others to pray for protection in times of stress and crisis, for example during hurricane season (Heaney 2003; Clark 2007). As city development progressed and as concern for social, economic, and political stability/instability grew, some conservative members of the Church began to pray for the protection, as well as the spiritual and moral conversion, of the city, forming organizations such as the Crusade for the Conversion of Greater New Orleans, founded in 1995. Members of this group participate in prayer groups and organize public demonstrations of faith and acts of reparation.

Devotion to St. Joseph grew in New Orleans in the late 1800s with the mass immigration of Catholic families from Sicily. Settling in the lower part of the French Quarter, these immigrants formed benevolent societies to maintain and protect their families and heritage, particularly in a new world increasingly hostile to newcomers. The Società Italiana Di Mutua Beneficenza Cefalutana, for example, was founded in 1887 and remains in existence. Members continue the religious tradition of building elaborate altars to St. Joseph on his feast day to give thanks and to pray for protection and relief (Orso 1990: 38). Daily devotions include the storing of St. Joseph Day bread and other altar souvenirs in the home year round to symbolically protect the family from starvation, poverty, and other crises and disasters. Such devotion is part of a lived religiosity, which permeates daily life, extending beyond the institutional structure of the Church, into communities and homes. Devotees form social and spiritual relations, share stories

and sacred objects, build personal shrines, and participate in prayer and ritual. More broadly, these saints are venerated as important symbols of quick help in times of need.

Saint devotion also exists outside of the Catholic community. Devotees of Our Lady of Prompt Succor, for example, are found in the local Voodoo religious community. These practices, descended primarily from Kongolese, Senegambian, and Haitian religious traditions, have become particularly distinct and localized, and there are close links to the Catholic tradition. Pairings exist between Voodoo Lwas (spirits) and Catholic saints, such as the association between Ezili Dantó, a black Madonna spirit who is a fierce protector of her child and devotees, and Our Lady of Prompt Succor. While over the years there have been many changes in the freedom with which Voodoo can be practiced, the public perceptions of the religion and the ethnic diversity of its leaders and practitioners, the religion remains a significant part of both public culture and private life in New Orleans (Long 2002). Societies, such as La Source Ancienne Sosyete Ounfo, hold annual ceremonies for the protection of the city that jointly honor Our Lady of Prompt Succor and Ezili Dantó. Members have also founded the New Orleans Hope and Heritage Project, dedicated to the rebuilding and the transformation of the city. Similarly, devotion to St. Joseph extends to worship in African-American Spiritualist churches, which are a synthesis of 19th Century spiritualist, Catholic, Pentecostal, and Voodoo traditions (Jacobs and Kaslow, 1991). Members of congregations, such as Israelite Divine Spiritual Church, build altars to the saint and call on his intercession as the patron saint of workers for the resolution of economic crises, such as poverty and unemployment (Estes 1987; Ware 1992). Petitions are also directed towards the repair and revitalization of churches and surrounding neighborhoods.

## **Methods and Case Studies**

This is an eighteen-month ethnographic field study based in New Orleans. Participants are recruited within four groups to allow for comparative analysis of findings across diverse populations and geographies. Devotion to Our Lady of Prompt Succor is compared across two communities: 1) Catholics and members of the Crusade for the Conversion of Greater New Orleans and 2) Practitioners of Voodoo in diverse local religious societies. Devotion to St. Joseph is also compared across two groups: 1) Descendants of Sicilian immigrants and members of local benevolent societies such as Società Italiana Di Mutua Beneficenza Cefalutana, and 2) Members of African-American Spiritualist congregations. These groups are selected based on the presence and role of each saint, the historical significance of the group and their shared moral and spiritual beliefs, and the diversity of populations and geographies they represent.

There are four primary methods of qualitative data collection: 1) semi-structured interviews of devotees and clergy, focusing on narratives of belief, practice, and meaning; 2) extensive observation, social-geographic documentation, and analysis of saint shrines, devotional activities, and resilience building; 3) individual, familial, group, and institutional life histories, and 4) archival and historic research on devotional practices and the growth and spread of religious movements, in particular, relation to local crises, disasters, and neighborhood development or decline. Data analysis will focus on comparisons within and between religious groups based on identifying factors, such as geographic location, socioeconomic status, ethnicity, age, or gender. Analysis will also work to determine any relation between saint shrines, social change, and revitalization, identifying points of convergence or conflict between the activities and objectives of these religious groups.

## **Preliminary findings, analysis, and discussion**

This research is currently in its first phase of interviews and archival research. Findings, therefore, are preliminary and can suggest only avenues for further investigation. The early evidence provides relevant data, nonetheless, pertinent to the three themes of inquiry presented earlier on resilience: 1) the everyday social-spiritual relations that make up and sustain social and cultural networks, 2) the role of faith

as it addresses conditions of vulnerability and motivates social organization, revitalization, and transformation, and 3) the relation of religious practices to lived experiences of human security and sustainability.

In daily practices of saint devotion, various bonds are formed, for instance between individuals, religious personnel, community members, and the divine forces with which they engage. These forms of relatedness have particular importance in relation to the recent natural disaster of Hurricane Katrina, the persisting conditions of vulnerability, and in relation to resilience building. As one participant describes her spiritual relationships:

I follow the relationship. I do love Jesus and... I go directly to him. And sometimes I kind of get angry with him [and ask] why is this happening, and why is this like that, and what am I supposed to do here? But I ask in a kind way, not in a mean way. From there, then if you have devotion to Jesus you have devotion to Our Lady also.<sup>11</sup>

Another participant describes the close bond felt with evacuees and with Our Lady of Prompt Succor in the days following Hurricane Katrina:

There was a seriousness about it that increased as time went on. But somehow we sensed that this Lady knows what it's all about; we're in her hands. There is nothing we can do except the best we can, dealing with the external situation. There is a trust level that is there, knowing that we're doing all we can and we trust her. The water was high up to right around there....and we could see all that. But there was a trust, there was a calmness, there was a supportive system.

Other participants describe the social bonds and networks that are built and supported through these religious practices. These develop through structures and systems of social support, for example prayer groups and other methods of fellowship and communion. As one woman describes her network:

It's a group of women who give a lot of praise to the Blessed Mother. It's a Marian thing. We meet once every so often to have breakfast, socialize, sing, and give praise. And there's usually a priest there who speaks.

One organizing member of the Cefalutana Society describes the post-Katrina resilience of this particular and close-knit group. As he states, 'I thought we would lose a lot of membership. But I was so proud of our people. In spite of the storm, they came back. Even if they weren't in town they paid their dues. Our membership actually increased'. Overall, findings like these illustrate the role of religion in the formation and sustainability of social and spiritual networks, particularly in relation to conditions of vulnerability and the building of resilience. The findings point out, also, the diverse nature of religious practice and the localized specificity, yet shared space, of cultural communities, an important consideration for studies of resilience in mega-urban areas.

Initial findings also indicate that practices of saint devotion are linked to the transformation and the revitalization of self and society. Particularly since Hurricane Katrina, religious services include prayers for the healing and recovery of the city. Such activities point out the active process by which people are reinventing their society, making and remaking themselves, and the surrounding world. Here, residents 'actively conceive, imagine, elaborate, devise, construct, and give shape' to their lives and 're-interpret and re-form existing cultural resources and social conditions' (Gammeltoft, 2006: 600). Such processes involve memory, narratives, the reclaiming of voice, healing, and the return to everyday life after disruption (Das, Kleinman, 2001: 6). However, early findings give some indication that religious groups do not necessarily share the same vision of recovery and revitalization. For example, members of the Crusade for the Conversion of Greater New Orleans pray for protection from further disaster, as well as for 'the conversion of our greater New Orleans area and for the rebuilding of our city according to God's holy and moral laws'. Thus, they hold specific visions of revitalization that may conflict with other groups. These findings can be examined in relation to theories of religion and revitalization that identify the role of religion in the development of particular visions of new ways of life, given the stressors that people face (Wallace 1956: 268) and the particular social and cultural force of religious practice. For example, the 'consolidating power' of religion refers to 'the peculiar ability of religious metaphors, places, and

11 All interview excerpts are from anonymous participants; the period of data collection was June – November 2007.

rituals to sum up and intensify experience....by joining everyday events to a sense of supernatural intervention and by reinforcing religious ideas with material resources and a net of repeated human interactions'. This process unifies behavior across social levels and in different arenas (Levine 1986: 97). Religious belief has a 'continuing power...and commitment [that] provides a basis for enduring solidarities and the construction of meaningful vocabularies of moral concern' (Levine 1992: 15–16).

Finally, early research findings suggest that religious practices and revitalization have a role to play in the lived experience of human security and sustainability. As devotees direct religious activities towards the revitalization of themselves and society, they envision a world where individuals do indeed to have equal opportunity to develop their full potential and may live free from fear, desire, and the impact of hazard. One devotee, for example, describes this objective: 'I still pray now to our Lady's intercession that our city will be rebuilt, that she'll continue to help in the rebuilding, and that in the end... we will all live as God wants us to live. And that's my dream'. For other groups, the vision is more localized and focused on the revitalization and resilience building of a specific community. As one member of a local Spiritualist church states, 'Our spiritual restoration... has enriched our lives and improves our resistance in ways beyond my dream'.

## **Directions for Continued Research**

The preliminary findings described here demonstrate the links between cultural practices, such as saint devotion, resilience building, and the promotion and experience of human security and sustainability. Additional empirical data, however, is required to make definitive conclusions about how these dimensions intersect. First, more research is needed on the nature and significance of these practices to determine what people do in response to the conditions of vulnerability they face and when, where, how, and why they do it. Second, further research is needed to fully understand how social and spiritual relations form and how they develop into religious and other movements of change and revitalization. The theory of revitalization identifies several stages: the reformulation of one's image of culture or society, the intent to change culture and society, communication, organization, adaptation, cultural transformation, and finally, routinization (Wallace 1956: 279). This progression, however, may not apply to all settings and may need to be revised or expanded for current conditions. For example, in post-Katrina New Orleans, religious groups may be working to fill the gap created by inadequate federal, state, and local relief and recovery efforts and mobilizing to develop alternative methods of disaster management that better meet their social, spiritual, and other needs. Religion may, thus, provide a way for individuals to maintain and preserve the social, cultural and spiritual ties that bind communities, reestablish protection and security, and rebuild life as they define it. Third, comparative research and analysis of findings is important in order to determine the differences in impact, significance, response, and resilience building for the multiple populations and conditions that make up mega-urban areas. Given the greater vulnerability of marginalized and impoverished groups and the diversity of cultural practices in large urban areas, it is reasonable to expect that there will be points of convergence as well as conflict between capacities and the various local visions of security and urban development. Further research will shed light on how resilience building proceeds or is inhibited at different levels and across different populations and regions. Finally, additional ethnographic research is needed to better understand the lived experience of resilience building, with particular attention to the role of culture in the development and experience of human security and sustainability.

## **Conclusion**

This paper contributes to emerging frameworks on social vulnerability and resilience in urban areas and megacities by investigating the cultural groundings of resilience, the everyday practices of resilience building, and the significance of these actions and experiences in the promotion and experience of human security and sustainable development. It proposes that an expanded, holistic, and cross-dis-

ciplinary approach will reinvigorate both a theoretical and practical investigation of these practices and processes. Literature from the humanities on relatedness, revitalization, social change, and human capacities and frailties is particularly valuable. In addition, the paper argues for more empirical research, particularly long-term ethnographic study, which allows for deeper immersion, repeated exchange, collaboration with participants, and close observation of changing conditions. The presented findings demonstrate the potential of such work; however, the inquiry should continue within diverse cultural and environmental contexts. It is important, however, that research be relevant and applicable, offering useful information for people in impacted communities, as well as for scholars, scientists, and policy-makers across disciplines.

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## 2.3 The Need for an Ecosystem-Inclusive Vulnerability Index for Coastal Areas in Colombia

*Carmen Lacambra S., Iris Möller, Tom Spencer*

Both climate-related events and seismic activities impact coastal areas of Latin America. Seismic events are more frequent on the Pacific coast, whereas the Caribbean coasts are affected more frequently by climate-related events. Quite apart from long-term sea level rise and individual extreme events, every year thousands of people are affected by storm surges and floods on both the Pacific and the Caribbean coasts. Reactions to these events are more focused on mitigation and emergency attention rather than on preventing or preparing for these frequent or even larger events. For some cities and towns in the region facing the impacts of coastal hazards, such as hurricanes, tsunamis, yearly floods, storm surges and even sea level rises, hard engineering solutions and infrastructure measures are not realistic options. Furthermore, these problems are intensifying. Whereas in the past the natural environment was able to adapt to such events, pressures, both natural and human created, on coastal ecosystems have increased enormously in recent years to the extent that this historical resilience has become compromised. It is important to recognise that the vulnerability of a particular region to natural disasters is affected by other equally important variables, such as the capacity of communities to respond or frequency and intensity of the events. Nevertheless, a proper knowledge and management of the natural environment of a region could help decision makers produce policies and plans for natural disaster prevention more in tune with the environment. This research aims to produce an 'ecosystem-inclusive' vulnerability index that assesses the use of coastal ecosystems in the coastal zone of Colombia as mitigation tools/strategies for coastal hazards (natural disasters), including sea level rise. The resulting product will be tested in similar coastal areas in Latin America, aiming to develop an index/pattern applicable to the region in which response and resilience capacities of natural ecosystems, as well as the geomorphology of coastal areas, are parameters considered together with the economic capacity and human settlements' capacity to respond.

### Introduction: The Case for an Ecosystem-Inclusive Vulnerability Index

The Asian tsunami of 26 December 2004 and the effects of Hurricane Katrina on New Orleans in August 2005 raised the profile of natural disasters on large-scale planning and policy-making agendas. Furthermore, there has been widespread concern that those disasters most closely related to climate will increase in frequency and intensity as a consequence of global climate change.

There has been a considerable volume of scientific research on the physical aspects of disasters. However, most of the research dealing with disaster management deals with emergency response, focusing on consequences to human populations and their responses. Vulnerability assessments have been produced for several regions of the world and for several events, but very few studies include the natural environment as part of the assessment.

Comprehensive databases have been constructed for and by insurance companies whose interests have not yet expanded to developing countries. Yet, statistics show that regions that will be potentially most affected by an increase in climate-related events will be developing nations whose economies largely depend on natural resources. In many of these countries at the local level, natural resources form an important proportion of people's livelihoods and incomes.

Little information is generally available regarding interactions between ecosystems and natural disasters. Such interactions include both the impacts of natural disasters on ecosystems and the responses of those ecosystems to such disasters. Immersed in these interactions are the ecosystem services pro-

vided to human communities, not only as sources of materials or livelihoods, but also as coastal defences, both directly, as in the case of wave attenuation, and indirectly, as in the accumulation of sediments. More recently, several studies have approached these interactions. There is plenty of anecdotal information on the protective role of natural ecosystems from the Asian tsunami and floods in Bangladesh (Sudmeier-Rieux et al., 2006; *United Nations Environmental Programme-World Conservation Monitoring Centre* (UNEP-WCMC) 2006). Such anecdotes could also be applied in other areas of the world that are as vulnerable, where communities depend as much on natural resources and where ecosystems are also being rapidly over-exploited. Furthermore, in recent years the term resilience, described by Holling (1973:17) as a characteristic of ecosystems, has been used in other disciplines. Terms related to ecological and social resilience are more common in recent literature (Adger et al., 2005; Cardona 2003), but the relationship between them is still descriptive and difficult to measure. Considering all the aspects briefly described before, two recurrent questions are:

Why have ecosystems not been included before in natural disaster preparedness, mitigation and response? Or even as an integral part of vulnerability assessments?

The responses to these questions could lead to a never-ending discussion between human and physical geographers, geologists and biologists; and that is not the purpose of this paper. However, some of the answers could include:

- Indexes have been produced for developed regions where the role of the natural environment is less critical and where the availability of secondary and long-term information for index construction has not been a constraint;
- Ecosystems services have only recently been recognized by the 'disasters community';
- Some countries (particularly in the developing world) do not have enough information on ecosystem characteristics to include them in any analysis;
- Tropical ecosystems are complex in structure and have multiple functions, making them very difficult to simplify;
- Ecosystems are considered a part of the physical environment;
- Status and type of ecosystems in a vulnerable area does not increase or diminish the vulnerability of an area to natural disasters.

## **Vulnerability and Vulnerability Indexes**

Vulnerability is a very broad concept that can be summarised as 'the quality or state of being wounded or susceptible of receiving wounds or physical injury' (Oxford English Dictionary 2006). Just as the concept of vulnerability has been defined in several ways and has been variously applied to locations, towns, people and the physical environment, so techniques to measure it have also varied according to the discipline assessing the vulnerability and 'what' is 'vulnerable to what'.

The term vulnerability is used by most disciplines involved in natural disasters, hazards or change research. Most disciplines addressing coastal vulnerability have produced indexes, methodologies or guides to assess the vulnerability of their topic of interest. Depending on the perspective of the analysis, there can be social vulnerability (Kreimer et al., 1992; Cardona 2003), which addresses the capacity of human populations to respond to an event. Alternatively, physical vulnerability (Alcantara-Ayala 2002; *United States Geological Survey* (USGS) 2001) addresses the capacity of a system to respond to a particular physical process; often in the case of coastal vulnerability, this process is taken to be sea level rise. Considering only natural disasters and the vulnerability of a region to different levels of impact, as a whole this should include: description of the impacts, magnitude and frequency of impact and type of physical environment, as well as the characteristics of the population inhabiting that region. Such cha-

racteristics should include social aspects, livelihoods, poverty/wealth levels, quality of life and also the values and mechanisms (policies) that structure that society.

