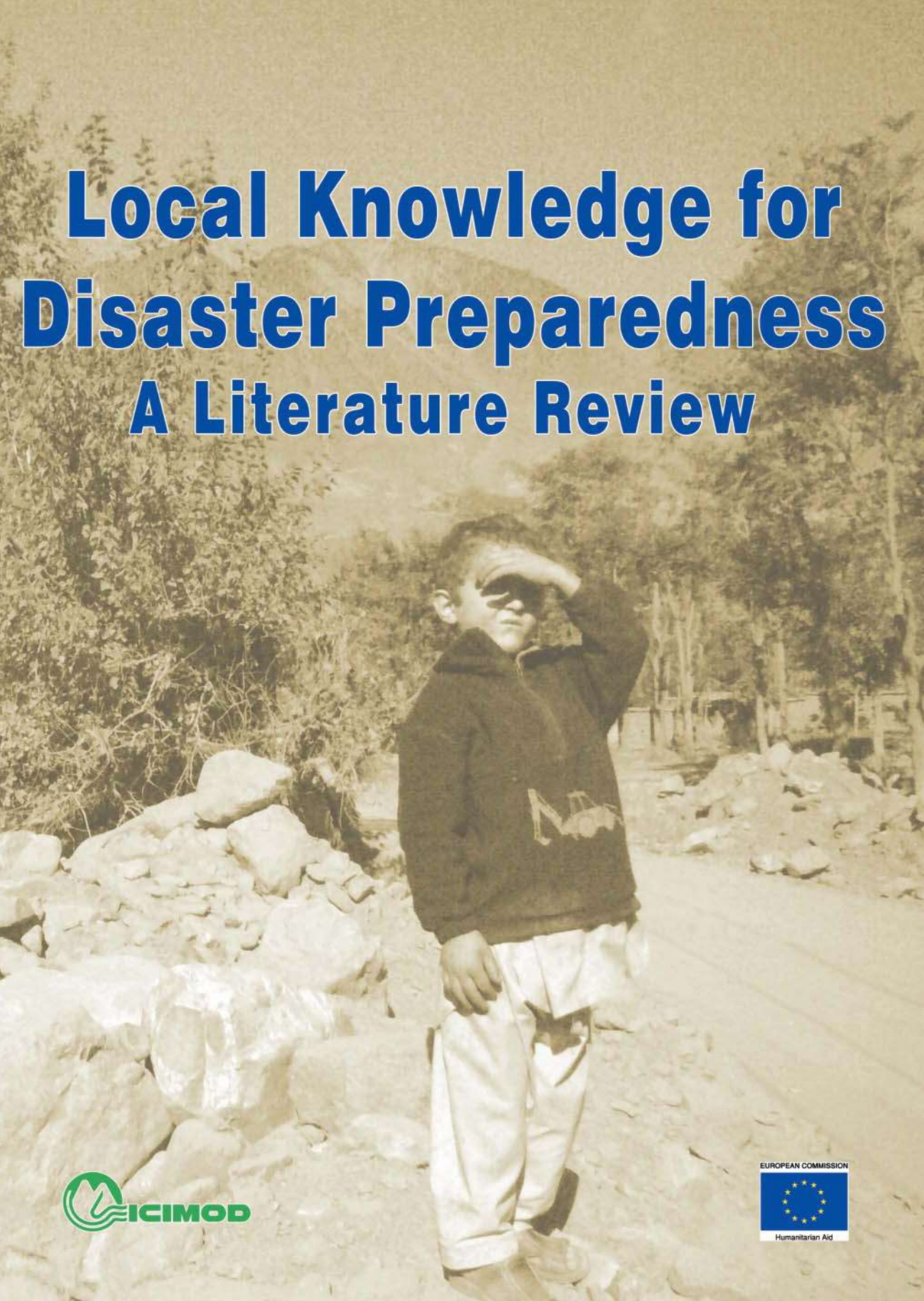


Local Knowledge for Disaster Preparedness A Literature Review



About the Organisations

International Centre for Integrated Mountain Development

The International Centre for Integrated Mountain Development (ICIMOD) is an independent 'Mountain Learning and Knowledge Centre' serving the eight countries of the Hindu Kush-Himalayas – Afghanistan 🇦🇫, Bangladesh 🇬🇧, Bhutan 🇧🇹, China 🇨🇳, India 🇮🇳, Myanmar 🇲🇲, Nepal 🇳🇵, and Pakistan 🇵🇰 – and the global mountain community. Founded in 1983, ICIMOD is based in Kathmandu, Nepal, and brings together a partnership of regional member countries, partner institutions, and donors with a commitment for development action to secure a better future for the people and environment of the extended Himalayan region. ICIMOD's activities are supported by its core programme donors: the governments of Austria, Denmark, Germany, Netherlands, Norway, Switzerland, and its regional member countries, along with over thirty project co-financing donors. The primary objective of the Centre is to promote the development of an economically and environmentally sound mountain ecosystem and to improve the living standards of mountain populations.

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The European Union as a whole (i.e., the Member States and the Commission) is one of the world's largest humanitarian aid donors; the Humanitarian Aid department (ECHO) is the service of the European Commission responsible for this activity. ECHO funds relief operations for victims of natural disasters and conflicts outside the European Union. Aid is channelled impartially, straight to victims, regardless of their race, religion and political beliefs.

DIPECHO stands for disaster preparedness in ECHO. It supports projects aimed at increasing the resilience of communities at risk of natural disasters by funding training, capacity building, awareness raising, early warning systems, and advocacy activities in the field of disaster risk reduction.

Local Knowledge for Disaster Preparedness: A Literature Review

Julie Dekens

International Centre for Integrated Mountain Development (ICIMOD)
Kathmandu, Nepal
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Foreword

Inhabitants in the Himalayan region are exposed to many natural hazards. The mountain ranges are young with an unstable geology, steep slopes, and a climate that is difficult to predict. As a result, the region is highly susceptible to natural hazards such as floods and flash floods, landslides, and earthquakes. In populated areas, these can lead to disaster. Vulnerable groups – the poor, women, and children – are often hit hardest.

Since its establishment in 1983, ICIMOD has dedicated much of its work to examining ways to reduce the risk of disasters from natural hazards, thereby working towards the decreased physical vulnerability of the people in the Hindu Kush-Himalayas. This work has encompassed training courses, hazard mapping, landslide mitigation and control, mountain risk engineering, watershed management, vulnerability assessment, and much more. ICIMOD has also fostered regional and transboundary dialogue for improved management of both the resources provided and the risks threatened by the big rivers in the Himalayan region; sharing of hydro-meteorological data and information among the countries in the region is of particular importance for mitigating the risk of riverine and flash floods in the major river basins.

This publication is one of a series produced under the project ‘Living with risk – sharing knowledge on disaster preparedness in the Himalayan region’, implemented by ICIMOD during a 15-month period in 2006 and 2007. The project was funded by the European Commission through their Humanitarian Aid department (DG ECHO) as part of the Disaster Preparedness ECHO programme (DIPECHO) in South Asia, and by ICIMOD. Through this project, ICIMOD has endeavoured to encourage knowledge sharing and to strengthen capacity among key practitioners in the field of disaster preparedness and management. This has been done through training courses, workshops, knowledge compilation and dissemination, and the establishment of a website (www.disasterpreparedness.icimod.org).

The publications resulting from this project include baseline assessments of the disaster preparedness status in the four target countries (Bangladesh, India, Nepal, and Pakistan); case studies and a framework on local knowledge for disaster preparedness; and gender and vulnerability aspects in disaster risk reduction. The publications, training sessions, and workshops were undertaken in the context of the ‘Hyogo Framework for Action 2005-2015’ which recommends that regional organisations should promote sharing of information; undertake and publish baseline assessments of disaster risk reduction status; and undertake research, training, education, and capacity building in the field of disaster risk reduction.

The long-term mission to bring the Himalayan region to an acceptable level of disaster risk has only just begun. The countries in the region are among the most disaster prone in the world in terms of number and severity of disasters, casualties, and impact on national economies. Only by strong commitment, hard work, and joint efforts can this situation be improved. It is ICIMOD's hope that our collective endeavours will help improve disaster risk reduction in the mountain region we are committed to serve.

Dr. Andreas Schild
Director General
ICIMOD

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Summary

This publication is based on a review of literature about local knowledge and practices and attempts to give an overview and framework of local knowledge in disaster preparedness, an understanding of its usefulness in disaster management, and the benefits and problems involved.

Since the 1970s, evidence that local knowledge and practices can help implementing organisations to improve disaster preparedness activities has grown; notwithstanding this evidence, the marginalisation of local knowledge and practices by mainstream literature and institutions involved with disaster management continues.

A local knowledge system is composed of different knowledge types, practices and beliefs, values, and worldviews. Such systems change constantly under the influence of power relations and cross-scale linkages both within and outside the community. As such, local knowledge and practices need to be understood as adaptive responses to internal and external changes which result (or not) in disaster preparedness at local level. In order to identify local knowledge on disaster preparedness, one should focus on four key aspects: people's ability to observe their local surroundings, people's anticipation of environmental indicators, people's adaptation strategies, and people's ability to communicate about natural hazards within the community and between generations. Overall, the ability a community has to prepare itself for disaster preparedness needs to be understood within the broader context of livelihood security and sustainability and building up community resilience in the long term.

Some Key Terms

Capacity – A combination of all the strengths and resources available within a community, society, or organisation that can reduce the level of risk, or the effects of a disaster.

Disaster – A serious disruption of the functioning of a community or a society causing widespread human, material, economic, or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

Disaster risk reduction (disaster reduction) – The conceptual framework of elements considered with the possibilities to minimise vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

Hazard – A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Mitigation – Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Preparedness – Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary evacuation of people and property from threatened locations.

Resilience/resilient – The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. It is determined by the degree to which the social system is capable of organising itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Risk – The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environmental damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions. Conventionally risk is expressed by the notation $\text{Risk} = \text{Hazards} \times \text{Vulnerability}$. Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

Risk assessment or analysis – A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

Vulnerability – The conditions determined by physical, social, economic, and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

Adapted from UN/ISDR (2004)

Part 1

Background



Introduction

This publication attempts to give an overview of and framework for local knowledge in disaster preparedness; an understanding of how it can be used in disaster management; and the benefits and problems it can involve. It is addressed to development and research organisations working in the field of disaster management mainly, but not exclusively; any development organisation working to ensure sustainable livelihoods and promote community resilience should take natural hazard risks into account.

Since the 1970s, a growing body of literature has highlighted the importance of integrating local knowledge and practices into development and conservation projects. A less well-known but also growing body of literature comes to a similar conclusion in relation to natural hazards and disasters. Literature reviews on early research findings in Sociology (Dynes 1974; Fritz 1968; Barton 1970; Quarantelli 1978), Geography (White 1974; Burton et al. 1978); and Anthropology (Torry 1979) are available elsewhere.¹ Most of the work on human response and adaptation to natural hazards and disasters advanced more in the developing world than in developed countries; much of it, especially on drought, focused on indigenous peoples, peasant farmers, and herders and much of it directly challenged mainstream academia, the media, government, and aid agencies' policies and practices. Similar work began in the Himalayas from the early 1980s. Journals like 'Cultural Survival', 'Human Ecology', and 'Mountain Research and Development' promoted this work.

Notwithstanding, the mainstream literature on natural hazards and disasters and the mainstream institutions charged with disaster management ignored local knowledge and practices until recently. The existence and usefulness of local knowledge rarely received attention. The emphasis of most academic work, both nationally and internationally, has been on the latest, 'advanced' geophysical knowledge and technical systems as the most effective disaster response mechanisms. The considerable body of work on local knowledge remained as marginal as many of the peoples whose knowledge it was. This is partly due to the enormous technical-social perspectives' divide and the privilege accorded the 'expertise' approach which emphasises formal education and degrees instead of life experience. Since the 1980s, however, increasing numbers of institutions have recognised the importance of integrating 'local knowledge' into development. The same applies to disaster management, with increasing research

¹ Examples of early case studies on human responses to natural hazards and disasters can be found in Latin America (e.g., Oliver-Smith 1973, 1977a, b; Dougherty 1971; Bode 1977 on the 70s Peruvian earthquake); in the Sahel and East Africa (e.g., Copans 1975; Watts 1983; Campbell 1984); and in New Guinea (e.g., Waddell 1975 contrasts disastrous official relief to damaging frosts with indigenous strategies). In the 1970s-80s, drought was the hazard studied most, especially among African pastoral people, but not exclusively (e.g., Jodha 1975 about community adaptation to drought in Rajasthan, India). (Torry 1979; personal communication Dr. Ken Hewitt)

initiatives, national and UN agencies, and major international NGOs beginning to take local knowledge and its stakeholders into account. Many NGOs have been established locally, regionally, and globally to address these issues or engage in activism on behalf of those at risk. To what extent the latest work on local knowledge and related participatory disaster management approaches are less vulnerable to marginalisation by national and international disaster management strategies than earlier work remains to be seen. A comprehensive framework through which to understand local knowledge on disaster preparedness cannot be found in mainstream literature, by and large. Many case studies about local knowledge exist, especially local environmental knowledge, but usually the links between this local knowledge and disaster management and preparedness are not made explicit.

Approach

Much of the literature on local knowledge is dispersed in various fields, for example, geography, anthropology, natural resource management, climate change, development, rural sociology, urban planning, and engineering. Based on the assumption that much can be learned from other fields, this paper is based on a cross-disciplinary literature review. The resulting framework enables identification of key findings and trends in current literature on local knowledge related to disaster preparedness. The literature review mainly draws from English language reports available on the Internet and from peer-reviewed research journals.

The great diversity of languages in the South Asian region make it difficult to tap into the resources available on local knowledge, as most of it is not recorded or is embedded in old religious and cultural works. Although the aim was to focus on disaster preparedness in South Asia, references and studies from a broader geographical area (i.e., other developing countries) were included to take advantage of lessons learned elsewhere.

Organisation of the report

This report is in four parts. Following this introduction, a short academic background gives a historical perspective of local knowledge and disaster preparedness. The limitations of current disaster management activities are highlighted as well as an understanding of how local knowledge has been marginalised by mainstream development, in general and in the literature, about natural hazards and disasters. The importance of local knowledge is discussed in the context of participation of local people in disaster management and preparedness activities. The third part of the report discusses the framework for understanding local knowledge related to disaster preparedness. The framework (Part 2) is based on four steps: (i) understanding the nature of local knowledge, (ii) the transformation processes surrounding local knowledge, (iii) the key dimensions of local knowledge on disaster preparedness, and (iv) the links between local knowledge, disaster preparedness, and livelihoods and poverty reduction. The concluding part (Part 3) contains an overview of lessons learned together with a list of the cited literature. Controversial aspects related to local knowledge on disaster preparedness that are often disregarded or misunderstood are also highlighted (box – ‘Did you know?’).

Beyond the framework

The present framework does not cover how to use local knowledge related to disaster preparedness and how to integrate it into disaster-related activities, plans, and policies. It aims to promote sensitivity towards and an understanding of local knowledge on disaster preparedness. **The assumption here is that local knowledge and practices, whether they are relevant or not in a specific context for a specific project, should not be ignored. Local knowledge always needs to be taken into account. However, and importantly, this does not mean that all local knowledge and practices are appropriate or sustainable.** Therefore, the next important step in providing policy recommendations involves assessing how to integrate local knowledge into your activities; which local knowledge and practices you can support within your timeframe; for whom and for what objectives; how it can be combined with other knowledge for disaster preparedness; and in which context local knowledge and practices contribute to improvement of disaster preparedness activities.

Definitions

The current report proposes investigation of natural hazards from a people-centred perspective: that is what the residents know about natural hazard risks and what they believe and do about them in a given situation. As such local knowledge is used here in its broadest sense.² We all have local knowledge: it refers to the relationship people develop with their surroundings over time. The terminology is diverse: the literature refers to: ‘indigenous knowledge’, ‘traditional knowledge’, ‘folk knowledge’, ‘folk science’, and ‘citizen science’ among others. Indigenous knowledge is part of local knowledge: it refers to:

“local knowledge held by indigenous people, or local knowledge unique to a given culture or society.” (Berkes 1999)

Local refers to, and emphasises, a place, a region, a location as much as the regular movements between different points (e.g., knowledge related to the routes or different locations of groups of people who migrate on a routine basis such as nomads, commuters, seasonal migrants (Antweiler 1998, p 17) rather than time (a knowledge that is anterior to another, traditional versus contemporary knowledge).

It is important to learn how people (local and indigenous) in a particular area view and interact with their environment; whether or not they have local knowledge that helps monitor, interpret, and respond to dynamic changes in ecosystems and the resources and services that people generate; and whether or not their knowledge can be used to design appropriate interventions, including disaster preparedness (Berkes et al. 2000; Langill 1999). Local knowledge is dynamic and is always changing over time through experimentation and adaptation to environmental and socioeconomic changes (Thrupp 1989, p 15).

² ‘Data’ refers to pure and simple facts, ‘information’ refers to structured data, and ‘knowledge’ refers to the ability to use information to achieve objectives (www.pascaru.net/English/1.html).

Disaster preparedness refers to a combination of short- and long-term strategies that help minimise or reduce the negative effects of natural hazards, prevent their impacts on assets, and escape certain peak values (e.g., during periods of excessive rainfall, etc) or their consequences. As such disaster preparedness is defined broadly and goes well beyond emergency preparedness which is used by nations to refer to crisis management based on command-and-control (civil defence) and short-term response strategies. It is difficult to isolate disaster preparedness from other components of disaster management (e.g., disaster relief) as they are inter-related.

Why Don't Abundant Data and New Technology Always Help?

The rise in vulnerability to and risks from natural hazards

Despite advances in knowledge and technology (e.g., satellite coverage or surveillance techniques), vulnerability to and the risks from natural hazards have been rising in developed and developing countries – and this may be the case even with the frequency and magnitude of hazard events remaining constant (Gardner 2002; Van Aalst and Burton 2002). In other words, what has been increasing is not the number of disasters as a result of natural hazard events per se, but the impacts of these events on people and property (Twigg 1998, p 1). The increase in risks and vulnerability is the result of changes in people's social, economic, cultural, political, and environmental contexts. The incidence of and toll disasters take have increased for decades both because of development processes and because of lack of development. For example, development processes (e.g., dams and road construction) have affected the allocation and distribution of resources between different groups of people and have created new natural hazard risks. When people are displaced, the poorest among them are forced to settle on marginal land and in risk-prone areas because of demographic and socioeconomic pressures.

The importance of local knowledge and coping strategies is entering national policies. For example, the Nepal Disaster Management Policy mentions the need to strengthen communities' coping strategies. This policy was drafted by the Nepal Centre for Disaster Management (NCDM) and Oxfam-Nepal and is currently being reviewed by the Government of Nepal, Ministry of Home Affairs, and the National Planning Commission (NCDM and Oxfam-Nepal 2007). However, most policies, plans, building codes, or land-use standards are not implemented and enforced effectively in developed countries (as illustrated recently in 2005 by the effects of floods in New Orleans, USA, following Hurricane Katrina) and this is more so the case in developing countries.

Dependence on public and humanitarian aid

International disaster relief and reconstruction funds have not kept up with the growing demand, and public support systems and services have eroded significantly as a result of privatisation of services (Alam 2006, p 2). International humanitarian aid for developing countries has been increasing (rather than reducing) their dependency on developed countries, creating new vulnerabilities (Jigyasu [2002] on earthquake rehabilitation in India and Nepal). Dependence on external aid is probably due to the nature of aid, which has mainly focused on short-term, immediate relief activities, and the lack of political will to implement the regulations and standards required. The influx of external help and the related dependency have created little incentive for governments to capitalise on their own resources (including local knowledge and practices) (Mercer no date, p 8). Public aid has also created dependencies at local level. As Schware (1982, p 215) states in the context of India:

“Monitoring and providing gratuitous relief – for unpreventable natural calamities such as droughts, floods, and famines – dates back at least to 1880. Since the Indian Famine Commission Report of 1880 and subsequent famine codes modelled after it, such public relief measures have become institutionalised. Thus the government has created a relief mentality that fosters expectations and reliance on government as well as international aid [...]. The informal warning process may be seen as a reaction to non-existent, irregular, or late formal flood warning messages.”

This realisation about humanitarian and public aid has led to a change in paradigm towards disaster preparedness rather than just focusing on relief. In light of this trend, certain questions come to mind: why is it that abundant data and new technology do not always help to decrease the level of risk from natural hazards? Is knowledge lacking? Is knowledge not used? Is knowledge used ineffectively? How are the increasing numbers of people affected by disasters going to cope with the deficit in supply of public goods (Alam 2006, p 2)? Does appropriate anticipation of natural hazard always lead to appropriate action (Howell 2003)? Whose interests are served by research into natural hazards and disasters? Is such research in the interests of those at risk or is it in the interest of the participating technical and research organisations which can gain through perpetuating and elaborating upon research and technology (Parker and Handmer 1998, p 48)? The realisation that technology and data alone will not be enough to improve people’s lives is growing. Research has to be tailored to people’s capacities (i.e., local knowledge and practices), based on their assets and needs, and based on building their trust (ISDR 2004) because:

“despite various systems (national warning systems, red crescent cyclone preparedness programme), household preparedness and survival potential appear to be very much dictated by economic and social circumstances.” (Howell 2003, p 4)

The literature shows that people affected by disasters play a crucial role in disaster preparedness and mitigation, but their knowledge is often ignored by both international aid agencies and by their national and regional governments. The failure of relief aid following the 2004 tsunami, for example, is now being attributed to a general misunderstanding of people’s needs and practices.

Local Knowledge about Natural Hazards and Disasters in the Literature

The critics of early research into natural hazards and disasters

In the 1960s and 1970s, geographers studied the impacts of natural disasters on people mainly from a technical perspective. The dominant approach to natural hazards and disasters focused on hazards as physical events requiring scientific and technical solutions (technical or technological fixes). Natural hazards were understood in the context of simplistic determinism (where physical processes determine human actions) and linear causal relationships from geophysical events to impacts to human responses. People were also assumed to be the masters of their fate to a much greater degree than now seems valid (White et al. 2001). They were assumed to live in vulnerable conditions due to a lack of knowledge (Schilderman 2004, p 416). In the 1980s and 1990s, researchers in the field of natural hazards and disasters began to criticise the deterministic, ahistorical, and asocial concept of hazards and disasters and its dependence upon the use of choice and decision models (Hewitt 1983; Gardner 2002). As Messer (2003, p 3) reports:

“As recently as the late 1990s, scholars complained of the absence of much social science research on disasters in developing countries.”

The growing focus of research and development is the need to take the human dimensions of natural hazards into account (including local knowledge, practices, and perceptions) in disaster management (Anderson and Woodrow 1989; Johnson et al. 1982 in a case study documenting local knowledge of landslide hazards in the Kakani-Kathmandu area, Nepal). In fact, the studies on hazard perception emerged in the US from Gilbert White’s group at Chicago in the 1960s. This work initially focused on wheat farmers’ perceptions of and responses to droughts in the Great Plains of North America (Saarinen 1969). However, a lot of this work degenerated into standardised questionnaire surveys and ‘official’ analyses applied in developing countries (Personal communication, Ken Hewitt).

