

NEPAL – Belhi, Deuri, Katarait, Malangawa, Pipariya,  
Phoolparasi, Shreepur, Singyahi, and Sundarpur



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**The Snake and the River Don't Run Straight:**  
Local knowledge on disaster preparedness  
in the Eastern Terai of Nepal

**Bibliographical reference:** Denkens, Julie. *The Snake and the River Don't Run Straight: Local knowledge on disaster preparedness in the Eastern Terai of Nepal*. ICIMOD, Kathmandu, Nepal (2007)

Click-on reference to the **ReliefWeb country file for Nepal:**

<http://www.reliefweb.int/rw/dbc.nsf/doc104?OpenForm&rc=3&cc=npl>

**Note:**

A Guidance Note has been developed for this case study. It contains an abstract, analyzes the main findings of the study, provides contextual and strategic notes and highlights the main lessons learned from the case. The guidance note has been developed by Stephanie Bouris in close collaboration with the author(s) of the case study and the organization(s) involved.

# The Snake and the River Don't Run Straight

Local Knowledge on Disaster Preparedness  
in the Eastern Terai of Nepal

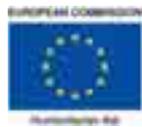


# About the Organisations

## 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.

# **The Snake and the River Don't Run Straight**

Local Knowledge on Disaster Preparedness in the Eastern Terai of Nepal

**Julie Dekens**

International Centre for Integrated Mountain Development (ICIMOD)  
Kathmandu, Nepal  
April 2007

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**Published by**

International Centre for Integrated Mountain Development  
G.P.O. Box 3226, Kathmandu, Nepal

**ISBN 978 92 9115 027 4**

**Photos** All photos Julie Dekens

Front cover: Katarait VDC, Dhanusha District

Page 2: Phoolparasi, Sarlahi District

Page 12: Recording local songs, Piparyia VDC, Sarlahi District – *Shreelal Pokharel*

Page 20: Embankment, Shreepur VDC, Sarlahi District

Page 64: Decorated walls of a house in Katarait VDC, Dhanusha District

Back cover: Man crossing the river, Deuri VDC, Dhanusha District

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**Printed and bound in Nepal by**

Hill Side Press (P) Ltd.

Kathmandu

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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, the International Centre for Integrated Mountain Development (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](http://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

# Preface

## Meanderings

“The snake and the river don’t run straight.”  
Local saying related to the Lakhandehi River,  
Belhi village, Sarlahi District

It is the rice-harvesting season. Mountains of straw are piling up in front of the houses and near the river beds. On the flat horizon, the sun is low and looks like a red ball ready to burn the congested settlements and the surrounding fields of rice, wheat, sugarcane, pulses, and vegetables. For the outsider, everything looks peaceful. The houses and the environment appear strongly intertwined, with settlements built using mud, straw, bamboo, and wood. Each section of a village is a microcosm of the whole based on different caste and social systems, mainly Hindu – but that, you only realise later. Socioeconomic disparities can be seen in the different types of houses. Most women have decorated their mud houses with a natural terracotta colour for Deepawali or Tihar, the major Hindu festival in the Terai region. The outside walls are covered with drawings using natural white and red colours or sculpted relief of human hands, cattle and crops, and elephants. These decorations represent, like other indigenous art, the interconnection between humans, farming activities, and the sacred.

Traditional farming is the major source of livelihood here. In many places, men and women are thrashing paddy by beating it manually, by using oxen, or by passing it through a rudimentary turbine. Elsewhere men are busy using oxen on the road to transport straw and grain, and in the fields to plough the land. Soon, wheat will be planted. Only a few villagers have tractors, so oxen are crucial to support human labour. Buffaloes, cows, and goats are also omnipresent and provide households with sources of additional food, income, fertiliser, and fuel. In front of the houses and along the road, women are preparing fuel from a mixture of cow dung, straw, and water. It is then piled up to dry beneath the sun. Children are resting on top of buffaloes as they take them to graze along the roads and by the river bed.

Settlements here are never too far away from rivers – or shall we rather say, the rivers here never let the settlements be too far away from them? They are, to name a few, the Bagmati and the Bakaiya rivers in Rautahat District, the Lakhandehi River in Sarlahi District, the Ratu River in Mahottari District, and the Jalaidh and Jamuni rivers in Dhanusha District. All flow from the Himalayas to form the northern edge of the vast Gangetic plain of North India. Access to the villages often involves crossing wide, river channels, some old, some new, on sandy roads and passing in front of large natural

ponds. Around the settlements, some of the agricultural fields are white from sandy sediments deposited by the last floods. The river took another path again this year. Women remember stories of past floods: *“Once I cut a snake while I was collecting grass for my cattle after a flood.”* And elsewhere: *“Three years ago, a girl from the village died from snakebite during the flood. No dry place*

*was available so we had to cremate her inside a building, which is against our traditions.”* Here, the meanderings of the river and the snake are often intertwined, and people find themselves in the middle.

Julie Dekens

# Acknowledgements

This study is part of a 15-month project (April 2006 – June 2007) entitled, *Living with risk – sharing knowledge on disaster preparedness in the Himalayan region*, supported by the European Commission through its Humanitarian Aid Department (DIPECHO).

I am grateful to all those who guided the project through its various phases: the project manager Mats Eriksson; the network officer Vijay Khadgi; the steering committee members at ICIMOD: Madhav Karki, Jianchu Xu, Michael Kollmair, Zbigniew Mikolajuk and Beatrice Murray; as well as the programme officers at ECHO Indira Kulenovic and Jyoti Sharma in New Delhi, and Béatrice Miège in Brussels.