For the purpose of this paper, vulnerability indexes have been categorised according to the main discipline underpinning their production: socio-economic, infrastructure, physical, environmental, political, multidisciplinary and related to the events per se. Table 1 presents the documentation reviewed, classified according to these categories. Regarding the natural environment and coastal areas, perhaps the most comprehensive index is the *Environmental Vulnerability Index* (EVI) produced (and still under revision) by *South Pacific Applied Geosciences Commission* (SOPAC). The EVI considers parameters from several disciplines (i.e. tourism and fisheries) assessed from the impact perspective, rather than from their contribution to the local/national economy (Kaly et al., 2002a; Kaly et al., 2002b).

**Table 1 Approaches to Vulnerability Classified According to the Discipline Underpinning Their Production**

Vulnerability indexes/ assessments Authors	
Socioeconomic vulnerability	Adrianto, Matsuda 2002; Blaikie <i>et al.</i> , 1994; Cardona, 2003; FAO, 2001; Frasser, 2003; Lavell, 1992; Wei et al. 2003; Wilches-Chaux 1989.
Physical vulnerability	Alcantara-Ayala 2002; Blaikie et al. 1994; Bush <i>et al.</i> , 1999; Cutter, 2001; Fraser <i>et al.</i> , 2003; IPCC, 2001; Perez, no date; Salomon, Forbes 1999; Scheigdegger 1994; Uitto 1998; UNCHS 2001; USGS 2001.
Environment related vulnerability	Blaikie et al. 1994; Brooks et al. 2005; Callow 1998; Hossain 2001; IPCC 2001; Kaly <i>et al.</i> , 2002a; Kaly <i>et al.</i> , 2002b; Livingston <i>et al.</i> , 2005; Papathoma, Dominey-Howes 2003; UNCHS 2001; UNEP 2002 & 2005; Wilches-Chaux 1989.
Infrastructure Vulnerability	Blaikie et al. 1994; Cannon 1991; Davidson 1997; FAO 2001; IDNDR, ISDR 1999; MMPND, UNDP 1999; Papathoma <i>et al.</i> , 2003; Papathoma, Dominey-Howes 2003; Perez, no date; Uitto 1998; UNCHS 2001; UNEP 2002.
Political Vulnerability	Briguglio 2003; Brooks <i>et al.</i> , 2005; Cannon 1991; Cardona 2003; Fraser 2003; Lavell 1999; Lavell, Cardona 2000; Kreimer et al. 1992; Mancilla 1996; Uitto 1998; Wilches-Chaux 1989.
From the events perspective	Alcantara-Ayala 2002; Cardona 2003; Davidson 1997; IDNDR and ISDR, 1999; Invemar 2003; Klein, Nicholls 1999; Lavell, Cardona 2000; Lozano 2003; Nyong 2005; Scheigdegger 1994; Uitto 1998; UNCHS 2001.
Natural disasters general	Brooks <i>et al.</i> , 2005; Briguglio 2003; Cardona 2003.
Natural disasters particular events	FAO 2001; IPCC-CZMS 1992; Papathoma, Dominey-Howes 2003.
Global and regional indexes	Chang 2004; FAO 2001; UNEP 2005.
Applied any of the countries of scope	Cardona 2003; Chang 2004; IDNDR, ISDR 1999; Invemar 2003; IPCC-CZMS 1992; Lavell 1992; UNEP 2005.
Applied in coastal areas of the countries of scope	IPCC-CZMS 1992; UNEP 2005; IDNDR, ISDR 1999; Invemar 2003
Multidisciplinary assessments vulnerability	Blaikie <i>et al.</i> , 1994; Briguglio 2003; Brooks <i>et al.</i> , 2005; Hossain 2001; IPCC-CZMS 1992; Mancilla 1996; Me-Bara, Valdez 2005; UNEP 2002 & 2005.

Source : authors

## Resilience and Natural Disasters

Although there is evidently a need to understand the linkages between ecosystems, social systems function and community interaction with the natural environment, most of the literature that aims to integrate these three areas is still very descriptive. In the hazards/disasters context, the term ecological

resilience is generally used to explain, describe or assess social resilience. However, there are some approaches addressing ecosystem resilience that have targeted resilience and adaptation to climate change (Roman et al., 1994; Peterson 1997; Adger 2000).

Climate change, biodiversity loss, land use change, hydrological modification and alteration of biogeochemical cycles alter ecosystems and their processes broadly, including resilience that depends on the continuity of ecological process at all scales. As Peterson et al. (1997:1) pointed out in reduction of ecosystems, resilience might result in ecosystems that are increasingly fragile and sensitive to disruption.

In relation to coastal hazards in particular, examples from Trinidad and Tobago show that an adaptive ecosystem management approach could improve community resilience and reduce their vulnerability to natural hazards. Still, there is a need for further research on this topic; current analysis and recommendations are more targeted to communities and social behaviour than to ecosystem management, impacts, or responses (Tomkins, Adger 2003:1).

Within the urban context, Klein et al. (2003:43) explored the resilience of coastal cities to natural disasters, concluding that, although natural environment, community resilience and adaptation are measurable and feasible to monitor questions about the relationship between natural system and social system; the resilience question remains yet to be fully explored.

Approaches to measuring social resilience seem to be easier and simpler because development indicators can be used. However, for ecological systems, all authors agree that there is a lot of information that needs to be drawn together in order to understand system resilience (Carpenter 2001:779; Tomkins, Adger 2003:1; Adger et al., 2005). Table 2, extracted from Kruijf and Van Vuuren (1998:8), associates resilience with ecosystem health. It describes some intrinsic and extrinsic requirements affecting the latter. However, the types of indicators used to measure ecological resilience or methodologies or protocols are not described.

**Table 2 Requirements for Ecosystem Health**

Requirement	Description of relevant aspects
<b>Intrinsic requirements</b>	
Resilience	Able/unable to react to perturbations
Vigour	Functioning measures
Organization	Structural measures; need/no-need subsidies
No <i>ecosystem distress syndrome</i> (EDS)	Presence of EDS signs
No impairment other systems	Does/does not impair adjacent systems coexistence)
<b>Requirements related to the relation with the environment of the system</b>	
Risk factors	Presence of risk factors (e.g., pollution)
Economical requirements/ exploitation (production/ infrastructure)	Providing economically interesting products; availability of sufficient primary products (water, wood, etc.); renewable vs non-renewable exploitation
Management	(Non) presence of policy framework (maintenance)
Social and cultural requirements	Value for recreation, amenity, social awareness

Source: Table 1 (Kruijf, Van Vuuren, 1998: 8)

Carpenter et al. (2001:765) relate biotic systems' resilience to genetic diversity, biodiversity and heterogeneity of landscape mosaics. They also relate resilience to sustainability and consider it a measurable characteristic of dynamic models.



Callow (1998:15), assessing ecological risk, points out the relationship between species losses and ecosystem integrity. Within ecosystem integrity, stability, resilience and process are mentioned in relation to ecosystems, but, again, indicators or methodologies to assess these properties are not considered.

In general, much present attention is focused towards species distributions and abundance patterns and less to their natural temporal relative abundance patterns (regionally or globally) or to species' functional attributes for responding to disturbances (Hughes et al., 2003:932). Existing examples come largely from fisheries and are not seen at the ecosystem level, but rather in terms of species distribution, template ecosystems and forests responses to fires (Palik et al., 2002:347; Olson et al., 2004:75; Livingston et al., 2005).

## Coastal Ecosystem Status in Central America and Northern South America

According to *Programa de Naciones Unidas para el Medio Ambiente* (PNUMA) (2003) there are 4630 km<sup>2</sup> of coral reefs and 13968 km<sup>2</sup> of mangrove forest distributed along the coastal areas in the region. Most of the corals are in the Caribbean Sea. Although mangrove characteristics are very different in the Pacific and the Caribbean coasts, most of the regional studies – although acknowledging such variations – analyze and describe them as one.

Reefs and mangroves play an important role in shore protection under both normal sea conditions and during hurricanes and tropical storms. It has been reported that at least 70-90 % of the energy of wind-generated waves is absorbed by coastal ecosystems depending on how healthy they are and on their physical and ecological characteristics (Roberts, Suhayda 1983:209; Kabdali, Turker 2002:153). Fringing corals and barrier reefs provide breakwaters to ocean waves, hence protecting coastal areas (Lugo-Fernandez et al., 1998:385; Kabdali, Turker 2002:153). Burke and Maidens (2005:14) estimated a figure of between \$ 700 – 2,200 US dollars as the value of the protective action of reefs in the wider Caribbean region in a year; also, it has been calculated that in the following 50 years, coral reefs degradation could lead to annual losses of between 140 and 420 USD. Other estimates have been summarised in table 3.

**Table 3: Potential Net Benefit Streams per Year and Net Present Value (NPV) of Coral Reefs per Region (in US\$ million) and Globally**

Good/service	Amount total	Caribbean exp USA	Pacific exp USA
Reef area (km <sup>2</sup> )	284,000	19,000	67,000
Fisheries	5,718	391	1,060
Coastal protection	9,009	720	579
Tourism/recreation	9,621	663	269
Biodiversity value	5,483	79	172
Total	29,830	1,853	2,079
NPV (50 year; 3%)	797,359	49,527	55,584

Sources: modified from tables 1 and 3 (Cesar et al. 2003:4, 10)

Both corals and mangroves have been severely exploited in the region. There is not much published information about their status prior to the 1970s. According to Ellison and Farnsworth (1996:552), reliable area estimates have only been produced since the early 1980s. There are, however, estimates from the 1970s and the 1960s that indicate a large-scale loss of mangroves in the region. Alarcon and Conde in Ellison and Farnsworth (1996:552) reported that only 10% of Venezuelan mangroves remained by 1993. D'Crozz (1993) in Ellison, Farnsworth (1996:552) reported that by the 1990s, Panama had lost 41%

of its mangrove forest, mostly on the Pacific shoreline. Much of this decline has been attributed to four anthropogenic activities: wood extraction, pollution, land reclamation and climate change (Ellison, Farnsworth 1996:552; Lugo 2002:10).

Land reclamation and transformation, for agricultural, urban or tourism uses, are regional threats to mangroves, corals and seagrass communities (Lugo 2002:11; Alvarez-Leon, Polania 1996; Botero, Mancera 1996). Several cities in the region have developed in what were once mangrove areas: Santa Marta, Cartagena, Tumaco, Buenaventura (Colombia), San Juan (Puerto Rico), Braganza City (Brazil), Cancun (Mexico), Guayaquil and Esmeraldas (Ecuador), Golfo de Fonseca (Honduras) and Maraciabo (Venezuela) amongst others (Lugo 2002:11; Alvarez-Leon, Polania 1996; PNUMA 2005). Cartagena is a standing testimony to coral reef limestone being used as construction material during the colonial period. Likewise, Pacific mangroves have been historically used and are still used as building material. Nowadays, mangroves are still claimed for habitat purposes, although mostly for tourism industry development. 29% of the reef areas of the sub-region are considered to be at significant risk from runoff and sedimentation caused by deforestation, nutrients discharged from hotels and vessels, construction projects along the coast, and mining activities, as well as from increases in sea surface temperatures (Bryant et al., 1998:21; UNEP 2000:44).

### **Natural Disasters and their Management in Central America and Northern South America, with Particular Reference to Colombia**

Latin America and the Caribbean region is an area with a high propensity to natural hazards: hurricanes, floods, earthquakes, tsunamis, volcanoes among other events have been reported in several areas within the region over the past 100 years. It is a region of great tectonic activity, as well as one affected by climate-related events. Combining Bryant's estimates (Bryant 2001) of the percentage of tsunamis reported around the world, the region could potentially be the most vulnerable to tsunamis: 13.8% in the Caribbean and 25.4% in the Pacific, giving a total of 39%. If to this propensity is added the lack of planning, weak institutions and economies, and populations concentrated in unplanned urban areas (PNUMA 2005; Cardona 2003; Chang 2004; Lavell 1999), the region appears to be very susceptible to natural disasters.

Colombia, due to its geographical position, is affected by natural events in both the Caribbean and the Pacific regions. Although it is too far south to be along the trajectory of most hurricanes, there are reports of hurricane damage at an average interval of 30 years on the Caribbean coast. During the hurricane season, storms and rains increase and cause damage to infrastructure and even death. The Pacific coast is not affected by hurricanes, but it is an area of tectonic activity and subsidence. There have been four tsunamis reported in the past 100 years, all of them devastating the region, even though they occurred in the best possible conditions (not an El Niño year, low tide, dry season, during the day). Because of the humid climatic conditions, floods are also very common during the wet season (Lacambra et al., 2003).

Table 4 presents a summary analysis of the regional organizations dealing with natural disasters, development and poverty, and Table 5 lists national agencies dealing with natural disasters as such, as well as any other related institutions from all disciplines (as much of the disaster related research and approach is social and related to poverty). Most of these organizations were originally created after or as result of a major disaster, and/or for the purpose of responding to disasters, not preventing their impacts or planning for the avoidance of such impacts; hence, most of these organizations' scope is to attend to emergencies, rather than prepare, plan or conduct research on the events themselves. Nevertheless, recently these organizations have been targeting education, risk, and institutional planning in order to prevent disasters and prepare communities for natural hazard impacts.

**Table 4 Regional Organizations Involved with Natural Disasters' Prevention, Preparedness and Attention.**

Name	Scope	Target
<i>Comité Andino para la Prevención y Atención de Desastres</i> (CAPRADE)	Andean Countries	Prevention and attention
<i>Centro Regional de Información sobre Desastres</i> (CRID)	Latin America and the Caribbean	Information on historical disasters and regional management
Practical Action	Latin America	Preparedness and mitigation of disasters through social development
Organización Panamericana de la Salud. Punto Focal de Desastres	Latin America	Attention
<i>International Strategy for disaster reduction</i> (ISDR)	Latin America and the Caribbean	Preparedness and prevention
La Red	Latin America	Information on historical disasters
<i>Pan American Disaster Response Unit</i> (PADRU)	Central America	Prevention and attention

Source: Table produced by the authors with information collected from each institution

**Table 5 National Agencies Dealing with Natural Disaster Prevention, Attention and Preparedness**

Country	Name	Target
Costa Rica	<i>Comisión Nacional Prevención de Riesgos y Atención de Emergencias</i> . (CNE) Emergency Attention and Risk Prevention National Commission	Coordination of activities in risk situations
Nicaragua	<i>Sistema Nacional para la prevención, Mitigación y Atención de Desastres</i> (SINAPRED) National System for Disasters Prevention, Mitigation and Attention.	Coordination
Salvador	<i>Comite Nacional de Emergencia</i> (COEN) National Emergency Committee.	Communication and communities preparedness to natural disasters
Panama	<i>Sistema Nacional de Protección Civil</i> . (SINAPROT) National System for civil protection	Education
Ecuador	<i>Programa de Emergencias para Afrontar Fenómenos Naturales</i> . (COPEFEN) Emergency program to address Natural hazards.	Education and research on el Niño event
Venezuela	<i>Protección Civil y Administración de Desastres</i> . Civil Protection and Disasters Management	Coordination attendance of disasters
Colombia	<i>Dirección de Prevención y Atención a Desastres</i> (DGPAD) System for prevention and Attention for disasters	Prevention, preparedness and attendance

Source: Table produced by the authors with information collected from each institution

Tables 6 and 7 summarise figures of natural disasters in the region's coastal areas, according to the different levels of administrative divisions and type of events most frequently reported. Floods are the most common events reported and are normally related to the rainy season. More storms and climate

related incidents are reported along the Caribbean coastlines than along the Pacific coast; along the latter, seismic activities are more common than along the Caribbean coast.

**Table 6 Natural Disasters Reported in the Region since 1498 until 2002**

Country	National Events	Coastal Events*	Coastal municipalities*	Selected events
Costa Rica	5 569	2 021	1 787	1 679
Nicaragua	146	73	49	49
Salvador	955	450	102	80
Panama	2 456	2 456	2 076	1 086
Venezuela	795	777	245	154
Ecuador	2 458	1 387	1 122	571
Colombia	17 569	9 921	3 337	3 032
	47 517	27 006	14 783	12 411

\* Coastal Events include all those events in the 1st order of administrative division. Coastal municipalities include those events at 2nd order administrative division.

Source: Table produced by the authors build up from DesInventar<sup>12</sup> database (DesInventar, 2005) and information extracted from archives and other historical sources

**Table 7 Common Events in the Coastal Areas of the Pacific Ocean and Caribbean Sea in the Region**

Events	Caribbean	Pacific	Total	Colombian Caribbean	Colombian Pacific	Total
Number of events	3 364	3 222	6 586	2 318	713	3 031
Floods	1 949	1 487	3 439	1 372	311	1 638
Storms	415	301	716	332	68	400
Rains	156	92	248	213	76	289
Sea surges	95	198	293	82	111	193
Earthquakes	63	118	181	40	49	89
Hurricanes	37	2	39	35		35
Tsunami		3	3	0	3	3
ENSO (El Niño)	50	271	321			

Source: Table produced by the authors build up from DesInventar database (DesInventar, 2005) and information extracted from archives and other historical sources

Although the first disaster reported was a tsunami that occurred in the coastal areas of Venezuela in 1498, most of the events listed in Tables 6 and 7 correspond to late 20th century events, up to 2004. In-land disasters have been more commonly reported. As Table 8 shows, and with the exception of Guayaquil (Ecuador) and Panama city (Panama), this might be because all the main metropolitan areas and capital cities in this region are inland. Exactly at these locations the population is concentrated, which leads to bigger disasters. In Colombia, the Caribbean coast is more populated and developed than the Pacific coast. Cartagena and Barranquilla are the most important metropolitan areas on the Caribbean coast, and, along 100 km of coast, there are almost 3,500,000 people. This population has

<sup>12</sup> DesInventar is a public database produced with support of UNDP, La Red and maintained by the Observatorio Sismológico del Sur-Occidente (OSSO)

been subjected to 20% of all the natural disasters reported for the Caribbean coast. There are only two urban areas along the Pacific coast – Buenaventura and Tumaco – and together they account for 36% of all the reported events in this coastal area.