The hazard perception studies show that natural hazards are non-linear and complex events shaped by and resulting from the combination of not only geophysical and meteorological factors but also (and mainly) political, economic, sociocultural, and psychological (or perceptual) phenomena and factors. The social dimension of risks and hazards is important because local communities see them through a cultural lens; and this is dependent upon their view of the cosmos and accumulated experience (Linkenbach-Fuchs 2002, p 7).

The case of flood management in Bangladesh can illustrate this shift in thinking. The ineffectiveness of flood management in Bangladesh has been attributed to the focus on large-scale technological solutions which tend to emphasise short-term, sectoral approaches. A growing literature has been promoting the importance of building upon local knowledge and local adaptive strategies for improved flood management in Bangladesh (Paul 1984; Rasid and Paul 1987; Haque 1988; Zaman 1991).

Research into natural hazards and disasters has been influenced also by the international arena. In 1989, the United Nations General Assembly proclaimed the decade from 1990-2000 as the International Decade for Natural Disaster Reduction. The United Nations recognised the disastrous impacts of natural hazards on vulnerable communities and, by the year 2000, all countries were encouraged to have comprehensive national assessments of natural hazards and risks integrated into national development plans and to address long-term disaster prevention, preparedness, and community awareness in mitigation plans. In reality, funds dropped – mainly because of the Gulf War (1991) and a series of natural disasters in developed nations, including the Kobe earthquake. The Kobe earthquake demonstrated that developed nations could not prevent disaster and that relief aid was inappropriate. In 1994, the United Nations World Conference on Natural Disaster Reduction in Yokohama called for paying more attention than before to traditional knowledge and community-based action. The Kobe earthquake also led to a switch from a technocratic view of natural hazards to a focus on vulnerability. (Personal conversation, Ken Hewitt)

From natural hazards to vulnerability and resilience

The criticism of research helped to generate a growing interest in the concept of vulnerability in hazard literature (Blaikie et al. 1994) as elsewhere (and it is also a central component of the sustainable livelihood approach) and especially led to a focus on reducing social and community vulnerability and examining its links to disaster and risk responses. Some researchers argue that the focus should be directed towards vulnerability and local coping strategies instead of hazard per se (Battista and Baas 2004). In any case, the shift towards the vulnerability perspective in research into natural hazards and disasters encourages looking at disasters through the lens of socioeconomic and political structures and processes. The recognition is growing that research should broaden its analytical scope to include questions of sustainable development such as livelihoods, poverty, governance, equity, climate change (which some research links with the threat of increased extreme events), and natural resource management (UNEP 2004; Van Aalst and Burton 2002; Sudmeier-Rieux et al. 2006).



Local community standing on a bridge destroyed by flood, Singyali VDC, Mohottari District, Nepal

The maintenance of sustainable livelihoods is based on people's adaptation to environmental changes (including natural hazards) together with economic and political changes (Batterbury and Forsyth 1999). Researchers examining adaptations to natural hazards and disasters study adaptation in terms of social and power relationships also (political-economic perspective) and not only from a biological point of view (i.e., adaptation perspective) (Goodman and Leatherman 2001, p 21). Some studies focus on community adaptation to climate variability and climate change (Allen 2006; Ahmed and Chowdhury 2006; Rojas Blanco 2006; Hageback et al. 2005; Stiger et al. 2005) and multiple stresses, including natural hazards (McSweeney 2005). That said, these aspects still lack visibility in mainstream literature (Flint and Luloff 2005) and are neglected in practice, reflecting the compartmentalisation of science and the difficulty of overcoming it; and this is also reflected in government and donor budgets and the challenges surrounding (real) inter- and cross-disciplinary studies.

Recently, resilience literature has examined the processes of adjustment and self-organisation from a more dynamic and complex perspective than the adaptation literature (IFRC 2004; Gardner and Dekens 2007). The resilience perspective also attempts to investigate adaptation to change from a more positive angle than the vulnerability perspective, focusing on people's strengths rather than on their vulnerabilities.

Overall local knowledge was absent from the early mainstream research into natural hazards and disasters. Then, the change from a focus on natural hazards to vulnerability

and resilience was accompanied by a growing recognition of the importance of local knowledge and practices. Yet, even though research and development organisations acknowledge the existence and importance of local knowledge and practices related to disaster preparedness, in practice little documentation of its application through official channels exists. Ultimately, the growing interest in local knowledge, including in disaster management and preparedness, should be understood in the context of governance issues and the movement to participatory approaches in development and resource management.

Why Local Knowledge is Important

Local knowledge and the debate about participation

Understanding local knowledge is not enough: it is only a means to the inclusion and participation of local people in disaster management and preparedness activities. As such local knowledge can be an entry point for promoting local people's participation with 'higher-level' institutions in those aspects of disaster risk prevention and management for which they have a comparative advantage (Battista and Baas 2004, p 8).

This paper does not discuss participatory literature in detail, but the rediscovery of local knowledge is concomitant with calls for flexible and adaptable management systems and the new discourse in the development field on a 'participatory', 'bottom up', and 'farmer first' approach. The catchwords of this approach are 'governance', 'empowerment', 'devolution', 'citizen science', 'community-based management', 'empowerment', 'self-reliance', 'decentralisation of decision-making', 'adaptive management', 'co-management', and the 'subsidiarity principle'. Hazard research has been relatively slow off the mark in engaging with these broad debates (Few 2003), but they are entering the humanitarian aid and disaster risk reduction fields (e.g., 'community-based risk reduction', 'community-based hazard identification and mitigation', and 'participatory hazard mapping') and an increase in community participation in disaster management is being called for (Linkenbach-Fuchs [2002], as well as on early warning research and systems (Schware 1982 [West Bengal]; Parker and Handmer 1998 [England]; ILO 2002 [India]; Pratt 2002 [Kenya]; ISDR 2004). The success of these participatory approaches lies in their generality, which enables them to link risk reduction with the issue of development as a whole (Few 2003).

Participatory approaches to disaster management and preparedness often pre-suppose a basis in local knowledge and practices because communities in disaster-prone areas have accumulated a lot of experience over time (Battista and Baas 2004, p 10). These approaches also recognise that local people are the primary actors by default when a disaster strikes. From a local knowledge perspective, according to Battista and Baas (2004, p 29), it is more interesting to examine recurrent shocks that gradually increase the vulnerability of communities. Exceptional disasters require external means, beyond normal coping strategies.

Local knowledge as a tool for change

According to the participatory discourse, taking local knowledge into consideration in terms of practices and contexts can help implementing organisations improve their planning for and implementation of disaster preparedness activities; and it can help improve project performance and project acceptance, ownership, and sustainability specifically. This means that understanding, accounting for, and respecting local knowledge contribute to cost-effectiveness in the long-term, from both a financial and a social point of view– especially in the context of complex, changing, and growing hazards.

Firstly, from a financial point of view, economies of scale are based on the assumption that people perform better on some scales than on others and that different resources are found on different scales (Berkes 2002, p 317). Solutions in resource management, development, and disaster management need to go beyond the dichotomy between local versus state management levels and integrate cross-scale institutional linkages. Understanding local knowledge and practices can help identify what is needed and acceptable locally and how people's participation can be solicited to ensure their support for external action. Building on local knowledge and practices (i.e., capitalising on local strengths), when it is relevant to do so, can decrease dependency on external aid. Local people provide continuity and can monitor the actions taken (Wisner and Luce 1995, p 344).

Secondly, from a social point of view, taking local knowledge and practices into account promotes mutual trust, acceptability, common understanding, and the community's sense of ownership and self-confidence. Understanding local knowledge, practices, and contexts helps development and research organisations to tailor their project activities and communication strategies to local partners' needs. It also enables development research organisations to act as intermediaries in translating messages from government level to communities in a way that is understandable and credible. For example, a meteorological agency might release the following message to communities: "the river is going to rise by one to two metres in the next 24 hours." But is it enough? What does it mean to the locals? Government agencies often release information that is not understood at local level (Cronin et al. 2004; Jaarsma et al. 2001; Messer 2003; ILO 2002; ISDR 2004). Cronin et al. (2004, p 663) in Ambae Island, Vanuatu, describe how depictions of volcanic hazard on a map could not be understood locally, because the community had a different perception of the landscape from that of the mapmakers. Hence, communication tools for disaster preparedness, such as official warning messages or hazard maps, need to incorporate local references.

The inclusion of local people in disaster management and preparedness activities is challenging. In practice, participation and decentralisation involve complex processes and the devolution of power to local levels does not always transfer into power being given to the most marginal groups, mainly because increased access to (political) resources does not always translate into increased benefits from those resources (see also Chapter 6, section on power relations). Chambers and Richards (1995, pxiii cited in Ellis and West 2000, pp 6-7) argue that development practitioners use jargon,

such as empowerment and participation, easily but have not changed their attitudes towards rural people and still undervalue their knowledge.

The renewed interest in local knowledge does not mean that outside economic interests in benefiting from local knowledge have disappeared, as demonstrated by controversies about intellectual property rights over medicinal plants and pharmaceutical commercialisation. These aspects illustrate how the use of local knowledge raises complex issues.



Malangawa, Sarlahi District, Nepal



Part 2

The Framework

The Framework

This section tries to unfold some of the complexities associated with local knowledge by presenting a general framework on how to understand local knowledge on disaster preparedness. An assessment of the literature shows that there is no comprehensive framework through which to understand local knowledge on disaster management and especially disaster preparedness. Although there are exceptions (Kates 1971; Clarke-Guarnizo 1992; Hall and Davis 1999), these frameworks focus on coping strategies only.

The framework on the following page can be used to identify linkages between local knowledge and disaster management, and to determine what influences them. This framework is based on a literature review and highlights the over-riding processes surrounding local knowledge on disaster preparedness rather than listing good practices for data collection and storing. Knowledge is not static; it is being lost and gained all the time. Local knowledge is meaningful within its own spatial and temporal contexts. As such, understanding the causation and process of knowledge creation and transformation is more important than focusing on the knowledge outcomes. This section describes each step of the framework: the need to understand the nature of local knowledge, the transformation processes influencing local knowledge, the key dimensions of local knowledge on disaster preparedness, and the links between local knowledge, disaster preparedness, and poverty reduction.

Figure 1 comes here on folding page

What is Local Knowledge?

What people know is influenced by (and influences) their beliefs, lifestyle, and behaviour. To understand local knowledge one has to understand and account for people's ways of knowing (i.e., different knowledge types) as much as their practices and beliefs, perceptions, and values. Understanding all these is crucial because it can explain why people do things the way they do.

Knowledge types

The interaction between conventional science and local knowledge is not new and the history of science demonstrates that the two knowledge systems have often been intertwined (Agrawal 1995). In the Himalayas, as elsewhere, trade routes; military and scientific expeditions; and political conquests have contributed to the exchange of knowledge (Linkenbach-Fuchs 2002). Local knowledge has never been isolated: it has always been connected to other places and other types of knowledge. If, as Agrawal argues (1995, p 433), the division between indigenous and scientific knowledge is artificial, then it makes more sense to talk about multiple knowledge types (or dimensions) which can serve different interests and purposes.



Man carrying wooden log, towards Kalash Village, Lower Chitral. Local knowledge of appropriate building styles can also contribute to disaster preparedness.

Local knowledge on disaster management has often been associated with local, **technical knowledge** only (Thrupp 1989), probably because it is the most visible and concrete aspect of local knowledge. Local, technical knowledge includes local methods of construction, use, and combination of specific materials for domestic and local buildings. Aside from local, technical knowledge, there are other types of knowledge such as environmental and agricultural knowledge, sociocultural knowledge, and historical knowledge. This local, non-structural knowledge is not easily identified by outsiders, because it is closely embedded in people's livelihoods and worldviews.

Environmental and agricultural knowledge or ecological knowledge is the most intensively studied (Antweiler 1998, p 10) and refers to local knowledge of natural resources (ICSU-UNESCO 2002). Langill (1999, p 4) discusses the importance sustainable development researchers give to it. Studies have highlighted the richness of local environmental knowledge (e.g., soil classification, land-use categories, and weather patterns) and have shown how local methods, such as agroforestry and polyculture, contribute to conservation of ecological diversity.³ However, they fail to make the link between aspects of it (e.g., soil classification, land use, and weather patterns) and natural disaster management. (See more on this aspect in Chapter 7.)

Sociocultural and historical knowledge is often ignored by studies of natural disasters, despite its importance (Ellis and West 2000). Sociocultural knowledge includes knowledge related to the sociocultural environment in its broadest sense, viz., social, political, economic, and spiritual aspects of life (Langill 1999; Antweiler 1998). According to Ellis and West (2000, p 13), it can be argued that local knowledge is embedded within both the historic understanding of (natural hazards and disasters) and current actions and events. Local history about social relations is important because it can influence the way people perceive and respond to natural hazards.

Knowledge about development projects refers to people's beliefs about the outside world (the regional, state, and international actors likely to intervene in disaster responses) which affects how they respond to interventions.

There are various classifications of knowledge, in general, and local knowledge, in particular, in the literature, reflecting the complexity and diversity of different modes of knowing by communities, households, and individuals. Importantly, this classification of local knowledge types (or knowledge dimensions) is not comprehensive. Other types of knowledge that are not well studied include, for example, local knowledge about conflict resolution or management and organisational and management knowledge (Antweiler 1998, p 10). Overall this classification tries to simplify the reality and

³ For examples of case studies on local knowledge related to land management in Nepal, see Muller-Boker (1991) who studied local soil classification in the Gorkha and Chitwan districts and Johnson et al. (1982) who studied local categories of land use in the Kakani-Kathmandu area. For examples of case studies on local knowledge related to landscape conservation in India, see Ramakrisnan 2001; Farooquee 2004. A World Bank report by Van Aalst and Burton (2002) provides a general overview of the linkages between natural resource management and disaster management. For examples of case studies on local climate knowledge and weather forecasting in agriculture – a field that has been poorly investigated according to Materer et al. (2001) – see Jaarsma et al. 2001 [Mozambique]; Kanani 1999 [Gujarat, India]; Materer et al. 2001 [Lesotho].

presents a false dichotomy between various knowledge types, which are, in the context of local knowledge, not separate but closely intertwined. The important lessons here are that a diversity of local knowledge exists and that most of it remains untapped despite growing evidence in the literature that it can play a valuable role in disaster risk reduction, directly or indirectly.

Did you know? Attitudes towards local knowledge

Historically, science-based attitudes (and including to some extent Asian attitudes) towards local knowledge have shifted from denial to romanticisation and, today, a growing acceptance. A great deal of knowledge has been based on local knowledge from various parts of the world to push the frontiers of scientific eclecticism forward. But often little credit was given to the origins of this knowledge. Scientific field work by Europeans during **colonisation** extracted the local knowledge of Asian countries. Local knowledge, and especially folk taxonomies, were systematically extracted, codified, and re-appropriated as western knowledge in numerous encyclopaedic inventories (Ellen and Harris 1996, p 14).

The **mid-1960s** symbolise the rediscovery and romanticisation of local knowledge through the stereotype of 'primitive' people in harmony with nature. Certain sectors in western society questioned the ability of science and technology to solve all problems. People started to react against the remoteness of science and its perceived arrogance and negative technological outcomes (Ellen and Harris 1996, p 16). At that time, a western counter-culture movement marked the rediscovery of local people and knowledge. Notions of traditional, indigenous, or 'primitive' peoples imagined an idyllic harmony with nature which western civilisation had lost – however, recent research shows that the relationships between traditional societies and civilisations and the environment have been anything but idyllic and well informed (e.g., Mann 2006; Diamond 2005; Williams 2002).

From the 1970s and 1980s to date, advocates of the importance of local knowledge slowly began to infiltrate the mainstream. A counter culture against the tendency to see top-down approaches and mega-projects as the only ways towards development promoted the philosophy that 'small is beautiful' (Schumacher 1973). The importance of accounting for and integrating local knowledge into development projects, including decision-making processes, gained recognition among academia, international development and funding agencies (e.g., World Bank, UNESCO, FAO, IDRC, UNEP), NGOs, and among policy-makers and governments. Various initiatives from the international community have recognised the role of indigenous knowledge in sustainable development, particularly in developing countries (e.g., Our Common Future (WCED) 1987, United Nations 1992 Earth Summit, Agenda 21, 1999 World Conference on Science, Johannesburg Plan of Implementation, Millennium Development Goals). This change in attitude has led to a new discourse on participatory and decentralised development (Agrawal 1995) and maybe disengagement of the state in favour of the growing role of the NGO sector.

Did you know? Common and specialist knowledge

Local knowledge is scattered and it is dispersed institutionally: it is located at the individual and household level as well as collectively through community stewards and other key social actors (e.g., shamans, elders, local religious and political leaders, and healing artists). As such, one can distinguish between common (or everyday or public) knowledge (i.e., held by the whole community) and specialist knowledge (i.e., retained by a few local experts, e.g., healers with specific medical expertise and knowledge of local curative plants; knowledge of local plants known only by women; or knowledge of crops known only by men) (Langhill 1999; Berkes 1999; Antweiler 1998; Materer et al. 2001). Blaikie et al. (1994, p 62) discuss specialist knowledge and its relationship to different resources. Langhill (1999, p 14) also distinguishes common and specialist knowledge from shared knowledge, that is knowledge held by many but not all (e.g., knowledge of herders, hunters, or farmers). Wisner and Luce (1993) found it useful to know why some people in a community:

“Are unable to avail themselves of [a particular] knowledge and practice [such as traditional building construction]; [that is to focus on] the vulnerability of people, not of systems.”

Did you know? Experiential and transmitted knowledge

Local knowledge derives more from memory, intuition, and the senses than from the intellect. It is always a mixture of experiential and transmitted knowledge. Experiential knowledge refers to knowledge gained through experience (i.e., historical observation). Transmitted knowledge refers to knowledge gained from one generation to another (as such local knowledge is also ‘multigenerational’ by nature – Berkes 1999). Often, transmitted knowledge does not meet with the same problems of legitimacy in the community as experiential knowledge, because the former has been culturally internalised (Personal communication, Dr. James Gardner). As such local knowledge is not easy to document because it is often invisible (see box on ‘invisibility’).

Practices

We mentioned that what people know is influenced by (and influences) what people do, that is their practices; in other words:

“local knowledge in addition to being ‘in people’s heads’ is embedded in individual and group action.” (Ellis and West 2000, p 14)

Local practices are not static traditions; they are rather complex adaptive responses to external and internal changes that have evolved throughout the generations from trial and error (Berkes 1999). People’s adaptive or coping practices can protect them from the impacts of natural hazards (i.e., preventative measures), and can help them to reduce the negative effects of natural hazards (i.e., ‘protective measures’, ‘risk reduction mechanisms’, ‘impact-minimising strategies’, ‘risk-spreading strategies’),

or help them to escape certain peak values or their consequences (i.e., ‘avoidance strategies’). Local practices are mediated by local institutions and associated power relations (see box on ‘local institutions’, this chapter, and the section on ‘power relations’, Chapter 6). Local practices may be different from one level to another. Certain disaster preparedness practices may be found only at the household level while others may be found only at the community or village level. Practices may differ from one social group to another according to factors such as age, gender, profession, caste, or ethnicity. Sinclair and Ham (2000) documented adaptive strategies related to household livelihoods in the western Himalayas and found that practices varied within villages according to socioeconomic, age, or caste status, among others, and that some strategies were interdependent upon others. Some practices may be directly designed for disaster preparedness; others may be designed for other purposes (e.g., making a living) but may contribute indirectly towards disaster preparedness. Some practices may help people to deal with natural hazards in the short term; while others may help them to be prepared and to adapt in the long term. Similarly:

“Some effective short-term human adjustments might actually increase the long-run vulnerability.” (White et al. 2001)

Not all adjustments to natural hazards are environmentally sustainable. Batterbury and Forsyth (1999, p 9) found that successful adaptations did not always protect the environment in general and did not benefit the community as a whole. Local strategies could also be weakened by socioeconomic changes. Similarly, not all adjustments to natural hazards are socially equitable. According to Dr. Ken MacDonald (personal communication):

“Some of the very practices that do reduce risk can be remarkably oppressive in other ways.”

The example cited is the marriage of women outside of their villages to establish a widespread family security network, whether the women are content or not. Another example comes from Schware (1982, p 215) in West Bengal, India, who cites the example of flood warnings being taken as an opportunity to impound floods to use on high-yielding paddy by some while it aggravated damage downstream for others.

Did you know? Survival and risk trade-offs

Survival might not always be the primary objective of coping strategies in the face of adverse events because vulnerable people may seek other human needs such as the receiving of respect, dignity, and the maintenance of family, household, and community cohesion (Blaikie et al. 1994, p 69). Lessons from research on coping strategies for famine revealed that people might choose hunger to preserve assets for the future (Frankenberger et al. 2001, p 68).

Natural hazards are often one among many other stresses that communities face, some of which might be perceived as more immediate threats than infrequent natural hazards.

Hall and Davis (1999), during their research in the Karakoram in the 1980s, found that priorities focused on everyday concerns affecting people's health, family life, and the all pervasive issue of livelihood security. People would live on steep slopes and reserve flat land for cultivation, risking infrequent landslide hazards (Hall and Davis 1999, p 3). Risk trade-offs present difficult choices between long-term protection against natural hazard risks and immediate livelihood gains such as income or food security.

Did you know? The rules of the game

Local practices are mediated by local institutions and associated power relations. Local institutions constitute a set of formal and informal rules, norms, values, organisations, and patterns of behaviour that define who is allowed to use what kind of assets (e.g., natural, sociocultural, economic, or political) at what time and in what circumstances; for example, through monitoring, sanctioning, and conflict resolution mechanisms. At the local level, various types of institutions exist. They can be classified in terms of social, religious, political, judicial, and economic characteristics (Appiah-Opoku and Hyma 1999) or in terms of familial, communal, social, and collective characteristics (Bingen 2001). Examples of traditional institutions are chieftaincies, clan heads, councils of elders, headmen, and other village assemblies. Institutions shape every aspect of a livelihood system⁴ from the type and amount of assets individuals, households, and organisations can build upon, together with the creation, transformation of, access to, returns from, and accumulation or reduction of assets (Bingen 2001) to their livelihood strategies (e.g., whether people manage to diversify, or innovate, intensify), their livelihood outcomes (e.g., whether people manage to increase social services or promote a certain type of rights), and the 'vulnerability context' (e.g., crisis, shocks, or trends) people face. Compared to central (state) institutions, local institutions often derive their strengths from proximity, responsiveness to social pressures, and adaptation. However, depending upon the type and scale of natural disasters local institutions may not be able to respond effectively (Battista and Baas 2004, p 13). Further, local institutions are not always equitable. For example, the poorest might not be able to invest the same amount of time and money as other members of the community in local institutions, and this means they benefit less from risk-sharing mechanisms associated with the institution (Messer 2003). Although local institutions are a key aspect of improved disaster preparedness, studies on the role of local institutions in disaster management, in general, and disaster preparedness, in particular, are limited (exceptions include Messer no date; Battista and Bass 2004; and Yongong et al. 2001). Yongong et al. (2001) found that in Northwest China informal herder groups, called 'zhangquans', play a key role in disaster preparedness, risk management, and poverty alleviation. Each group is composed of about four to five households. Together they organise grazing, exchange labour, share information, protect animals from theft, address risk avoidance, organise meetings, and make decisions. For the prevention of snow disasters, herders' groups prepare joint emergency plans and organise pasture movements if an emergency situation arises. In order to protect animals from theft and predators, households within the herders' community organise themselves in rotation. Such inter-household cooperation can help to reduce the risk for individual households.