**Rapid Assessment Team:** The team members during the field trip were Julie Dekens (ICIMOD), a social scientist with a background in community-based resource management, and Pradeep Singh, a local translator.

**Local Partners:** This study was made possible with the help and collaboration of many people including: the villagers of Belhi, Deuri, Katarait, Malangawa, Pipariya, Phoolparasi,

Shreepur, Singyahi, and Sundarpur; the collaboration of the Action Aid Nepal Team, especially, Manoj Kumar Sah (Disaster Management Committee Chairman, Laxmipur Sukhchaina VDC), implementing partner of PRERANA through Action Aid Bharati Jha (Social Mobiliser in Laxmipur VDC), and Arun Kumar Yadav (Social Mobiliser in Phulparasi VDC); and not least with the help of CARE-NEPAL through its DIPECHO-SAMADHAN project especially, DIPECHO SAMADHAN's local implementing partners, Christina Chan (DIPECHO Manager) and Rita Dhakal (Project Manager). The project staff from the VDCs helped us in the field: Dinesh Baral (District Coordinator in Sarlahi District), Saroj Ghimire (District Coordinator in Dhanusha District), Bir Bahadur Singh (Local Resource Person of Singyahi VDC, Mahottari District), Shreelal Pokharel (Field Officer in Sarlahi District), and Dhanilal Yadav (Local Resource Person of Andupatti Katarait VDC, Dhanusha District).

**Reviewers:** The author owes grateful thanks for their useful comments to Christina Chan (DIPECHO Manager, CARE-Nepal), Peter Crawford (DIPECHO Project Manager, Practical Action), Jim Gardner (Professor Emeritus, Natural Resources Institute, University of Manitoba), Megh Ranjani Rai (ACT/DCA Project

Coordinator for DIPECHO Community Preparedness for Disaster Risk Reduction in Central and Eastern Nepal), Mats Eriksson (Senior Water Specialist, ICIMOD), Vijay Khadgi (Project Network Officer, ICIMOD), Michael Kollmair (Programme Manager and Senior Social Scientist, ICIMOD), Fang Jing (Eco-health specialist, ICIMOD), and Narpat S. Jodha (Senior Associate Scientist, ICIMOD).

**Editors and production team:** I am grateful to the editors and layout persons for their dedicated work to get this publication finalised, Greta Rana, Beatrice Murray, Dharma Ratna Maharjan and Asha Kaji Thaku.

# 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 Risk = Hazards x 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)

Note: The term 'VDC' used in the description of place names is short for 'village development committee', the local level administrative unit in Nepal. In general, a VDC comprises a number of villages.



Part 1

# Introduction



# Did You Know?

In the Terai region of Nepal, the flat lands of Nepal on the border with India, floods are a regular phenomenon. Flash floods and riverine floods mainly affect domestic property and agricultural fields. Over the years, local people, especially elders and other critical actors (e.g., 'innovative farmers') have accumulated everyday knowledge and specialist knowledge about the floods through daily observation and practical experience of their surroundings. Local stories and anecdotes related to floods abound and reveal how people live and interpret their landscape over time. Their accounts provide many interpretations of the history and nature of past floods. For example, people distinguish between normal and exceptional floods and have been witnessing changes in the rivers' morphology. Life stories reveal the influence of different caste systems, mainly Hindu, on people's ability to adjust to floods. These stories highlight how in many cases floods contribute to making the poor poorer while the rich are more likely to profit.

When heavy and continuous rains start in the village or higher up in the mountains, people know that these are warning signals of an impending flood and this alerts them to the danger. Before

the floods come, they notice changes in the colour, smell, and sound (due to the speed) of the water and floating wood and dead animals. Depending on their household characteristics (e.g., socioeconomic status, capacity to rely on relatives outside, number of vulnerable members, such as a sick or elderly person or pregnant women), some family members may leave the house in advance, or as soon as the water starts to overflow, and go to safe places in the village, to friends, or to relatives outside the village. Villagers use high places such as elevated private houses or courtyards, elevated common grounds, and safe public buildings to escape from floods; and they take their cattle with them. Depending upon their economic status, households who stay in the village during the floods start storing food and firewood one to three months before the rainy season.

Some households have learned over time to adjust to recurrent floods; and often the richest households who have more land manage to turn change into opportunity. The poorest, on the other hand, manage to adapt somehow but may become embedded in a poverty spiral because of their lack of assets and options. People's coping strategies include combining different materials

for construction, elevating house foundations, and consolidating the walls of their houses with mud, bamboo fences, and/or vegetation. Local indigenous structures such as grain stores, multipurpose platforms, and circular mud repositories enable people to store food and keep other important belongings in elevated places. In some cases, drinking water pumps are elevated, embankments are built with local materials to protect the village from floods, and small boats are made to prevent the villagers from being completely isolated from the outside during floods. Other non-structural measures include seasonal and permanent migration, drying and collecting food and firewood in advance for food security, changing land-management strategies, adopting soil conservation methods along the river bed, adopting informal rules for grazing and firewood cutting, and relying on dispersed

landholdings. Finally, learning from past mistakes also enables people to prepare for future floods.