**Table 8 Population distribution in Coastal Areas of Tropical Latin-America**

Country	Main metropolitan area	Main coastal city	Population more than 1 million in Coastal areas
Costa Rica	San Jose	Puerto Limon	none
Nicaragua	Managua	Puerto Cabezas	none
El Salvador	San Salvador		none
Panama	Panama city	Ciudad de Panama and Colon	none
Colombia	Bogota	Barranquilla and Cartagena	Barranquilla and Cartagena
Venezuela	Caracas	Maracaibo	Maracaibo
Ecuador	Guayaquil	Guayaquil	Guayaquil

Source : authors

### Deficiencies in Information Availability

Much of the regional information targeting vulnerability and natural disasters has been produced for policy implementation and impacts of natural hazards on infrastructure and populations. At regional, national and local levels there is little information available on both historical hazards (prior 1960s) and historical distribution of natural ecosystems. Documents and processes related to colonization and development can facilitate research into how ecosystems have been used and exploited historically.

Although some ecosystem services have been researched, their incorporation into policy is not clear. Biodiversity indicators, however, have been used to monitor natural areas as part of national policies to protect biodiversity. Nevertheless, other services, such as coastal protection or soil retention, have been neither researched nor applied in coastal management for disasters in the region.

The capacity of institutions has not been documented either. The documentation is missing for who is responding in case of emergency/disaster, but also for all national institutions and governmental offices in charge of natural disasters. In this respect, and in particular regarding policies, it seems that at least at the local and national levels, the environment has not been considered in any initiatives for the prevention or mitigation of disasters, nor in any contingency plans. Having said this, new policies are being incorporated that could change this historical approach to ecosystem and disasters management.

Regarding research and policy information related to the events as such, it has been found that some particular events and particular areas have been studied with more detail. This has been the case for tsunami impacts in Tumaco, for example, because this area has been devastated four times in the past 100 years by tsunamis. However, floods that occur annually in several coastal, rural and urban areas, causing thousands of displaced people, have not been documented. In general, much of the available documentation on natural disasters has been collected from newspapers by research institutes; there is no series of data with scientific information available for any disaster, at least not in Colombia.

### A New Approach Towards Vulnerability Assessment in Latin America

Recognising the above shortcomings, this research project aims to contribute to a better understanding of the role of coastal ecosystems in affecting the vulnerability of tropical coastal areas to natural disasters, with particular interest in the Latin American tropics. Considering the available information, the gaps in information, the type of events affecting the region and the region's coastal ecosystems (his-



torical and present distribution), a decision tree analysis has been applied to select the possible parameters to be included in an ecosystem-inclusive vulnerability index. To achieve the aim of prioritising individual characteristics of the coastal system in terms of their importance in affecting ecosystem vulnerability to hazards, a conceptual model approach is being adopted, which, at the present time has resulted in the selection of a set of parameters summarised in Table 9 and Figure 1. Each general indicator is composed by a set of simple parameters defining, directly or indirectly, the general indicator in question. For example, migration capacity is defined by land use, soil type, artificial areas and infrastructure, slope, geographical barriers and available land. Strength and resilience of the ecosystem is defined by the ecosystem's intrinsic defence capacity, its current health and the pressures upon it.

**Table 9 Parameters Selected to Define a Coastal Area Vulnerability to Natural Hazards in Tropical Coastal Areas of Latin America**

General Parameters	Measure Capacity for:		
	Adapt	Avoid	Respond
<i>Natural Environment</i>			
Migration capacity	x		x
Ecosystem extent	x		x
Ecosystem health	x		x
Structure	x		x
Human Intervention		x	
Area surrounding it		x	
Evidence of damage	x		x
Protected areas	x		x
<b>Events Characteristics</b>	x	x	x
<b>Physical environment</b>		x	x
<b>Infrastructure</b>		x	x
<b>Economy Characteristics</b>	x	x	x

Source: authors

These parameters and indicators are being assessed and evaluated during ground-truthing visits to the study areas in Colombia. Old maps, historical photographs, aerial photographs and satellite images provide a good idea about how the coastal zone and its ecosystems have changed.

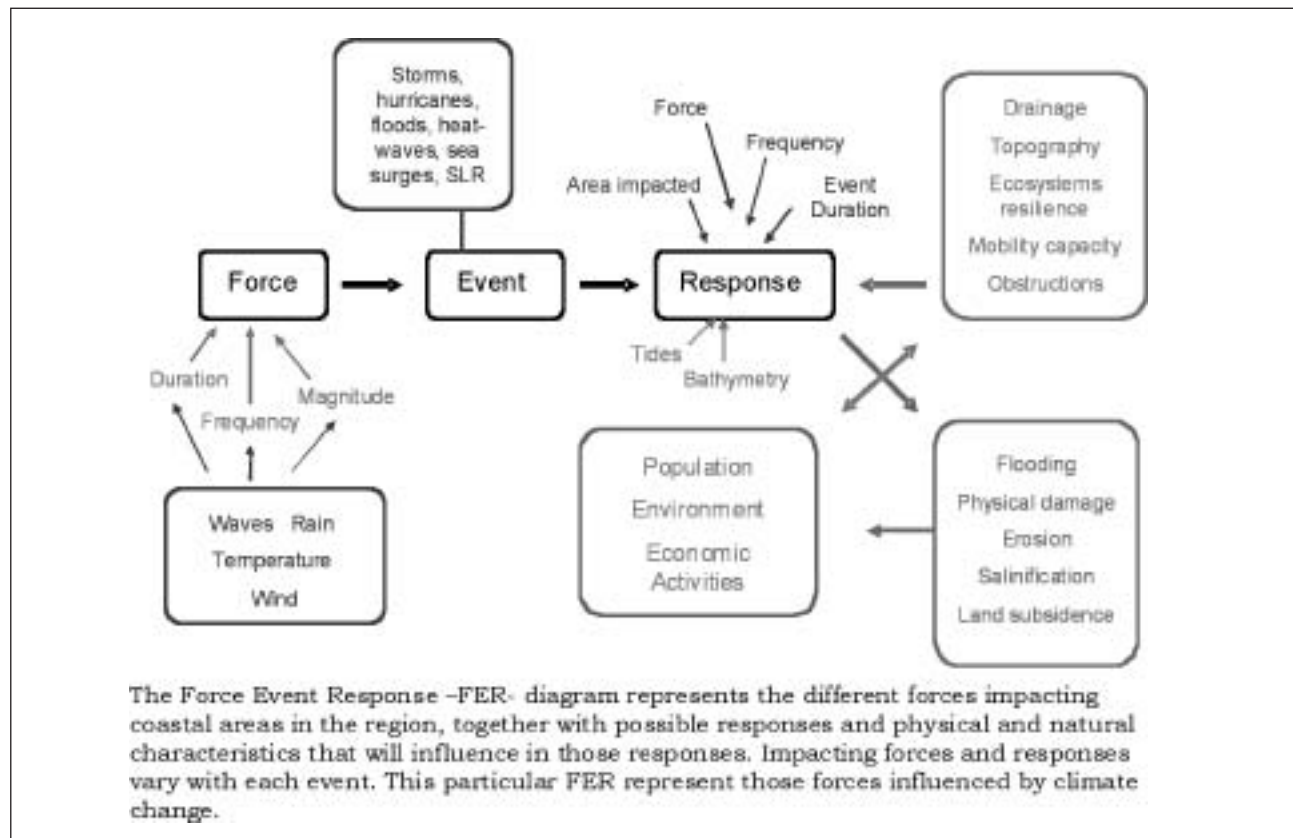
The *Force Event Respond* (FER) diagram (Figure 1) represents an idealised view of the different forces that can impact a coastal area and, of those factors, that influence the responses of the system. The FER model can be applied to each of the different forces (waves, wind, water) and to each event (rain, storms, floods, hurricanes, tsunamis) reported in the region. For example, a FER for storms includes rain, waves and wind; a FER for waves lists hurricanes, storms and tsunamis.

The systems' characteristics have been classified into four categories: drainage, topography, the system's mobility capacity (migration) and ecosystem resilience. The interaction between forces impacting coastal areas and those areas' characteristics and conditions, including their alteration by human intervention and past and current uses, result on various consequences summarised as flooding, physical damage, erosion, salinisation and land subsidence. For each system characteristic – topography, drainage, mobility and resilience – a set of parameters can be produced.

Some parameters, such as ecosystem fragmentation or continuity, and fresh water availability, for example, can provide a good idea of its intrinsic defence status, its health and the pressures upon it. A

fragmented ecosystem will show less structural defence, less area to resist any force (wave, flood), will provide less habitat area for animals and plants, and is likely to be fragmented by roads, artificial channels and buildings, all of which represent a stress for the system. Fresh water availability not only provides an idea of an ecosystem's health and its capacity to respond to events, but also gives information of the surrounding environment and its communities.

**Figure 1 Force Event Respond Diagram**



Source: authors

## Anticipated Outcomes

Once all the information has been integrated and the assessment has been produced, there are four main outcomes:

- A tool that is applicable, at least at the regional level, and that can indicate the relative importance of individual drivers of vulnerability in a particular area from an environmental perspective;
- Parameters selected are simple and do not necessarily require a large data series. Thresholds are given, on the one hand, by the area's natural dynamics and the geomorphology and, on the other, by the pressures imposed by human activities. Historical information that can be gathered at a local level and through communities is likely to be very useful in understanding how the ecosystem has changed and how natural events have affected each community;
- Throughout the process, information from several disciplines is integrated, contributing to the understanding of natural hazards affecting a region and, hence, the opportunity to plan for their prevention and mitigation; and
- When historical information is considered, planners can identify patterns and changes in the natural dynamics of an area, among many other important lines of information. Knowing historical events, his-

torical land use and changes in the landscape may explain much of what happens at the present time and help to plan for the future.

## Concluding Remarks

Over the past 30 years earthquakes, tsunamis, landslides, floods and hurricanes have affected all different areas within the region of Latin America. Response mechanisms have considerably improved, and governments are increasingly incorporating preparedness for disasters into their agendas. Compared to other developing regions in the world, the analyses of disasters, the responses and the socio-economic understanding, however, are very broad. In fact, most of the research has been produced from the social and economic perspective – not surprisingly, as it is communities and their livelihoods that are ultimately affected. However, without a real understanding of local coastal dynamics, the forces behind the hazards will not be fully understood. The same applies to the natural environment's intrinsic capacity (physical or ecological). Without this understanding, a response in accordance with a respective region will not be possible and, therefore, a plan to avoid disasters will not be feasible.

With the exception of a few cities, coastal areas in the tropical region of Central and South America are not overpopulated. Most urban and industrial development has occurred inland and, hence, most of the information on natural disasters also comes from inland locations. However, in those coastal areas, where cities are becoming larger, vulnerability to natural disasters is also increasing and very little information about coastal dynamics, natural hazards and the natural environment is available.

Most strategies implemented to address natural disasters vulnerability in the region aim to attend to emergencies rather than to plan prevention. There is a need for a much closer relationship between land planning agencies, research institutes, natural environment management agencies and risk, prevention and response assessment organizations.

Results from this research could contribute to the ongoing work on indicators and indexes to assess vulnerability to natural disasters and their applicability in the region or other coastal regions of the world. Results related to environmental services, ecosystem health and ecosystem resilience could help narrow the gap in understanding interactions between disasters, populations and the natural environment, as well as providing new questions and ideas for future research.

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### **3. SECTION**

## **LOCAL AND GLOBAL DISASTERS AND MEGACITIES**

### 3.1 Shifting Vulnerabilities: A Study in Flood Affected Slums of Mumbai

*Monalisa Chatterjee*

Megacities of developing countries are experiencing unprecedented population growth that promotes extensive disparities of risk and vulnerability. Low income populations in such megacities are often located in places that are prone to excessive losses from hazardous events, like floods. However, it is also clear that broad social, economic, political, cultural and global forces play important roles in affecting impacts and losses during hazard events. Based on primary fieldwork undertaken between March and August 2007, this paper presents an empirical analysis of factors that drive vulnerability in the slum populations of Mumbai. Using quantitative methods, it explores the relation between specific socio-economic characteristics of households and their impact on household survival during, immediately after and in the long term recovery phases of an extreme event. Particular attention is paid to the extent to which local patterns of vulnerability are connected with supra-local and global processes of socio-cultural and political-economic restructuring, as well as the shifts that occur in different stages of the disaster cycle.

#### Introduction

The dynamics of urban demography have a strong influence on human vulnerability to environmental risks and hazards in developing countries. By 2025, it is expected that 57 percent of developing countries' populations will live in cities (UNCHS 2001). Likewise, in 2015, there will be as many as 22 megacities (cities with populations of more than 10 million), of which 17 will be located in third world countries (United Nations 2005). It is estimated that 3.9 billion people will be living in cities of developing countries by the end of this period (2015)(United Nations 2005). Rapid concentration of population in urban settlements changes existing socio-economic, political, cultural, infrastructural and ecological conditions and magnifies the complexities of present day urban systems. Consequent imbalances are evident in the unequal distribution of risk and vulnerability in megacities of developing countries (Hardoy et. al., 2001; McGranahan et. al., 2001). Populations in cities are exposed not only to increased risk generated from structural impacts of global change, but also to aggravated vulnerability from complex natural or anthropogenic disasters (Mitchell 1998; Mitchell 2004). These processes change the type, extent, nature and distribution of vulnerability by altering resources, rights and access of affected people (Moser 1998; Pelling 2003; Wutich 2006).

#### Background

In developing cities, urbanization, augmented by processes of globalization, intensifies ecological, economic, political and societal dimensions of vulnerability (Kraas 2007a), often in complex and sometimes contrasting ways. Ecologically, the accumulation of large numbers of people exerts an enormous pressure on the immediate surrounding environment (Araby 2002). Rapid population growth tends to trigger the emergence of brown, gray and green environmental issues simultaneously (Marcotullio and Lee, 2003; Maziak et.al., 2005). Economically, megacities are internally segregated in terms of income, types of opportunities (Marcuse and Kempen, 2000) and basic infrastructure available (Gulis et. al., 2004). Another common economic consequence is a dominant and ever growing informal sector (Davis, 2004; Mead et. al., 1996) that thrives on increased means of communication and networking (Mitra 2004; Teranishi 1994). Growth in the informal sector is negative because third world megacities are mostly 'absorption pools'(Kraas 2007b:13) for people migrating from rural areas; they do not have the required infrastructure or suitable administrative systems for sustainable and inclusive urban development. Government policies are often deficient because specific socio cultural and religious groups are marginalized in the urban decision making process (Appadurai 2001; Quarantelli 2001; Rao 2005). There-



fore, vulnerability is further increased by social segregation and exclusion (Heller 1996; O'Brien et. al., 2004; Pelling 2001; Wisner 2002). However, megacities are also nodes of global importance with increased numbers of directly or indirectly connected actors (Kraas 2007a; Leichenko et. al., 2008). Although these cities have more vulnerable people, it has been shown that increases in the number of stakeholders improves their absorptive capacity and resilience (Mitchell 2006; Pelling 2003).

In summary, vulnerability is an expression of fluctuating social and economic conditions (Bankoff et. al., 2004). Megacities provide researchers with suitable 'laboratories' (Kraas 2007a:80) to understand the nature and definition of vulnerability. Therefore, the first step in the assessment of vulnerability at the megacity level is to acknowledge its shifting character and then to identify the multitude of actors involved in producing and reducing vulnerability. This paper uses the relationship between socio economic characteristics of households and types of support received or acquired at different levels of hazard recovery to trace the changeable nature of vulnerability and its impact on households' recoveries in a third world global mega city.

## Study Area

Mumbai (Bombay) is one of the rapidly growing megacities of the south with a population of 16 million (2001) (Risbud 2003) and an expected population of 22 million in 2015. It is predicted to be the second largest urban agglomeration in world by 2015 (United Nations 2005). Like many megacities in developing countries, Mumbai has increased its presence in the global economy (Sita and Bhagat, 2007), while still retaining a large population that is predominantly poor (Kraas 2007a) and vulnerable to changes in the environment and in socio economic and political structures (Appadurai 2001). Although, the growth of Mumbai has been accompanied by excessive disparities and segregation, it also provides local and globally linked actors with exposure to and opportunities for the adoption of better practices (Keyder 2005; Linnerooth-Bayer et. al., 2005; Mitchell 2005). In view of their increasing global salience, it is imperative to understand how the poor in megacities, like Mumbai, accommodate changes in vulnerability that accompany large scale processes of urbanization, global change and human security.