⁴ A livelihood system refers to a combination of modes of livelihood at one time – e.g., farming, migrant labour, and informal activities (Murray 2001).

Belief systems

The filters of human action

“Perhaps the most fundamental lesson of traditional ecological knowledge is that worldviews and beliefs do matter.” (Berkes 1999, p 163)

Local belief systems are understood here as the combination of people’s beliefs (e.g., sociocultural and religious belief systems), worldviews (i.e., ways of perceiving the world), values and moral principles (e.g., respect, reciprocity, sharing, and humility), and ethics. Belief systems shape people’s understanding, perceptions, and responses to natural hazards. These perceptions are mediated by cultural interpretations, in combination with a range of other factors proper to each community and household at a specific time and place which will influence how people are going to prepare themselves or not.⁵ These factors influence people’s perceptions and responses to natural hazard risks: for example, from the outside two similar households might face the same risks; however, they will have different perceptions of risk and address it differently (Heijmans 2001, p 1).

These factors (or filters) influence local knowledge and practices on disaster preparedness in a complex way and can act simultaneously (or not) as amplifiers and/or attenuators of natural hazards. For example, the nature and behaviour of hazard events may be perceived as ‘chronic’, ‘part of normal life’, ‘rare’, ‘new and never experienced locally’, ‘an unavoidable climatic or seismic extreme’, or a ‘just form of retribution meted out for a community’s transgressions’ (Bankoff 2004, p 92). Cronin et al. (2004) in a case study in Ambae Island, which has the largest and most hazardous of Vanuatu’s volcanoes, describe the failure by scientific experts (such as volcanologists) to understand and account for local beliefs and how this has contributed to the failure of volcanic hazard education brought from outside. They argue for the establishment of a common ground for communication about hazards in which the principles of considering local views can be used to adapt and communicate scientific, hazard information to non-scientists anywhere. Understanding local beliefs, perceptions, and values is crucial because it provides insight into why people do things the way they do. In that sense, “with some groups, how people say things (and in which context they say things – Author) may be more important than what they say” (Berkes 1999) because the outcome can be interpreted in many ways unless you understand the context.

The attenuators and amplifiers of natural hazards

Belief systems can help to create shared cultural attitudes and community spirit, which in turn can help the community to withstand natural hazards and risk disasters. Collective ceremonies may even simulate elements of natural disasters through symbolic actions and act as cathartic events for the whole community. For example, during Lavak

⁵ Other factors include life stage; age; gender; class; ethnicity; life history; formal and informal education; local knowledge and information; peers’ influence; experience of past hazards; perceived personal exposure to hazards; existing power relationships, community processes, and shared experience; past experience with outsiders such as local government officers and aid agencies; warning signals; other communities or households affected; wealth; labour; social networks; links to town and administration; and so on (Wisner 1998; Heijmans 2001; Flint and Luloff 2005; Swift and Baas 1999).

Natek, an important festival of the Kalash community, an ethnic minority in Chitral District in Pakistan, men and boys run down the hills and shout. If they see a fox, it is believed to be a sign of a good year. During that time, women watch the scene from the village. Ceremonies, such as the Lavak Natek can be interpreted as symbolic methods of dealing with anxiety. This festival can be interpreted as a collective forecasting ceremony; a way of helping the community overcome the anxieties associated with future uncertainties (including uncertainties about the weather and natural hazards). The ceremony helps to reduce stress and the psychological distress associated with living with risks and uncertainties (Dekens 2007b). It is a means of incorporating these times of great stress or loss into a community's collective memory in such a way that they are rendered manageable on an individual human scale. Such ceremonies permit the incorporation of hazards into daily life within the structure of people's everyday cultural construction of reality, and they can contribute to the normalisation of natural hazards (Bankoff 2004).

Religious activities, such as prayers and collective gatherings, can also be part of long-term coping strategies to natural hazards by providing rules for wise natural resource management. Examples can be found in relation to water management: in Bali local priests used to monitor and manage the local irrigation system, the 'subaks', and this ensured the maintenance of biodiversity and helped avoid localised landslides (Lansing 1987); in the Newari communities of the Kathmandu valley, temples are found close to ponds and they are used to ensure and mediate the sustainable management of water for drinking and irrigation. The key point was the ethics or the codes promoted by socioreligious symbols in the use of natural resources (Berkes 1999, p 22); in other words, in practices.

Just as all adjustments are not sustainable, not all beliefs are sustainable or relevant. They can act in a negative or dysfunctional way. Some values have led to massive environmental degradation and the collapse of entire societies (Diamond 2005)! For example, the ritual of slaughtering goats in the Kalash communities to prevent floods confers ritual, symbolic values on goats. They are used for ceremonial purposes only and never sold (no economic value is attached to goats). Hence it might prevent the community from having sufficient food or cash income during or after hazard events. The entire flock of goats is ceremonially slaughtered whenever a Kalash person dies – which has led to the local saying, that “the death of a Kalash is Kalash destruction.” (Personal communication, Mr. Aziz Ali)

Another example of the negative effects of local beliefs can be found in Howell (2003). The author describes indigenous early warning indicators of cyclones in Bangladesh and how the custom of 'purdah' can prevent women from having access to information related to cyclone forecasts. According to the custom of 'purdah', women are not allowed to visit the market (where radio warnings might be heard or news discussed) or to publicly interact with other men. They are also:

“not allowed to leave the house without their husband's permission, even to go to a cyclone shelter: their long hair and saris hamper survival strategies such as swimming and tree-climbing.” (Howell 2003, p 2)

The various examples above demonstrate how local beliefs (and related practices) can have both positive and negative effects on disaster preparedness. Disaster preparedness programmes need to capitalise on cultural aspects that contribute strengths and moderate them when they create obstacles (Bankoff 2004).

Belief systems are also dynamic and constantly changing due to internal and external influences. Wisner and Luce (1993, p 129) report how the idea of scientific progress promoted by development workers and others has created a mistrust of time-tested practices.

All three dimensions of local knowledge (knowledge types, practices, and beliefs) are inter-related and influence one another constantly. Examples show that these dimensions can contribute towards disaster preparedness and can integrate elements that are obstacles to preparedness. Local knowledge and knowledge in general emerges from a dynamic process of knowledge creation, use, management, and transmission influenced by a combination of internal and external processes. In fact, local knowledge is disappearing and being created all the time (Berkes 1999). Building upon local knowledge and practices requires an understanding of the transformation processes involved.

Did you know? Invisibility

In terms of local knowledge, practices (especially non-technical practices), and disasters, vulnerable groups are often invisible to outsiders and even to some extent to insiders. Indeed:

“most people are not aware or fully aware, certainly never constantly aware, of the influence that their native or adopted world view has on the choices they make and the way they question reality.” (Wisner 1998, p 2)

In some contexts, women (and other marginalised groups) are invisible both geographically (their duty is to stay at home usually and they are not allowed in public places) and (consequently) ideologically (their knowledge does not count) and this is despite the fact that they may suffer disproportionately in disasters (Metha 2007) – this is all most ironic considering the anthropomorphisation and feminisation of disasters in many cultures (Bankoff 2004)! These invisibilities are related to the nature of local knowledge: holistic and closely embedded in people’s livelihoods and worldviews; often taken for granted by insiders; and scattered and institutionally dispersed – which often makes it difficult for people to talk about what they do to prepare themselves for disasters. Disaster preparedness strategies are often shaped (and hidden) by complex processes of oral knowledge transmission, knowledge internalisation, power relations, and rapid change and adaptation. It means that local knowledge is very dynamic; some practices can change quickly, which may explain why they can remain unnoticed and understudied (Blaikie et al. 1994, p 62). For example, even if local activism is going on (e.g., community sandbagging against floods) it is not documented or made visible and most NGOs do not have time to document such aspects. The ‘invisibility’ of local knowledge, practices, and vulnerable groups also refers to many practices that can contribute to disaster preparedness but which are not directly orchestrated towards it. Therefore what remains ‘invisible’ to outsiders includes not only practices per se but also their linkages with disaster preparedness. Further, many localised and recurrent hazards that contribute to the gradual erosion of people’s livelihoods do not receive political attention and media coverage because the death toll at a particular time is not high enough to make the front page. Interestingly, disasters are also the evidence of failure and can reveal to outsiders what was invisible before: that is pre-existing vulnerabilities and vulnerable groups (Hewitt 2007).

Did you know? Bounded rationality

Some disaster preparedness strategies at the household and community levels (e.g., 'running away' when the water rises during the monsoon) might seem like 'common sense' or 'universal knowledge'. However, it is important to recognise that people have bounded rationality; that is, people's rationality is limited to their own information and beliefs (and the tradeoffs discussed earlier). Bounded rationality might be driven by economic reasons. For example, it has been widely reported that some people leave their houses only as a last resort because of fear of thieves. In other contexts, cultural and religious factors also play an important role. A man interviewed in a village prone to flash floods in the Chitral District of Pakistan described how his wife ran away from the house as a flash flood was coming, but then, seeing many people on the street, decided to go back to get her veil. She was trapped then in the house, but did not die. Her husband likes to believe that the veil saved his wife from the flood; seeing her return to get it as a protection factor rather than as a risk (Dekens 2007b). This story illustrates the point that 'running away' when the water starts rising might not always be accepted as common sense depending on religious and cultural beliefs and practices. And this is also observed in flood hazard situations in most western contexts where people tend to prefer to stay with their assets; and this means that laws had to be passed to forcefully evacuate people in such circumstances (Personal communication, Dr. James Gardner).

Did You Know? Fatalism

The perceived fatalism of the rural poor in the Himalayas, and in Asia generally, in accepting natural hazards as the 'will of God' or as a 'punishment delivered by God' cannot be understood simply as the equivalent to the western connotation of fatalism, which is associated with passivity, resignation, and apathy (Hutton and Haque 2003; Schmuck-Widmann 2001; Bankoff 2004). In fact, labelling these attitudes as fatalistic reflects a misunderstanding of other worldviews influenced by many Asian religions such as Hinduism, Buddhism, and Taoism and a lack of reflexivity. As Wisner (1998, p 3) puts it:

"Fate is, actually a very western idea rooted in the classical Greek and Roman world. It is something personal and often, as in the classical tragedies, something connected to a flaw in one's character. By contrast, disasters just happen in the mainstream Asian view, the way that trees, birds, day, and night happen and in the way that people are born, grow old, and die."

As such what is perceived by outsiders as fatalism is in fact part of a sociocultural and psychological coping response for people who have no, or who lack, the individual choice and power to reduce or eliminate psychological distress during stressful situations. What it means is that:

"the perceived powerlessness among the poor reflects [...] a realistic perception of their position vis-à-vis dominant resource relationships." (Hutton and Haque 2003)

Pratt (2002, p iii) also highlights in a case study on community response to drought in Kenya how the act of praying often involves other actions, enabling the community to come together and be better prepared mentally and sometimes physically as well. He reports how the process also involves a:

"mutual assessment of the resources currently available to communities for strategic redistribution or redeployment in the event of drought, as directed by elders in the communities."

What Influences Local Knowledge?

Many external and internal barriers exist that have prevented local knowledge and practices from being exercised in mainstream institutions working on disaster management. We already mentioned in the background to this paper how the low prestige value given to local knowledge compared to conventional (or scientific) knowledge is rooted in colonialism. Mainstream institutions forgot to reflect upon and question their own myths, including the belief that technical and command-and-control solutions will solve all problems. Until today, natural hazards and disasters are mainly conceived as an issue for national defence and security, contributing to a failure to decentralise power in this sector. Another barrier to the use of local knowledge in disaster management, described in the previous section, is based on the nature of local knowledge itself (dynamic, invisible, complex, diverse, and context-specific in both time and space), which makes it a challenge to identify, understand, and use it. This section investigates factors that contribute to the marginalisation of local knowledge and practices in disaster management and in the process reveals the transformation factors that influence local knowledge. In some cases, it is also seen that the same factors can become new windows of opportunity for empowering communities. These factors include power relations both within a community and between the community and outside organisations, scale issues, and the impact of multiple stresses in a context of rapid change which renders some local knowledge and practices inappropriate or inaccessible.

Power relations

Power relations partly explain why local knowledge has been ignored by the mainstream literature on disasters and institutions charged with disaster management and especially disaster preparedness. Power relations refer to the exercise of control over resources, decision-making processes, knowledge creation, transmission, interpretation, and validation. The nature of control depends upon divers factors (e.g., sociocultural, economic, political, and ecological), takes various forms (e.g., direct and indirect, formal and informal, discursive and non discursive, and symbolic), and has various degrees of influence throughout time and space (e.g., local and extra-local power relationships). The following passage investigates how the use of knowledge is political and reflects conflicts of interest among various stakeholders and, by providing examples in the context of disaster management, how local knowledge reflects local power.

The use of local knowledge is political

The use of local knowledge is political because it threatens to change power relations between different groups, ideologies, cultures, and so on (Berkes 1999). Conflict of interests can reflect divisions between natural sciences and social sciences; science and politics; the official and the non-official (or international, national, and local interests); north and south; highland and lowland; centre and periphery; and short- and long-term interests, as well as among social groups within a community. White et al. (2001) report from a review of the natural hazard and disaster literature:

“Conflicting interests and lack of political will to resolve them seems to be at the base of many failures to apply knowledge effectively.”

Conflicts of interest may be increasing, especially in mountain communities that face the influence of a range of different actors and interests (state agencies, industry, development and research organisations, and tourists). Each actor tends to impose its own agenda and define local knowledge differently according to its own culture, experience, and agenda (Berkes 1999, p 165). For example, the focus on environmental and technical aspects of natural hazards is often used in the political arena as a Trojan horse to mask the real issues (i.e., environmental, geophysical, and meteorological issues as a downstream manifestation of political-economic issues). People may also use local knowledge in discourse because it is now becoming politically correct – however it may not reflect their real agenda and practices. Suparamanian and Dekker (2003, p 313) analysed issues of coordination experienced by relief workers in the field and inside mother organisations and revealed how disaster relief work is about control of finances, being political, getting a reputation, or furthering aims not specifically related to the issue at hand. This means that conflicts of interest take place not only between different actors but also within organisations. Ultimately, incorporating local knowledge into a policy framework requires institutional changes and this is hampered by hierarchical structures, institutional inertia, and path dependency.⁶

Knowledge is power: power produces knowledge

We are not equal regarding access to, and benefits from, knowledge and information.

“How knowledge is generated, organized, stored, disseminated presupposes certain relationships of power and control.” (Agrawal 1995, p 431)

Who has the knowledge has the power; that is the ability to control resources and discourse over resources (Raffestin 1980). One key instrument of power and knowledge is language. Hewitt (personal communication) refers to the fact that choice of words and how they happen to be translated influences how they are understood. Outsiders do not speak local languages and this often means that local people’s interests are not represented because of the language barrier.

⁶ Ostrom (1992, p 61) defines ‘path dependency’ as follows: “Over time, experience with successful rules enables individuals to learn how to use these rules even more effectively. Any effort to use alternative rules may then be doomed to rejection. Even if those alternative rules could help increase the performance of the system (once individuals gained experience with them), initial efforts to experiment with them are not likely to lead to their adoption.”

The support of local knowledge and participatory approaches can be seen as a threat to national interests and political structures, especially in authoritarian regimes (Thrupp 1989). We have mentioned already how natural hazard and disaster risk management have often been associated with issues of national defence, and the army often plays a key role in responding to natural disasters. This might cause an institutional barrier to integrating local knowledge and practices into what is often considered as an issue of national security. Interestingly, Agrawal (1995) denounces the limits of the current method of archiving local knowledge outside of its context as a means of replicating power asymmetries instead of enabling the poor to exercise control over their knowledge. Indeed, those who document indigenous knowledge are often western educated or are outsiders. Agrawal (1995) argues in favour of going beyond the rhetoric that knowledge is power to understand how power produces knowledge.

Local knowledge reflects local power

Power relations related to the creation, interpretation, or validation of local knowledge can be found not only between community and external organisations but also within communities – or rather within what is often (mis) conceived as being a homogenous community. According to Thrupp (1989, p 16) certain members of a community control more information than others and that gives them power and privilege. Local power dynamics and hierarchies influence relationships between local knowledge and external agencies. Mosse (2000) argues that local knowledge is often ‘planning knowledge’ meaning that it is shaped by dominant groups in the community and development project interests. Khan (1991) provides a detailed case study in Northern Bangladesh of how the local elite influenced NGOs’ decisions to locate flood shelters and control access to the shelters. As a result the shelters were not placed in the best locations either for vulnerable people or in terms of hazard risk (Twigg 2001).

Elsewhere, Howell (2003) in a case study in the ‘char’ lands⁷ of Bangladesh reports how attitudes to preparedness are often influenced by religious leaders, some of whom advocate prayer as the only appropriate and necessary measure. She states that prayers are used as a power tool by religious leaders and other elite groups to discourage cooperative preparedness measures amongst the poor and therefore to preserve the status quo. Another example of the role of political and religious factors in influencing people’s vulnerability to natural hazards comes from a case study on local knowledge related to flood preparedness in the Chitral District of Pakistan (Dekens 2007b). The case study shows how local political and religious powers can influence local practices in flood preparedness by inhibiting community initiatives and institutional cross-scale linkages. Political and religious powers are divided between the Ismaili Muslims in Lower Chitral and the Sunni Muslims in Upper Chitral. The Ismaili Muslims follow the Aga Khan, the founder of the regional NGO called the Aga Khan Rural Support Programme (AKRSP), as their spiritual leader. Therefore, some religious and political Sunni Muslim leaders refuse to accept any intervention from the AKRSP as a way of opposing the Ismaili Muslims. In another case study on local early warning about drought in Kenya, Pratt (2002, pp 63-4) mentions how religious fundamentalism

⁷ ‘Char’ lands refer to new islands of land in Bangladesh: the islands are formed from depositions caused by erosion processes associated with constant changes in river path and size.

in the past decade contributed to the declining practice of traditional knowledge and drought indicators because this was perceived to interfere with the prerogatives of religious leaders in the community.

“People are no longer consulted or prefer not to share their knowledge, because this practice is misconstrued in some communities as ‘predicting the future’, an act prohibited by the Koran.”

External organisations can play a key role in mediating local power relations and improving internal community communications. For example, Cronin et al. (2004) report how a participatory hazard mapping exercise in Ambae Island, Vanuatu, uncovered the influence of a traditional social organisation in disaster preparedness. In the local hierarchical structure, women and youths are the lowest ranking community members. Male chiefs dominate all decision-making, on disaster preparedness as well, and women are poorly represented in the process, inhibiting their ability to make timely decisions. These examples illustrate how local power groups become involved in and capture projects to further their own interests and maintain their authority (Mosse 2000, p 4).

Mosse (2000) demonstrates how access to all local perspectives is problematic and challenging and how participatory approaches often serve to represent external interests as local needs, dominant interests as community concerns, and so forth. Ironically:

“rather than project plans being shaped by indigenous knowledge, it is farmers who acquire and learn to manipulate new forms of planning knowledge. In this way, local knowledge becomes compatible with bureaucratic planning.” (Mosse 2000, p 12)

Scale issues

How do temporal, spatial, and functional scales of an institution influence the use of local knowledge in natural hazard management? The scale of observation and management of natural hazard risks determine the representation of (and therefore the response to) changes induced by (or influenced by) natural hazards. What may appear to be a negative change on one temporal scale may be part of a positive cycle when viewed from a higher-order temporal scale. One such example is the processes leading natural hazard risks to decrease or increase ecological diversity, depending on the spatial and temporal scales of observation and/or the scale of occurrence of hazard events. Agricultural fields destroyed by a flood can become very fertile after a few years, for example, because of the capacity floods have to:

“irrigate and fertilize fields, flush out salts and toxins from soils and watercourses, and recharge reservoirs. In many regions, annual flooding sustains current levels of agriculture.” (Few 2003, p 45)

Issues related to scale dynamics, scale mismatches, and scale myopia influence how and why local knowledge on disaster preparedness is (mis)used (or not).

Scale dynamics

Some scale dynamics influencing local knowledge and practices from being exercised include cross-scale linkages, cascading effects, and scaling up and down processes. Firstly, we mentioned in the background to this report that most natural hazard risks are multi-scale and that they should be managed on different scales simultaneously instead of in isolation from one another. This means investigating cross-scale linkages, in other words:

“linking institutions both horizontally (across scale) and vertically (across levels of organisation).” (Berkes 2002, p 293)

Cross-scale analysis is important because:

“events or phenomena at one scale influence phenomena at other scales” (Cash and Moser 2000) in complex ways and with positive and/or negative effects on the different scales (Young 2000, p 4). Indeed, processes are interrelated. According to Wisner and Luce (1993, p 129) local problems may have their origins in another part of the world. Cross-scale analysis is challenging since:

“data requirements are huge and applicable theories at each level may be quite different.” (Berkes et al. 2000, p 13)

Secondly, and consequently, scale dynamics refer to the way natural hazards cascade down (in combination with other exogenous and endogenous perturbations and responses) across different scales, and through various filters that can simultaneously, or not, amplify or attenuate the impacts of hazards (Kasperson and Kasperson 2001, p 5). D’Souza (1984) mentions:

“how the labour market for skilled craftsmen in the oil fields of the Middle East may draw away artisans from the mountains of Pakistan, reducing the ability of local people to build houses reinforced against the impact of earthquakes.” (Wisner and Luce 1993, p 129)

Thirdly, scale dynamics can also refer to ways of upscaling and/or downscaling ‘good practices’. Many local practices related to disaster preparedness are localised and context and time specific. Wisner and Luce (1995) have reported how in the urban context:

“in general the community is active on its own behalf, but efforts are fragmented and not often recognised and supported by official agencies.”

The recognition that local best practices in disaster risk reduction that capitalise upon local strengths need to be upscaled is growing. Berkes (1999) argues in the context of natural resource management that a potential exists to generate universal management principals from locally-developed practices. Further, if the scaling up of local practices remains challenging; the scaling down is often bound to fail:

“reducing vulnerability at, say, the national level [does not] automatically reduce vulnerability among social groups, households and individuals in that nation.” (Wisner and Luce 1993, p 128)

As Sen (1981) demonstrated in the case of food security, the issue is not one of availability of resources per se but rather one of entitlements such as access, control, and management of assets.