Local people communicate about past natural disasters from one generation to another and from place to place, mainly orally, using local stories, songs, and proverbs. Songs and proverbs related to floods help people to remember past events and play a key role in building community awareness (especially for the younger generation who may not have witnessed exceptional floods). Unfortunately, local singers are leaving in search of well-paying jobs outside the village and as a result of the growing use of radio and, in some cases, television. Thus the oral tradition is weakening, and new ways need to be found to capture and transmit the folk memory.

## Chapter 1

# Background

**T**he general purpose of this report is to secure the interest of implementing organisations (governments, and non-government organisations) in, and improve their understanding of, local knowledge, practices, and contexts identified in relation to disaster preparedness so that they can be used in disaster management activities. The case study described here was carried out with the aim of identifying and documenting local knowledge and practices related to disaster preparedness in various villages prone to natural hazards, and developing and testing an analytical framework on local knowledge about disaster preparedness (Figure 1). The goal of the analytical framework is to lay out the key themes and show how the themes are related to, and influence, each other.

### Who should read this report?

In theory, since the 1980s, implementing organisations have begun to acknowledge the existence of local knowledge and practices related to disaster preparedness. However, in practice, many implementing organisations (1) do not have a primary understanding of the value of local knowledge for the success

and sustainability of their projects; and (2) do not have a clear idea of what local knowledge related to disaster preparedness really means and/or how to identify and collect information related to it. This discrepancy between theory and practice is based on biases and constraints existing at all levels (donor, project/organisational, community, household) that result in local knowledge and practices being overlooked. It is beyond the scope of this publication to describe them all in detail. Suffice it to say here, for example, that too often a teaching bias prevails even within community-based organisations whereby communication is restricted to a one-way process (i.e., an external organisation is teaching ‘a community’) instead of a two-way process. One of the reasons for this ‘teaching bias’ is the confusion between education and knowledge: illiteracy does not imply lack of knowledge. Communities can learn from outsiders, but simultaneously, outsiders can also learn from local people. Another reason for the teaching bias is that local knowledge still lacks legitimacy as far as outsiders are concerned, mainly because of their own lack of knowledge, mistaken assumptions, and power relations (knowledge is power!). More importantly, the lack of legitimacy attributed to