## Field Methods

In a monsoon flood event that Mumbai and its surrounding areas experienced during the third week of July 2005, the highest rainfall was recorded on 26 July when the city received 944 millimeters (37 inches) in 24 hours (Government of Maharashtra, 2005). Although these floods impacted different sectors of the city, slum dwellers were the most severely affected. Therefore, impoverished, flood-affected slum dwellers who work as skilled, semi-skilled and casual laborers in the industrial and private sector have been used as the targeted population for a sample survey in this study<sup>13</sup>.

Two slum settlements located in L and P South wards of Mumbai city were chosen for data collection. These wards: (1) contained high percentages of slum dwellers; (2) were heavily affected by floods in 2005 and 2006; and (3) were located near or in major industrial land uses with large numbers of industrial workers. Using visual observations and interviews with random key informants, a sampling frame of people who work in the industrial and private sectors was identified. Fifty of the households in this population were selected randomly as observational units for the collection of data on flood impact, mitigation and redistribution practices used to recover from flood losses.

A semi structured questionnaire was administered that comprised eight sections, including information on: socio economic status; flood risk; infrastructure availability; access to basic amenities; flood impacts; mitigation; specific loss sharing mechanisms adopted; and perceptions about insurance coverage. Each

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13 It forms a part of doctoral dissertation survey on 'Urban Flood Loss Sharing and Redistribution Mechanisms among the Impoverished Industrial Population of Mumbai' Monalisa Chatterjee, Department of Geography, Rutgers University.

section contained categorical and open-ended enquiries. Here, I will focus only on results that pertain to hazard mitigation during floods in 2005. In addition to interviews, observation and ethnographic methods were used to observe lifestyle, resources and attitudes of slum dwellers about their vulnerabilities, potential risks of recurrent floods, perceptions of flood loss causation and responsibilities for dealing with floods. These data illuminate the general attitude of the targeted low-income population towards flood loss reducing mechanisms and their receptivity to adopting them. Results from the survey on mitigation measures used by slum dwellers at different stages of the 2005 flood event (during, immediately after and in the long term recovery stage) were juxtaposed with socio economic, political and cultural characteristics of the households. Cross tabulation of these variables for all households were used to identify existing patterns. A chi square test established the statistical relation between variables.

## Findings

**Table 1: Surviving During Floods in 2005**

Social Characteristics	Shelter
Years of Residence in the present place	<ul style="list-style-type: none"> <li>• New (&lt;10 years) and Old (&gt;20 years) residents are less dependent on relatives.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>
Religion	<ul style="list-style-type: none"> <li>• Christian Households are more dependent on religious associations.</li> <li>• Hindu and Muslim households are reliant on social connections for shelter.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>
State of Origin	<ul style="list-style-type: none"> <li>• Households from Mumbai and other places in Maharashtra are more dependent on family and relatives.</li> <li>• Others are dependent on other social connections.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>
Economic Characteristics	
Number of employed people in Households	No Specific Pattern or Relation
Type of Industries	<ul style="list-style-type: none"> <li>• All households with members employed in service industries like IT took shelter in formal places like hotels</li> </ul>
Type of Employment	No Specific Pattern or Relation

Source: Chatterjee, 2007

Means of hazard mitigation were compared with socio-economic and cultural characteristics, like years of residence at present address, religion, original home state; number of employed in households, type of industry employed in and employment. During the flood event of 2005, respondents took shelter in different types of buildings or on higher ground near their slums (Table 1). Cross tabulation of survey results show that old and new residents are less dependent on relatives for shelter; Christian families are likely to take shelter in religious centers; and families from near-by areas in Maharashtra live with relatives, whereas families originally from more distant states rely more on other types of social connections. Families with members working in the Information Technology (IT) and service sectors are able to take shelter in formal places like hotels. Most (80 %) families could not safeguard anything, including important documents or collect money to carry with them because water rushed in suddenly.

After the flood, immediate relief was distributed by government, non government, private and local agencies (Table 2); NGOs helped 64%; private Institutions, 62%; local people, 50%; government, 40%; and political parties, 26% of the surveyed population. This underscores the relatively limited role played

by government. After the event, households had support from more than one agency; for example, 72 % received rations (food material cooked and uncooked) from three or more sources. NGOs and Private Institutions commonly distributed in-kind material aid to 50 % and 26 % of the surveyed population respectively. Only 44 % of households received medical assistance. NGOs and government helped 34% and 28% of households with medical support. Flood compensation funds were distributed by the government to 38% of households. It was also observed that members in 56% of households were absent from work for an average of two weeks and 82% of households surveyed suffered health disorders after the floods. Chi square tests show significant statistical relationships between relief received in the form of food and household commodities with socio cultural variables, like years of residence, religion and state of origin. There was also a direct relationship between compensation received with state of origin and years of residence.

Most households did not have any institutional support for information on flood mitigation measures that might assist their long term security. Similarly, only 20% of families surveyed had access to organizations that provide consultancy for effective credit practices. On average, each household had access to four or five sources of loss redistribution after the flood event (Table 3). Employers and family members were the most common source of economic support during recovery. Statistically, variables like religion, state of origin, type of industry and type of employment are significantly related to factors like loss redistribution, access to information and resources available to assist long term recovery.

**Table 2: Support Immediately after Floods in 2005**

<b>Social Characteristics</b>	<b>Food/Ration</b>	<b>Household Commodities</b>	<b>Medical Assistance</b>	<b>Compensation</b>
<b>Years of Residence in the present place</b>	<ul style="list-style-type: none"> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>	<ul style="list-style-type: none"> <li>• <math>\chi^2 &lt; 0.00</math></li> <li>• 70% of medial, 58% of new and 57% of old residents received help.</li> </ul>	<ul style="list-style-type: none"> <li>• 8% of new, 50% old and 58% of medial resident received medical assistance.</li> </ul>	No specific pattern or relation
<b>Religion</b>	<ul style="list-style-type: none"> <li>• Christian families – dependent on government and religious agencies.</li> <li>• Hindu and Muslim families – dependence equally distributed between state and community organizations.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>	<ul style="list-style-type: none"> <li>• 89% of Muslim, 70 % Hindu and 63% Christian families received help from non governmental agencies like NGOs, private institutions, and local people.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>	<ul style="list-style-type: none"> <li>• 51% of Hindu, 44% of Muslim, and 12% of Christian families received medical assistance.</li> </ul>	<ul style="list-style-type: none"> <li>• 55% of Muslim, 39% of Hindu and 12% of Christian families received compensation from government.</li> </ul>
<b>State of Origin</b>	<ul style="list-style-type: none"> <li>• Families from Mumbai and Maharashtra region received help from government and political agencies.</li> <li>• Households from other parts of the country were dominantly helped by non governmental and private sector.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>	<ul style="list-style-type: none"> <li>• Families from states like Tamil Nadu (100%), Uttar Pradesh (50%) did not receive any help.</li> <li>• Households primarily from Mumbai (65%) and Maharashtra (70%) received help.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>	<ul style="list-style-type: none"> <li>• People originally from outside of Mumbai and Maharashtra were the main recipient of medical service.</li> </ul>	<ul style="list-style-type: none"> <li>• 90% of families from Mumbai received compensations from government.</li> <li>• <math>\chi^2 &lt; 0.00</math></li> </ul>

<b>Social Characteristics</b>	<b>Food/Ration</b>	<b>Household Commodities</b>	<b>Medical Assistance</b>	<b>Compensation</b>
<b>Number of employed people in Households</b>	No specific pattern or relation	<ul style="list-style-type: none"> <li>Families with one working member receive relief from government and religious organizations.</li> <li>Families with more working members rely on NGOs and private sector.</li> <li><math>\chi^2 &lt; 0.00</math></li> </ul>	<ul style="list-style-type: none"> <li>Families with one working member receive relief from government; families with more working members rely on NGOs and private sector.</li> <li><math>\chi^2 &lt; 0.00</math></li> </ul>	<ul style="list-style-type: none"> <li>Higher percentage of households with more working members received compensation.</li> </ul>
<b>Type of Industries</b>	No specific pattern or relation	No specific pattern or relation	No specific pattern or relation	<ul style="list-style-type: none"> <li>Households with members working in manufacturing (75%) and transport (71%) industries received compensation.</li> </ul>
<b>Type of Employment</b>	No specific pattern or relation	No specific pattern or relation	No specific pattern or relation	No specific pattern or relation

Source: Author's primary fieldwork (Chatterjee, 2007)

**Table 3: Long Term Recovery Support after Floods in 2005**

<b>Social Characteristics</b>	<b>Loss Redistribution</b>
Years of Residence in the present place	<ul style="list-style-type: none"> <li>Medial and old residents had access to more sources of economic assistance.</li> <li><math>\chi^2 &lt; 0.00</math></li> </ul>
Religion	<ul style="list-style-type: none"> <li>Christians (100%) and Muslim (77%) families receive long term economic assistance from religious organizations.</li> <li>Hindu Families are more reliant on social connections.</li> <li><math>\chi^2 &lt; 0.00</math></li> </ul>
State of Origin	<ul style="list-style-type: none"> <li>Households originally from others states rely more on social connections for economic assistance.</li> <li>Households from Mumbai and surrounding area use economic associations for economic assistance.</li> <li><math>\chi^2 &lt; 0.00</math></li> </ul>
<b>Economic Characteristics</b>	
Number of employed people in Households	<ul style="list-style-type: none"> <li>Families with less working members are more dependent on employers and local traders for economic assistance.</li> <li><math>\chi^2 &lt; 0.00</math></li> </ul>
Type of Industries	<ul style="list-style-type: none"> <li>No Specific Pattern or Relation</li> </ul>
Type of Employment for financial assistance.	<ul style="list-style-type: none"> <li>100% of permanent workers and 90% of temporary workers use employers</li> <li><math>\chi^2 &lt; 0.00</math></li> </ul>

Source: Author's primary fieldwork (Chatterjee, 2007)

## Discussion

Survey results show that social, economic and cultural characteristics of households play important roles in determining their vulnerabilities to floods. The results illustrate also the shifting nature of vulnerability and how a particular characteristic contributes to exacerbate or reduce a households' vulnerabilities at different stages of the hazard cycle (Table 4). For example, new residents (less than 10 years) and old residents (more than 20 years) are dependent on randomly available places for shelter during the event and are more at risk in comparison to those in the medial residence category (10-20 years) who found refuge with the assistance of the social networks they have developed in situ. Moreover, immediately after the event, new and old residents are again more vulnerable, as they are likely to acquire less relief from different agencies. Exclusion accounts for the high degree of vulnerability among new and old report that new residents do not have access to networks of support – old residents, because of their established lifestyle – and do not maintain connections to support systems. However, old residents are able to renew social connections and use these resources for long term recovery after the flood event and, therefore, are much less vulnerable at the recovery stage. Medial residents are least vulnerable to floods because they are the most socially connected section of population in a mega-city. This section of the population is active in the process of consolidating their presence in the city system; when a sudden event occurs, they are able to exercise all resources immediately.

**Table 4: Distribution of Vulnerability at Different Stages of the Hazard Cycle**

<i>Indicator</i>	<i>During Flood Event</i>	<i>Immediately After Event</i>	<i>Long Term Recovery</i>
Years of Residence in the present place	<ul style="list-style-type: none"> <li>• New and old residents are more dependent on random places for shelter and are more vulnerable.</li> <li>• Medial residents rely mostly on relatives and social connections.</li> </ul>	<ul style="list-style-type: none"> <li>• NGOs and Private Institutions are main supporters after the event.</li> <li>• New and old residents are more vulnerable as they receive less relief in comparison to medial residents.</li> </ul>	<ul style="list-style-type: none"> <li>• Old and medial residents have access to more resources of recovery, new residents are less resilient</li> </ul>
Religion	<ul style="list-style-type: none"> <li>• Christian families have support of formal institutions.</li> <li>• Hindu and Muslim families are dependent on social institutions and more vulnerable as individual household capabilities play a significant role.</li> </ul>	<ul style="list-style-type: none"> <li>• Muslim and then Hindu families are better connected and receive help from social and political agencies.</li> <li>• Christians rely only on religious organizations.</li> </ul>	<ul style="list-style-type: none"> <li>• Christian families have institutional support for loss redistribution, financial and flood mitigation consultancy. Muslim families have institutional support for loss redistribution and financial consultancy.</li> <li>• Hindu families are most vulnerable because they rely on social networks, support from which depends on individual capacities.</li> </ul>
State of Origin	<ul style="list-style-type: none"> <li>• Residents originally belonging to other states than Maharashtra are more vulnerable.</li> </ul>	<ul style="list-style-type: none"> <li>• Government assistance received by families from Mumbai and Maharashtra are significantly higher than others like from Tamil Nadu and Uttar Pradesh</li> </ul>	<ul style="list-style-type: none"> <li>• Households from Maharashtra have more support for long term recovery and are less vulnerable.</li> </ul>



<i>Indicator</i>	<i>During Flood Event</i>	<i>Immediately After Event</i>	<i>Long Term Recovery</i>
Number of employed people in Households	No specific pattern or relation	<ul style="list-style-type: none"> <li>Households with less working members rely more on government support, families with more working members are likely to receive support from NGO and private sector.</li> </ul>	<ul style="list-style-type: none"> <li>Employers are important source of financial support or families with less working members.</li> </ul>
Type of Industries	<ul style="list-style-type: none"> <li>Households with members working in IT and service sector have more resources and information and are less vulnerable.</li> </ul>	<ul style="list-style-type: none"> <li>Manufacturing sector employees are more likely to receive compensation.</li> </ul>	<ul style="list-style-type: none"> <li>People in IT and service sector have more information and support for flood mitigation.</li> </ul>
Type of Employment	No specific pattern or relation	<ul style="list-style-type: none"> <li>Permanent workers are able to resume work faster than other type of workers</li> </ul>	<ul style="list-style-type: none"> <li>Seasonal and daily workers are most vulnerable permanent and to some extent temporary workers have significant support from employers.</li> </ul>

Source: Author's primary fieldwork (Chatterjee, 2007)

Shifting vulnerability is also evident in the case of different religious groups. At the time of the flood, Hindu and Muslim households relied on social connections and were more vulnerable than Christian families who had access to local religious buildings. However, immediately after the event, vulnerability shifted as Muslim and Hindu families were able to receive help from more agencies than Christian households. The latter are primarily dependent on religious organizations and, hence, have limited sources of cultural support. During long term recovery, vulnerability changed again, as Christian and Muslim households were able to receive additional support in the form of (1) technical information on mitigation, as well as (2) advocacy for financial services and economic assistance. In this case, Hindu households are marginalized because they are dependent on their own capacity to procure support for recovery and they do not receive any aid from religious organizations at this stage.

In addition to years of residence and religion, the original home state is another socio cultural factor that affects vulnerability among slum dwellers in Mumbai. Survey results show that households originally belonging to other states than Maharashtra are more vulnerable because they lack resources and access to decision making. In comparison to households from other states, like Tamil Nadu and Uttar Pradesh, Maharashtrian families, or those originally from other parts of Mumbai, received more aid of all kinds after the events. This distinct difference is also apparent in the long term recovery stage where families from Mumbai and nearby areas have economic and institutional support from more networks.

Economic characteristics of members in the household also play important roles in defining vulnerability for the household. The impact is especially clear immediately after floods and during the long term recovery stage. Households with members working in the service and IT sector are most capable of securing formal means of shelter and safeguarding resources. The fact that skilled and permanent workers are advantaged over unskilled laborers seems to reflect the influence of economic restructuring and globalization on household vulnerability to floods. Permanent and skilled workers received financial assistance as compensation or easy loans from employers and, therefore, are able to recover and resume usual life much faster than other households.

In summary, in Mumbai, local and global factors both affect the flood vulnerability of slum households. Some vulnerability-forcing social, cultural and political factors are inherent in the local context. However,

economic aspects determined by global labour demands are equally important in delineating vulnerability for these households. Secondly, vulnerability generated from these factors is a fluid condition that shifts at different stages of the hazard cycle. But perhaps the most important observation is the complex interplay of vulnerability-forcing factors over time. For example, during the event, factors like the number of employed in households and the type of employment do not affect vulnerability for the household. However, these factors become very significant in procuring support for post-disaster recovery. Similarly, for some groups, vulnerability increases as the disaster proceeds and decreases in recovery stage (e.g. Christian families).

## Conclusion

Third world megacities make ideal venues for studying the production and modification of urban vulnerability. This paper confirms that flood vulnerability in the slums of Mumbai is a dynamic state that reflects the ongoing dual restructuring of global society and local communities. Moreover, the same global processes that increase the vulnerability of megacity populations also facilitate the post-disaster recovery of slum dwellers, especially by mobilizing and constraining existing informal and formal systems for redistributing loss. This bifurcated relationship makes the task of designing appropriate policies for reducing urban vulnerability in third world cities especially difficult. Since the degree and type of household membership in support networks is closely connected with levels of vulnerability, the success of future hazard-reduction interventions will be closely tied to the accuracy and timeliness of knowledge about network memberships.