Scale mismatches

Scale mismatches preventing the use of local knowledge and practices are administrative, organisational, and sociocultural. Firstly, mismatches on the administrative and organisational scales relate to the disconnection between people-at-risk, their own national government, and international agencies; and this is mainly due to distance management (i.e., centralisation of decision-making at national level). Mismatches exist especially between the location of disasters and knowledge related to it and the location of authority and capacity to do something about it. For example, local knowledge was often vested in the older generation of informal leaders who may not hold official positions anymore (UNEP 2004). The weakening of local governance illustrates a mismatch between the traditional and administrative authorities in the context of democratisation, which can have a negative effect on institutional coordination in disaster management (Battista and Baas 2004, p 25). Suparamanian and Dekker (2003) argue that, in the context of relief aid, local knowledge about what to do (because they are there locally, in the field) and authority to implement things are rarely located in the same sector. Knowing what to do is a necessary but not sufficient factor to be able to carry out actions (this is valid for exceptional and/or extreme disasters but not necessarily recurrent ones): Suparamanian and Dekker (2003) state that this mismatch creates a paradox of power and often requires a ‘renegotiation of authority’.

Secondly, sociocultural scale mismatches refer to cultural incompatibilities between the local level and external organisations. For example, Materer et al. (2001, p 10) describe how people approach and classify rainfall in a different way from conventional science:

“Actual rainfall data did not correspond to how the villagers remembered the production year. In statistically high rainfall years locals defined drought by rainfall variability, locality and timing and not as the amount of rainfall received in a year.”

However and, at the same time, scale mismatches can be interpreted as an opportunity to build upon different strengths on different levels. Often local warning systems tend to replace the official warning system when the latter breaks down (Schware 1982, p 212). As Battista and Baas (2004, p 13) point out, more than one approach is needed; whereas exceptional disasters are beyond local capacities and call for widescale, external intervention, recurrent natural disasters can be managed best by local means. The necessity to combine ‘top down’ and ‘bottom up’ approaches in disaster

management, depending on the scale and frequency of natural hazards, has been raised elsewhere (Brouwer and Nhassengo 2006).

Scale myopia

Scale myopia (or ‘amnesia’ in the sense of ‘forget to consider or take into account’) refers to the incapacity of central authorities to see far away, in both time and space, what is outside the national canvas. Often policy-makers have the big picture but lack understanding of what really happens and the impacts of the implementation (or non implementation) of their policies locally. This is ironic as:

“their decisions are often most strongly felt at the very local, individual level.” (Hall and Davis 1999, p 1)

Often national disasters hide small, local ones which occur more frequently (e.g., landslides) and do not matter on the local scale (Van Aalst and Burton 2002, p 21). For instance, landslides are a major hazard in the Darjeeling district of West Bengal in India; however, this is disregarded by policy-makers sitting in Kolkata who mainly focus on floods, which are perceived to be the major problem (Personal communication, Mr. Roshan Rai).

Another aspect of scale myopia relates to time preference. Ideally, immediate measures and long-term measures need to be combined. The International Labour Organisation (ILO 2002, p xiv) mentions that, however important short-term preparedness and relief measures might be, long-term measures focusing on self-reliance are essential for ensuring livelihoods and capacities. It argues for state-people partnerships.

The following section on transformation processes illustrates the role of multiple stresses, global factors, and trends in influencing local knowledge on disaster preparedness.

Natural hazard risks, global factors, and trends

In many cases, natural hazards, although they can represent an important stress, are not the major stress faced by communities. Aside from natural hazard risks, community ability to anticipate and respond to disaster is influenced by other stresses (e.g., poverty, state policies, and legislation) and global factors and trends (e.g., climate change, globalisation, and privatisation). Studies focusing on multiple stresses and how they interact with one another to give a specific type of response (or no response) are still few in the field of natural hazard and disaster research. For the purpose of this report, we will focus on three major factors of change influencing people’s coping strategies to natural hazard risks: the impact of state legislation; policies, especially those promoted through ‘conservation’ and ‘development’ projects; and economic and cultural globalisation processes.

The impacts of nation-state interventions

Many communities are at risk from natural hazards due to lack of development, but in this section we will investigate the other side of the coin: that is, how development processes can increase the risks from natural hazards in some communities. Contemporary states, through legislation, policies, and development projects at national level, and even outside their boundaries through development aid, have transformed traditional agrarian societies in the Himalayas and elsewhere. The nation state has taken control of community resources, thereby changing (and often restricting) community access to, and benefit from, resources and often undermining their traditional management strategies and local institutions (Linkenbach-Fuchs 2002, p 11). The alienation of communities from their environment as a result of state intervention has been documented most in the context of natural resource management and change in community access to natural resources (e.g., forest and non-forest products, land, water, and stones). These changes have led to increasing dependency on external aid and market forces, as well as increasing vulnerability of the community to perturbations such as natural hazards (Farooquee 2004).

The nature of development projects in the Himalayas is based mainly on resource-extraction (e.g., hydropower projects) and centred on service activities (e.g., tourism). It has contributed to an increase in accessibility because of the establishment of infrastructure, intensification of resource use, monetisation of the economy, and commercialisation of resources; and it has created new (natural hazard) risks for local communities and led to the loss of material and land resources for many (Linkenbach-Fuchs 2002). Government development projects, such as dams for electricity generation and irrigation, mining operations, plantations, and recreation areas that convert agricultural land to industrial and commercial uses are undermining people's capacities to cope with natural hazards by restricting their access to land and other resources they used to fall back on before, during, and after disasters. Ironically, some of these development projects are perceived to be more disastrous than natural hazards from a community perspective (Heijmans 2001). Das (1998), in a case study in Dibrugarh town in Assam, India, relates how the construction of a dam following a major earthquake led to gradual changes in the river ecology in and around the town. The control measures disrupted the traditional, local flood management system. Before, recurring floods were responsible for fertilising the soil, cleaning the stagnant water from the town, and providing a source of protein because of the large quantity of fish caught – but this system has disappeared now. Local environmental warning signals for natural hazards that people used to rely on have become obsolete due to rapid change in climatic conditions combined with excessive human intervention (Rural Volunteers Centre no date, p 9 – Dhemaji district, Assam, India).

Elsewhere the impacts of development projects are influencing animal migration patterns, which used to provide local warning signals of hazards (Jaarsma et al. 2001 in a case study on flood early warning in Mozambique). Engineering programmes administered by government agencies upstream can render the traditional flood responses of villagers located downstream obsolete – especially if the transformation of the ecosystem caused by government projects upstream is not communicated

to villagers downstream, as mentioned by Schware (1984) in a case study on local knowledge about flood hazards in West Bengal, India. Development processes therefore can induce major ecological changes, often leading to the decline of the natural resource base. Many people are losing their access to natural resources and this increases their vulnerability to natural hazard risks.

Ironically, natural hazards themselves can also lead to growing state control over community resources with the motive of resource conservation. In some cases, natural hazards are associated with degradation of natural resources, leading to top-down conservation projects (Mc Sweeney 2005). McSweeney (2005, p 1458) describes how changes in forest policy undermined the capacity of some communities in Honduras to adapt, following Hurricane Mitch, because of change in access to forest resources and the ability to extend agricultural lands into primary forests; a measure essential to their ability to reconstruct their homes and re-establish the agricultural base. This case study shows that conservation policies might actually create perverse incentives in the long-term for community-based conservation. McSweeney (2005, p 1467) concludes that forest conservation policies often discourage local people from protecting forests as they are forced into wage labour. She suggests that incentives in terms of forest resources would prevent labour migration and encourage local monitoring of forests.

Finally, major natural disasters can also create a culture of dependency on government intervention (UNEP 2004). The influx of external help can become a disincentive for both local governments' support for local coping strategies and for the communities themselves, as mentioned already in the background section of this report. One example comes from the impact of relief aid following recurrent hurricanes in Vanuatu. External food aid acted as a disincentive to cultivation of emergency food supplies, upon which they used to rely, thereby creating new dependencies and undermining people's self-reliance and self-organisation (Mercer no date, p 5; UNEP 2004). External help can create a 'financial mask' that can prevent people from learning from and adapting to natural hazard risks in the long term.

Economic globalisation

Market-induced demands in combination with the rapid population growth has led to an increased focus on cash cropping (e.g., horticulture, vegetable cropping) pushing staple food crops (and emergency food crops – Author) on to more marginal, fragile slopes (Jodha 2001, p 331). The increasing commercialisation of agriculture and resources associated with economic globalisation has often led to the conversion of resilient, diversified agroecosystems focused on subsistence into monocultural ecosystems focused on (often short-term) cash cropping (Farooquee 2004 [Western Himalayas], Mercer no date [South Pacific, especially Fiji]) – that said, cases illustrating a reverse tendency can also be found. Dekens (2005), for example, describes the emergence of a polycultural system following the closure of tea plantations that had monopolised cultivation in a village of Darjeeling District, West Bengal, India, from the 19th century. This, together with the dominance of a few seed companies, promotes an extremely negative attitude to 'old' crops and open-pollinated varieties (Stiger et al. 2005) and is leading to a reduction of traditional crops that are less marketable but more tolerant to

hazards (Mercer no date [Fiji]; Heijman 2001 [Kalimantan, Indonesia]). Similarly, new materials and building practices used for house construction do not provide the same disaster-proof features as the traditional ones (Dekens 2007b [Chitral]; Rautela 2005 [India]; Mercer no date [Fiji]; Jigyasu 2002 [India and Nepal]). Economic changes are also leading to the loss of craftsmanship.

Cultural globalisation

Cultural globalisation is also influencing how people perceive their own resources and knowledge. Local coping strategies are eroding also because the people themselves, especially the younger generation, tend to disregard their own resources and knowledge because of growing exposure to global and national influences and the pressure of modernisation and cultural homogenisation. They are exposed to different (western) standards, values (e.g., individualism, consumerism), and lifestyles. Linkenbach-Fuchs (2002, p 11) mentions how:

“heteronomy has to a large extent replaced local autonomy. [...] [And how] a culture of indifference (against humans and nature) has started to replace a culture of solidarity.” As a result, “traditional communication networks are breaking down, meaning that elders are dying without passing their knowledge on to children.” (Langill 1999, p 8)

Also due to formal education, the position of elders within the community is undermined. Changes in information technology influence the geography of personal networks. Parker and Handmer (1998, p 55) argue that personal networks are dispersing because of information technology. Hence local knowledge will be hard to obtain.

In order to understand how to identify and use local knowledge and the process of marginalisation surrounding local knowledge, one has to contextualise local knowledge and practices on disaster preparedness within the wider context – rather than merely describing knowledge per se. Although it might seem obvious, often the content of local knowledge has been recorded leaving out the context in which it had developed (Antweiler 1998, p 35). In fact, understanding the context and processes surrounding local knowledge creation, transmission, and interpretation is more important than understanding the knowledge outcome per se. This is because local knowledge is context-specific in both time and space. Understanding transformation processes in the sociocultural, political, and economic contexts and how they cascade through different scales (international, national, regional, local) can help to identify the changing nature and status of local knowledge and practices and the consequences for changing vulnerability (Jigyasu 2002, p xxv). How to identify local knowledge and practices on disaster preparedness despite its changing nature and status? What can be learned from it? The various dimensions of local knowledge on disaster preparedness are described in the following section.

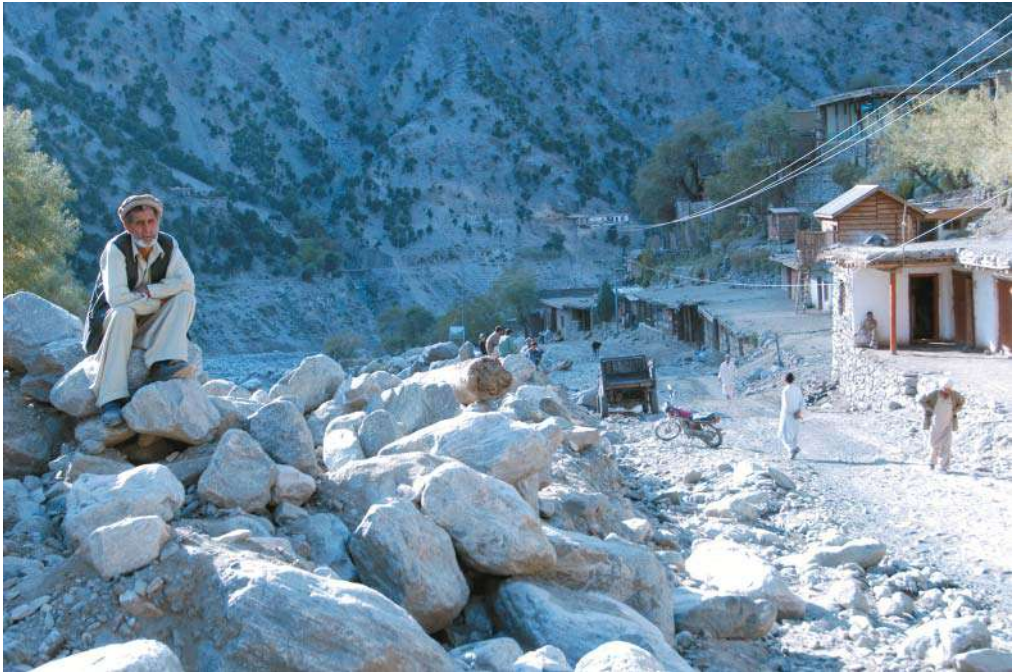
Did you know? 'The earth is faster now'

The loss of traditional knowledge and coping strategies is being reported widely throughout the world. The erosion of local knowledge and coping strategies due to a combination of rapid changes has contributed a great deal to the controversy surrounding the current use of local knowledge and practices. To quote the title of a book on community observations of climate change in the Arctic, 'The earth is faster now' (Krupnik and Jolly 2002), what is new is the rate of change: change is happening faster – supposedly than people's capacity to adapt (?). The 'transition hypothesis' raised in hazard research (White et al. 2001) has been that "in periods of rapid social and economic change marking development, societies may become peculiarly vulnerable to hazard as older forms of adjustment may deteriorate before new forms become available." The factors responsible for the erosion of local, coping strategies are many and include a combination of demographic, sociocultural, political, economic, environmental, and other financial and technological factors.

Did you know? Transition time in Chitral District, Pakistan

In the Chitral District of Pakistan, communities used to rely on a diversity of early warning systems (i.e., mirror and traditional fire systems, call for prayer, herder, shouting, whistling, and running downstream). The traditional system of fire signalling ('phumbarrash') for example was used by upstream communities to communicate the danger of flash floods at night to downstream communities. In daylight, gunfire was used – and this system has been reported elsewhere in Northern Pakistan (Iturrizaga 1997, 2005). These traditional warning systems of imminent hazards in Chitral and surroundings have something in common: they are all set up on an ad hoc basis (i.e., not in a systematic way) and they are all used indirectly as flood warning systems. For instance, the mirror and fire systems were first and foremost traditional ways of defence, and the call for prayers has obviously been first and foremost related to religious activities. Therefore, the traditional warning system was based on a diversity of strategies related to military, religious, and pastoral or herding activities. This combination of systems was probably the weakness as much as the strength of the system. Indeed, this diversity of strategies using both visual (mirror and fire systems) and audio (mosque and herders) means of communication allows the system to be kept flexible enough to adapt to a diversity of contexts. The traditional warning systems were also very well adapted to and in tune with the local sociocultural context, ensuring some level of acceptability, trust, and cost effectiveness (e.g., use of the mosque). The Chitral district is now in a transition period, leaving many villages in an institutional vacuum: as a local respondent summarised: "the old system is gone and the new system is not working." Most of the traditional early warning systems have disappeared due to a combination of socioeconomic, geo-political, technological, land-use, and perception factors and changes. The new early warning systems rely upon scouts' sirens, telephones, and information delivered by the central government through the Flood Forecasting Division of the Meteorological Office in Lahore, based on data from radars and satellites. However, new technologies have limitations. Firstly, although they provide relatively rapid means of communication, not everybody can benefit from these new technologies. The early warning systems might, therefore, contribute to increasing socioeconomic disparity among households and villages because not every village and household can have access to and, more importantly, benefit from the new technologies and information delivered by them. Shouting and whistling is still the most common form of communication used today. Secondly, the scouts' sirens are only posted in two places. They do not reach all the villages. Due to the rapidity of flash floods, the Chitral scouts are mainly able to release post-hazard warning signals. Thirdly, the diversity of communication strategies and options has been replaced by technological solutions that are centralised. People are now more dependent on external technologies and external experts, which may be contributing to a reduction in their flexibility, adaptability, and creativity and to the development of dependency.

(Source: Dekens 2007b)



Man sitting on rocks deposited by a flash flood on the road from Chitral towards the Lawari Pass, Lower Chitral.

Did you know? Increasing vulnerability to earthquakes in a village of Nepal

Jigyasu (2002, p xxx) describes the process of increasing vulnerability to earthquakes of Bungamati village in the Kathmandu Valley in Nepal following the transformation processes in traditional rural communities in buildings, land-use and ownership patterns, occupational structure, cultural practices, and governance systems. He argues that the traditional systems of rural settlements like Bungamati based on private and collective agricultural land demonstrate various aspects that used to contribute towards mitigating, preparing, and recovering from the impacts of earthquakes. Income produced from the cultivation of common agricultural land ('guthi' lands) was used to carry out religious and other collective activities. However, nowadays, various transformation processes in Bungamati are affecting the use of private and collective agricultural land, thereby increasing the community's vulnerability to earthquakes. Some of the major changes include densification of the village as private vegetable gardens are being used for construction, a decreasing level of cooperation among villagers due to increasing social and economic segregation, and weak governance at the village level due to lack of financial resources and the concentration of political power on the village development committee.

How to Identify Local Knowledge

The key characteristics of local knowledge on disaster preparedness are presented in detail in Figure 2. This framework can be employed to identify the four pillars of local knowledge on disaster preparedness. It focuses on the instrumental use of local knowledge and can be used as a checklist for the key dimensions of local knowledge during project planning and implementation. The objective is to identify and document local knowledge, not to conserve it but to learn from it in order to create new concepts, methods, or strategies for improved disaster preparedness.

Observation

Local knowledge on disaster preparedness relates to people's observations of natural hazards through their experience of their local surroundings. Many people have direct experience of natural hazards (i.e., they have witnessed natural hazards) and/or indirect experience (i.e., they have been told stories of past natural hazards). Daily observation of local surroundings over generations gives communities localised knowledge of the history and nature of natural hazards as well as knowledge about changes in their own social and physical vulnerabilities to natural hazards over time. Historical knowledge may include knowledge of the location, time, duration, frequency, intensity, and predictability of previous hazards. Environmental knowledge can include knowledge of the characteristics of natural hazards such as the onset, origin, velocity of water flow, and knowledge of different types of rain. Social knowledge may include knowledge of the impoverishment processes of households following recurrent natural hazards and other stresses and/or knowledge of the ability of some to take opportunities from previous natural hazards. Knowledge related to the observation of natural hazards over generations can be very useful to external organisations in complementing their understanding of localised natural hazards and how they are perceived. It can help them to adjust their information and capacity-building activities to local perceptions of localised hazards and trends – that is the associated perceived changes related to their location, frequency, and impacts (i.e., how they, and their impacts, are perceived by the communities themselves) which determine how people respond to the hazards.

Anticipation

Local knowledge about disaster preparedness also relates to people's anticipation of natural hazards by identifying, interpreting, and monitoring early warning signs in the local environment. This is especially true for resource- dependent communities

because their livelihoods are closely dependent on their ability to observe and read the environment. Indicators of imminent flood hazards can include, for example, the colour of the clouds, location, intensity, and frequency of rainfall and unusual sounds, and changes in water flow, water colour, wind direction, and vegetation. Some people are able to identify the unusual behaviour of wildlife (e.g., ants, birds, rats, mice, and snakes). Such local environmental indicators are reported widely in the literature. Schware (1982, p 214) reports in a case study from West Bengal, India, how local flood warning systems used by some elderly flood-plain inhabitants along the lower Damodar River, before the official system was introduced, varied from observing natural signs such as old flood markers inscribed on trees or ants moving their eggs to higher ground, to setting up a network of voluntary night watchmen for the river and embankment. On monitoring, Hall and Davies (1999, p 2) state that in the Karakoram:

“local communities [...] [rely] on a range of traditional risk reduction measures, such as [...] community warning systems to alert communities to landslides and rock-falls where in times of heavy rain villages would plant a ‘sentry’ who would shelter under a tree all night and on hearing the noise of a landslide high above the settlement on the mountain slope would raise the alarm.”

Generally, people manage to anticipate natural hazards by making basic emergency plans and identifying time thresholds for saving key belongings and for moving out and to higher locations in the case of floods. People have knowledge of safe settlement areas also and from whom to seek advice and support within the community (Dekens 2007a, b).

However, this ability to observe and monitor environmental signals is weakening today in the Himalayas, as elsewhere, mainly due to changes in the social system and structure.

Did you know? Traditional weather forecasts

Traditional weather forecasts are based on multigenerational observations of change in the local environment, including knowledge about the movements of the sun, the moon, and the stars. In some cases, this knowledge was recorded in cultural and religious texts (Kanani 1999 in Gujarat, India). It has been used as a decision-making tool for agricultural practices (especially cropping patterns and timing) and, in some contexts, for livestock migration itineraries and timing (Battista and Baas 2004 in a case study on pastoralists’ coping strategies during drought in Iran, Burkina Faso, and Niger). Akbar Khan (1996), a poet from Chitral District in Pakistan, has described how the long observation of astronomical bodies used to help people make decisions about farming activities:

“In a mountainous country, the sun rises over the hills and the rays of the sun coming out earlier through notches in the cliffs have been closely observed and marks made to record the advance of a season.”

Some studies have tested the accuracy of those traditional weather forecasts. For example, the Gujarat Agricultural University undertook a project based on the systematic validation of farmers’ traditional meteorological beliefs and principles over a period of eight years from 1990 to 2003. The observations taken have indicated that many of these beliefs are likely to provide reliable indicators of monsoon (Kanani 1999, 2001). Elsewhere, Orlove et al. (2000) have analysed the traditional weather forecasting of farmers in a drought-

Figure 2 comes here on folding page

prone region of Andean South America against 'scientific methods'. Local farmers make their forecast based on observations of changes in the apparent brightness of stars in the Pleiades around the time of the southern winter solstice in order to forecast inter-annual variations in summer rainfall and in autumn harvests. They moderate the effect of reduced rainfall by adjusting the planting dates of potatoes, their most important crop. Their results suggest that this ancient method of forecasting seasonal rainfall may be based on a simple indicator of El Nino variability. They found that:

"poor visibility of the Pleiades in June – caused by an increase in subvisual high cirrus clouds – is indicative of an El Nino year, which is usually linked to reduced rainfall during the growing season several months later." (Orlove et al. 2000, p 68) It has been suggested that using traditional and modern prediction techniques could be quite effective. For instance, local astrological knowledge could be combined with rainfall gauges, information records, and growth plots (Battista and Baas 2004, p 23). Indeed, in many cases, and as Jaarsma et al. (2001) argue:

"often official weather forecasts have not been able to achieve the credibility of the ants" – that is the local forecasting system.

This lack of credibility of official weather forecasts can be partially attributed to technical limitations related to the lack of real-time data and the centralised or distant nature of official weather forecasts without involving the locals.