## Local knowledge on disaster preparedness is based on the following

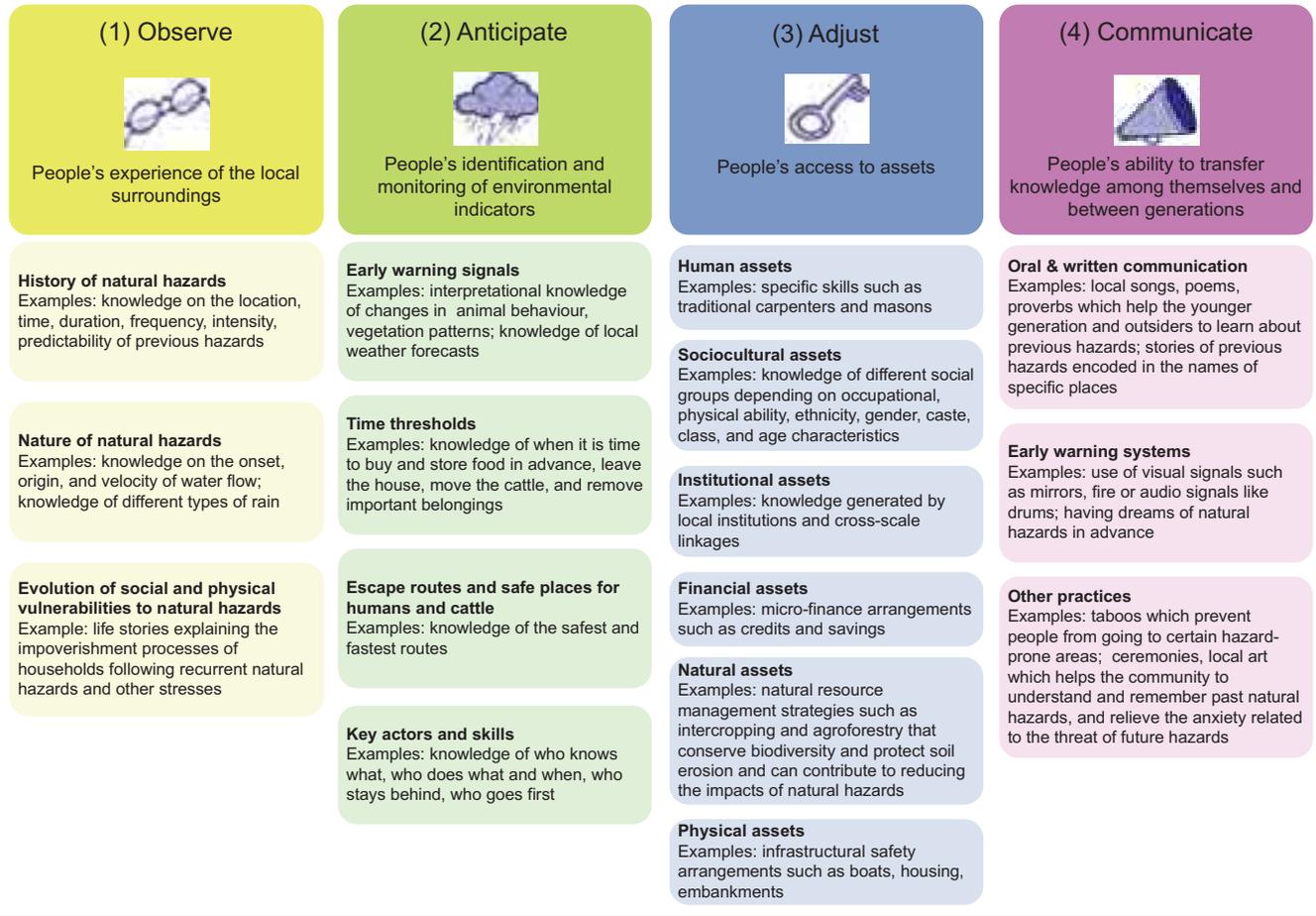


Figure 1: The four pillars of local knowledge on disaster preparedness

local and indigenous knowledge is as much a problem from within as it is from without: communities themselves need to be convinced (maybe by governments and non-government organisations) that they have knowledge and that some of it can be useful.

## Why you should read this report

This case study can help practitioners to build confidence by providing methodological guidance on how to integrate local knowledge into disaster preparedness activities. The underlying assumption behind this case study is that improving understanding of local communities will help both national and international organisations empower the communities served and hence improve their disaster preparedness. 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. It can help to improve project performance in general; that is, project acceptance, ownership, and sustainability. Understanding, accounting for, and respecting local knowledge can contribute to cost-effectiveness in the long-term, from both a financial and a social point of view. Firstly, economies of scale are based on the assumption that people do different things better on different scales. Understanding local knowledge and practices can facilitate identification of what can be promoted at local level. Building upon local knowledge and practices, when it

is relevant to do so, can decrease dependency on external aid. Secondly, and from a social point of view, taking local knowledge and practices into account can help promote mutual trust, acceptability, common understanding, and the community's sense of ownership and self-confidence. Specifically, understanding local knowledge, practices, and contexts can help development and research organisations to tailor their project activities and communication strategies to needs of local partners (or 'beneficiaries' as they are often termed). It also enables development and research organisations to act as intermediary organisations that are able to translate messages from government level to communities in a way that is understandable and credible. For instance, 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? (Other key questions are: do the locals trust this source of information? are the locals even able to receive the information? do all segments of society – women, poor, and marginalised groups – receive the information?). Government agencies often release information that is not understood at local level. Disaster preparedness communication tools, such as official warning messages or hazard maps, need to incorporate local references. How can you do so unless you understand and you have identified local knowledge, practices, and contexts; unless you are accounting for them in your project activities; and unless you respect this knowledge?

## How this report was compiled

Primary data were collected over a period of six days in the Eastern Terai of Nepal, in the districts of Dhanusa, Mahottari, Rautahat, and Sarlahi (see Figure 2) between November and December 2006. Semi-structured interviews and group discussions, especially with elders and women, were held in nine villages. The villages were selected in collaboration with CARE-Nepal and local partners through the CARE DIPECHO SAMADHAN project and following discussions with other key informants in the field. Key criteria for selection of villages included communities that (a) are affected by frequent floods (at least once per generation) to enable the study of community responses to hazards, (b) have been settled in their current geographic location for at least 50-100 years to enable the study of traditional coping strategies (underlying assumption: new settlements have had less time to build up coping strategies); and (c) have had little or no exposure to external intervention to enable the study of local responses and innovation (underlying assumption: communities tend to become dependent on external help and are losing their local coping mechanisms).

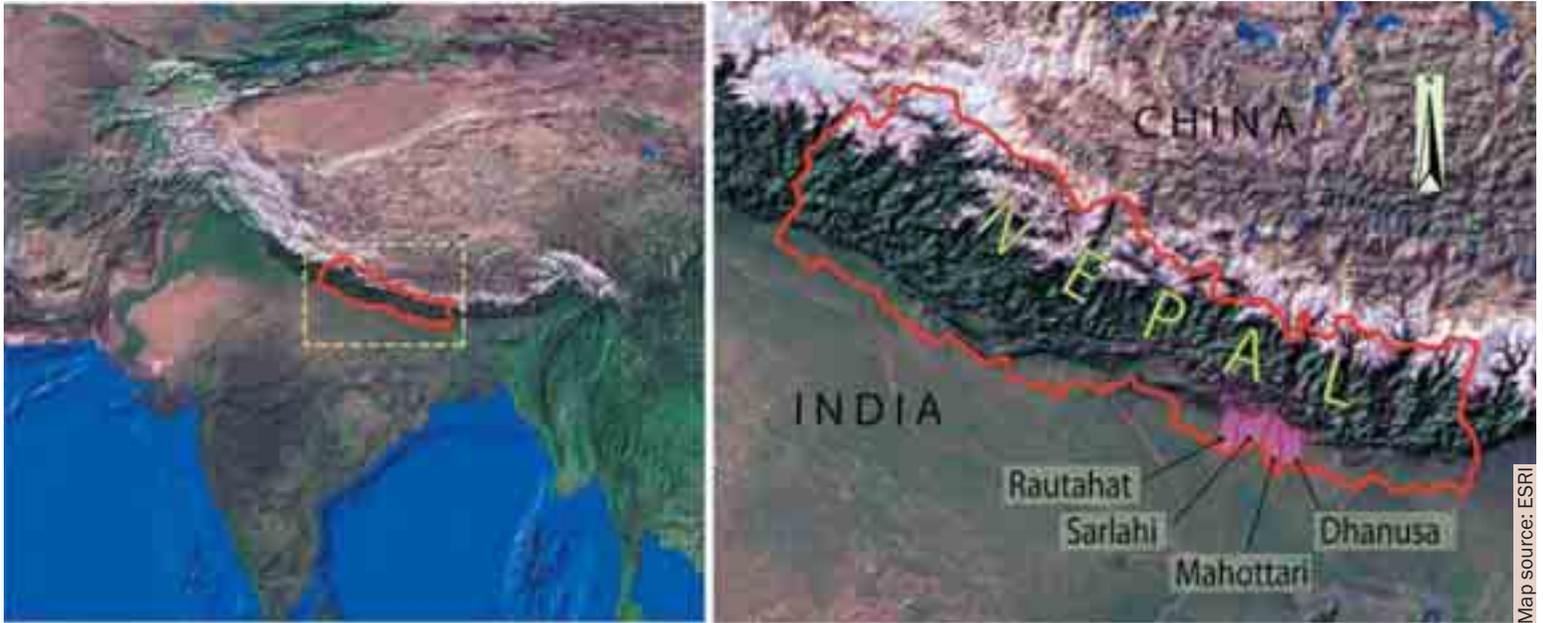
Interviews focused on both community and household strategies, from those of rich landowners to those of the poorest of the poor. Questions focused on preparedness for the rainy season in general, and for the flood season in particular. Qualitative data collected from the interviews with the villagers and other key informants were complemented by direct