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## 3.2 The Economic and Social Effects of Small Disasters Revision of the Local Disaster Index and the Case of Study of Colombia

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### Abstract

Analysis of small disasters illustrates how these frequent events, usually as result of the climate variability, increase difficulties for the local development and entail a serious problem for the development of a country as a whole. These disasters, contrary to the extreme and extraordinary events, are not visible at the national level very often and their effects are not relevant from macro-economic point of view. Small disasters usually affect the livelihoods of poor people in rural areas and small municipalities, perpetuating their level of poverty and human insecurity as factors of social vulnerability. On the other hand, in urban centers, small and moderate disasters have allowed having a light of the city zones that historically have presented the greatest vulnerability levels. The main objective of this paper is to present the revision made to the methodology of the *Local Disaster Index* (LDI), developed in the framework of the Program of Indicators for Disaster Risk Management in the Americas. The LDI in the new version illustrates that the accumulative impact may be highly significant at the local level and, consequently, to the national level from social point of view. In addition, the paper presents the results of the evaluation of the proneness of Colombia to small scale and chronic disasters and the type of impact they have to the local development and to the country from an aggregated point of view. Such analyses have detected the spatial variability and dispersion of vulnerability and risk in the country as a result of events that rarely enter the international or even national disaster databases, but which pose an accumulative development problem for local areas and, given their overall probable impacts, for the country as a whole.

### Introduction

The effects of natural hazard events of small or moderate size are not considered by many people as 'disasters', although they have the same origins and causes of those of large and extensive effects. The impact of these types of events can not be underestimated because, in general terms, they are a window to typify the disaster risk problem of a city, region or country. This is not a debate on risk regarding of extreme events with a long return period, but insular, real and daily risk that multiple communities are exposed to in rural areas and in small and large cities. The most of these disasters are the result of socio-natural processes associated with environmental deterioration and are associated with persistent small hazard events, such as landslides, avalanches, flooding, storms, and also lower scale earthquakes and volcanic eruptions.

Risk regarding to small disasters usually is not considered relevant; nevertheless, small disasters are a social and an environmental problem that have big implications. These events, in their majority, are related to persistent hazard events such as landslides, avalanches, floods, forest fires, droughts and so on, that are the result of socio-natural processes associated with climatic variability and environment deterioration that affect, in a chronic way, the most fragile socio-economical low income population. In general, small and frequent disasters prevent the sustainability of local human development and they reveal in which areas of urban centers the vulnerability is growing and where new hazards, or the exacerbation of the already existing hazards, is occurring as a result of inadequate environmental, social and economical processes.



## Hypothesis and Method

At present, climate change impacts worry several scientists and some politicians. Particularly the effects related to risk and human insecurity increasing. However, it is important to mention that risk growing is not only due to climate variability hazard events exacerbated as result of climate change. There are also other risk factors that have to be seen with the same thoroughness as the 'vulnerability' conditions and the need of 'adaptive capacity' to the action of the natural hazard events. These are risk factors that have not been perceived well enough due to the lack of systematized information. For this reason, this paper presents data that illustrate the increasing of what can be called 'small disasters' or 'invisible disasters'. They are a result of climate variability and the vulnerability increasing from an economic, social and environmental perspective. These figures point up, from a new perspective, that climate change implies a serious problem of disaster risk, not only related with the potential of future extreme events, but small and frequent disasters that destroy the livelihoods of the poorest and deepen their incapacity of adaptation, perpetuating their vulnerability and poverty.

In Colombia, during the period between 1971 to 2002, 'EM-DAT' disaster database, constructed by Center of Epidemiology of Disasters of Catholic University of Lovaina, registered 97 events that fulfilled at least one of the following criteria: a) 10 or more death people; b) at least 100 affected people; c) emergency state has been declared; and, d) international assistance has been required. Summarizing, it is about events that in some way have called attention of authorities or news reports. That is, it deals with visible disasters. However, beyond these notable disasters, there are also hundreds, even thousands, of events that have occurred in the same period that have not been registered into statistics of international organizations related to this subject. Now then, according to DesInventar database, developed by the *Social Network for Disaster Prevention in Latin America* (La RED in Spanish), more than 19,000 events during the same period happened in Columbia. This number of events contrasts considerably with 97 events registered by EM-DAT disaster database. This paper presents a summary of the results of the analyses made by Marulanda and Cardona (2006) on the impact of the small and local disasters in Colombia during 32 years using the DesInventar database. The analyses involved the reformulation of the Local Disaster Index approach and the results of the evaluation of the proneness of Colombia to small scale disasters and the type of impact they have to the local development and to the country from aggregated point of view.

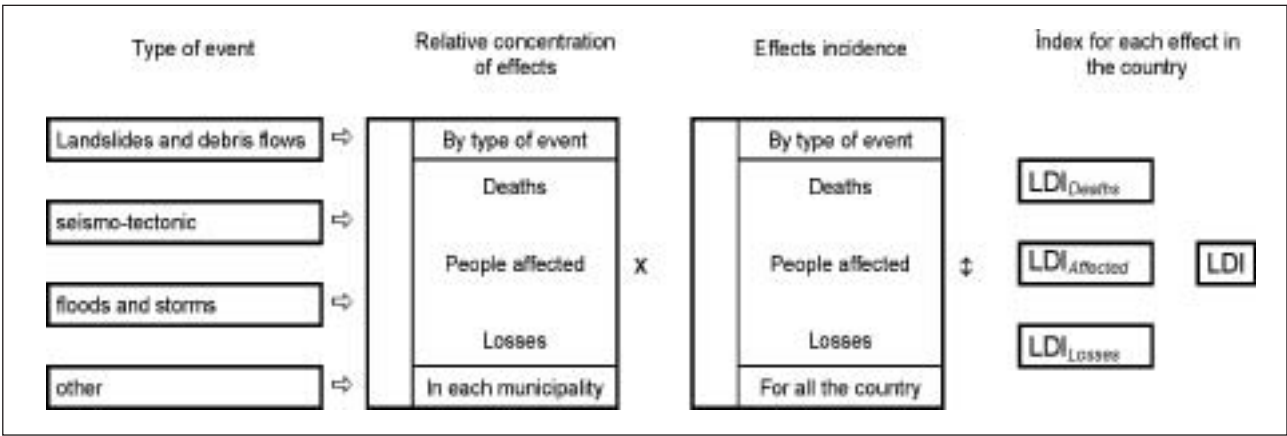
## New Formulation of the Local Disaster Index

Small and moderate disaster analysis and the consequently definition of large events, establish diverse methodological problems. On one hand, the problem of threshold from which a disaster is considered large and, on the other hand, given the effects of an event (for example an earthquake) on different territorial units, which of these effects should be included or excluded of an analysis of small and moderate disasters, given the singular impact registered in each unit (i.e. a municipality).

Without pretending to have an answer to these two problems, analysis should be inclined to exclude from databases the information of effects related to the large disasters. Taking into account the preparation of databases and the difficulties to identify all potential wrong data by a detailed analysis and, particularly, the shortcomings as a result of several doubted figures of affected people and affected hectares of crops, outlier identification process defining arbitrary thresholds was applied. Although the direct selection of large disasters is an acceptable procedure, the definition of a large disaster is a problem if a systematic approach is attempted in any country. The process of identification of outliers, any way, detected the extreme main effects of the large hazard events, but their small or moderate effects remained considering that the selection should be based on the size of the effects and not because the effects were made by a 'recognized' hazard event.

The LDI was proposed and developed by the Institute of Environmental Studies (*Instituto de Estudios Ambientales* (IDEA) in Spanish) of the National University of Colombia in Manizales, in the framework of the program ‘Indicators on Disaster Risk Management in the Americas’ for the *Inter-American Development Bank* (IDB)<sup>14</sup>. This index represents the propensity of a country to experience small-scale disasters and their cumulative impact on local development. The index attempts to represent the spatial variability and dispersion of risk in a country resulting from small and recurrent events. The LDI captures, simultaneously, the incidence and uniformity of the distribution of local effects. That is, it accounts for the relative weight and persistence of the effects attributable to phenomena that give rise to municipal scale disasters. The higher the relative value of the index, the more uniform the magnitude and distribution of the effects of various hazards among municipalities. A low LDI value means low spatial distribution of the effects among the municipalities where events have occurred. Figure 1 illustrates schematically how LDI is obtained for a country based on the information of events in each municipality.

**Figure 1: LDI Estimation**



Source: Program of Indicators on Disaster Risk and Risk Management for Americas, National University of Colombia, Manizales, Institute of Environmental Studies, Inter-American Development Bank

The LDI was evaluated by IDB-IDEA program of indicators taking into account the effects of the extreme hazard events. It means the evaluation included the effects of all disasters, both small and frequent as extreme and sporadic. For this reason, the original LDI would be better denominated as ‘Local Effects Index’ (LEI). In order to have a real *Local Disaster Index*, the values should be based on the effects of small scale disasters, most of them considered actually as local. Therefore, once the outliers have been obtained and excluded of the database, the results of the computed index would be considered as a real LDI. The results are very different indeed. The LDI in the new version illustrates that the accumulative impact may be highly significant at the local level and, consequently, to the national level from a social point of view. It attempts to represent the spatial variability and dispersion of risk within a country, expressed in the occurrence of smaller and more recurrent events.

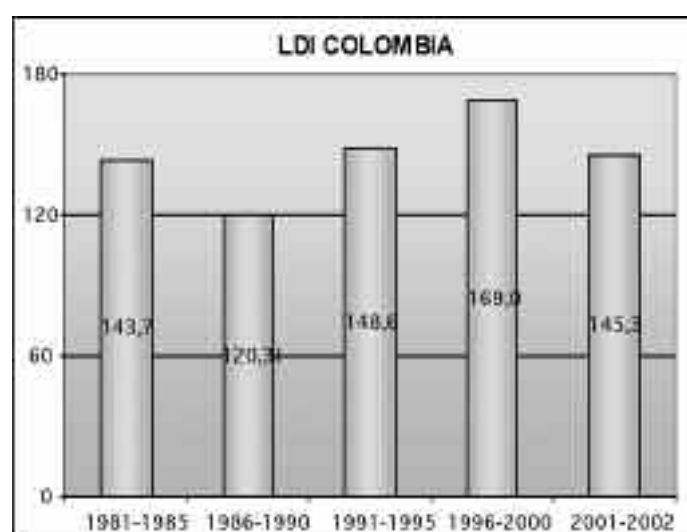
Table 1 shows the new version of LDI calculated without outliers. On the whole, the trend of the new LDI shows clearly that in Colombia the effects of the small disasters are growing. It means greater regularity and incidence of effects on the territory due to local disasters, with serious implications for local level. Figure 2 shows the graphics of LDI values in the different periods.

14 Technical fundamentals and details on the Local Disaster Index can be found in the Main Technical Report of the Program of Indicators on Disaster Risk and Risk Management for Americas, National University of Colombia, Manizales, Institute of Environmental Studies, Inter-American Development Bank (Cardona et al, 2005) <http://idea.unalmz.edu.co> Cardona (2006) and Marulanda and Cardona (2006).

**Table 1 New LDI for death people (K), affected people (A) and losses (L) without outliers**

	1981–1985	1986–1990	1991–1995	1996–2000	2001–2002
<b>LDIK</b>	70,63	83,21	75,22	76,20	82,15
<b>LDIA</b>	67,69	8,62	62,12	78,00	62,15
<b>LDIL</b>	5,44	28,54	11,26	14,81	1,07
<b>LDI</b>	<b>143,75</b>	<b>120,38</b>	<b>148,61</b>	<b>169,01</b>	<b>145,37</b>
<b>LDI'</b>	0,95	0,93	0,90	0,90	0,89

Source: based on DesInventar (2007) without outliers

**Figure 2: Local Disaster Index of Colombia from 1980 to 2002**

Source: based on DesInventar (2007) without outliers

In general, as total LDI shows, small scale disasters have caused a growing in the incidence and uniformity of effects among all municipalities of the country in the period evaluated. From the perspective of vulnerability assessment and policy implications, the increasing of LDI reflects vulnerability growing, environmental deterioration and hazard event recurrence as result of the climate variability and change. The figures of LDI at subnational level allow identifying hot spots of vulnerability in the country or in urban areas of megacities. In addition, LDI targets vulnerable populations differently than large scale disaster targeting due to the fact that LDI identifies the frequent destruction of livelihoods as a result of 'invisible' disasters.

## Revealing the Impact of Small Disasters

DesInventar<sup>15</sup> constitutes simultaneously a database system for elaborating historical inventory of disasters and a methodology for its analysis. It is constituted, on one hand, by software that allows gathering, systematizing, organizing and consulting information incorporated to the system from a space point of view and a temporal point of view, and, on the other hand, by information capture and analysis methodology that makes special emphasis in the following aspects:

<sup>15</sup> For a detailed information about conception, methodology and use of DesInventar see: [www.desinventar.org](http://www.desinventar.org), especially methodological and user manual that appear there. Also, the work made by LA RED-OSSO for UNDP-ISDR "Comparative analysis of disaster database EmDat-DesInventar" January 2003 in [www.desenredando.org](http://www.desenredando.org) can be consulted.

- a) DesInventar has interest in disasters as a set of adverse impacts over lives, goods, infrastructure and social relations caused by inter-relation of socio-environment and anthropogenic phenomena in given vulnerability conditions. It includes those disasters with very few effects (i.e. destruction of a house or five affected people because of a crop loss caused by a frost) to those with large effects.
- b) Disasters materialize in communities and their environments. Resolution observation levels of disasters affect vision and understanding. This is why they should associate to various spaces scales. This allows to see disasters as an expression of daily risk construction, and to discompose those disasters in multiple and differentiable effects, as they are singularities for each affected community.
- c) Information that gives an account of exposition, vulnerabilities and risks conditions at all scales must be constructed as variables and indicators that are as much as possible, homogeneous, both in terms of effects and in trigger effects. Then, there must be a common language looking for a compromise between rigorous definitions on comparability of data set at continental scale.

According to the aforementioned, the second objective of this paper has been to present the results of the evaluation of the proneness of Colombia to small scale and chronic disasters and the type of impact disasters have on the local development and to the country from aggregated point of view. The Appendix 1 presents the results obtained from the evaluation of the effects and economic costs of the small disasters in Colombia using the DesInventar database. Such analysis has detected the spatial variability and dispersion of risk in the country as a result of events that rarely enter in the international, or even national, disaster databases, but which clearly pose serious and accumulative development problems for local areas and, given their overall probable impacts, for the country as a whole. Most of these disasters are the result of socio-natural processes associated with environmental deterioration and are associated with persistent small events.

This type of context must be identified given that recurrent small scale disasters notably increase the difficulties of local development. Such events usually affect the livelihoods of poor populations, thus, perpetuating their levels of poverty and human insecurity. This aspect is also relevant to evaluate the fiscal exposure of government and its contingency liabilities of the government related to compensate housing and recovering of the livelihoods of poorest people.

## Conclusions

Experience of application of DesInventar for other Latin American and Caribbean countries in the last years has given extremely positive results when allowing to build a general, wide view of the type of events that most frequently appear in these countries. However, it is important to emphasize that the study made for Colombia represents, until present, the most complete effort of application of this tool and the deepest analysis that has been made because it has not only allowed making a description of frequent type of disasters that affect the country, but also to establish the origin of their causes in some cases. On the other hand, it has allowed identifying the effects, the high priority attention zones, and fundamentally, the impact that small disasters have caused on the economy of specific sectors and at the national level.

Interesting results and implications for development have been detected, considering the dispersion, as well as the persistence, of the effects at local level. The Local Effects Index (old LDI by IDEA for the IDB) or the new Local Disaster Index proposed herein as an alternative with a subtle variation, reveal and measure the susceptibility of the country to small scale and recurrent disasters. They illustrate that the accumulative impact may be highly significant at the local level and, consequently, to the national level from social points of view; small and frequent disasters prevent the sustainability of local human development.

The results obtained from the analysis of the impact of small scale disasters emphasizes and demystifies that extreme disasters are not necessarily what determine the history of disasters in the countries. Until now, in the case of Colombia, this recent history has been dominated by big disasters, such as those caused by Popayan earthquake in 1983, Nevado del Ruiz eruption in 1985, Tierradentro (Paez) earthquake in 1994 and Quindio earthquake in 1999. Nevertheless, accepting the relevance of their effects on the population and the economy of the country as a whole, it is also necessary to recognize that each year an important number of small and moderate disasters, not very spectacular in terms of damage and losses in individual way, certainly do affect the population and the diverse economic sectors as a result of their frequency and impact accumulation over time.

The outcomes of these analyses have been useful for economic analysts and sectoral decision makers related to the promotion of urban policy development, because they can detect not only the potential impact of extreme events, but also the persistence and accumulation of effects of the small and local disasters. As such, they can prompt the consideration of vulnerability and risk in territorial planning at the local level, as well as the environmental protection of specific ecosystems and hydrographic basins. They can also be used to justify resource transfers to the local level that are earmarked for risk management and social development.

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## Appendix 1 The Impact of Small Disasters: The Case Study

### Effects of Small Disasters

After making a gross computation of damage and losses caused by small and moderate events that have occurred in the Colombian territory during the last 32 years, it can be seen that, indeed, they have not been marginal. Table 1 shows that close to nine and a half thousand people died, almost two million people were affected, 93 thousand destroyed homes and 217 thousand affected houses, as well as close to 2 million crop hectares destroyed, have been the result of the accumulation of this type of disasters from 1970 in the country.