Did you know? Integrated warning systems

Local early warning systems are a critical component of preparedness. They are characterised by the inclusion of local environmental cues and the reliance on informal personal networks to assist with designing the systems and carrying and interpreting the message and decision-making. They are designed over time, through need, trial, and error; or emerge, as required, using pre-existing networks. They are easily visible and simply disseminated among rural people without any special equipment (Howell 2003, p 7). One of the major disadvantages of the local, early warning systems is that they are limited by the personal experience of members of the relevant network (Parker and Handmer 1998). Various studies have reported that often people resist or neglect the official warning (Jaarsma et al. 2001, p 97) – especially in the context of rapid onset disasters which give a very short time for central agencies to notice early warning signs. A growing interest has emerged concerning the advantages of combining local early warnings with official ones. As Howell (2003, p 6) suggests:

"it is certainly possible that if a particular combination of two or three of these [local environmental] indicators were used to give extra validation to the official warning signals, then more accurate (and more believable) early warning could be achieved."

ISDR (2004) points out the necessity of accounting for the human dimensions of early warnings (including the importance of community involvement in early warning systems) and not simply the scientific or technological issues related to hazard monitoring, forecasting, and telecommunications. This is because the ways that people generate, perceive, use, interpret, and respond to official warning systems are complex and are related to issues of trust, power relations, and experience. The human dimensions of early warnings imply that traditional systems are more likely to factor in attachment to the home environment, assets, belief systems, and traditional coping strategies (ISDR 2004, p 363).

Did you know? Early warning of earthquakes using snakes in Nepal

The history of Nepal shows that earthquakes of great magnitude occur every 75 to 100 years and a mild one every 50 years. The failure to implement building codes and the lack of suitable earthquake prediction mechanisms are reasons to investigate innovative prediction methods using local knowledge and resources for cost efficiency and ease of implementation. One possible option proposed by Professor Jiba Raj Pokharel (Nepal Centre for Disaster Management [NCDM] and Director, Centre for Disaster Studies, Nepal) is to use snakes. The observation of changes in snakes' behaviour as an early warning signal for earthquakes has already been used in China. It is based on the fact that snakes feel earth tremors before humans do and come out of their holes. So far, no consensus exists on the exact reason why snakes detect earthquakes first. Among possible reasons could be the unusually high temperature, gas erupting through cracks in the ground, and vibrations taking place before the earthquake. Professor Pokharel proposes to use diurnal and nocturnal snake yards to predict earthquakes based on the assumption that if the snakes come out during their hibernation period (mid-November to March), it is a sign that an earthquake might occur; the rest of the time, if the snakes come out in the nocturnal yard in daytime and the diurnal yard in the night time, then it also provides an early warning signal of earthquake (Pokharel 2006). To date, this proposal still has to be tested and could be used in combination with other indicators to give extra validation.

Adaptation

Analytical frameworks have been developed to focus specifically on community adaptation to natural hazards. One such example is the framework developed by Clarke-Guarnizo (1992) for mapping adjustment mechanisms based on categories of mechanisms (social organisation, economic relationships, technology use, and cultural arrangements) and how they relate to different phases in the disaster lifecycle (before, during and after). To quote Green et al. (2000), one of the most extreme forms of adaptation to natural hazards – and relatively well documented – is perhaps that found in the char lands⁸ of Bangladesh. There, people have adapted to the constant change of river courses which erodes land and creates new land constantly. Local knowledge on disaster preparedness also relates to people's adjustment strategies through trial and error. Knowing how to respond to change may include how people cope, adapt, experiment, and innovate in the face of natural hazards and how they learn from previous hazards they have faced (e.g., which plant to conserve and protect for land and water management or where to find wood and water in times of crisis). Their capacity to adjust is based on their access to, and benefit from, assets (or people's strengths, or capital endowments which – as mentioned previously – are mediated by local institutions and influenced by external institutions and global factors and trends). Categories of assets include the human, sociocultural, institutional, financial, economic, political, physical, and natural.

With respect to human assets – Examples of skills that can contribute to natural hazard preparedness include knowing how to swim (in flood-prone areas), knowledge related to carpentry, masonry, and bamboo weaving (e.g., construction of elevated platforms to keep key belongings and small livestock safe from floods ('machhan' in Nepal and Bangladesh), earthquake resistant houses, communication skills (local

⁸ See footnote 7

singers who used to raise awareness about past hazards in the community), ability to speak in public and convey messages, and others. The community also trusts some people more than others, because of their specific skills and ability to ‘read’ the landscape, the sky, and other elements of the environment, and their advice is followed. Nowadays, economic change (remittances for jobs outside the village) and changes in the education system (the young ones do not value the ‘old’ skills) result in the weakening of traditional skills.

With respect to sociocultural assets – Different people in the same community have different types of knowledge depending upon occupation, physical ability, ethnicity, gender, caste, class and age, as well as their family history, their skills, and/or specific gifts. Langill (1999, p 13) discusses women’s subsistence activities in this context. Coping practices are often based on strong social networks and ties grounded in solidarity, sharing, and reciprocity, which help communities and households in the face of natural hazards and disasters (see box on ‘social capital’).

With respect to institutional assets – Institutional assets may include such things as local, informal conflict resolution mechanisms, informal land tenure and natural resource management rules, and various other institutions in and around the villages that fulfil religious, economic, and social purposes (See box on ‘rules of the game’). These are critical for ensuring effective community monitoring of the local environment and the sustainable use of community resources.

With respect to financial assets – Financial assets include cash savings, equity in property and possessions, and access to credit. Such assets may help a community and its households to recover more quickly following a disaster. Often access to credit and savings is very limited for the most vulnerable groups in a community. Furthermore, only a few people might have the entrepreneurial skills to make good use of financial assets. This means that improving access to micro-credit and savings may not always transfer into improved benefits for those most in need. As suggested elsewhere (Dekens 2005), entrepreneurship may have to be taught.

With respect to economic assets – The most common or widespread response in the face of recurrent natural hazard risks is for men to seek jobs outside the village (remittances). Seasonal and permanent migration is a common strategy to help people cope with different kinds of stress, including natural hazards, and thus provide economic resilience. Men go out to make money to advance their families economically and, in the process, it may help buffer some of the effects of natural hazards. It enables households to compensate for the loss of income caused by damage to agricultural land from natural hazards. In this context, remittances contribute to economic diversification and are a mechanism for (social and economic) risk sharing and providing insurance against floods. (See also negative effects of economic diversification, Chapter 8, under ‘Community resilience building’.)

With respect to political assets – Political assets can refer to the role of key local leaders and their personal and professional networks outside the village, in initiating

and influencing community initiatives in disaster preparedness, and in building linkages with external organisations to give voice to their issues, including the threats from natural hazards and mitigation measures.

With respect to physical assets – Physical assets refer to infrastructural safety arrangements such as boats, housing, embankments, food stores, terraces, and retaining walls to minimise the impacts of natural hazards.

With respect to natural assets – Natural assets include the natural resources available to the community and management strategies associated with them that can minimise the impact of natural hazards, especially in the long term (e.g., land arrangements, landscape management, slope management – see Zurick 1990, in a case study in Nepal – community regulations on grazing and deforestation, and seed management systems including methods of selection and storage, and water management). For example, intercropping and agroforestry that conserve biodiversity and help to prevent soil erosion can spread the risks from natural hazards and reduce crop damage. As Schilderman (2004, p 424) puts it:

“farmers often cultivate a mixed range of grains of which they know some will do well if there is not enough rain, although in normal circumstances they might be less productive.”

Another strategy for spreading risks is to rely on dispersed landholdings. If a flood damages one field, for example, the landowner can still fall back on other fields located elsewhere. However, in most cases, only the richest people have dispersed landholdings. Zurick (1990) documented traditional knowledge on slope conservation in the Salyan district of Western Nepal. Local land-use systems maximise the diversity of micro-habitat conditions in order to avoid total crop failure by distributing farm fields across a broad range of micro-environments. Slope conservation strategies can also include planting vegetation barriers ('kanlo') between cultivated fields to break the slope during the monsoon season, restricting grazing, and cutting grass and shrub fodder on specific sites. The use of different types of traditional crops resistant to floods has been widely documented in Bangladesh. In the Jamuna flood plain, farmers have learned to adjust their agricultural rice cropping patterns to recurrent floods. The inter-culture of 'aman' and 'aus' is a risk-spreading strategy: the former variety can grow during abnormal floods while the latter resists drought (Paul 1984).

All these assets are inter-related. As such, this classification is only one option among others. For example, ensuring seed security raises questions of resources, land access, organisation (e.g., community seed banks), and seed storage technology (Berg et al. 2001 in a case study in Mozambique on community adaptation to drought). Or, natural insurance can also serve as financial insurance during crises (e.g., sale of wood and charcoal) and informal leaders can contribute or not to promoting these aspects through their networks outside of the village. Local institutions governing access to and use of land can contribute to tenure, (in) security, and (dis)incentives for investments in natural resource management. Adjustment strategies to natural hazards can be

more broadly classified into technical and non-structural measures, which often build upon a combination of the assets listed above. Ultimately, household and community adaptation are complex processes based on the ability to experiment, innovate, learn, and share the lessons learned. Investigating household and community assets can provide implementing organisations with an entry point for unfolding this complexity.

Did you know? Social capital and disaster preparedness

Social capital is the ability to rely on strong social and personal networks based on social cohesion, trust, and reciprocity. It refers to the ideas of unity, togetherness, the sense of shared identity and community, common association, neighbourhood, inter-household cooperation, and self-generated community action (e.g., in the form of sandbagging and dyke maintenance in flood-prone areas). The importance of social capital for providing resources during vulnerable times can be found in studies of drought and famine (Materer et al. 2001); in literature about early warning systems (ISDR 2004), in communities facing risks regularly (Bankoff 2004 on cyclones in the Philippines; Swift and Baas 1999 on herders' groups); and in natural resource management (Ostrom 1992 on traditional irrigation systems).

For most vulnerable groups (e.g., young children, elders, and pregnant women) in areas prone to natural hazards, leaving the house is the first thing they do. Few households can afford to move out of the village permanently. Therefore, social safety nets are a crucial means of temporary adjustment. In some households, the most vulnerable members move out of the village to their relatives during the most critical times of the year. In other cases, people can also move to their neighbours because they are located in safer places than they are. Relatives and neighbours often provide social and psychological insurance before, during, and after natural hazards. For example, women may go back to their parents' homes during the flood season.

Households can have strong family or clan ties and social support networks that help reduce their sense of helplessness. Most villagers are embedded in more than one network (e.g., social networks such as the network formed by the family; cultural networks such as being a member of a cultural association; spatial networks such as the network formed by village boundaries; professional networks; and political networks). Some people have access to influential networks outside the community boundaries, and these sometimes help the community to adjust to natural hazards. It might be important to investigate how people are embedded in various networks and how they can be best used in the face of hazards and disasters. Brouwer and Nhassengo (2006, p 241), in a case study on community adaptation to floods in Mozambique, describe exchange relationships as part of people's livelihood strategies; e.g., keeping livestock in somebody else's home ('kuvekissa'); moving temporarily to another area to work for food ('kuthekela'); sharing means of production, principally ploughs and draught animals (kukashela); working on someone's land in exchange for ploughing (kurimela); and providing a herdsman or boy in exchange for cattle (kulusela). Brouwer and Nhassengo record that 'kuvekissa' can be interpreted as a risk reduction strategy: if one's own herd is struck by a disaster, including a drought or flood, there is still the chance that the animals that one has entrusted to a relative or friend will survive. At the same time, a strong sense of place and family ties can lead to underestimation or disregard of the possibility of future hazards. Despite knowing about the danger, some people affected by floods may still prefer to resettle in the same vulnerable area to maintain, and still benefit from, family support as reported in a case study on the Chitral District (Dekens 2007b). The poorest of the poor may also not be able to rely on their relatives as they too face economic constraints. This

means there is less social and spatial mobility for the poor than for the rich. Low caste people may also not be accepted in the house of people of high caste and vice versa. Overall, physical mobility (within the village and outside the village and the country) is often strongly dependent upon social mobility (family, friends, and neighbours), which is itself determined or influenced by sociocultural relations (e.g., caste system).

The extent to which risks of natural hazards increase social capital or, on the contrary, increase individualism is not always clear: the sense of solidarity in the face of threat may weaken as men start to work outside the villages to earn cash, therefore increasing individualism. Economic changes tend to favour profit maximisation strategies instead of 'traditional' risk minimisation strategies. Battista and Bass (2004), in the context of Iran and Niger, report a decrease of reciprocity mechanisms between farmers and herders due to privatisation of wells.

Did you know? Housing

The first step in disaster preparedness in mountain regions is for people to locate their houses in safe places, away from debris flows, flash floods, and snow avalanches. The location of houses relatively safe from hazards has been documented in the Himalayas (in Pakistan: Davis 1984a,b,c; Coburn et al. 1984; Hughes 1984; D'Souza 1984; Moughtin 1982; De Scally and Gardner 1994; Iturrizaga 1997; and in India: Rautela 2005). Iturrizaga (1997) in a case study in the Shimshal Valley, Pakistan, describes how houses are placed one behind another down slope, thereby diminishing the risk of destruction by mass movements or rock falls which represent a permanent threat in the region. Aside from house location, construction materials and techniques can decrease the impacts of natural hazards. Traditional earthquake-resistant houses have also been documented in the Himalayas (Rautela 2005 [Narwhal Himalaya, India]; Dekens 2007b [Chitral District, Pakistan]; Ranjitkar 2000 [Nepal]; Jigyasu 2002 [India and Nepal]). In the Yamuna Valley, Garhwal Himalayas, India, traditional earthquake-resistant structures still remain. These multi-storeyed houses are made of a combination of long, thick wooden logs, stones, slates, and clay. According to the tradition, the foundation had to witness seven monsoons before construction to ensure the structure's stability (Rautela 2005). That said, Jigyasu (2002) states, from a case study in Nepal and India, that despite traditional building qualities most of these structures at present are weak and highly vulnerable to earthquakes, and this is due to maintenance problems, economic pressures forcing householders and builders to cut costs by excluding some of the traditional reinforcement details (e.g., use of timber in the walls to strengthen and stabilise stonework and for its capacity to absorb shocks throughout the entire structure), unavailability of certain materials (e.g., due to restrictions upon traditional rights to forests for timber and stone in the name of environmental protection and increasing cost of timber due to growing demand and ease of transportation), import of reinforced concrete building technologies causing a loss of traditional knowhow, social status attached to concrete buildings, and local artisans switching to concrete construction because of lack of work. Still, many lessons can be learned from traditional buildings to improve current ones. The National Society for Earthquake Technology – Nepal (NSET) is currently carrying out a study in the Himalayas to identify earthquake-resistant elements in traditional buildings.

Communication

Local knowledge on disaster preparedness also includes the way people communicate among their peers and between generations. In traditional rural communities, knowledge is usually, but not exclusively, transferred orally. Understanding local knowledge about disaster preparedness requires us to pay attention to informal education and internal learning processes. How is local knowledge used in a specific context and who uses it? How is local knowledge transmitted within the community and between generations and who is transmitting it? How is local knowledge used at household and community levels? Who has access to local knowledge, how, and under what conditions?

The process of knowledge creation itself is complex and includes aspects of internalisation, socialisation, and externalisation of knowledge, as well as the combination of one type of knowledge with other types (Nonaka 1991). In many societies with oral traditions, past events, including flood events, are embedded in individual and collective memory through stories, songs, poems, proverbs, worship, ceremonies, and rituals. These activities serve as a way of communicating in time (between different generations) and in space (from place to place). Various studies in anthropology and human ecology (Folke et al. 2002; Berkes 1999) have shown how rituals and taboo are the transformation of social memory into practical resource and ecosystem management. Worship, stories, songs, and proverbs not only help people to remember past events but also help them to convey messages in an attractive and convincing manner. Local songs and proverbs also help to turn abstract events into something more vivid and concrete. The younger generation may not have faced a major flood, and it is difficult for them to understand what it means and to consider it possible in the future. Today, local singers are disappearing from the villages due to modernisation of media, globalisation processes (i.e., access to radio and for the better-off television), and livelihood diversification (getting jobs outside the village).

Did you know? Songs that saved lives

Following the 2004 tsunami in South Asia, the media reported how some communities managed to save lives and property using local knowledge. In some cases, people managed to identify early warning signals of the tsunami through change in animal behaviour and through local songs. One such example is the 'smong' song in Simeulue Island, west of Aceh, which had been composed after the 1907 tsunami and helped locals to interpret signals of the 2004 tsunami (McAdoo et al. 2006). Another example comes from a case study in the Eastern Terai of Nepal (Dekens 2007a). Some of the songs collected focus entirely on floods, whereas others mention floods among other important issues the villagers are facing. In some cases, songs and proverbs become the repository (as much as the relay) of past flood events and can help stimulate people's learning, memory, and creativity. They contribute to the transmission of flood-coping strategies (e.g., 'machhan'), create common knowledge, and share a common understanding of change related to frequent and infrequent flood events. As such, songs and proverbs can also help to build a sense of community and solidarity within the village and/or within the different groups affected. They serve as a way of communicating in time (between different generations) and in space (from place to place).

Beyond Local Knowledge

Livelihood security and sustainability

The lack of an explicit connection between local knowledge and disaster management in the literature reflects the lack of linkages between poverty reduction and disaster management and the dominance of a sectoral approach to disaster management. Did we forget that disaster risk reduction is also poverty reduction? The issue of local knowledge on disaster preparedness needs to be understood and integrated into the wider context of sustainable development, especially issues of sustainable livelihoods and poverty reduction. This will help to bring a long-term perspective into disaster management rather than considering it to be a matter of emergency aid and humanitarian assistance only. Projects focusing on sustainable livelihoods and natural resource management should have a disaster preparedness component if resilient communities are to be built. The practices in everyday life need to be understood. Wisner and Luce (1993, p 131) point out in regard to women that it is not women per se, but rather what they do in given situations, that has to be understood and the way their responsibilities increase: marginalisation is a long, continual process.

Ultimately, improving the understanding of implementing agencies about local knowledge on disaster preparedness can help them to promote livelihood security and build resilient communities. Local knowledge can be used as a key entry point for this. As such, and in order to provide a more holistic view of disaster management, the framework builds upon the livelihood framework. This is because it is a people-centred approach which is already being used by donor agencies and research and development organisations and it has:

“become standard in the exploration of poverty-environment links and are common in assessments of householder coping strategies following aggregate shocks.” (McSweeney 2005)

Investigating local knowledge about disaster preparedness from a livelihood perspective means that it cannot be isolated from other cross-cutting issues such as poverty, local control of land and material resources, and equitable participation through empowerment (Jigyasu 2002, p xxxii).

Community resilience building

Most approaches to disaster management tend to focus on people's vulnerabilities and on what people do not know. Heijmans (2001) and Ellemor (2003) criticise the concept of 'vulnerability' and argue that communities do not use the concept and this is because:

"they approach recurrent 'adverse events' as part of 'normal life', while rare or new disasters are dealt with from a perspective of survival." (Heijmans 2001, p 1)

The focus on local knowledge and practices (especially adaptation strategies) provides an entry point for reversing this tendency. It enables internal and external organisations to explore what people's strengths are and what they actually do know, that is to build upon community resilience (Gardner and Dekens 2007). For instance, natural hazards can have profound impacts on social and ecological systems such as the loss of subsistence practices, the breakdown of sharing networks, and the disruption of communal control of native resources among others. However, they may also generate positive, social impacts to some extent, when strengthening social networks, and positive, ecological impacts, when revitalising soil for instance (Smith 2003; Colding et al. 2003). Natural hazard risks and disaster can also offer new opportunities. Swift and Baas (1999) highlight the importance of identifying winners and losers. The rapid changes facing communities are as much a source of new vulnerabilities as of new opportunities and exploring new ways of risk adjustment. Oliver-Smith (1996, p 313) reports for example that:

"reconstruction after the 1970 Peruvian earthquake stimulated certain social changes that produced greater freedom of action for oppressed indigenous people. [...] However, reconstruction generally produced urban and housing patterns that tended to reinforce traditional social hierarchies."

Overall, it is difficult to generalise about whether or not people's ability to cope with natural hazards has been eroded, has remained the same, or has increased. It depends on a combination of factors acting at a particular point in time and space, showing the complexity of the processes influencing people's coping mechanisms.

The process of livelihood diversification can illustrate the above point. Livelihood diversification creates new opportunities for households because access to government jobs, jobs outside the village, or outside the country provides additional financial assets that help the household during crises and/or to be prepared (e.g., savings) and access brings new ideas. At the same time, the diversification process can weaken social cohesion within the community due to absent husbands (McSweeney 2005). Social cohesion is a key asset that prepares people and helps them bounce back following natural disasters. Berg et al. (2001, p 4) in a case study on household flood-coping strategies in Mozambique report that the most vulnerable households were those from which husbands were absent, working in the gold mines of South Africa.

Saxena et al. (2005, p 30) conclude their analysis of livelihood changes in the Himalayas by saying:

“such changes (i.e., emphasis on market economy, ‘maximisation of profit motive’) have benefited local people in economic terms but, at the same time, increased their vulnerability to environmental and economic risks.”

A case study of a village in Darjeeling District, India, (Dekens 2005) similarly shows how the process of livelihood diversification over a 50-year period and following an economic crisis contributed to new socioeconomic disparities within the village and new dependencies between the village and outside markets and organisations. For example, villagers had better access to markets than before and had developed a wider range of income sources. At the same time, some villagers were neglecting their land to earn quick, short-term cash incomes. The case study shows that further research is required to understand if and how much livelihood diversification invested in production enables villagers to move beyond survival strategies, and to what extent the short-term benefits of livelihood diversification can be transferred into long-term benefits.

In a literature review on livelihood diversification in sub-Saharan Africa and in Asia, Hussein and Nelson (1998) confirm that the effects of diversification are complex and do not necessarily lead to more sustainable livelihoods. As such the process of livelihood diversification illustrates that the impacts of change on people’s capacity to adapt to natural hazards is neither white nor black, rather it includes a mixture of positive and negative factors that require careful analysis in time and space.

Ultimately, one should not underestimate people’s capacity to adapt even in the context of rapid change. Linkenbach-Fuchs (2002, p 6) found that the influence of modernity led people to devise new solutions and strategies and led them to discover themselves as citizens with rights vis a vis welfare and development. She (2002, p 11) adds that people have started to establish new methods to cope with change, partly by reconsidering or revising old practices such as migration, wage labour, illegal felling of trees, producing and selling alcohol, and converting forests into fields for cash crops. Examples indicate that some households within communities manage to explore new ways of adjusting to risks especially in a context in which:

“the growth of risk factors (population and development) (...) is occurring more rapidly than the capacity of national and international programmes designed to deal with the problem.” (Van Aalst and Burton 2002, p 18)

Swift and Baas (1999, p 6) in a study on pastoral systems in central and inner Asia describe how herders respond to risk through moving livestock away from a threat or towards assistance, labour and food sharing within small social groups, and using extended forms of urban-rural exchange of food and other commodities. These local responses to risk became less important, but did not disappear, during the socialist period and have now been revived since liberalisation as state responses have

decreased (this echoes what was highlighted earlier in this report about the effects of development that can simultaneously, or not, increase as well as reduce the impacts of disasters). This demonstrates how local responses can adapt to changes in state involvement.