observation and transect walks in and around the villages. Although fire is one of the main hazards during the summer season, and especially in the poorest wards due to congested houses and storing of straw, it was not investigated here due to time constraints. The information collected in this report was validated through a half-day feedback and discussion session with CARE-Nepal and DIPECHO SAMADHAN project staff.

## How to use this report

The report is in four parts: this introduction followed by the methods, the findings of the case study and a conclusion. The methods section explains the four major steps one has to follow in order to collect and analyse data on **local knowledge related to disaster preparedness**. These four steps can be used as a checklist by implementing organisations.

The third part of the report, the case study itself, provides implementing organisations with a concrete example of what local knowledge on disaster preparedness is and how it can be documented. The case study is based on people's anecdotes and stories. The report uses citations to give local people a voice. Additional comments are given to put people's voices into context and to reflect their contradictions, repetitions, and complexity. Examples of key questions that implementing organisations should use to improve their understanding and to integrate local knowledge into their disaster preparedness projects are also provided (Box – 'Did you ask?').



**Figure 2: This report is based on studies undertaken in the Rautahat, Sarlahi, Mahottari, and Dhanusha districts at the foot of the Himalayas in Nepal**

The lessons learned from the study are discussed in the concluding section, which also provides a summary of the key findings in tabular form and a bibliography.

The case study itself by definition is not and cannot be complete (i.e., integrating all aspects of local knowledge related to disaster preparedness). The topic is complex and each case is context specific. However, as mentioned already, the case study is organised around an analytical framework that can be used anywhere (Figure 1: the four pillars of local knowledge on disaster preparedness). Most importantly, this case study can help implementing organisations to use and develop the analytical framework to their own requirements. Understanding the process of data collection and the type of information collected in this report is even more important than the outcomes per se, as it helps similar exercises documenting local knowledge to be carried out in other contexts. As such, the intention is that this should be a **learning** case study: it is designed to raise questions and stimulate practitioners to find their own answers (Hussain-Kaliq 2004). The report can be most useful in the project development and implementation stages, especially during analysis of local contexts (e.g., socioeconomic surveys), and during the design of project activities.

What is **not** covered in this report? This report does not cover how to use the information collected – that is how to use local knowledge related to disaster preparedness and how to integrate it into your own activities (e.g., street drama, school curriculum). The present case study aims only to facilitate understanding about 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, cannot and should not be ignored. Local knowledge and practices always need to be taken into account.** However, and importantly, it does not mean that all local knowledge and practices are appropriate or sustainable. Therefore, the next important step – which is not part of this case study – includes: assessing which local knowledge and practices you can support within your timeframe; for whom and for which objectives; how to integrate it into your activities; how it can be combined with other knowledge on disaster preparedness; and within which context local knowledge and practices can help to improve your disaster preparedness activities (i.e., contextualising local practices and disasters and providing policy recommendations).

Part 2

# Key Steps in Data Collection and Analysis



## Chapter 2

# Collecting Data

**C**ollecting information on local knowledge related to disaster preparedness involves four major steps: (1) understanding the nature of local knowledge; (2) understanding how local knowledge is being (or not being) produced, used, transmitted, and adapted; (3) understanding the four pillars of local knowledge on disaster preparedness; and (4) understanding the wider context, that is the linkages between local knowledge, disaster management, sustainable livelihoods, and poverty reduction.

### Step 1: Understanding the nature of local knowledge

*“Local knowledge refers here to knowledge generated through observation and experience of the local environment by a specific group of people.”* (Berkes 1999)

What people know is influenced by, and influences, what people do and do not do, and what people believe in. To understand local knowledge one has to understand and account for people’s

various ways of knowing as much as people’s practices and beliefs. In this report, we use the term ‘local knowledge’ in the broadest sense to include each dimension: knowledge types, practices, and beliefs (Berkes 1999) because these dimensions are closely interrelated. As such, the nature of local knowledge tends to be more holistic than other forms of knowledge in the sense that it is highly embedded in people’s livelihoods. ‘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).