**Table 1: Gross Figures of Effects as a Result of Small and Moderate Disasters**

Period	Death	Affected	Destroyed houses	Affected houses	Damage crop hectares
<b>1971–1980</b>	<b>2,964</b>	<b>204,393</b>	<b>18,588</b>	<b>16,604</b>	<b>327,497</b>
<b>1981–1990</b>	<b>3,812</b>	<b>608,180</b>	<b>19,754</b>	<b>16,044</b>	<b>738,743</b>
<b>1991–2000</b>	<b>2,394</b>	<b>871,374</b>	<b>50,465</b>	<b>163,051</b>	<b>964,450</b>
<b>2001–2002</b>	<b>305</b>	<b>61,584</b>	<b>4,353</b>	<b>21,376</b>	<b>144,023</b>
<b>1971–2002</b>	<b>9,475</b>	<b>1,745,531</b>	<b>93,160</b>	<b>217,075</b>	<b>2,174,713</b>

Source: DesInventar (2007) database

In a shorter term analysis, it can be seen that a larger number of effects tend to accumulate during the decade from 1991 to 2000, the period during which the greatest number of small disasters occurred. With the exception of the number of dead people, this is the period when the largest damage and loss quantity occurred by local disaster. It even reaches to be much greater than the average registered by local event during the 32 years studied, as is illustrated by the Table 2.

**Table 2: Average of Effects by Local Event as a Result of Small Disasters**

Period	Death	Affected	Destroyed houses	Affected houses	Damage crop hectares
<b>1971–1980</b>	<b>0.57</b>	<b>39.11</b>	<b>3.56</b>	<b>3.18</b>	<b>62.67</b>
<b>1981–1990</b>	<b>0.71</b>	<b>112.52</b>	<b>3.65</b>	<b>2.97</b>	<b>136.68</b>
<b>1991–2000</b>	<b>0.34</b>	<b>123.37</b>	<b>7.14</b>	<b>23.09</b>	<b>136.55</b>
<b>2001–2002</b>	<b>0.20</b>	<b>40.84</b>	<b>2.89</b>	<b>14.18</b>	<b>95.51</b>
<b>1971–2002</b>	<b>0.49</b>	<b>90.90</b>	<b>4.85</b>	<b>11.30</b>	<b>113.25</b>

Source: DesInventar (2007) database

The decade between 1981 and 1990 registers losses and damage in deaths, affected people and destroyed crop hectares categories over the total average; the period between 1971 and 1980 just reaches to be greater than the total average in the number of diseased people by event. Finally, the comparison of annual averages in the previous decades and the period 2001–2002 shows that the latter presents very high values, considering it is a period of only two years against periods of ten years.

Accepting that, from 1970s, the quality and the opportunity of data are similar, the trend towards an increase in the amount of damage and losses by small disasters throughout the years can be only explained by two factors: first, the increment of the intensity and recurrence of the hazard events; second, the increasing of vulnerability and volume of exposed elements. The increment of hazard events

is detected particularly in some hydrographic basins, likely a result of environmental degradation and climate change, particularly a result of the climate variability. On the other hand, taking into account the growing population and urbanization in the last 40 years, it is possible to accept an increase in the volume of exposed elements and their vulnerability. In any case, it is possible to say that the risk increase and accumulation in the country are consequences of the rising of the natural and socio-natural hazard events, due to the kind of development model followed by the country during the last years. In comparative terms, the accumulation of damage and losses induced by small disasters during the all considered period of time is notable. Establishing a comparison between two of the greatest disasters that the country suffered during last 32 years – the Nevado del Ruiz volcanic eruption in 1985 and the Quindio earthquake in 1999 – the figures cannot be undervalued, as is presented in Table 3.

**Table 3: Comparison Between the Effects Due to Small and Extreme Disasters**

Type of damages and losses	Nevado del Ruiz eruption (1985)	Quindio Earthquake (1999)	Small disasters (1971-2002)
<b>Deaths</b>	<b>24,442</b>	<b>1,862</b>	<b>9,475</b>
<b>Affected people</b>	<b>232,546</b>	<b>160,336</b>	<b>1 745,531</b>
<b>Destroyed houses</b>	<b>5,402</b>	<b>35,949</b>	<b>93,160</b>
<b>Affected houses</b>	<b>NA</b>	<b>43,422</b>	<b>217,075</b>
<b>Damage crop hectares</b>	<b>11,000</b>	<b>NA</b>	<b>2 174,713</b>

Source: DesInventar (2007) database

Even number of deceased people in the volcanic disaster of 1985 represents an extraordinary event that exceeded predictions of any type of specialist during that time; accumulation of deaths caused by small disasters over time tend to be also an elevated figure. It represents 38.8% of deaths occurred in Armero and Chinchina by the volcanic eruption. People affected outnumber those affected by large disasters by 7.5 and they are almost 11 times greater than the figure of the Quindio earthquake of 1999, which severely affected the whole coffee-growing region. Finally, taking into account the number of destroyed houses, small disasters represent more than 2.5 times the number of destroyed houses in the Quindio earthquake and more than 17 times the destroyed houses in Armero and Chinchina. Houses affected by small disasters outnumber by five the houses affected by the the Quindio earthquake.

## Economic Cost of Small Disasters

In terms of economic cost, the registered losses by small and moderate local events are very significant. Considering two categories of economic losses (damaged houses and crop hectares), total amount accumulated for 32 years of study exceeds 1,650 million dollars, according to Table 4. Of this total, 35.1% corresponds to the number of destroyed and affected houses and the other part (64.9%) corresponds to the amount of damage in crop hectares. Calculation of losses caused by small disasters was developed using methodology proposed by Risk Indicators Project, IDB-IDEA. In the case of houses, it was considered total of destroyed houses plus affected houses, where four affected houses correspond to a destroyed house. Estimation of loss is made assuming reposition of a social interest house (average number of square meters by value of square meter constructed of this type of construction in each period) and without the cost of land. For the case of the loss estimation of crops, it was obtained based on the average cost of the typical hectares of crops in the flooded zones by total number of affected hectares. This approximation is useful for estimating the magnitude of losses and to make general comparisons. For example, although in the case of affected crops overestimations can exist, by valuation errors or by difficulty estimating the real surface affected, it is possible to detect that losses in the agricultural sector are very important although they are rarely visible.

**Table 4: Estimated Cost of Losses and Damage Caused by Small Disasters, Thousand Dollars**

PERIOD	LOSSES IN HOUSES	LOSSES IN CROPS	TOTAL
<b>1971–1980</b>	<b>68,217.00</b>	<b>98,249.10</b>	<b>166,466.10</b>
<b>1981–1990</b>	<b>78,424.50</b>	<b>295,497.20</b>	<b>373,921.70</b>
<b>1991–2000</b>	<b>385,892.33</b>	<b>578,669.70</b>	<b>964,562.03</b>
<b>2001–2002</b>	<b>47,127.42</b>	<b>100,816.45</b>	<b>147,943.87</b>
<b>1971–2002</b>	<b>579,661.25</b>	<b>1 073,232.45</b>	<b>1 652,893.70</b>

Source: based on the methodology of the IDB-IDEA Program of Indicators

Now then, these are hypothetical values and they neither correspond to real reposition expenditures nor any coverage of losses made by the government. That is, in most cases, neither any formal reconstruction program has been made, nor any government credits or subsidies were paid. Although these estimations are not accurate, the figures give an order of magnitude of a problem that is worrying and overlooked. In these cases, most of affected people are low-income communities with scarce resources that do not receive any recovery aid from the government when this type of event occurred. In addition, they are recurrently affected by these small disasters at the local level, losing their livelihoods. This chronic situation, certainly, is not relevant from the macroeconomic point of view, but it perpetuates the poverty and underdevelopment of the country.

From Tables 1 and 4 it is clearly observed that the losses have been increased over time in different ways with the respective number of occurred events. Thus, between the 1970's and 1980's the number of events had an increment only of 3.42%, but the losses occurred had an unexpected increment of 224.6%. Whereas the increment of events from the 1980s to 1990s was of 130.68% –in fact notable– the losses had an extraordinary increment of 257.96%. The importance of these figures, expressed in monetary terms, can be seen also if the average cost of each registered event is considered. In this form, the average cost of an event for the period of 1971 to 1980 was 31,853 dollars; for the period between 1981 and 1990, it was 69,181 dollars; and for 1991 and 2000, it was 136,566 dollars.

A comparative analysis of losses caused by small events and some of the recognized extreme disasters with massive destruction that have occurred in Colombia is useful to calculate the impact that small and moderate events have had over time. According to the figures of Table 5, material losses in current million dollars caused by small disasters in 32 years represent 6.7 times the losses caused by the Nevado del Ruiz volcanic disasters in 1985. Even the aggregated losses during the decade 1981–1990, due to small disasters, are 1.5 times the losses caused by the same disaster in Armero and Chinchina. On the other hand, the total of losses produced by small local events only considering figures of destroyed houses and crop hectares surpassed the material losses caused by the Quindio earthquake in 1999. That means that approximately every 30 years, the losses caused by small disasters to housing and agriculture are similar to the losses produced by a large event, such as the Quindio disaster.

**Table 5: Losses of Extreme Hazard Events, Current Million Dollars and (%GDP)**

Events	Estimated losses	Costs of rehabilitation
<b>Eruption of Ruiz Volcano (1985) Armero</b>	<b>246.05 (0.70)</b>	<b>359.95 (1.02)</b>
<b>Coffee Region Earthquake (1999) Quindio</b>	<b>1 590.81 (1.88)</b>	<b>856.72 (1.01)</b>
<b>Small and moderate events (1971–2002)</b>	<b>1 652.89</b>	<b>NA</b>

Source: Extreme events, ERN report on small disasters for National Department of Planning, (2005)

Nowadays it is very common to evaluate the economic impact of disasters, taking into account aggregated macroeconomic variables, such as the *Gross Domestic Product* (GDP). This has been the ap-

proach of the International Financial Institutions as the banks and agencies of the *Economic Commission for Latin America and the Caribbean* (ECLAC). Although it is recognized that the economic losses do not correspond to the real impact of disasters, the economic losses expressed as a percentage of national and sectoral GDPs are certainly useful herein to illustrate the relevance of small disasters and their impact on the national economy. In the agriculture sector, for example, small disasters registered elevated amounts of losses. Table 6 shows that accumulated losses for the period 1971-1980 were equivalent to 1.52% of agricultural GDP for 1980. Furthermore, the impact of small disasters was more significant in the 1980s because the total amount of losses in the sector represented 4.52% of agricultural GDP for 1990; it was also greater (5.6%) for 1990's. Losses in the sector have been equivalent to 12.65% of sectoral GDP, constant prices, for the period of 32 years.

**Table 6: Accumulated Losses of Small Disasters in Million Dollars and %GDP of Agricultural Sector**

Period	Losses in crops current (constant)	GDP agricultural sector current (constant)	Losses in sectoral GDP (%)
<b>1971–1980</b>	<b>98,25 (172.64)</b>	<b>6,466 (11,352)</b>	<b>1,52</b>
<b>1981–1990</b>	<b>295,50 (689.50)</b>	<b>6,539 (15,257)</b>	<b>4,52</b>
<b>1991–2000</b>	<b>578,67 (758.38)</b>	<b>10,330 (13,358)</b>	<b>5.60</b>
<b>2001–2002</b>	<b>100,82 (138.80)</b>	<b>10,103 (13,909)</b>	<b>1.00</b>
<b>1971–2002</b>	<b>1 073,24 (1 759.32)</b>	<b>(13.909)</b>	<b>(12.65)</b>

For estimation, it was taken GDP of the last year of each period using data of the World Bank (2003).

Table 7 shows losses due to destruction of housing by small disasters in terms of GDP of the construction sector. The amount of losses is considerably smaller than registered in the agricultural sector, but the impact respecting to the sectoral GDP is quite larger. During the 1970s, losses were equivalent to 4.25% of the construction GDP. In the 1980s, it was 3.95%; and in the 1990s, losses raised to 12.62%. In accumulative terms, damage produced to housing over the 32 years represented 19.92% of the sectoral GDP at constant prices.

**Table 7: Accumulated Losses of Small Disasters in Million Dollars and %GDP of Housing Sector**

Period	Losses in houses current (constant)	GDP construction sector*current (constant)	Losses in sectoral GDP (%)
<b>1971–1980</b>	<b>68.22 (119.87)</b>	<b>1,607.20 (2,824.11)</b>	<b>4.25</b>
<b>1981–1990</b>	<b>78,42 (182.98)</b>	<b>1,993.10 (4,650.58)</b>	<b>3.95</b>
<b>1991–2000</b>	<b>385.89 (505.73)</b>	<b>3,058.10 (4,007.80)</b>	<b>12.62</b>
<b>2001–2002</b>	<b>47.13 (64.88)</b>	<b>3,184.95 (4,354.89)</b>	<b>1.48</b>
<b>1971–2002</b>	<b>579.66 (873.47)</b>	<b>(4.354.89)</b>	<b>(19.92)</b>

For estimation, it was taken GDP of the last year of each period using data of the World Bank (2003).

Finally, at aggregated level, the impact of small disasters results significant. According to Table 8, the total of relative losses to housing and agricultural sector caused by small disasters in the period of 32 years represents 2.25% of national GDP for 2002 at constant prices. This number is significant, taking into account that losses caused by the Quindio earthquake represented 1.88% of national GDP of 1999.

**Table 8: Accumulated Losses of Small Disasters in Million Dollars and %GDP of Colombia**

Period	Losses [crops+houses] current (constant)	National GDP current (constant)	Participation of losses in national GDP %
<b>1971–1980</b>	<b>166.47 (264.81)</b>	<b>33,400 (53,180)</b>	<b>0,50</b>
<b>1981–1990</b>	<b>373.92 (688.05)</b>	<b>40,274 (74,108)</b>	<b>0,93</b>
<b>1991–2000</b>	<b>964.56 (1 129.24)</b>	<b>83,220 (96,652)</b>	<b>1,16</b>
<b>2001–2002</b>	<b>147.95 (175.94)</b>	<b>84,002 (99,893)</b>	<b>0,18</b>
<b>1971–2002</b>	<b>1 652.89 (2 249.03)</b>	<b>(99,893)</b>	<b>(2.25)</b>

For estimation, it was taken GDP of the last year of each period using data of the World Bank (2003).

Using previous figures obtained for small disasters, it is difficult to talk about no disasters with null impacts. Furthermore, when the cost of damage in other kind of infrastructure (i.e. lifelines, facilities, roads, bridges, etc.) and on productive sectors (industry, commerce, electricity and others) have not been included in the estimated losses.

These figures are not only significant in quantitative terms, but they can be considered evidence that confirms the hypothesis that recurrent and accumulated effects of damage and losses by small disasters can be equivalent and in many cases larger than caused by extreme disasters, whose correlation or simultaneousness of effects are very visible. Even though these small disasters continue being 'invisible', they are not considered concerning events. Results given in this document illustrate the relevance of these kinds of disasters because they indeed represent a worrying risk situation that now exists in all countries of Latin America.



### 3.3 Wastewater Related Risks and Social Vulnerability: A Case Study of Delhi

Reena Singh

#### Introduction

Megacities<sup>16</sup> are increasingly referred to as hotspots of multiple risks which come from overcrowded living conditions, infrastructural stress, increasing inequality and marginalization and failure of governance to address the basic needs of the citizens and adequately care for environmental and social wellbeing. Quantitative and qualitative undersupply of basic infrastructure is one of the major consequences affecting large parts of the urban population. This is particularly true for urban water systems entrusted with the task of providing safe water supply and safe disposal of waste water.

There are numerous 'inadequacies' in urban wastewater and sanitation infrastructure. In many urban areas these basic services are either non-existent or difficult to access. If existent, many times it does not fulfill its primary task of ensuring the safe disposal of wastewater due to various reasons, like ageing infrastructure and poor maintenance leading to creation of 'unsafe conditions'. Unsafe conditions are the specific forms in which vulnerability is expressed in time and space (Blaikie et al., 1994). Watts and Bohle (1993) argued by formalizing the 'social space of vulnerability', which is constituted by exposure, capacity and potentiality. The influences of these infrastructural inadequacies, prolonged exposures to unsafe conditions and poor potentiality are finally reflected as health burden and other allied costs to people in terms of money, time and effort involved for managing their own wastes, protecting and treating themselves against various water-related illnesses.

Threats due to prolonged exposures to harmful perturbations largely remain invisible or only mildly perceived until they strike as major outbreaks. Nature of vulnerability associated with long-term damaging processes, like environmental risks pertaining to increase inadequately managed wastes and sewage, has been underestimated and less prioritized by urban managers and, simultaneously, less understood and studied by the experts. There are technical literatures on critical infrastructure, particularly urban water and wastewater systems sorting engineering solutions, but this continues to remain outside the lens of most social science research and vulnerability studies.

Present literature on social vulnerability sees it as one-dimensional, focusing on the human inability to withstand adverse impacts triggered by multiple stressors and shocks (Blaikie et al., 1994; Henninger 1998; Frankenberger et al., 2000; Alwang et al., 2001; Oliver-Smith 2003; Cannon et al., 2003). In this context of analysing social vulnerability to wastewater risks against the backdrop of uncontrolled urbanisation and infrastructural inadequacies, the main focus remains to grasp the characteristics of household in terms of their susceptibility to be harmed from the existing wastewater and sanitation situation and their capacity to anticipate and cope with the situation within their given resources.