Did you know? Not all the poor are vulnerable

Poverty is often associated with vulnerability, including increased vulnerability to natural hazards, because of the related lack of assets associated with poverty (e.g., financial, migration, and social networks). Research shows that the relationships between hazards, poverty, and vulnerability are complex and that not all the poor are vulnerable (Kasperson and Kasperson 2001; Blaikie et al. 1994; Wisner and Luce 1993; Brouwer and Nhassengo 2006). As Wisner and Luce (1993, p 127) put it:

“persons at the same level of income do not suffer equally in disaster situations nor do they encounter the same handicaps during the period of recovery. [...] It is necessary [...] to ‘deconstruct’ poverty, [...] to disaggregate the structure of poverty itself.”

Jigyasu (2002, p 316) states that poverty is the result of processes (historical) of resource deprivation, whereas vulnerability is deprivation of the means to cope, which in turn marginalises and impoverishes people physically and mentally. For example, McSweeney (2005), in a case study on community response to Hurricane Mitch in Honduras, shows how the poor can also be enriched by natural hazards:

“we find in Krausirpi that whether a household had recapitalised or not two and a half years after the flood had more to do with pre-Mitch endowments. In effect, the Krausirpi case suggests that under specific conditions, disasters can also offer unexpected opportunities for the poor.” (McSweeney 2005, p 1468)

– and this is also described elsewhere in a case study on short-term effects of large-scale flood disasters (Brouwer and Nhassengo 2006)

Did you know? Risk screening tool

Tools are being developed to integrate local, coping strategies into development projects. One example is the CRYSTAL tool being developed by the International Union for the Conservation of Nature (IUCN), Stockholm Environmental Institute (SEI), and Intercooperation. This tool is a community-level, risk screening tool to gather information on the current climate and the livelihood contexts in a systematic way. It also generates information on the impacts of development activities on key assets. Information gathered relates to the vulnerability to climate variability experienced by communities, the main impacts of climate variability at the livelihood level (i.e., impacts on all key assets), the current coping strategies, how a specific development activity and/or a local initiative affects or will affect the key assets of a specific livelihood, how a specific development activity and/or a local initiative affects or will affect livelihood vulnerability (and vice versa), and what kinds of adjustment are necessary so that a specific development activity can increase the resilience of a community to climate variability. The tool has already been tested in Africa, Latin America, and Asia.

Part 3

Conclusions and Literature



Lessons Learned

The purpose of this report is to re-affirm the importance of accounting for local knowledge in disaster risk reduction by presenting a general framework through which to understand local knowledge on disaster preparedness based on a literature review. The literature review and related framework revealed the following.

- **Despite evidence since the early 1970s, at least, that local knowledge and practices can help implementing organisations to improve their disaster preparedness activities, local knowledge and practices are marginalised from the mainstream disaster literature and within institutions working in disaster management – and this has been the case in the Himalayas as elsewhere around the world both in developing and developed countries.**

Key factors that have prevented the use of local knowledge include historical factors (e.g., the legacies of colonialism), ideological factors (e.g., the beliefs that conventional or scientific knowledge is ‘superior’), institutional factors (e.g., it is difficult to identify and use local knowledge and practices because of their ‘invisibility’, complexity, diversity, and changeability), political factors (e.g., natural hazards and disasters have been conceived primarily as an issue pertaining to national defence and security), economic factors (e.g., the impact of multiple stresses in a context of rapid change render some local knowledge and practices inappropriate or inaccessible over time), and geographical and temporal factors (e.g., distance management).

Opening the debate – To what extent is the latest work on local knowledge and related participatory disaster management approaches not as vulnerable to marginalisation or co-opting into national and international disaster management strategies? How can we reverse the process of marginalisation of local knowledge and practices from mainstream disaster literature and within institutions working in disaster management?

- **Local knowledge and practices are complex adaptive responses to internal and external change. Combined with conventional knowledge and understood in the wider context of sustainable development, they have a potentially valuable role to play in disaster risk reduction.**

A local knowledge system is not only composed of what people know but also of what people do (practices) and believe in (beliefs, values, and worldviews). Local knowledge and practices are being transformed all the time through the influence of power relations both within and outside the community and the way hazards (in combination with exogenous and endogenous perturbations and responses) are cascading down across different scales. As such local knowledge and practices need to be understood

as adaptive responses to internal and external changes that increase, or not, disaster preparedness at the local level. In order to identify local knowledge on disaster preparedness, one should focus at least on four key aspects of local knowledge: peoples' ability to observe their local surroundings, anticipation of environmental indicators, adaptation strategies, and people's ability to communicate about natural hazards within the community and between generations. Finally, the ability a community has to prepare itself for disaster preparedness should be understood in the broad context of livelihood security and sustainability and building community resilience in the long term. Focusing on local knowledge and practices can help understand local contexts and needs that influence how people perceive and respond to natural hazards, risks, and disasters. Local knowledge can provide information related to local environmental variability and specificities; local perceptions of natural hazards; risk tradeoffs in the context of multiple stresses; vulnerable groups and individuals; the local elite and power relations; and changes in people's vulnerability to natural hazards over time. Examples of potential applications of local knowledge in disaster preparedness include accounting for local advice about safe locations, construction sites (buildings and roads), combining local knowledge with conventional knowledge for hazard mapping, surveys and other inventories in order to verify information, adapting communication strategies to local understanding and perceptions, and integrating local values into decision-making processes.

Opening the debate – How to make use of local knowledge in disaster preparedness? How can local knowledge and practices improve disaster preparedness projects and vice versa? How to strengthen existing coping strategies for disaster preparedness? How to strengthen the role of local government and community-based organisations in disaster risk reduction and improve their ways of communication and active interaction?

- **Recognising and respecting local knowledge and practices empowers local communities. While not all local knowledge, practices, and beliefs are relevant, they always need to be taken into account to ensure project acceptance and sustainability.**

Understanding local knowledge and practices can help identify what can be promoted at local level and how to foster people's participation to ensure the support of local knowledge and practices for external action. Solutions in disaster management need to go beyond the dichotomy between local versus state management levels and to integrate cross-scale institutional linkages. Due to changes in the education system and the growing influence of the west, among other things, communities themselves need to be convinced that some of their local knowledge and practices are of relevance to disaster preparedness. The current systems of education should be reconsidered in order to clearly link local communities with schools so that school curricula are adapted to local needs and realities and incorporate and foster local knowledge and practices. The focus on local knowledge and practices helps to identify and capitalise upon people's existing strengths and local institutions (instead of creating parallel institutions). In the context of rapid change and multiple stresses such as complex,

changing, and growing hazards, the extent to which local knowledge and practices actually contribute to improving disaster preparedness at the local level or not is not white or black. We cannot afford to ignore any knowledge or potential low-cost strategy which might improve survival and mitigate property losses.

Opening the debate – How can communities themselves (re)gain confidence in their own knowledge system and consolidate it as an effective tool? What forms of community-based action are likely to be effective for improved disaster preparedness? How can external organisations help the communities to consolidate their knowledge system on an equal basis and as an effective tool for disaster preparedness? What kinds of structures of governance at the local level can promote local knowledge?

- **There are many challenges to the documentation and use of local knowledge in disaster preparedness, and they can only be resolved through respect, understanding, and reflexivity as well as through creative and innovative solutions. Best practices at the local level in the context of disaster risk reduction that capitalise on local strengths need to be up-scaled.**

Ultimately, the use of local knowledge raises ethical and practical questions about social justice, because local knowledge can be used against the people themselves and because it can be used also as an umbrella to mask what still remains ‘business as usual’ (the status quo). Innovative initiatives at the local level are happening but they are scattered, fragmented, and often not documented. Lessons learned from such initiatives should be documented and upscaled to foster creative solutions in this field. Based on the assumption that different things can be done better on different scales, depending on the nature and type of natural hazards, for example, partnerships among local government, private sector, non-government organisations, and community groups should be explored.

Opening the debate – How to document and identify local knowledge on disaster preparedness? Who is really going to benefit from the studies on and uses of local knowledge? How do the studies and uses of local knowledge employ and serve the dominant power relationship? Who is going to represent the people who do not have the power? How can we legitimise local knowledge without its being presented in ‘conventional’ scientific terms? How to foster the cooperation of local communities with external institutions on an equal basis?

Bibliography

(not necessarily cited in the text)

- Abdur Razzaque, M.; Zainul Abedin, M. (2001) 'Developing Farming Systems and Best Practices for Flood-prone Areas.' In *Report of the FAO Asia-Pacific Conference on Early Warning, Prevention, Preparedness and Management of Disasters in Food and Agriculture*, pp 321-337. Chiangmai, Thailand, 12-15 June. APDC/01/REP. Rome: FAO
- Adger, W.N. (2000) 'Institutional Adaptation to Environmental Risk Under the Transition in Vietnam'. In *Annals of the Association of American Geographers*, 90(4): 738-58
- Agrawal, A. (1995) 'Dismantling the Divide between Indigenous and Scientific Knowledge'. In *Development and Change*, 26(3): 413-439
- Agrawal, A.; Narain, S. (1997) 'Dying Wisdom. Rise, Fall and Potential of India's Traditional Water Harvesting Systems'. In *State of India's Environment. A Citizen's Report 4*. New Delhi: Centre for Science and Environment
- Ahmad, Q.K.; Warrick, R.A. (Eds.) (2004) 'Community Approaches to Flood Management in South Asia. Special Double Issue'. In *Asia Pacific Journal on Environment and Development*, 11 (1-2)
- Ahmed, A.K.; Chowdhury, E.H. (2006) *Study on Livelihood Systems Assessment, Vulnerable Groups Profiling and Livelihood Adaptation to Climate Hazard and Long-term Climate Change in Drought-prone Areas of NW Bangladesh, Final Report*. Bangladesh: Centre for Environmental and Geographic Information Services and United Nations Food and Agriculture Organization (FAO)
- Ahmed, A.U. (2005) *Engagement of People-Centric Institutions for Managing Floods at Community Levels: Perspectives of Rural Bangladesh*. Dhaka: Unnayan Parishad (BUP)
- Akbar Khan, R.R. (1996) 'An Account of the Movements of the Sun and the Pleiades in Chitrali Tradition'. In Bashir, E.; ud-Din., I. (eds) *Proceedings of the Second International Hindukush Cultural Conference*, pp 217-224. Oxford: Oxford University Press
- Alam, K. (2006) *Why Should Community Coping Mechanisms be the Center of Disaster Reduction Policy and Practices?* Paper prepared for a Regional Workshop on Community Coping Mechanisms organised by CCDB
- Alcantara-Ayala, I. (2004) 'Flowing Mountains in Mexico, Incorporating Local Knowledge and Initiatives to Confront Disaster and Promote Prevention'. In *Mountain Research and Development*, 24(1): 10-43
- Alcantara-Ayala, I.; Lopez-Mendoza, M.; Melgarejo-Palafox, G.; Borja-Baeza, R.C.; Acevo-Zarate, R. (2004) 'Natural Hazards and Risk Communication Strategies among Indigenous Communities. Shedding Light on Accessibility in Mexico's Mountains.' In *Mountain Research and Development*, 24(4): 298-302
- Allen, K.M. (2006) 'Community-based Disaster Preparedness and Climate Adaptation: Local Capacity-Building in the Philippines'. In *Disasters*, 30(1):81-101

- All India Disaster Mitigation Institute (2006) *Supporting Local Capacities: From Jargon to Impact*, Special Issue 18. Ahmedabad: All India Disaster Mitigation Institute. Available at www.southasiadisasters.net/publication.htm
- Ananthkrishnan, M.V.; Tripathi, R. (no date) *Think! Towards Handling Intuitive and Nurtured Knowledge*. Bombay: Indian Institute of Technology
- Anderson, J.R. (2003) 'Risk in Rural Development: Challenges for Managers and Policy Makers'. In *Agricultural Systems*, 75: 161-197
- Anderson, M.B.; Woodrow, P.J. (1989) *Rising from the Ashes: Development Strategies in Times of Disasters*. Boulder: Westview
- Anonymous (2001) 'Folk Wisdom, Traditional Weather-Forecasting on Trial'. In *The Economist*, 11/24/2001, 361(8249): 74-75
- Antweiler, C. (1998) 'Local Knowledge and Local Knowing. An Anthropological Analysis of Contested 'Cultural Products' in the Context of Development'. In *Anthropos*, 93(4-6):469-494
- Appiah-Opoku, S.; Hyma, B. (1999) 'Indigenous Institutions and Resource Management in Ghana'. In *Indigenous Knowledge and Development Monitor*, 7(3): 15-17
- Backstrand, K. (2004) 'Civic Science for Sustainability: Reframing the Role of Scientific Experts, Policy-Makers and Citizens in Environmental Governance'. In Biermann, F.; Campe, S.; Jacob, K. (eds) *Proceedings of the 2002 Berlin Conference on the Human Dimension of Global Environmental Change 'Knowledge for the Sustainability Transition. The Challenge for Social Science'*, pp 165-174. Amsterdam, Berlin, Postdam and Oldenburg: Global Governance Project
- Bankoff, G. (2004) 'In the Eye of the Storm: The Social Construction of the Forces of Nature and the Climatic and Seismic Construction of God in the Philippines'. In *Journal of Southeast Asian Studies*, 35(1): 91-111
- Barton, A.H. (1970) *Communities in Disasters: A Sociological Analysis of Collective Stress Situation*. New York: Anchor
- Batterbury, S.; Forsyth, T. (1999) 'Fighting Back. Human Adaptations in Marginal Environments'. In *Environment*, 41(6): 6-30
- Battista, F.; Baas, S. (2004) *The Role of Local Institutions in Reducing Vulnerability to Recurrent Natural Disasters and in Sustainable Livelihoods Development. Consolidated Report on Case Studies and Workshop Findings and Recommendations*. Rome: Rural Institutions and Participation Service, Food and Agriculture Organization (FAO)
- Berg, T.; Dava, F.; Muchanga, J. (2001) *Post-Disaster Rehabilitation and Seed Restoration in Flood Affected Areas of Xai-Xai District, Mozambique. Summary of Findings from Visits to Affected Villages and Suggestions for Action Research (for Gender, Biodiversity and Local Knowledge Systems (LinKS) to Strengthen Agricultural and Rural Development)*. Rome: FAO. Available at <http://www.fao.org>
- Berkes, F. (1999) *Sacred Ecology: Traditional Ecological Knowledge and Resource Management*. Boca Raton (USA): Taylor and Francis
- Berkes, F. (2002) 'Cross-scale Institutional Linkages: Perspectives from the Bottom-Up'. In Ostrom, E.; Dietz, T.; Dolsak, N.; Stern, P.C.; Stonich, S.; Weber, E.U. (eds) *The Drama of the Commons*, pp 293-321. Washington, DC: National Academy Press

- Berkes, F.; Colding, J.; Folke, C. (2000) 'Rediscovery of Traditional Ecological Knowledge as Adaptive Management'. In *Ecological Applications*, 10(5): 1251-1262
- Berkes, F.; Folke, C. (2002) 'Back to the Future: Ecosystem Dynamics and Local Knowledge'. In Gunderson, L.H.; Holling, C.S. (eds.) *Panarchy. Understanding Transformations in Human and Natural Systems*, pp 121-146. Washington D.C.: Island Press
- Bhaumik, S. (2006) *NGOs Criticize Tsunami Shelters*. U.K.: BBC News. 22 December 2006 Available at http://news.bbc.co.uk/2/hi/south_asia/6202363.stm
- Bingen, J. (2001) 'Institutions and Sustainable Livelihoods'. In Proceedings of the Forum on *Operationalising Participatory Ways of Applying Sustainable Livelihoods Approaches: Inter-agency Experiences and Lessons*, 7-11 March 2000, Certosa di Pontignano, Italy, pp. 119-140. Rome: DFID and FAO. Available at http://www.fao.org/sd/2001/PE0903_en.htm.
- Bjonness, I.M. (1986) 'Mountain Hazard Perception and Risk-Avoiding Strategies among the Sherpas of Khumbu Himal, Nepal'. In *Mountain Research and Development*, 6(4): 277-292
- Blaikie, P.; Cannon, T.; Davis, I.; Wisner, B. (1994) *At Risk. Natural Hazards, People's Vulnerability and Disasters*. London: Routledge
- Bode, B. (1977) 'Disaster, Social Structure, and Myth in the Peruvian Andes: the Genesis of an Explanation'. In Freed, S. (ed) *Anthropology and the Climate of Opinion*, pp 246-74. Annals of the New York Academy of Sciences 293. New York: NYAS
- Boven, K.; Morohashi, J. (eds) (2002) *Best Practices using Indigenous Knowledge*. The Hague and Paris: NUFFIC and UNESCO/MOST
- Brammer, H. 'Floods in Bangladesh: Geographical Background to the 1987 and 1988 Floods'. In *The Geographical Journal*, 156(1): 12-22
- Brouwer, R.; Nhassengo, J. (2006) 'About Bridges and Bonds: Community Responses to the 2000 Floods in Mabalane District, Mozambique'. In *Disaster*, 30(2): 234-255
- Brown, O.; Crawford, A.; Hammill, A. (2006) *Natural Disasters and Resource Rights. Building Resilience, Rebuilding Lives*. Winnipeg (Canada): International Institute for Sustainable Development (IISD)
- Buckle, P.; Marsh, G.; Smale, S. (2001) *Assessment of Personal and Community Resilience and Vulnerability*. Report to Emergency Management Australia, Department of Defense, Project Report 15/2000. Canberra: DoD
- BUP (2006) *Proceedings of a Regional Workshop on Community Approaches to Flood Management in South Asia*. Dacca: Bangladesh Unnayan Parishad (BUP)
- Burton, I.; Kates, R.W.; White, G.F. (1978) *The Environment as Hazard*. New York: Oxford University Press
- Campbell, B. (2000) 'Whose Knowledge? Indigenous Views on the Terms of Development Participation'. Paper for the ASA 2000, SOAS Conference on *Participating in Development: Approaches to Indigenous Knowledge*. Available at <http://www.asa2000.anthropology.ac.uk/bcampbell/bcampbell.html>
- Campbell, D.J. (1984) 'Response to Drought among Farmers and Herders in Southern Kajiado District, Kenya'. In *Human Ecology* 12(1): 35-64

- Cash, D.W.; Moser, S.C. (2000) 'Linking Global and Local Scales: Designing Dynamic Assessment and Management Processes'. In *Global Environmental Change* 10: 109-120
- Chan, N.W.; Parker, D.J. (1996) 'Response to Dynamic Flood Hazard Factors in Peninsular Malaysia'. In *The Geographical Journal* 162 (3): 313-325
- Centre for Disaster Management (2005) Summary of 'Learning Lessons from Cultural Heritage for Sustainable Island Development' a joint Symposium between Forum for Island Research and Experience (FIRE), University College London and Coventry Centre for Disaster Management, 18 Feb 2005. Available at www.homepages.ucl.ac.uk/~tcnrjec/homepage.html, www.conventry.ac.uk/disaster
- Chaudhury, D.; Datta, J. (2006) 'Traditional Rice Varieties for Barak Valley. An Under-utilized Germplasm for Sustainable Agricultural Development for Flood-Prone Areas'. In Sengupta, S.; Sinha, K.R.; Das, S.; Rani, W.B.; Purkaystha, S. (eds) *Rivers and Riverine Landscape in North East India*. New Delhi: Concept Publishing Company
- Chowdhury, M. (2001) 'Women's Technological Innovations and Adaptations for Disaster Mitigation: A Case Study of Charlands in Bangladesh', paper presented at an Expert Group Meeting on *Environmental Management and the Mitigation of Natural Disasters: A Gender Perspective*, 6-9 November 2001. Ankara: Division for the Advancement of Women (DAW), International Strategy for Disaster Reduction (ISDR)
- Clarke-Guarnizo, C. (1992) 'Living with Hazards. Communities' Adjustment Mechanisms in Developing Countries'. In Kreimer, A. Munansinghe, Y.M. (eds) *Environmental Management and Urban Vulnerability*, pp 93-106. Washington DC: World Bank
- Coburn, A.W.; Hughes, R.E.; Illi, D.; Nash, D.F.T.; Spence, R.J.S. (1984) 'The Construction and Vulnerability to Earthquakes of some Building Types in the Northern Areas of Pakistan'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 2, Proceedings of the International Conference. pp 228-251. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Colding, J.; Elmqvist, T.; Olsson, P. (2003) 'Living with Disturbance: Building Resilience in Social-Ecological Systems'. In Berkes F., Colding J., Folke C. (eds) *Navigating Social-Ecological Systems. Building Resilience of Complexity and Change*, pp 163-185. Cambridge: Cambridge University Press
- Copans, J. (1975) *Secheresses et Famines du Sahel*. Paris: F. Maspero
- Cronin, S.J.; Gaylord, D.R.; Charley, D.; Alloway, B.V.; Wallez, S.; Esau, J.W. (2004) 'Participatory Methods of Incorporating Scientific with Traditional Knowledge for Volcanic Hazard Management on Ambae Island, Vanuatu'. In *Bulletin of Volcanology*, 66: 652-668
- Cumming, G.S.; Cumming D.H.M.; Redman, C.L. (2006) 'Scale Mismatches in Social-Ecological Systems: Causes, Consequences, and Solutions'. In *Ecology and Society* 11(1): 14. Available at www.ecologyandsociety.org/vol11/iss1/art14/
- Das, A.K. (1998) 'The Brahmaputra's Changing River Ecology'. In Saraswati B. (ed) *The Cultural Dimension of Ecology*. New Delhi: IGNCA and D.K. Printworld Pvt. Ltd. Available at http://ignca.nic.in/cd_07.htm
- Datt, D. (1991) 'Land Systems, Land Use, and Natural Hazards in the Lower Bino Basin (Lesser Himalaya), India'. In *Mountain Research and Development*, 11(3): 271-276