**Firstly, with respect to knowledge types** – Local knowledge is often associated with local technical knowledge probably because it is the most visible/concrete aspect of local knowledge. Technical local knowledge includes, for instance, local methods of construction, use and combination of specific local materials for houses, retaining walls, terraces, and so on. Additionally, many other types of local knowledge exist (e.g., ecological, social, and historical knowledge). For instance, local ecological knowledge provides local methods such as agroforestry and polyculture which can contribute

to conservation of ecological diversity. Local non-technical knowledge is often not easily identifiable by outsiders because it is closely embedded in people's livelihoods and worldviews. Local knowledge is scattered and institutionally dispersed: it is located at the individual/household level as well as collectively through community stewards and other key social actors (e.g., shamans, elders). One can also make a distinction between everyday knowledge about the environment and specialist knowledge retained by a few individuals or local experts. Local knowledge also tends to derive more from memory, intuition, and the senses than from the intellect. Finally, another distinction can be made between experiential knowledge (i.e., knowledge gained through experience) and transmitted knowledge (i.e., knowledge gained through transmission from stories, poems, songs, and religious practices, for example). Obviously local knowledge is always a mixture of the two. However, transmitted knowledge does not meet with the same problems of legitimacy in the community as experiential knowledge (personal communication, James Gardner).

**Secondly, with respect to local practices, institutions, and skills** – In the literature, local practices are also referred to as 'risk-spreading strategies', 'preventive measures', 'adaptation strategies', 'coping strategies', 'adjustment strategies', 'safety nets', and so on. 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 (i.e., natural, sociocultural, economic, political) at what time and under what circumstances. At the local level, various types of institutions exist. For instance, institutions can be classified in terms of social, religious, political, judicial, and economic institutions (Appiah-Opoku and Hyma 1999) or in terms of familial, communal, social, and collective institutions (Bingen 2001). Examples of local institutions are: the family, the household, marriage, the caste system, kinship exchange networks, traditional rural reciprocity networks, schools, and so on. Institutions shape every aspect of a livelihood system<sup>1</sup> 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, 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, trends) that people face. Ostrom (1992) identifies several reasons why institutions matter. First, "institutions shape the patterns of human interactions and the results that individuals achieve" through monitoring, sanctioning, and conflict resolution mechanisms for instance (Ostrom 1992). Second, institutions can increase and/or decrease the benefits from a fixed set of inputs. Third, "institutions shape human behaviour through their impact on incentives" (Ostrom 1992). Incentives are rules,

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<sup>1</sup> A livelihood system refers to a combination of modes of livelihood at one time - e.g., farming, migrant labour, and informal activities (Murray 2001).

norms, values that control material, energy, and information flows, and therefore livelihood decisions and strategies.

Local practices and institutions encompass various dimensions. Practices may be different from one level to another. For instance, some local disaster preparedness practices may only be found at the household level while others may only be found at the community/village level. Further, practices may be different from one social group to another. For instance, Sinclair and Ham (2000) documented adaptive strategies related to household livelihoods in the Western Himalayas and concluded that, “not all strategies are viable for each group within the village. Some strategies may be village-wide, while others are specific to socioeconomic status, age, or caste, or any mixture of variables. [...] This picture of complexity is deepened when it is recognised that some strategies are only viable when others are in place.”

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. Finally, 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.

**Thirdly, with respect to local belief systems** – Local belief systems are understood here as the combination of people’s

beliefs (e.g., sociocultural, religious belief systems), worldviews (i.e., ways of perceiving the world), values/moral principles (e.g., respect, reciprocity, sharing, humility), and ethics. Belief systems shape people’s understanding, perceptions, and response to natural hazards. Understanding local beliefs, perceptions, and values is crucial therefore because it gives one 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. In other words, understanding the process is more important than understanding the outcome per se. For instance, the perceived fatalism of the rural poor in the Himalayas in accepting natural hazards as the ‘will of God’ cannot be understood simply as equivalent to the western connotation of fatalism, which is associated with passivity and apathy. As Hutton and Haque (2003) put it, “the perceived powerlessness among the poor reflects not resignation and passivity but a realistic perception of their position vis-à-vis dominant resource relationships”.

As such what is perceived as fatalism is part of a sociocultural and psychological coping response for people who lack individual choice and power. At the same time not all beliefs are sustainable or relevant. Some values have led to massive environmental degradation and the collapse of entire societies (Diamond 2005).

## Step 2: Understanding the processes surrounding local knowledge

All three dimensions of local knowledge (knowledge types, practices, and beliefs) are interrelated and influence one another constantly. Local knowledge and knowledge in general emerges from a dynamic process of knowledge creation, use, management, and transmission. In fact, local knowledge is disappearing and being created all the time (Berkes 1999). Before trying to build upon local knowledge and practices, one needs to understand the processes involved. How is local knowledge disappearing and being created? How is local knowledge used in a specific context and by whom? How is local knowledge being transmitted within the community and between generations and who is transmitting it? How is local knowledge managed at the household and community levels? What are the key local institutions that influence knowledge management? Who has access to local knowledge, how, and under which 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). For the purpose of this report, two important points need to be highlighted. First, the internalisation of practices means that, “local people often have difficulties identifying specific practices or institutions as specifically oriented toward coping with hazards, even though those same practices do play a role in reducing risk. This makes sense given that most of these practices have been developed over centuries of trial and error. Also, some of the very practices that do reduce risk can be remarkably oppressive in other ways. In some cases [...], for example, the need to create social obligations outside of the community (that can protect households in the event of disaster) leave little options for women when it comes to choosing a marriage partner. They have virtually no voice in the matter, but their enforced silence helps to ensure the security of their natal household (and the household they are married into)” (personal communication, Ken MacDonald).