#### Importance of Safe Water Supply, Waste Disposal and Sanitation

Domestic water supplies, wastewater disposal and sanitation provisions are the fundamental requirements for a decent settlement that bears direct impact on public and environmental health too. *The World Health Organization* (WHO) has recognized that lacking or inadequate basic services make urban areas the world's most threatening human environments. Many water-borne and water-related diseases

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<sup>16</sup> In quantitative terms, according to different authors, megacities are defined to be metropolises with a population of over 5 million (Bronger 1996), more than 8 million (UN 1987:iii) or more than 10 million inhabitants (Mertins 1992)

are associated with inadequate disposal of wastewater, including a group of diseases for which water or wastewater provides a habitat for diseases vectors or host (UN-HABITAT 2003). Diarrhea due to unsafe water, sanitation and hygiene account for 1.73 million deaths each year and is placed as the 6th highest burden of disease on a global scale – a health burden that is largely preventable (WHO 2002). Other water related and water washed diseases related to poor water, sanitation and hygiene are dysenteries, trachoma, schistosomiasis, conjunctivitis, hookworm disease, malaria and Japanese encephalitis, thus contributing to an additional burden of disease on the marginalized groups (Howard and Bartram, 2003)

Lack of access to a safe water supply and sanitation is directly related to poor health, environmental degradation and indirectly related to weak governance reflected through government inability to control and administer planned urban expansion and ensure adequate investment in provision and improvement of basic infrastructures. The health of people is strongly influenced by the prevailing environmental conditions, as well as their levels of economic and social prosperity. Poor and near-poor are more likely to be malnourished and develop a low immune system against diseases. This, coupled with low capabilities to adequately respond to risks by adopting preventive measures and access health care facilities, makes them perceivably more vulnerable and susceptible to welfare losses. Additionally, increased expenditure on treatment of water related illnesses that could have been largely avoidable adds to their impoverishment. Although sanitation and hygiene is a household decision, availability of basic infrastructure is important and its adequate provision is a major responsibility of city administration.

### **Why Study Megacity Delhi?**

Delhi has grown from a settlement of less than one million in 1947 to 15.3 million in 2005 and is still growing. Such hyper urbanisation in Delhi has not been backed by a commensurate growth in basic infrastructure and housing, which has led to the proliferation of informal settlement quarters. Currently, more than 45% of the populations are residing in unplanned settlements and are plagued by various sewerage and sanitation related problems (Govt. of India 2001). The city is also affected by a high degree of fragmentation between urban upper class quarters and squatter settlements of urban poor, hence attesting to a strong heterogeneity within close quarters.

The landscape of Delhi is dotted with different kinds of residential districts with distinctive features and respect to the level of civic amenities provision and legal status. These colonies are categorized as Jhuggi-Jhompri (JJ) clusters (these are squatter settlements almost equivalent to slum areas in the international terminology), resettlement colonies (low cost housing), so-called unauthorised colonies (which are the residential pockets that have come up illegally without approval from the municipal corporation and violate the Master Plan and Zonal Plan regulations), and authorised colonies (with presumably safe standards of basic amenities and provision of basic services is precarious). Owing to varying status of residential quarters with varying state of infrastructural facilities and inhabitant by communities belonging diverse socio-economic strata differential access to basic services has developed. This is particularly true for water supply, sewerage and waste disposal. There is significant inequality in the regional distribution of sewerage and sanitation services, depending on the social status of the respective neighborhoods.

The quality of life for residents of Delhi is directly influenced by the standard of basic amenities and its level of access and indirectly influenced by the quality of urban management. The common fundamental questions that still remain to be answered are:

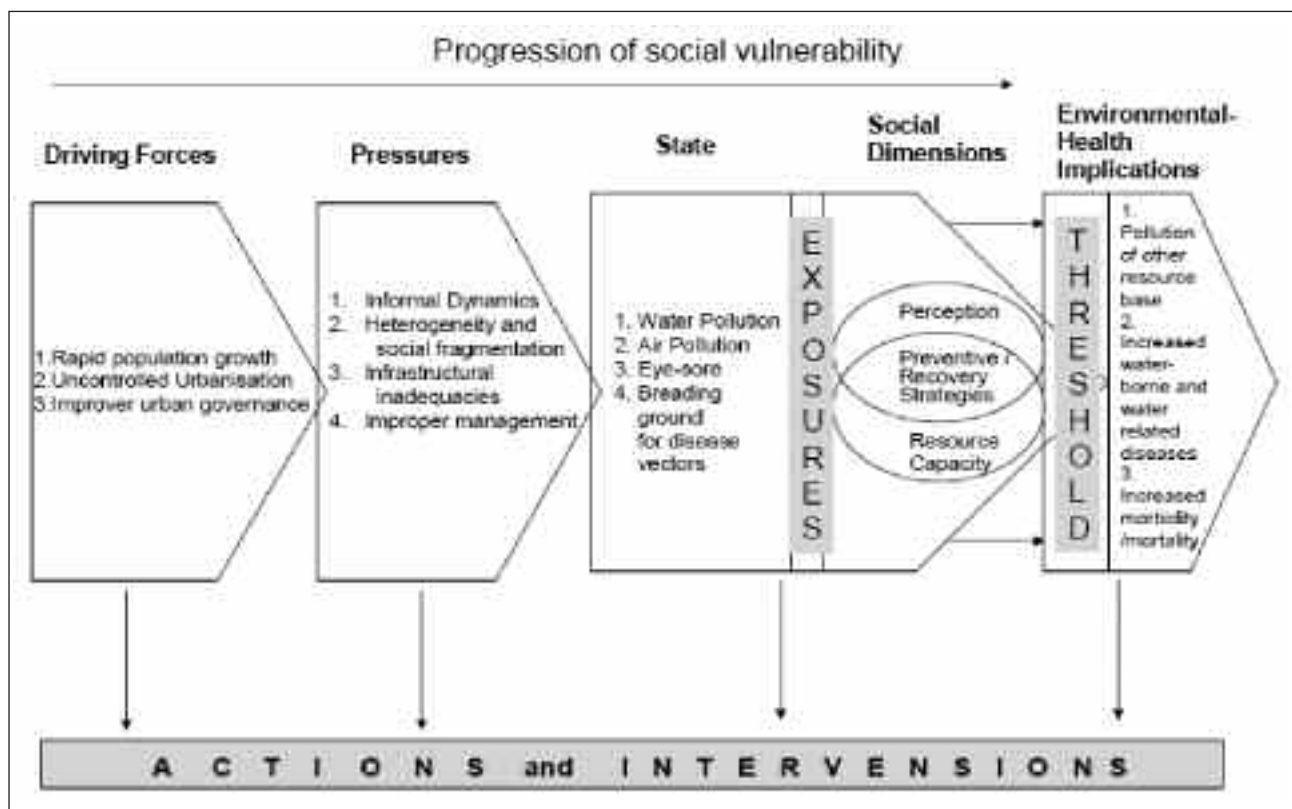
- To what extent does city life benefits all social communities?
- Why benefits of urbanisation are coming at environmental and health costs?
- How can urbanisation be balanced with ecological sustainability?
- How can a city system be made more resilient to inadequacies and stresses?

Although these questions cannot be answered fully, probing into them would provide some insight into existing gaps in urban management that is making city life increasingly vulnerable. It would further help in identifying the point of action and policy intervention and recognising the appropriate approach for an appropriate solution. At the same time, analysis of the Delhi case can provide perspective for other cities grappling with similar issues.

## The Conceptual Framework

Vulnerability has been studied in various disciplines including economics, sociology, anthropology, disaster management, environmental science and health/nutrition through different perspectives. Geographers' concerns remain the spatial dimension of social vulnerability. Some social geographers have also talked about vulnerable people. The focus here is primarily on people who, for whatever reasons, are at risk of being hurt, damaged and discriminated (Knox 1989). The present study tries to focus social vulnerability on wastewater related threats by conceptually placing the research at the interface of uncontrolled urbanisation led infrastructural stress and environmental-health implications (Fig. 1).

**Fig.1: Basic Components of Infrastructural Stress Driven Social Vulnerability**



Source: Own draft (Influenced by Blaikie et al. 1994, Wisner et al. 2004)

The factors of vulnerability can be classified as driving forces – the kind of pressure it generates leading to the creation of unsafe state. Exposure occurs when humans encounter these unsafe conditions within a given environment. Driving forces of unruly urbanisation and improper urban governance leads to many pressures in the form of infrastructural stress giving rise to the state of unsafe conditions. Prolonged exposure to harmful perturbations are counteracted by various compensating forces in the form of coping measures dependent upon social perception and resource capacity. After crossing the threshold, harmful perturbations get manifested as environmental-health implications. A range of

health effects may then occur, from minor illness to death, depending upon the intrinsic harmfulness of the pollutant and the severity of exposure and the susceptibility of the individual concerned.

People belonging to different socio-economic strata, gender and age groups develop varying levels of resistance to the harmful exposures and so are affected differently. This is eventually reflected in the wellness of the environmental and public health. Peoples' perceptions here plays a very important role in understanding the level of risk awareness among individuals and social groups, which in turn gets their responses mobilised. Awareness also helps to strengthen the coping capabilities of the social groups in terms of getting the timely preventive measures in place and adopting the appropriate measures for recovery (in case the event has occurred).

## **Research Questions and Study Design**

This study is based on comprehensive household surveys and aims to analyse wastewater related to vulnerability of different social groups due to changes in the physical, socio-economical, infrastructural and institutional environments of the city. In order to achieve the above mentioned major objective, some specific research questions were raised:

1. How are people exposed to wastewater and what are the factors contributing to it?
2. What are the resultant environmental and health implications?
3. What are peoples' perceptions regarding wastewater problem and implications?
4. What is the level of response in different residential areas?

Test areas for the study were selected within the *National Capital Territory* (NCT), with different locational, social and settlement structures; specific care was taken to include all kinds of residential quarters. Purposive-random sampling techniques were applied to choose the respondent household from various kinds of colonies, including authorized, resettlement, unauthorized, JJ clusters and slum designated areas. Adequate representation of socio-economic hierarchies was also kept in mind, as the household income status was intended to be used as an important frame for vulnerability analysis. In total, 28 different residential colonies were chosen from central, east and south districts and 696 households were interviewed, covering a population of 4,358 persons.

## **Status of Wastewater Generation and Collection in Delhi**

Wastewater generated from domestic, commercial and industrial establishments enter the same sewer system without segregation. Additionally, Delhi receives about 89% of total rainfall only during the monsoon months of June-September (IMD 2005). The dilapidated and silted drainage system of the city is further burdened by additional storm water causing severe problems within monsoon flooding and inundation of low lying areas. Currently, Delhi generates 3267 Mld (Million Litres/Day) wastewater, including 218 Mld from industrial sources. The corresponding treatment capacity is 2330 Mld and capacity utilised is only 1478 Mld (Central Pollution Control Board 2004).

The existing capacity of treatment plants is under utilized because of a deficiency in the sewerage network of insufficient coverage and siltation. The trunk sewers are heavily silted, and the internal and peripheral sewers are old and damaged. Only part of the total amount of wastewater generated is actually collected and effectively treated. The balance of untreated domestic sewage, toilet water, discharges from unsewered areas, treated effluents and overflows from the sewer system are discharged in open drains and finally joins the river Yamuna, which forms drinking water sources for downstream communities.

Although Delhi has the largest treatment and collection system in the country, large areas in the city are still unsewered. As per present policy, no sewer facility is provided in JJ clusters and unauthorized colonies. According to the survey results, only 53% of the population was connected to the sewer. 10%

privately connected to the sewer in an illegal manner and another 3% used septic tanks. As high as 34% of the population had no access to any wastewater disposal infrastructure, which forced them to either restrict their water use so as to generate less wastewater and or to take other alternative disposal practices of compromised hygiene.

## Wastewater Mismanagement Risks

Mismanagement of domestic wastewater is a main cause for surface and ground water pollution in Delhi, which further reduces the availability of usable water for future supply. Freshwater lines, which often run close to drains, are contaminated by the intake of wastewater into the freshwater system due to frequent changes in pressure. Inadequate wastewater management has polluted the resource base, degraded the environmental aesthetic and negatively impacted the quality of life, while water borne and water related diseases, like dysentery, diarrhea, typhoid, dengue and malaria, are occurring frequently and showing devastating impacts on public health.

Though there is no comprehensive health data available for the whole city, some reference hospitals provide basic informations. According to data reported by a small sample of 22 index hospitals under the Municipal Corporation of Delhi, 77355 cases of gastroenteritis, 1784 cases of cholera and more than 900 cases of malaria were reported during a 12 months period (Jan-Dec 2004).

Improper management of wastewater also involved considerable economic risks in terms of increased household expenditure for treating the water borne and water related diseases, loss of work days and expenses involved in managing their own wastes privately. Such expenditures, which could be largely avoidable, add to the impoverishment of the already poor community. In this respect, various kinds environmental, health and economic risks exist cumulatively (Table 1).

**Table 1: Risks Associated with Inadequate Management of Wastewater**

Type of Risk	Risk Summary
Environmental Risk	<ul style="list-style-type: none"> <li>• Pollution of ground water through unlined drains;</li> <li>• Septic tanks contribute to high rates of pollutant infiltration;</li> <li>• Open drains are a source of bad odor and air pollution;</li> <li>• Unmanaged wastewater accumulating in pot holes and muddy pits serve as breeding grounds for disease carrying vectors;</li> <li>• Unhygienic sights and degradation of environmental aesthetic;</li> </ul>
Health Risks	<ul style="list-style-type: none"> <li>• Drinking water supplies are contaminated with harmful chemicals and pathogens from wastewater as a result of contamination.</li> <li>• Illnesses that are contracted from consumption of contaminated water include cholera, typhoid, gastroenteritis, dysentery and diarrhea. A significant risk of illness like ear, eye and skin infections exists if people come into physical contact with raw sewage.</li> <li>• Stagnant wastewater creates conducive habitats for disease vectors making the region infested with illnesses like malaria and dengue.</li> <li>• Open drains and uncovered manholes are death traps for people especially children, who fall into it and die of suffocation if not rescued in time.</li> </ul>
Economic Risk	<ul style="list-style-type: none"> <li>• Expansion of infrastructure and rehabilitation and maintenance of the existing ones in good standard involves considerable funding.</li> <li>• Increased expenditure of family income on treatment of member suffering from water borne or water related diseases.</li> <li>• Additional economic expenditure on hiring private cleaners for desilting and cleaning of local drains.</li> </ul>

Source: Own draft after Smith et al., 2002



## Routes of Exposure to Wastewater

Maladies of insufficient sewer networks and improper disposal of wastewater plague various residential areas differently. The narrow lanes of informal colonies remained flooded even during the non-monsoon period which led to frequent direct physical contact with sewerage. Apart from such direct human exposures, sewage nuisance also affected human health through indirect routes, like seepage to fresh water sources, contamination of piped water supply, air pollution and allied environmental degradation. The connected population of formal quarters could escape the risks associated with direct physical contact but the threat of sewerage contaminated water supply via pipelines was unavoidable. On the other hand, large numbers of unconnected residential quarters had to regularly face the problem of sewerage flooding, drain overflows and more direct exposures to the unhygienic conditions created by rotting sewage and wastes.

People made efforts to clean and maintain the drains in their households, but the ones in surrounding neighbourhood were grossly neglected by the residents, as well as the authority<sup>17</sup> concerned, which was obviously evident from the existing unhygienic conditions of the lanes, especially in the informal settlement quarters. In such situations people usually got adapted to the conditions and developed means to cope with them or remained ignorant about the prevailing situation. However, human exposure to wastewater remained unavoidable. Observations during the field survey brought to notice various compulsive practices at the community level that paved the way for sewage contaminants to pollute groundwater and the piped water supply, which was ultimately posing health risks for the end-users (Fig. 2).

**Fig. 2: Sewage Contamination of Fresh Water**



Household wastewater is collected in a ditch or cesspool, which percolates down over time. These serve as open unlined onsite wastewater disposal point. The contaminants easily percolate down to join the groundwater. These are sources for bad odour, mosquitoes and flies.

Open drain running through the residential colony carries a mix of urban wastewater. High pollution levels of the drains finally join the river, degrading its quality. The unlined bed (porous subsurface under such drains) provides continuous area for sewage pollutants to infiltrate down and contaminate the ground water.

The poor flow in tap is being accentuated by attaching a hand pump in order to pump out more water. This increases the pressure in the pipe, which results in a backflow of sewage through loose joints, resulting in the high possibility of sewage mixing with fresh water that is pumped out.

Freshwater pipelines often running close to wastewater drains and channels are affected by the intake of contaminated wastewater into the freshwater system due to frequent decreases in pressure, thus causing numerous leakages and further mixing wastewater with the fresh water and resulting in contaminated water for the end users.