- Davis, I. (1984a) 'The Vulnerability and Reduction of Damage Risk in Small Houses Subject to Natural Hazards'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 1, Proceedings of the International Conference, pp 290-310. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Davis, I. (1984b) 'A Critical Review of the Work Method and Findings of the Housing and Natural Hazards Group'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 2, Proceedings of the International Conference, pp 200-27. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Davis, I. (1984c) 'Analysis of Recovery and Reconstruction Following the 1974 Patan Earthquake'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 2, Proceedings of the International Conference, pp 323-42. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Dekens, J. (2005) *Livelihood Change and Resilience Building: A Village Study from the Darjeeling Hills, Eastern Himalaya, India*. Unpublished Master's Thesis in Natural Resource Management. Winnipeg (Canada): Natural Resources' Institute, University of Manitoba
- Dekens, J. (2007a) *The River and the Snake Don't Run Straight. Local Knowledge on Flood Preparedness in the Eastern Terai of Nepal*. Kathmandu: ICIMOD Available at: www.disasterpreparedness.icimod.org
- Dekens, J. (2007b) *Herders of Chitral: the Lost Messengers? Local Knowledge on Disaster Preparedness in Chitral District, Pakistan*. Kathmandu: ICIMOD Available at: www.disasterpreparedness.icimod.org
- Desai, R. (2001) *Upgrading Vernacular Building Systems for Enhanced Earthquake Resistance. Uttaranchal (Himalayan Foothills) Intervention. A Case Study*. Paper presented at a Workshop on Collaborative Open Source Design of Appropriate Technologies, July 22nd, MIT, Cambridge, Massachusetts, USA
- De Scally, F.A.; Gardner, J.S. (1994) 'Characteristics and Mitigation of the Snow Avalanche Hazard in Kaghan Valley, Pakistan Himalaya'. In *Natural Hazards*, 9: 197-213
- DFID (1999) 'Sustainable Livelihood Framework'. In *Sustainable Guidance Sheets*. London: Department for International Development
- Diamond, J. (2005) *Collapse: How Societies Choose to Fail or Survive*. London: Penguin
- Dougherty, P.L. (1971) 'From Disaster to Development'. In *Americas*, 23(5): 25-35
- D'Souza, F. (1984) 'The Socio-Economic Cost of Planning for Hazards: An Analysis of Barkulti Village, Yasin, Northern Pakistan'. In Miller, K.J. (ed) *The International Karakoram Project*. Volume 2, Proceedings of the International Conference, pp 289-306. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Duffield, C.; Gardner, J.S.; Berkes, F.; Singh, R.B. (1998) 'Local Knowledge in the Assessment of Resource Sustainability: Case Studies in Himachal Pradesh, India, and British Columbia, Canada'. In *Mountain Research and Development*, 18(1): 35-49
- Dynes, R. (1974) *Organizational Behavior in Disaster*. Columbus: Ohio State University Disaster Research Centre
- Ellemor, H. (2003) *Emergency Management and Remote Indigenous Communities: Reconsidering Key Concepts*. Australia: Government of Australia, Emergency Management. Available at <http://www.ema.gov.au/agd/EMA/rwpattach.nsf/>

viewasattachmentpersonal/(63F21BC6A4528BAE4CED2F9930C45677)~DC+ellemoor.pdf/\$file/DC+ellemoor.pdf

- Ellemor, H. (2005) 'Reconsidering Emergency Management and Indigenous Communities in Australia'. In *Environmental Hazards*, 6: 1-7
- Ellen, R. (no date) *Traditional Environmental Knowledge in Island Southeast Asia: Some Consequences of Its Demise and Re-discovery for Local Coping Strategies*, unpublished report. Canterbury (U.K.): University of Kent
- Ellen, R.; Harris, H. (1996) *Concepts of Indigenous Environmental Knowledge in Scientific and Development Studies Literature. A Critical Assessment*. East-West Environmental Linkages Network Workshop 3, 8-10 May, Canterbury. Available at http://lucy.ukc.ac.uk/Rainforest/SML_files/Occpap/indigknow.occpap_TOC.html
- Ellis, F. (2000) *Rural Livelihoods and Diversity in Developing Countries*. Oxford: Oxford University Press
- Ellis, D.; West, P. (2000) *Local History as "Indigenous Knowledge": Applications for Conservation and Development in Papua New Guinea*. Paper for the ASA 2000 Conference on Indigenous Knowledge and Development. Available at <http://www.asa2000.anthropology.ac.uk/ellis/ellis.html>
- Elmqvist, T. (no date) *Indigenous Institutions, Resilience and Failure of Co-Management of Rain Forest Preserves in Samoa*. Uppsala: Swedish Biodiversity Centre
- Emery, A. (2000) *Integrating Indigenous Knowledge in Project Planning and Implementation*. Canadian International Development Agency (CIDA), International Labor Organization (ILO), KIVU Nature, and the World Bank. Available at <http://www.acdicida.gc.ca/CIDAWEB/acdicida.nsf/En/REN-218131253-PHH>
- Enarson, E. (1998) 'Through Women's Eyes: A Gendered Research Agenda for Disaster Social Science'. In *Disaster*, 22(2): 157-173
- FAO (2004) 'AIDS and Agriculture: Impact and Response. What Disasters Cost Farming in Lost Know-How and Seed'. In *Focus, FAO Newsroom*, 23 August. Available at <http://www.fao.org/newsroom/en/focus/2004/49923/index.html>
- Farooquee, N.A. (2004) 'Indigenous Knowledge Systems and Sustainable Management of Natural Resources in a High Altitude Society in Kumaun Himalaya, India'. In *Journal of Human Ecology*, 16(1): 33-42
- Faupel, C.E.; Styles, S.P. (1993) 'Disaster Education, Household Preparedness, and Stress Responses following Hurricane Hugo'. In *Environment and Behavior*, 25: 228-249
- Few, R. (2003) 'Flooding, Vulnerability and Coping Strategies: Local Responses to a Global Threat'. In *Progress in Development Studies*, 3(43): 43-58
- Firth, R. (1959) *Social Change in Tikopia. Re-study of a Polynesian Community after a Generation*. London: George Allen & Unwin
- Flint, C.G.; Luloff, A.E. (2005) 'Natural Resource-based Communities, Risk and Disaster: An Intersection of Theories'. In *Society and Natural Resources*, 18: 399-412
- Folke, C.; Colding, J.; Berkes, F. (2002) 'Synthesis: Building Resilience and Adaptive Capacity in Socio-Ecological Systems'. In Berkes, F.; Colding, J.; Folke, C. (eds) *Navigating Socio-Ecological Systems: Building Resilience for Complexity and Change*, pp 352-387. Cambridge: Cambridge University Press

- Folke, C.; Pritchard, L.; Berkes, F.; Colding, J.; Svedin, U. (1998) *The Problem of Fit between Ecosystems and Institutions*, IHDP Working Paper 2. Bonn: International Human Dimensions Programme on Global Environmental Change
- Form, W.H.; Loomis, C.P.; Clifford, R.A.; Moore, H.E.; Nosow, S.; Stone, G.P.; Westie, C.M. (1956) 'The Persistence and Emergence of Social and Cultural Systems in Disasters'. In *American Sociological Review*, 21(2): 180-5
- Forsyth, T. (1996) 'Science, Myth and Knowledge: Testing Himalayan Environmental Degradation in Thailand'. In *Geoforum*, 27(3): 375-392
- Frankenberger, T.; Drinkwater, M.; Maxwell, D. (2001) 'Operationalizing Household Livelihood Security'. In *Forum on Operationalizing Participatory Ways of Applying Sustainable Livelihoods Approaches, Proceedings Inter-agency Experiences and Lessons*. Certosa di Pontignano, Italy, 7-11 March 2000, pp 63-99. Rome and London: FAO and DFID. Available at http://www.fao.org/sd/2001/PE0903_en.htm
- Fritz, C. (1968) 'Disaster'. In Sills, D. (ed) *International Encyclopedia of the Social Sciences*, 4: 202-7
- Gallopin, G.C. (2006) 'Linkages between Vulnerability, Resilience, and Adaptive Capacity'. In *Global Environmental Change*, 16: 293-303
- Gardner, J. (2002) 'Natural Hazards Risk in the Kullu District, Himachal Pradesh, India'. In *The Geographical Review*, 92(2): 282-306
- Gardner, J.S.; Dekens, J. (2007) 'Mountain Hazards and the Resilience of Social-ecological Systems: Lessons Learned in India and in Canada'. In *Natural Hazards*, 41(2): 317-336
- Goodman, A.H.; Leatherman, T.L. (2001) 'Traversing the Chasm between Biology and Culture: An Introduction'. In Goodman, A.H.; Leatherman, T.L. (eds) *Building a New Biocultural Synthesis. Political-Economic Perspectives on Human Biology*, pp 3-41. Ann Arbor: University of Michigan Press
- Green, C.H.; Parker, D.J.; Tunstall, S.M. (2000) *Assessment of Flood Control and Management Options, World Commission on Dams (WCD) Thematic Review, Options Assessment 4.4*. Cape Town: WCD
- Gurung, S.M. (1989) 'Human Perception of Mountain Hazards in the Kakani-Kathmandu Area: Experiences from the Middle Mountains of Nepal'. In *Mountain Research and Development*, 9(4): 353-364
- Gurung, J.D. (1994) *Indigenous Knowledge Systems and Biodiversity Management*, Proceedings of a MacArthur Foundation, ICIMOD Seminar, April 13-14. Kathmandu: ICIMOD
- Gutierrez, J. (2004) *Notes on the Seismic Adequacy of Vernacular Buildings*. 13th World Conference on Earthquake Engineering, Vancouver, B.C., Canada, August 1-6, 2004. Available at www.curee.org/architecture/docs/13WCEE-GUTIERREZ-5011.pdf
- Hageback, J.; Sundberg, J.; Ostwald, M.; Chen, D.; Yun, X.; Knutsson, P. (2005) 'Climate Variability and Land-Use Change in Danangou Watershed, China. Examples of Small-Scale Farmers' Adaptation'. In *Climatic Change*, 72: 189-212
- Hall, N.; Davis, I. (1999) *The Perception of Risk at Local Levels, and Ways to Measure Community Vulnerability*. London: Benfield Grieg Hazard Research Centre, University College London (UCL)

- Haque, C.H. (1988) 'Human Adjustments to River Bank Erosion Hazard in the Jamuna Floodplain, Bangladesh'. In *Human Ecology*, 16(4): 421-437
- Haque, C.H.; Hossain, Md. Z. (1988) 'Riverbank Erosion in Bangladesh'. In *Geographical Review*, 78(1): 20-31
- Haque, C.E.; Zaman, M.Q. (1993) 'Human Responses to Riverine Hazards in Bangladesh: A Proposal for Sustainable Floodplain Development'. In *World Development*, 21(1): 93-107
- Heijmans, A. (2001) '*Vulnerability: A Matter of Perception*'. London: Benfield Greig Hazard Research Centre, University College, London
- Henry, D. (2005) 'Anthropological Contributions to the Study of Disasters'. In McEntire D.; Blanchard W. (eds) *Disciplines, Disasters and Emergency Management: the Convergence and Divergence of Concepts, Issues and Trends from the Research Literature*. Emmitsburg: Federal Emergency Management Agency. Available at <http://training.fema.gov/emiweb/edu/ddemtextbook.asp>
- Hewitt, K. (ed) (1983) *Interpretations of Calamity from the Viewpoint of Human Ecology, The Risks and Hazards Series: 1*. New York: Allen and Unwin
- Howell, P. (2003) *Indigenous Early Warning Indicators of Cyclones: Potential Application in Coastal Bangladesh*. London: Benfield Hazard Research Centre, UCL
- Hughes, R.E. (1984) 'Yasin Valley: The Analysis of Geomorphology and Building Types'. In Miller, K.J. (ed) *The International Karakoram Project*. Volume 2, Proceedings of the International Conference, pp 253-88. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Hughes, R. (2000) *Cator and Cribbage Construction of Northern Pakistan*. Paper presented at the UNESCO-ICOMOS International Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18, 2000. Available at <http://www.icomos.org/iwcc>
- Hussein, K.; Nelson, J. (1998) *Sustainable Livelihoods and Livelihood Diversification*, Working Paper 69. Sussex: University of Sussex, Institute for Development Studies (IDS)
- Hutton, D.; Haque, C.E. (2003) 'Patterns of Coping and Adaptation among Erosion-Induced Displaces in Bangladesh: Implications for Hazards Analysis and Mitigation'. In *Natural Hazards*, 29: 405-421
- Hutton, D.; Haque, C.E. (2004) 'Human Vulnerability, Dislocation and Resettlement: Adaptation Processes of River-bank Erosion-induced Displaces in Bangladesh'. In *Disasters*, 28(1): 41-62
- ICIMOD (2007) *Sharing Knowledge on Disaster Risk Reduction in the Himalayan Region. Conclusions from Two Workshops on Planning Processes, Social Inclusion, and Local Knowledge for Disaster Preparedness - Leaflet*. Kathmandu: ICIMOD. Available at: www.disasterpreparedness.icimod.org
- ICSU and UNESCO (2002) *Science, Traditional Knowledge and Sustainable Development*. ICSU Series on Science for Sustainable Development 4. Paris: International Council for Science (ICSU) and United Nations Educational, Scientific and Cultural Organisation (UNESCO)

- IFRC (2004) *World Disaster Report. Focus on Community Resilience*. Geneva: Jonathan Walter International Federation of Red Cross and Red Crescent Societies
- Illi, D. (1984) 'The Vulnerability to Fire Risk of Some Building Types and Traditional Settlements with Reference to the Fire which Destroyed "Gayal-Kot" in July 1981'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 2, Proceedings of the International Conference, pp 343-50. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- ILO (2002) *Coping Strategies and Early Warning Systems of Tribal People in India in the Face of Natural Disasters*. New Delhi: International Labour Office
- ISDR (2004) *Living with Risk. A Global Review of Disaster Reduction Initiatives*. Geneva: Inter-Agency Secretariat of the International Strategy for Disaster Reduction (ISDR)
- ISDR (2005) *Invest to Prevent Disaster*. Geneva: United Nations and Inter-Agency Secretariat of the International Strategy for Disaster Reduction (ISDR). Available at http://www.unisdr.org/eng/public_aware/world_camp/2005/events/Micro-insurance-Viewpoint.pdf
- Israr-ud-Din (1984) 'House Types and Structures in Chitral District'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 1, Proceedings of the International Conference, pp 265-89. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Iturrizaga, L. (1997) 'The Valley of Shimshal. A Geographical Portrait of a Remote High Mountain Settlement and Its Pastures with Reference to Environmental Habitat Conditions in the North-West Karakoram (Pakistan)'. In *GeoJournal*, 42(2-3): 303-328
- Iturrizaga, L. (2005) 'New Observations on Present and Prehistorical Glacier-dammed Lakes in the Shimshal Valley (Karakoram Mountains)'. In *Journal of Asian Earth Sciences*, 25: 545-555
- Jaarsma, M.; Bos, H.; Vijfhuizen, C.; Ganhane, A. (2001) *The Credibility of an Ant. Flood Forecasting, Hydrological Models, Credibility and Communication in Mozambique*. Paper presented at the 2nd Water Research Fund of Southern Africa (WARFSA) / WaterNet Symposium on Integrated Water Resource Management: Theory, Practice, Cases, Cape Town, 30-31 October
- Jha, H.; Jha, S.; Karmacharya, B. (2000) *Flood Control Measures. Best Practices Report. An Approach for Community Based Flood Control Measures in the Terai Rivers*. Kathmandu: German Technical Cooperation (GTZ) Food for Work Project
- Jigyasu, R. (2000) *From 'Natural' to 'Cultural' Disaster. Consequences of Post-Earthquake Rehabilitation Process on Cultural Heritage in Marathwada Region, India*. Paper presented at the UNESCO-ICOMOS international Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18, 2000. Available at <http://www.icomos.org/iawc>
- Jigyasu, R. (2002) *Reducing Disaster Vulnerability through Local Knowledge and Capacity. The Case of Earthquake Prone Rural Communities in India and Nepal*. Unpublished PhD thesis, Department of Town and Regional Planning, Faculty of Architecture and Fine Art, Norwegian University of Science and Technology, Trondheim, Norway
- Jodha, N.S. (1975) 'Effectiveness of Farmers' Adjustments to Risk'. In *Economic and Political Weekly*, 13(25): 38-48

- Jodha, N.S. (1988) 'Reviving the Social System-Ecosystem Links in the Himalayas'. In Berkes F.; Folke C.; Colding J. (eds) *Linking Social and Ecological Systems. Management Practices and Social Mechanisms for Building Resilience*, pp. 285-310. U.K.: Cambridge University Press
- Jodha, N.S. (2001) 'Global Change and Environmental Risks in Mountain Ecosystems'. In Kasperson, J.; Kasperson R. (eds) *Global Environmental Risk*, pp 306-342. London: Earthscan Publications
- Jodha, N.S. (2005) 'Adaptation Strategies against Growing Environmental and Social Vulnerabilities in Mountain Areas'. In *Himalayan Journal of Sciences*, 3(5): 33-42
- Johnson, K.; Olson, E.A.; Manandhar, S. (1982) 'Environmental Knowledge and Response to Natural Hazards in Mountainous Nepal'. In *Mountain Research and Development*, 2(2): 175-188
- Kanani, P.R. (1999) 'Everything is Written in the Sky!: Participatory Meteorological Assessment and Prediction Based on Traditional Beliefs and Indicators in Saurashtra'. In *Eubios Journal of Asian and International Bioethics*, 9: 170-6
- Kanani, P.R. (2001) *Validation of Traditional Meteorological Principles in Saurashtra, India*, Dantiwada (India): Department of Extension Education, Gujarat Agricultural University. Available at <http://ma.caudillweb.com/documents/bridging/papers/kanani.pr.pdf>
- Kasperson, J.; Kasperson, R. (eds) (2001) *Global Environmental Risk*. London: Earthscan Publications
- Kates, R.W. (1971) 'Natural Hazard in Human Ecological Perspective: Hypothesis and Models'. In *Economic Geography*, 47(3): 438-451
- Khan, M.M.I. (1991) 'The Impact of Local Elites on Disaster Preparedness Planning: The Location of Flood Shelters in Northern Bangladesh'. In *Disasters*, 15(4): 340-354
- Kirschenbaum, A. (2004) 'Generic Sources of Disaster Communities: A Social Network Approach'. In *International Journal of Sociology and Social Policy*, 24(10/11):94-129
- Krupnik, I.; Jolly, D. (eds) (2002) *The Earth is Faster Now. Indigenous Observations of Arctic Environmental Change*. Fairbanks (AK): Arctic Research Consortium of the United States
- Langenbach, R. (2000) *Intuition from the Past: What we can Learn from Traditional Construction in Seismic Areas*. Paper presented at the UNESCO-ICOMOS international Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18 2000. Available at <http://www.icomos.org/iwc>
- Langenbach, R. (2000) 'Traditional Buildings and Earthquakes'. In *Yapi*, 228: 100
- Langill, S. (1999) *Indigenous Knowledge. A Resource Kit for Sustainable Development Researchers in Dryland Africa*, People, Land and Water Programme Initiative. Ottawa: IDRC. Available at: <http://idinfo.idrc.ca/archive/corpdocs/114518/ikkit.pdf>
- Lansing, J. S. (1987) 'Balinese "Water Temples" and the Management of Irrigation'. In *American Anthropologist*, 98(2): 326-341
- Lansing, J. S. (1991) *Priests and Programmers. Technologies of Power in the Engineered Landscape of Bali*. U.S.A.: Princeton University Press
- Lansing, J.S.; Singer, A. (1988) *The Goddess and the Computer*. Video Cassette. Massachusetts: DER Documentary

- Linkenback-Fuchs, A. (2002) *Cultural Strategies for Risk Adjustments in Mountains*. Paper presented at the Asia High Summit 2002, May 6-10. Kathmandu, Nepal
- Luintel, Y.R.; Amatya, K.K.; Gauchan, B. (2001) *Indigenous Knowledge on Disaster Mitigation: Towards Creating Complementarity between People's and Scientists' Expertise* (NEP/99/O14). Kathmandu: Participatory Disaster Management Programme, UNDP
- Lovell, C.; Mandondo, A.; Moriarty, P. (2002) 'The Question of Scale in Integrated Natural Resource Management'. In *Conservation Ecology*, 5(2): 25
- Mann, C.C. (2006) *1491: New Revelations of the Americas before Columbus*. New York: Vintage Press
- Maskrey, A. (1989) *Disaster Mitigation: A Community Based Approach*, Development Guidelines, 3. Oxford: Oxfam
- Materer, S; Valdivia, C.; Gilles, J. (2001) *Indigenous Knowledge Systems: Characteristics and Importance to Climatic Uncertainty*, Working Paper AEW 2001-3. Colombia (USA): Department of Agricultural Economics, University of Missouri. Available at <http://dass.missouri.edu/agecon/research/workingpapers/index.php>
- Matin, N.; Taher, M. (2000) *Disaster Mitigation in Bangladesh: Country Case Study of NGO Activities*. Report for the research project 'NGO Natural Disaster Mitigation and Preparedness Projects: An Assessment and Way Forward'. London: British Red Cross Society and Department for International Development.
- Matsushita, T. (1999) *Messages for the 21st Century. Sabo Works and Its Achievements*. Tokyo: Sabo Publisher Centre
- McAdoo, B.; Dengler, L.; Eeri, M.; Prasetya, G.; Titov, V. (2006) 'Smong: How Oral History Saved Thousands on Indonesia's Simeyleue Island during the December 2004 and March 2005 Tsunamis. In *Earthquake Spectra*, 22(S3): S661-S669
- McSweeney, K. (2002) 'Two Years after Hurricane "Mix": Indigenous Response in the Rain Forest of Eastern Honduras'. In *FOCUS on Geography*, 46(4):15-21
- McSweeney, K. (2005) 'Natural Insurance, Forest Access, and Compounded Misfortune: Forest Resources in Smallholder Coping Strategies Before and After Hurricane Mitch, Northeastern Honduras'. In *World Development*, 33(9): 1453-1471
- Mercer, J. (no date) *Reducing Vulnerability in South Pacific Small Island Developing States: The Indigenous or Modern Way?* Coventry: Coventry Centre for Disaster Management, Coventry University
- Messer, N.M. (2001) *Household Livelihood Strategies and Local Institutions. Mapping Traditional Structures in Decentralisation Policies: Illustrations from Three Countries in Sub-saharan Africa and the Near-East*, Working Paper 12, Rural Development Division. Rome: United Nations Food and Agriculture Organization
- Messer, N.M. (2003) *The Role of Local Institutions and their Interaction in Disaster Risk Mitigation: a Literature Review*. Rome: Food and Agriculture Organization and SDAR
- Messerschmidt, D.A. (1990) 'Indigenous Environmental Management and Adaptation: An Introduction to Four Case Studies from Nepal'. In *Mountain Research and Development*, 10(1): 3-4
- Mehta, M. (2007) *Gender Matters: Lessons for Disaster Risk Reduction in South Asia*. Kathmandu: ICIMOD