Sometimes, prior experience of a natural hazard is forgotten because the event does not happen frequently enough for people to remember and internalise it. The combination of local knowledge with external knowledge is not new. Communities totally isolated from outside influence are rare. Local knowledge is not isolated: it has always been connected to other places and other types of knowledge.

## Step 3: Understanding the four pillars of local knowledge on disaster preparedness

The framework in Figure 1 can be employed to identify the four pillars of local knowledge on disaster preparedness. It can be used as a checklist of the key characteristics to identify and take into consideration during project planning and implementation. Local knowledge on disaster preparedness relates to four major dimensions of knowledge: observation, anticipation, adjustment, and communication.

**Firstly, with respect to observation** – Local knowledge on disaster preparedness relates to people’s observations of natural hazards through their daily experiences of their local surroundings.

**Secondly, with respect to anticipation** – Local knowledge on disaster preparedness also relates to people’s anticipation of natural hazards through identifying and monitoring local indicators such as early warning and environmental signs of imminent hazards as well as time thresholds, escape routes and safe places for humans and cattle, and key skills, actors, and the roles they play within the community.

**Thirdly, with respect to adjustments** – Local knowledge on disaster preparedness also relates to people’s adjustment strategies through trial and error. It includes aspects of how people cope, adapt, experiment, and innovate in the face of natural hazards and how they learn from previous hazards they have faced. Their capacity to adjust is based on their access to assets (or people’s strengths, or capital endowments including human, sociocultural, institutional, financial, economic, political, physical, and natural aspects) which – as mentioned previously – is mediated by local institutions and influenced by external institutions and global factors and trends. Importantly, not all adjustment strategies are sustainable in the long term.

**Fourthly, with respect to communication** – Local knowledge on disaster preparedness also relates to the communication strategies about natural hazards among community members and between generations. Here communication refers to the sharing of information related to past and imminent natural hazards. In traditional rural communities, knowledge is usually transferred orally, but not exclusively so. Understanding local knowledge on disaster preparedness therefore requires us to pay attention to informal education and internal learning processes.

## Step 4: Understanding the wider context: the relationship of local knowledge, disaster preparedness, and livelihoods to poverty reduction

Local knowledge is influenced by the type, frequency, and intensity of past and present natural hazards, as well as by other shocks and global trends and factors – for instance, the impacts of climate change, globalisation, road construction, and national policies on natural resources. Indeed, in many cases, natural hazards, although constituting an important stress, are not the major stressor faced by communities. From a local knowledge perspective, as suggested by Battista and Baas (2004), it is more interesting to, *“look at shocks that are recurrent and chronic and that contribute to gradually increasing the vulnerability of the community instead of exceptional natural events which require emergency operations from outside”*.

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, more generally, 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 issues of sustainable livelihoods and poverty reduction. Ultimately, improving implementing agencies’ understanding of the linkages between local knowledge and disaster preparedness can help implementing organisations to promote livelihood security and build resilient communities. Local knowledge can be used as a key entry point for this.

The four steps outlined above can be used as a checklist to verify that you have incorporated the key aspects of local knowledge on disaster preparedness into your project. The next part of the report presents the information collected in Nepal on local knowledge related to flood preparedness. The case study is organised according to the framework in Figure 1. Chapter 3 focuses on local knowledge related to the observation and experience of floods. Chapter 4 focuses on local knowledge related to the anticipation of floods. Chapters 5 and 6 focus on technical and non-structural adaptation strategies. Finally, Chapter 7 focuses on how local people communicate and share information about past and imminent hazards.

Part 3

# The Case Study



## Chapter 3

# Observing and Experiencing Floods

**L**ocal knowledge on disaster preparedness in the eastern Terai of Nepal includes aspects related to people's observation and experience of floods, anticipation of floods, technical adaptation strategies, non-technical adaptation strategies, and communication strategies.

Based on daily observation of their local surroundings, close ties to their environment for survival, and an accumulated understanding of their environment through generations, local people have knowledge about the history and nature of floods in their own locality. People can also describe and explain how their own vulnerability to floods has changed over time.

## History of floods in people's localities

*"Eighty families used to live here, but they had to be resettled twice due to major floods about 20 and 3 years ago. Forty-three years ago, the village school used to be right here in the current river bed. At that time, the river was not here. It was a*

*cultivated area. We never thought the river could go this way. The flood happened at night around 11-12 pm and lasted for 6-7 days. The water reached the settlement. For 8-9 days we could not eat because grain stores and livestock were washed away. Nobody died but lots of fields could not be cultivated anymore. After that, we made an embankment and the floods stopped for about 20 years. Recently, a new stream came and then disappeared again."* (Kishun Devi Yadav, around 70 years' old, Katarait VDC, Dhanusha District)

Such stories about the history and nature of past floods abound in the eastern Terai of Nepal. They are a testimony to people's experience of floods based on historical observations of their own place which, in some cases, enables a speedy appreciation of the situation and flood forecasts. The eastern Terai of Nepal has a tropical monsoon climate characterised by hot, wet summers and mild, dry winters resulting in wide seasonal variations in terms of water discharged. Most of the rainfall is concentrated during the months from June to August. Any continuous and heavy rainfall during the monsoon season