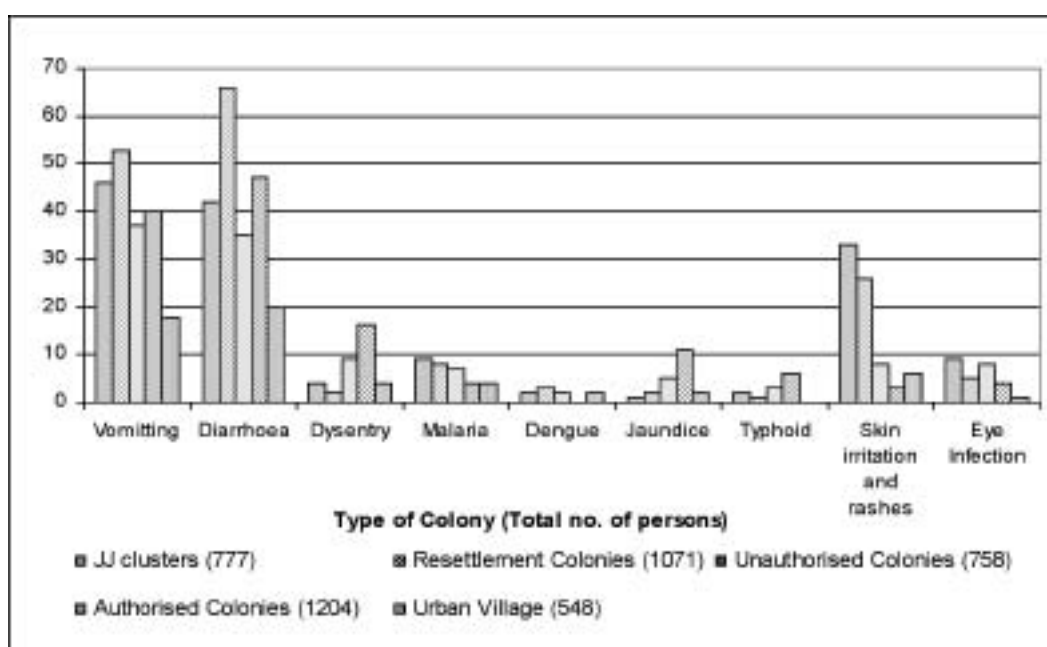
Source: Field Photos: R.Singh, 2005–2006

<sup>17</sup> Delhi Jal Board (DJB) is responsible for the production and distribution of drinking water, treatment and disposal of waste water as well as water quality control, water pollution monitoring in the Municipal Corporation of Delhi.

## Burden of Waterborne and Water Related Diseases

A small section of the surveyed questionnaire was also devoted to investigate about the kind of water-related diseases that were common among different social groups in the studied localities. This was done because health effects are seen as a major outcome of exposure and locational vulnerability. It has to be underlined that not primarily an epidemiological study was conducted and, therefore, no attempt was made to establish a relation between the kind of diseases and wastewater nuisance. But the field experience showed some causal relationships between the water and sanitation conditions of the different localities, and it commonly reported illnesses in some places that could not be overlooked. Apart from fever and cold, which were extensively reported from all kinds of localities as a regular phenomenon, diarrhea, vomiting, dysentery, malaria, dengue, jaundice, as well as skin and eye infections were also common diseases prevalent among the surveyed communities (Fig. 3). Though the number of cases differed across the colony types depending upon the level of exposure, timely adoption of preventive measures as well as the hygiene behaviour.

**Fig. 3: Reported Cases of Waterborne and Water Related Diseases**



Source: household survey 2005–2006 (Draft: R. Singh).

Water-borne diarrhea infection was common at all localities, but it was comparatively higher amongst the social communities where piped water supply was provided, e.g. resettlement and authorised colonies. A similar trend was observed in the number of jaundice cases, which can be attributed to the unsafe quality of piped water supply. Since water is officially supplied to these colonies through pipelines after considerable treatment, it was taken to be sufficiently safe and suitable for direct consumption, in which case people were reluctant to use any further purification measure. But sewage leaking into the pipelines contaminated the water before it reached the endpoint. Such occurrence indicates compulsive exposure of the formal settlement even with presumable good water and sewerage infrastructures.

A higher proportion of malaria cases was reported from the JJ Clusters (although mosquito problems are prominent and ubiquitous), affecting even the posh residential locations; poor people of the JJ clusters are usually lacking preventive measures and were more affected. Skin irritation and rashes were also highly reported from those localities where contacting raw sewage was unavoidable and personal hygiene was compromised due to restrictive water usage.

## People's Perception of Wastewater Risks

The way a person forms his or her opinion about the risk and its possible consequences depends upon direct experience of the person involved and experience of others in near surroundings (Hauger et.al., 2003). People's perceptions of risk is also largely influenced by the behavioral understanding of the harmful event or risky perturbation as seasonal phenomenon, rare event or something unexpected, which never happened before. The threat, which a social group or individual feel, is proportional to the severity and magnitude of impacts that can bring e.g. outbreak of life threatening cholera. The threat caused by consumption of sewage contaminated water is well conceived as a severe threat of unsafe water consumption. Therefore, if the water is coming from an unreliable source, people would make an effort to clean it before direct consumption. But other subtle impacts of wastewater related hazards, which would only be visible after prolonged exposures, were somehow underestimated and, thus, ignored. People usually failed to perceive the long term risk associated with such exposures until it manifested as major outbreaks.

A combination of factors, such as socio-economic conditions, level of awareness, prior experience, and individual opinion, influence perceptions and may lead to differential perception of same risk. Social groups inhabiting informal quarters and deprived of basic amenities, like water and sanitation facilities are presumable considered to be at higher risk and more vulnerable, while in reality people, who face greater impoverishment and other economic problems do not consider wastewater hazards as their priority to be worried about. Consequently, they continue to live in the potentially hazardous conditions and confront higher incidences of avoidable illnesses.

## Resource Capacity and Coping Mechanisms

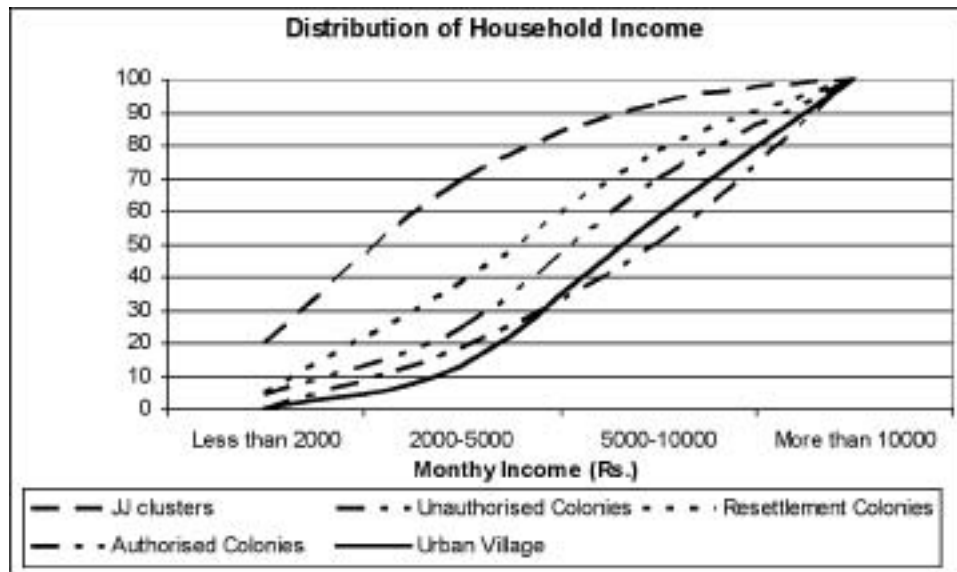
Resource capacity directly influences the choice of coping mechanisms that are made on the basis of awareness about their availability, accessibility and effectiveness. These factors cannot be treated independently, as they frequently act in conjunction with each other. In the present study, economic income was taken as an indicator for analyzing household resource capability, which in turn influenced the choice of coping options. Not all available coping mechanisms are always easily accessible by the social groups due to various reasons of their economic and legal status. Therefore, it was important for people to be aware of the limitations and options available for mitigating wastewater risks.

In the absence of sewer facilities in informal settlements, people usually limited their water use and took to on-site disposal mechanisms in the form of poorly maintained septic tanks, both of which led to compromises in hygiene. Some of the households living along the bank of the river took to open defecation into the river itself, as this was the most convenient option available. In JJ clusters and unauthorised colonies where the sewer network was present, households were not connected due to the informal status of the colony, private illegal connection was sorted.

Accessibility of the available measures and effective success of adopted strategies to deal with wastewater mismanagement depended primarily upon the economic conditions at household level and upon political and institutional sensitivity, will and intentions at regional level. The existence of social capital in the form of people's group also played an important role in strengthening the coping capacity of community groups. Such groups were better organised and more successful amongst the residents of the authorized colonies who were economically well placed and socio-politically better networked. About 80% of the respondents in JJ cluster had household incomes between 2000–5000 Indian National Rupees (INR) while it was lowered with the improving status of colony. 30% of households in the resettlement colony were earning between 2000–5000 INR, which further decreased to only 15% and 10% respectively for authorised colonies and urban villages (Fig. 4). However, higher household incomes did not necessarily mean investment in wastewater infrastructure improvement. In addition to

the factors mentioned above, differential priorities of the households influenced their response towards wastewater exposure risks.

**Fig. 4: Distribution of Household's Income per Settlement Colony (N=696)**



Source: household survey 2005–2006 by the author (Draft: R. Singh).

## Discussion

Vulnerability studies had largely focused on extreme events and natural disasters at one time; the present study looks at household defenselessness against harmful implications of wastewater infrastructural stress by interlinking uncontrolled urbanisation driven implications to marginalized living, poor health and increasing vulnerability for the disadvantaged. It strongly calls for need based provisions, responsible citizenship and a strong political will to improve the access and management of basic sewerage and sanitation needs in order to reduce exposures and to strengthen resilience of the city system on the whole.

The findings of this study reiterate that a severe crisis exists in adequate provisions of water and sanitation for all in the city and it adversely influences urban health. Even if the structural arrangement exists, it is not quantitatively and qualitatively adequate to guarantee quality service. In this respect, unruly city growth has led to disorders and encouraged unorganisation and informality. Developmental efforts have not proved to be far reaching and effective. Although multiple stresses exist in urban settings, it can be argued that adequately securing the basic right of water and sanitation of acceptable quality to all would improve urban environment and health and add to economic gains in terms of reduced expenditures on avoidable disease treatment and increased work hours.

It needs to be mentioned that the findings of this social analysis would be further integrated with the visual details as interpreted from the remote sensing data. It is foreseen that this integrated modelling of remote sensing and social science research approaches would be able to provide quick insight into the dynamics of fast changing megacities with greater precision in shorter time and help in overcoming the limitations of only traditional methods, like statistical analysis, qualitative interpretation and fieldworks.

## Conclusions

Social groups are at varying levels of risk depending on their advantageous or disadvantages locational settings (in this case, easy access to the water sources, wastewater disposal and sanitation arrangement)

and their internal capacity to cope with them. The higher levels of risk and greater exposures to wastewater nuisance are manifested in higher prevalence of water related diseases in disadvantageous areas, primarily in the informal settlement quarters. Apart from physical and economic barriers, institutional limitations, too, prohibit such households from making private provisions for sewerage and waste disposal. Although the socio-economic attributes remain a supportive factor, households lacking knowledge and awareness about the ways and means of solution to their wastewater and sanitation related problems remain vulnerable to the prevailing infrastructural stress. Lack of any clear direction regarding responsible authorities and ways of getting problems (ones beyond household capacity to solve) reported and solved by the right department was a hindrance, too.

Households with good economic assets to support were not necessarily investing in water and wastewater disposal improvement or were not in a conducive socio-political environment that kept them exposed to wastewater risks. The means of exposure to wastewater differed for formal to informal settings, varying between perfectly direct to indirect exposures. Populations of both formal and informal colonies were affected by harmful implications of wastewater mismanagement. But relatively better awareness, coping capability, social network and favourable political backing significantly reduced the severity of implications on the advantaged social groups making them less vulnerable. The wastewater disposal and other sanitation-related problems discussed here only highlight inequitable distribution of basic services, planning failures, weak governance and lack of political will.

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## Acronyms

BID	Inter-American Development Bank (Banco Interamericano de Desarrollo)
BMBF	German Ministry for Education and Research (Bundesministerium für Bildung und Forschung)
CAPRADE	Comité Andino para la Prevención y Atención de Desastres
C.B.D	Central Business District
CNE	Comision Nacional Prevencion de Riesgos y Atencion de Emergencias
COEN	Comité Nacional de Emergencia
COPEFEN	Programa de Emergencias para Afrontar Fenómenos Naturales
CPCB	Central Pollution Control Board
CRID	Centro Regional de Información sobre Desastres
DFID	Department of International Development
DFG	Deutschen Forschungsgemeinschaft
DGPAD	Dirección de Prevención y Atención a Desastres
DJB	Delhi Jal Board
DUEIIP	Delhi Urban Environment and Infrastructure Improvement Project
ECLAC	Economic Commission for Latin America and the Caribbean
EDRI	Earthquake disaster index
EDS	Ecosystem distress syndrome
EIRD	ISDR in Spanish
ENSO	El Nino Southern Oscillation
EPM-	Environmental Planning And Management
EPOC	Equity Policy Centre
EVI	Environmental Vulnerability Index
FAO	Food and Agriculture Organization of the United Nations
FER	Force Event Response Diagram
GDP	Gross Domestic Product
GEC	Global Environmental Change
GECAFS	Global Environmental Change and Food Systems
GEO	Global Environmental Outlook
GEOLAC	Global Environmental Outlook Latin America and the Caribbean
GIP	Gross Island Product
GOI	Government of India
ICT-	Information Communication Technology
IDB	Inter-American Development Bank
IDEA	Institute of Environmental Studies [Instituto de Estudios Ambientales de la UNC, Manizales]
IDNDR	International Decade for Natural Disaster Reduction
IFI	International financing institution
IITA	International Institution for Tropical Agriculture
ILO	International Labour Organisation

IMD	Indian Meteorological Department
INR	Indian National Rupees
INVMAR	Instituto de Investigaciones Maritimas y Costeras
IPCC	International Panel for Climate Change
ISDR	International Strategy for Disaster Reduction
IT	Information Technology
JJ	Jhuggi-Jhompri
LA RED	Latin American Network of Social Studies on Disaster Prevention [Red de Estudios Sociales en Prevención de Desastres en América Latina]
LDI	Local Disaster Index
LECZ	low elevation coastal zone
LEI	Local Effects Index
MMPND	Maldives Ministry of Planning and National Development
MOHFW	Ministry of Health and Family Welfare (India)
NCT	National Capital Territory
NGO	Non Governmental Organization
NFHS	National Family Health Survey
NPV	Net Present Value
OSSO	Corporation Observatorio Sismológico del Sur Occidente
PADRU	Pan American Disaster Response Unit
PMC	Pune Municipal Cotporation
PNUD	Programa de Naciones Unidas para el Desarrollo
PNUMA	Programa de Naciones Unidas para el Medio Ambiente
SINAPRED	Sistema Nacional de Prevencion de Desastres
SINAPROT	Sistema Nacional de Protección Civil
SOPAC	South Pacific Applied Geosciences Commission
UN	United Nations
UNCHS	United Nations Centre for Human Settlements (Habitat)
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
UNEP-WCMC	UNEP- World Conservation Monitoring Centre
UNFPA	United Nations Population Fund
UN-HABITAT	United Nations Human Settlements Programme
UPC	Technical University of Catalonia [Universidad Politécnica de Cataluña, Barcelona]
USGS	United States Geological Survey
WHO	World Health Organization

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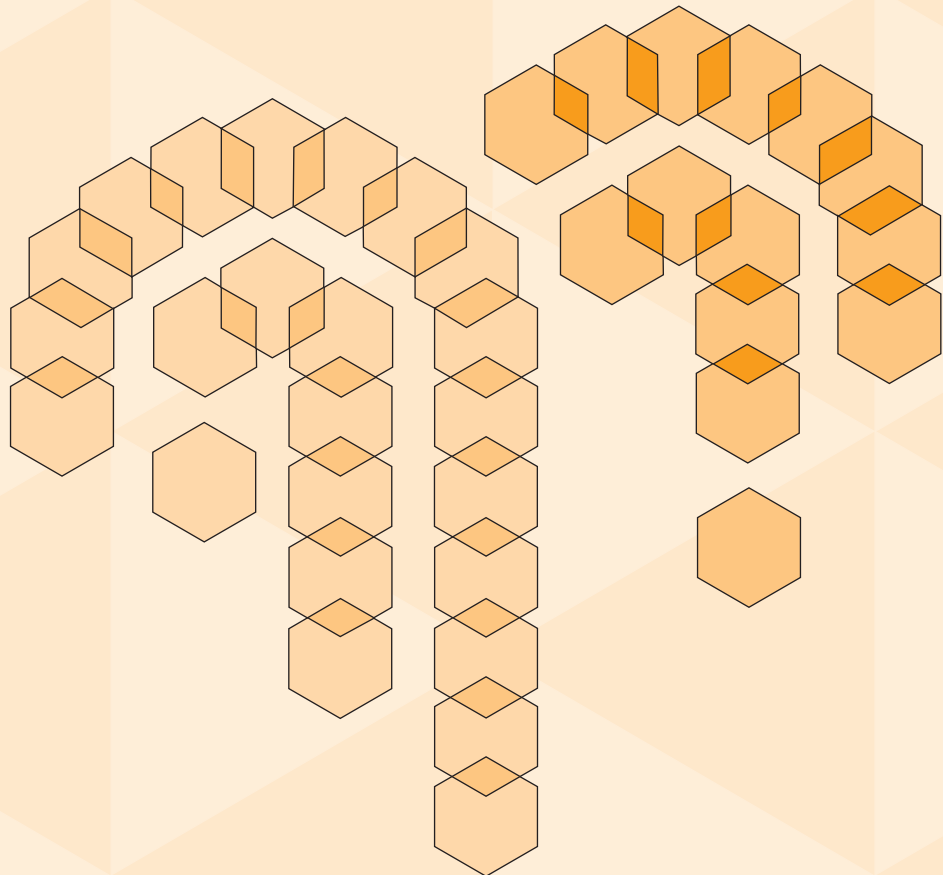


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