- Miller, K.J. (1982) *The International Karakoram Project*, Volumes 1&2, Proceedings of the International Conference. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Miral, M.S.; Kumar, K.; Dumka, R.K. (2003) 'Traditional Construction Practices in the Seismically Active Areas of Uttaranchal'. In ENVIS Bulletin: Himalayan Ecology, 11(1): 35-37
- Mishra, A.S. (1998) 'Traditional Knowledge and Management of Natural Resources'. In Saraswati, B. (ed) *The Cultural Dimension of Ecology*. Electronic version available at http://ignca.nic.in/cd_07.htm
- Mitchell, B. (2002) 'Local Knowledge Systems'. In *Resource and Environmental Management*, 1st Ed (1997), pp 210-243. Singapore: Prentice Hall
- Moench, M.; Dixit, A. (2004) *Adaptive Capacity and Livelihood Resilience. Adaptive Strategies for Responding to Floods and Droughts in South Asia*. Boulder and Kathmandu: The Institute for Social and Environmental Transition International
- Mosse, D. (2000) *People's Knowledge, Participation and Patronage: Operations and Representations in Rural Development*. Paper presented at the ASA 2000 Conference on Indigenous Knowledge and Development. Available at <http://www.asa2000.anthropology.ac.uk/mosse/mosse.html>
- Moughtin, C. (1982) 'Barkuti in the Yasin Valley: A Study of Traditional Settlement Form as a Response to Environmental Hazard'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 2, Proceedings of the International Conference, pp 307-322. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Muller-Boker, U. (1991) 'Knowledge and Evaluation of the Environment in Traditional Societies of Nepal'. In *Mountain Research and Development*, 11(2): 101-114
- Murray, C. (2001) *Livelihood Research: Some Conceptual and Methodological Issues*, Background Paper 5. Manchester, Department of Sociology, Chronic Poverty Research Centre, University of Manchester. Available at http://www.omrn.ca/eng_conferencesworkshops.html
- Myer, L. (1998) 'Biodiversity Conservation and Indigenous Knowledge: Rethinking the Role of Anthropology'. In *Indigenous Knowledge and Development Monitor*, 6(1) 13-15
- Nakashima, D.; Roue, M. (2002) 'Indigenous Knowledge, Peoples, and Sustainable Practice'. In Munn, T. (ed) *Encyclopedia of Global Environmental Change*. Chichester: John Wiley & Sons
- Nash, D.F.T.; Spence, R.J. (1984) 'Experimental Studies of the Effect of Earthquakes on Small Adobe and Masonry Buildings'. In Miller, K.J. (ed) *The International Karakoram Project*, Volume 1, Proceedings of the International Conference, pp. 245-52. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Nasreen, M. (2004) 'Disaster Research: Exploring Sociological Approach to Disaster in Bangladesh'. In *Bangladesh e-Journal of Sociology*, 1(2): 21-28. Available at <http://www.bangladeshsociology.org>
- NCDM and Oxfam-Nepal (2007) *Nepal Disaster Management Policy*, unpublished report. Kathmandu: Nepal Centre for Disaster Management (NCDM) and Oxfam-Nepal

- Nepal Centre for Disaster Management (NCDM) and Oxfam-Nepal (2007) *Disaster Management Policy*. Final Draft submitted to the Government of Nepal, Ministry of Home Affairs and National Planning Commission
- Newton, J.; Paci, J.C.D., Ogden, A. (2005) 'Climate Change and Natural Hazards in Northern Canada: Integrating Indigenous Knowledge with Government Policy'. In *Mitigation and Adaptation Strategies for Global Change*, 10: 541-71
- Nonaka, I. (1991) 'The Knowledge Creating Company'. In *Harvard Business Review*, 69: 96-104
- O'Brien, K.; Leichenko, R.; Kelkar, U.; Venema, H.; Aandahl, G.; Tompkins, H.; Javed, A.; Bhadwal, S.; Barg, S.; Nygaard, L.; West, J. (2004) 'Mapping Vulnerability to Multiple Stressors: Climate Change and Globalisation in India.' In *Global Environmental Change*, 14: 303-313
- Oliver-Smith, A. (1973) *Aid, Popular Participation, and Social Change in Post-Disaster Yungay*. Paper presented at the 72d Annual Meeting of the American Anthropologist Association, New Orleans, LA
- Oliver-Smith, A. (1977a) 'Traditional Agriculture, Central Places, and Post-Disaster Urban Relocation in Peru'. In *American Ethnologist*, 4:102-16
- Oliver-Smith, A. (1977b) 'Disaster Rehabilitation and Social Change in Yungay, Peru'. In *Human Organization*, 36: 5-13
- Oliver-Smith, A. (1996) 'Anthropological Research on Hazards and Disasters'. In *Annual Review of Anthropology*, 25: 303-328
- Ostrom, E. (1992) *Crafting Institutions for Self-governing Irrigation Systems*. San Francisco: Institute for Contemporary Studies
- Orlove, B.S.; Chiang, J.C.H.; Cane, M.A. (2000) 'Forecasting Andean Rainfall and Crop Yield from the Influence of El Niño on Pleiades Visibility'. In *Nature*, 403: 68-71
- Parker, E.; Dawson, H. (no date) *Resilience in Island Knowledge*. Coventry: Coventry Centre for Disaster Management (CCDM), Coventry University
- Parker, D.J.; Handmer, J.W. (1998) 'The Role of Unofficial Flood Warning Systems'. In *Journal of Contingencies and Crisis Management*, 6(1): 45-60
- Paton, D.; Johnston, D. (2001) 'Disasters and Communities: Vulnerability, Resilience, and Preparedness'. In *Disaster Prevention and Management*, 10(4): 270-277
- Paul, B.K. (1984) 'Perception of Agricultural Adjustments to Floods in Jamuna Floodplain, Bangladesh'. In *Human Ecology*, 12(1): 3-19
- Paul, B.K. (1997) 'Flood Research in Bangladesh in Retrospect and Prospect: A Review'. In *Geoforum*, 28(2): 121-131
- Paul, B.K.; Rasid, H. (1993) 'Flood Damage to Rice Crop in Bangladesh'. In *Geographical Review*, 83(2): 150-159
- Pelling, M (1998) 'Participation, Social Capital, and Vulnerability to Urban Flooding in Guyana'. In *Journal of International Development*, 10: 469-86
- Pelling, M. (1999) 'The Political Ecology of Flood Hazard in Urban Guyana'. In *Geoforum*, 30: 249-61

- Perez, F.Y.L. (2005) *Tsunami. Survival Tactics of Indigenous People*. Available at <http://academic.evergreen.edu/g/grossmaz/LEEPERFY/>
- Platteau, J-P. (2000) *Community Imperfection*. Paper prepared for the Annual Bank Conference on Development Economics, Paris
- Pokharel, J.R. (2006) *Proposed Early Warning System for Earthquake in Nepal Using a Snake Yard*. Unpublished paper
- Pomeroy, R.S.; Ratner, B.D.; Hall, S.J.; Pimoljinda, J.; Vivekanandan, V. (2006) 'Coping with Disaster: Rehabilitating Coastal Livelihoods and Communities'. In *Marine Policy*, 30: 786-793
- Pradhan, R. (2000) *Seismicity and Traditional Buildings of Kathmandu Valley, Nepal*. Paper presented at the UNESCO-ICOMOS International Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18, 2000. Available at <http://www.icomos.org/iwc>
- Pratt, C. (2002) *Traditional Early Warning Systems and Coping Strategies for Drought among Pastoralist Communities. Northeastern Province, Kenya*, Working Paper No. 8. Medford (MA, USA): Feinstein International Famine Centre, Fletcher School of Law and Diplomacy, Tufts University
- ProVention Consortium (2007) *Community and Civil Society Perspectives, Local Knowledge and Coping Strategies*. Workshop 4 Concept Note for ProVention Consortium Forum 2007, 'Making Disaster Risk Reduction Work: Building Saver Communities in Africa and Worldwide', Dar Es Salaam, February 13-15. Available at <http://www.proventionconsortium.org/>
- Quarantelli, E.L. (ed) (1978) *Disasters: Theory and Research*. London and Beverly Hills: Sage
- Raffestin, C. (1980) *Pour une Géographie du Pouvoir*. Paris: LITEC
- Ramakrishnan, P.S. (2001) *Ecology and Sustainable Development*. Delhi: National Book Trust
- Ranjitkar, R.K. (2000) *Seismic Strengthening of the Nepalese Pagoda: Progress Report*. Paper presented at the UNESCO-ICOMOS International Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18, 2000. Available at <http://www.icomos.org/iwc>
- Rasid, H. (1993) 'Preventing Flooding or Regulating Flood Levels?: Case Studies on Perception of Flood Alleviation in Bangladesh'. In *Natural Hazards*, 8: 39-57
- Rasid, H.; Mallik, A. (1995) 'Flood Adaptations in Bangladesh. Is the Compartmentalization Scheme Compatible with Indigenous Adjustments of Rice Cropping to Flood Regimes?' In *Applied Geography*, 15(1): 3-17
- Rasid, H.; Paul, B.K. (1987) 'Flood Problems in Bangladesh: Is There an Indigenous Solution?' In *Environmental Management*, 11(2): 155-173
- Rautela, P. (2005) 'Indigenous Technical Knowledge Inputs for Effective Disaster Management in the Fragile Himalayan Ecosystem'. In *Disaster Prevention and Management*, 14(2): 233-241
- Rengalakshmi, R. (no date) *Linking Traditional and Scientific Knowledge Systems on Climate Prediction and Utilization*. Chennai: M.S. Swaminathan Research Foundation

- Rhoades, R.S.; Thompson, S.I. (1975) 'Adaptive Strategies in Alpine Environments: Beyond Ecological Particularism'. In *American Ethnologist*, 2(3): 535-557
- Rojas Blanco, A.V. (2006) 'Local Initiatives and Adaptation to Climate Change'. In *Disasters*, 30(1): 140-147
- Roncoli, C.; Ingram, K.; Kirshen, P.; Jost, C. (2001) 'Burkina Faso: Integrating Indigenous and Scientific Rainfall Forecasting'. In *IK Notes* 39. Published by African Region's Knowledge and Learning Centre
- Roncoli, C.; Ingram, K.; Kirshen, P. (2002) 'Reading the Rains: Local Knowledge and Rainfall Forecasting in Burkina Faso'. In *Society and Natural Resources*, 15: 409-427
- Rural Volunteers Centre (no date) *Early Warning System: Break Drop of the Studies*. Assam (India): RVC. Available at http://dhemaji.nic.in/flood/early_warning_system.htm
- Saarinen, T.F. (1969) *Perception of the Drought Hazard on the Great Plains*. Chicago: University of Chicago Press
- Salas, M.; Jianchu, X.; Tillmann, T. (2003) *Participatory Technology Development. Linking Indigenous Knowledge and Biodiversity for Sustainable Livelihoods*. Kunming (China): Yunnan Science and Technology Press
- Salazaar, A. (2000) *The Crisis and Modernity of Housing Disasters in Developing Countries: Participatory Housing and Technology after the Marathwada (1993) Earthquake*. Paper presented at the UNESCO-ICOMOS International Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18, 2000. Available at <http://www.icomos.org/iwc>
- Saxena, K.G.; Maikhuri, R.K.; Rao, K.S. (2005) 'Changes in Agricultural Biodiversity: Implications for Sustainable Livelihoods in the Himalaya'. In *Journal of Mountain Science*, 2(1): 23-31
- Schilderman, T. (2004) 'Adapting Traditional Shelter for Disaster Mitigation and Reconstruction: Experiences with Community-based Approaches'. In *Building Research and Information*, 32(5): 414-426
- Schware, R. (1982) 'Official and Folk Flood Warning Systems: An Assessment'. In *Environmental Management*, 6(3): 209-216
- Schware, R. (1984) 'Flood Information Systems: Needs and Improvements in Eastern India'. In *Environmental Management*, 8(1): 55-66
- Schipper, E.L.F. (2006) *Climate Risk, Perceptions and Development in El Salvador*, Working Paper 93. Norwich: Tyndall Centre for Climate Change Research
- Schumacher, E.F. (1973) *Small is Beautiful: Economics as if People Mattered*. New York: Harper & Row Publishers
- Schmuck-Widmann, H. (2001) *Facing the Jamuna River. Indigenous and Engineering Knowledge in Bangladesh*. Dhaka: Bangladesh Resource Centre for Indigenous Knowledge (BARCIK)
- Scott, C.A.; Walter, M.F. (1993) 'Local Knowledge and Conventional Soil Science Approaches to Erosional Processes in the Shivalik Himalaya'. In *Mountain Research and Development*, 13(1): 61-72
- Seit, S. (1998) 'Coping Strategies in an Ethnic Minority Group: The Aeta of Mount Pinatubo'. In *Disasters*, 22(1): 76-90

- Sen, A. (1981) *Poverty and Famines: An Essay on Entitlement and Deprivation*. Oxford: Oxford University Press
- Shakya, N. M. (2000) *Temples and Buildings Standing over Kathmandu Valley which are Vulnerable to Earthquakes*. Paper presented at the UNESCO-ICOMOS International Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18, 2000. Available at <http://www.icomos.org/iawc>
- Sharma Paudel, G.; Thapa, G.B. (2001) 'Changing Farmers' Land Management Practices in the Hills of Nepal'. In *Environmental Management*, 28(6): 789-803
- Shaw, R. (1989) 'Living with Floods in Bangladesh'. In *Anthropology Today*, 5(1): 11-13
- Shrestha, B.K. (2000) *Building a Disaster Resistant Community in Kathmandu: A Community-based Approach*. Paper presented at the UNESCO-ICOMOS International Conference on the Seismic Performance of Traditional Buildings, Istanbul, Turkey, November 16-18, 2000. Available at <http://www.icomos.org/iawc>
- Shrestha, B.K. (2002) *Cultural Practices as Facilitator and Barrier to Economic Development in the Mountain Communities*. Paper presented at the Asia High Summit 2002, May 6-10, ICIMOD, Kathmandu
- Sinclair, J.; Ham, L. (2000) 'Household Adaptive Strategies: Shaping Livelihood Security in the Western Himalaya'. In *Canadian Journal of Development Studies*, 11 (1): 89-112
- Smith, A. (2003) *Background to the Story of Tikopia. An Essay Prepared for the BBC*. January 5. Available at http://www.kevinfbates.com/current_affairs/bishop_adrian.htm
- Sogani, R. (no date) *Regaining Self Reliance from Using Traditional Knowledge. Work of Community Action Centre in Kumaon Region*. Available at http://www.aidsfbay.org/events/2005/reetu/Food_Security_and_Traditional_Knowledge.html
- Spence, R.J.S.; Coburn, A.W. (1984) 'Traditional Housing in Seismic Areas'. In Miller, K.J. (ed) *The International Karakoram Project, Volume 1, Proceedings of the International Conference*, pp 253-64. Islamabad and Cambridge: Quaid-i-Azam University and Cambridge University Press
- Srinivasan, A. (2004) *Local Knowledge for Facilitating Adaptation to Climate Change in Asia and the Pacific: Policy Implication*. IGES-CP Working Paper (2004-002). Tokyo: Institute for Global Environmental Strategies
- Stephens, C.; Patnaik, R.; Lewin, S. (1994) *This Is My Beautiful Home. Risk Perceptions towards Flooding and Environment in Low Income Urban Communities: A Case Study in Indore, India*. Research Report. London: London School of Hygiene and Tropical Medicine
- Stiger, C.J.; Dawei, Z.; Onyewotu, L.O.Z.; Xurong, M. (2005) 'Using Traditional Methods and Indigenous Technologies for Coping with Climate Variability'. In *Climatic Change*, 70: 255-271
- Sudmeier-Rieux, K.; Masundire, H.; Rizvi, A.; Rietbergen, S. (eds) (2006) *Ecosystems, Livelihoods and Disasters. An Integrated Approach to Disaster Risk Management, Ecosystem Management Series No 4*. Gland and Cambridge: IUCN, CEM, CARE, IWMI
- Suparamaniam, N.; Dekker, S. (2003) 'Paradoxes of Power: The Separation of Knowledge and Authority in International Disaster Relief Work'. In *Disaster Prevention and Management*, 12(4): 312-318

- Swift, J.; Baas, S. (1999) *Pastoral Institutions and Approaches to Risk Management and Poverty Alleviation in Central Asian Countries in Transition*. Rome: Sustainable Development Department, Food and Agriculture Organization of the United Nations. Available at <http://www.fao.org/sd/ROdirect/ROan0018.htm>
- Thapa, R. (2005) *Impacts of Flood Hazard and Coping Strategies: A Case Study of Jagatpur Village Development Committee in Chitwan District, Nepal*. Unpublished Master's Thesis in Mountain Ecology and Human Adaptations, Department of Geography, University of Bergen, Norway
- Thomalla, F.; Schmuck, H. (2004) 'We all Knew that a Cyclone was Coming: Disaster Preparedness and the Cyclone of 1999 in Orissa, India'. In *Disasters*, 28(4): 373-87
- Thrupp, L.A. (1989) 'Legitimizing Local Knowledge: From Displacement to Empowerment for Third World People'. In *Agriculture and Human Values*, 6(3): 13-24
- Torry, W.I. (1979) 'Anthropological Studies in Hazardous Environment: Past Trends and New Horizons'. In *Current Anthropology*, 20(3): 517-540
- Trosper, R.L. (2003) 'Resilience in Pre-contact Pacific Northwest Social Ecological Systems'. In *Conservation Ecology*, 7(3): 6. Available at <http://www.consecol.org/vol7/iss3/art6>
- Twigg, J. (1998) 'Understanding Vulnerability. An Introduction'. In Twigg, J.; Bhatt, M.R. (eds) *Understanding Vulnerability: South Asian Perspectives*, pp 1-11. London: Intermediate Technology Publications
- Twigg, J. (2001) *Sustainable Livelihoods and Vulnerability to Disasters*, Working Paper 2/2001. London: Benfield Greig Hazard Research Centre for the Disaster Mitigation Institute
- Twigg, J. (2004) 'Disaster Risk Reduction: Mitigation and Preparedness in Development and Emergency Programming'. In *Good Practice Review*, 9. Published by Humanitarian Practice Network, Overseas Development Institute (ODI), London, UK
- Twigg, J. (2006) *Technology, Post-Disaster Housing Reconstruction and Livelihood Security*, Disaster Studies Working Paper 15. London: Benfield Hazard Research Centre, UCL
- Twigg, J.; Benson, C.; Myers, M. (2000) *NGO Initiatives in Risk Reduction: A Summary of Research Studies*. London: British Red Cross Society
- UNDP (no date) *When Disaster Strikes: The Story of Samiyarpettai*. Delhi: United Nations Development Programme-India in partnership with Government of India and Government of Tamil Nadu. Handmade Cinema Production
- UNEP (2004) *Meeting of Coordinators of the Project on Capacity-Building through Partnership and Information and Communication Technology for Using Indigenous Knowledge for Nature Conservation and Natural Disaster Management in Africa*. Meeting report, Nairobi, Kenya, 3-4 November, 2004
- UNESCO (no date) *Documentation and Application of Indigenous Knowledge in Charan (Tangail), Bangladesh*, Field Project. Available at http://portal.unesco.org/sc_nat/ev.php?URL_ID=4574&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1118678097
- UNESCO (2005) 'The Knowledge that Saved the Sea Gypsies'. In *A World of Science*, 3 (2): 20 (Paris: UNESCO)

- UNESCO-ICOMOS (2006) *Risk Preparedness, Heritage at Risk, Bibliography*. Paris: United Nations Educational, Scientific and Cultural Organization and International Council on Monuments and Sites, Documentation Centre
- UNFCCC Website: *Database on Local Coping Strategies*. United Nations Framework Convention on Climate Change. Available at <http://maindb.unfccc.int/public/adaptation/>
- UN/ISDR (2004) *Living with Risk: A Global Review of Disaster Reduction Initiatives*. Geneva: United Nations Inter-Agency Secretariat of the International Strategy for Disaster Reduction (UN/ISDR). Available at http://www.unisdr.org/eng/about_isdr/basic_docs/LwR2004/ch1_Section1.pdf
- Usapdin, T.P., Soemantri, A.; Agustin, V. (2005) *The Story that Saved the Lives of the People of Simeuleu, Indonesia*. Geneva: International Federation of Red Cross and Red Crescent Societies (IFCR). Available at <http://www.ifrc.org/docs/News/05/05121901/index.asp> and at <http://www.reliefweb.int>
- Valdivia, C.; Gilles J.L. (no date) *Climate Variability and Household Welfare in the Andes: Farmer Adaptation and Use of Weather Forecasts in Decision-Making, May 2001-May 2002*. Interim Progress Report Submitted to NOAA's Human Dimensions of Global Change Research (HDGCR) Programme. Available at http://www.climate.noaa.gov/cpo_pa/sarp/1999_valdivia_final.pdf
- Van Aalst, M.; Burton, I. (2002) *The Last Straw. Integrating Natural Disaster Mitigation with Environmental Management (with Examples from Dominica, the Dominican Republic and St. Lucia)*, Working Paper Series No. 5. Washington DC: World Bank
- Villagran de Leon, J.C.; Bogardi, J.; Dannenmann, S.; Basher, R. (2006) 'Early Warning Systems in the Context of Disaster Risk Management'. In *Entwicklung & Landlicher Raum*, 2: 23-25. Available at http://www.unisdr.org/ppew/info-resources/docs/ELR_dt_23-25.pdf
- Visser, R. (2006) *About the Discourse on Knowledge. Note for ICIMOD*. Unpublished paper prepared for ICIMOD, Kathmandu
- Waddell, E. (1974) 'Frost over Niugini: A Retrospect on Bungled Relief'. In *New Guinea*, 8(4):39-49
- Watts, M.J. (1983) *Silent Violence: Food, Famine and Peasantry in Northern Nigeria*. Berkeley: University of California Press
- White, G.F. (ed) (1974) *Natural Hazards: Local, National, Global*. Oxford: Oxford University Press
- White, G.F.; Kates, R.W.; Burton, I. (2001) 'Knowing Better and Losing Even More: The Use of Knowledge in Hazards Management'. In *Environmental Hazards*, 3: 81-92
- Williams (2002) *Deforesting the Earth: From Prehistory to Global Crisis*. Chicago: University of Chicago Press
- Wisner, B. (1998) *World Views, Belief Systems, and Disasters: Implication for Preparedness, Mitigation and Recovery*. Paper Prepared for a Panel on World Views and Belief Systems at the 23rd Annual Natural Hazards Research and Applications Workshop, Boulder, Colorado, 12-15 July 1998
- Wisner, B.; Luce, H.R. (1993) 'Disaster Vulnerability: Scale, Power and Daily Life'. In *GeoJournal*, 30(2): 127-140

- Wood, G. (1999) 'Contesting Water in Bangladesh: Knowledge, Rights and Governance'. In *Journal of International Development*, 11: 731-754
- Woodley, E. (1991) 'Indigenous Ecological Knowledge Systems and Development'. In *Agricultural and Human Values*, Winter-Spring: 173-178
- Yongong, L.; Baas, S.; Hongxing, N.; Jinbiao, W. (2001) *Strengthening Pastoral Institutions in North-West China Pastoral Area to Access Improved Extension Services for Risk Management and Poverty Alleviation*. Beijing: FAO/Ministry of Agriculture/Centre for Integrated Agricultural Development
- Young, O.R. (2000) *Institutional Interplay: The Environmental Consequences of Cross-Scale Interactions*. Conference Paper Presented at Constituting the Commons: Crafting Sustainable Commons in the New Millennium, the Eighth Conference of the International Association for the Study of Common Property, Bloomington, Indiana, USA, May 31-June 4. Available at <http://dlc.dlib.indiana.edu/archive/00000384>
- Zaman, M.Q. (1989) 'The Social and Political Context of Adjustment to Riverbank Erosion Hazard and Population Resettlement in Bangladesh'. In *Human Organization*, 48(3): 196-205
- Zaman, M.Q. (1991) 'Social Structure and Process in Char Land Settlement in the Brahmaputra-Jamuna Floodplain'. In *Man*, 26(4): 673-690
- Zaman, M.Q.; Wiest, R.E. (1991) 'Riverbank Erosion and Population Resettlement in Bangladesh'. In *Practical Anthropology*, 13(3): 29-33
- Zaman, M.Q. (1993) 'Rivers of Life: Living with Floods in Bangladesh'. In *Asian Survey*, 33(10): 985-996
- Zurick, D.N. (1990) 'Traditional Knowledge and Conservation as a Basis for Development in a West Nepal Village'. In *Mountain Research and Development*, 10(1): 23-33

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