**Figure 3: Girl showing the level of the previous flood, Pipariya VDC, Sarlahi District**

can provoke inundation in the already saturated soil. Similarly, heavy rainfall higher up in the mountains can trigger a flash flood or a riverine flood downstream. Loss of life due to floods is low, but physical damage to agricultural land and domestic property is high with important consequences for people's livelihoods, because people mainly depend on farming. Historically, it should be mentioned that,

*"Before malaria eradication in 1956, almost all the river valleys, including those of the Dun or Inner Terai, where the threat of floods is high, were prone to malaria. People used to*

*shuttle between mountain ridges during the summer monsoon season and lowland areas during winter in order to avoid malaria. This also helped to avoid or reduce the impact of flood hazards. After the eradication of malaria, investment in the development of human settlements, other infrastructure, and agriculture in the lowland areas has increased tremendously and exposed [the area] to flood hazards."* (Khanal et al. 2007)

## **Nature of floods in people's localities**

### **Normal and exceptional floods**

*"The water started to come slowly so we had time to leave."* (Ram Ekbal Yadav, 2003 flood in Jhauwa Tole, Bhaisarawa VDC, Rautahat District)

*"No flood stays for more than one day here."* (Byagiya Devi, 70, Singyahi VDC, Mahottari District)

*"If we have one to three days of rain, the water stays for more than 20-30 days. If it rains just one day, it takes one week for the water to go."* (Jeevan Roy, Deuri VDC, Dhanusha District)

*"During the rainy season, the water can stay for one week then go away and then come back again."* (Bhuli Devi Sahani, Laxmipur, Sukchaina)

*"A normal flood is when we get water up to the knees."* (Ram Ekbal, 52, Pipariya VDC, Sarlahi District)

The Snake and the River Don't Run Straight

## Change in river paths and river size

*“Before, the stream was further away but it came closer and closer to my house.”* (Laxmi Suri, 60 years old, Singyahi VDC, Mahottari District)

*“Every year the water takes another path!”* (Deuri VDC, Dhanusha District)

*“The river was not here before. It took a new path 15 years ago. Two years ago it took a new path again. The river has kept on changing its stream for the last 50 years!”* (Ramkailash Roy, Shreepur VDC, Sarlahi District)

*“We cannot trust the river because it can change its course within two hours.”* (Ram Prasad, VDC President, Phoolparasi VDC, Sarlahi District)

*“The current riverbed used to be fields 13 years ago. Rice, pulses, and wheat were cultivated here. In 1993 a major flood partially damaged the fields and two years ago they were completely damaged. Since the 1993 flood, the water has started to enter the village.”*

*“Before, the course of the stream was straight.”* (Gropi Shah, Piparyia VDC, Sarlahi District)

*“Twenty years ago you could jump across the river in one step!”* (Gropi Shah, Pipariya VDC, Sarlahi District)

*“The river used to be narrower and deeper and it was not a problem for us 15 years ago.”* (Ram Prasad, Phoolparasi VDC, Sarlahi District)

### Part 3 – The Case Study

## Comments on nature of floods

People have been living with floods and have learned to survive. Flooding has become part of their lives, as it generally happens every year. They know the nature of floods; they know they can happen during the day or night; and they know that flooding often comes in waves. They often remember the water levels of previous floods. They know that the nature of rain as well as the number and the spatial and temporal location of rainy days influence floods. The level of floods varies from village to village and place to place within the village itself, depending upon the number of continuous rainy days before and during a flood event, the local topography, and infrastructure. Water generally stays for a period of from one day to one month. People can easily draw a boundary between normal yearly flooding and exceptional floods that are more destructive and that happen at greater intervals than normal ones.

Local communities are closely related to – and dependent upon – their local environment for survival. Over the years, they have accumulated knowledge about the morphological changes that have occurred in their surroundings. Their stories provide many elements for landscape interpretation based on daily observation and life experiences. As such, many anecdotes relate to the constant expansion of the river bed due to heavy sediment loads, constant rise in bed level, riverbank cutting, and frequent channel shifting. As suggested by the title of this report, the shape of the river can be compared to the movement

of a snake. The water channels are very unstable, taking new directions and changing the landscape on a regular basis. This active landscape makes the environment very unpredictable. The behaviour of the rivers described here is fairly common in the pro-Himalayan plains and piedmont area, especially in the eastern Himalayas. The Brahmaputra River provides us with a very good example with fairly frequent flood discharges from rain in the mountains, middle mountains, and sub-hill areas; local inundation and water-logging due to localised heavy rain; and shifting channels and lots of sediment (generally fine sands) that are deposited, eroded, and re-deposited by succeeding floods. Two different ‘flood’ processes are happening in the region. One process is channel overflow and the other is surface water-logging from heavy rain. People’s stories reveal that both these processes are taking place. Often the latter is more damaging because the water stays around longer than in the case of the former. The former, of course, causes more physical damage because of erosion and sedimentation and re-arrangement of the land surface.

## Evolution of vulnerability to floods

### Social and gender vulnerabilities

*“Wherever they are found, members of the various occupational castes and the fewer higher castes form a socially and economically interdependent group. In the Terai, as elsewhere in strongly Hindu districts, high and low caste is closely correlated with, but not identical to, wealth and poverty*

*levels. Many of the high-caste people are wealthy landowners in need of the services of people of occupational (lower) and other castes. In return, the occupational castes are tied to their respective roles because the income from the meagre land holdings of those who have land is not enough to maintain the family.”* (Bista 2004, p134)

People are not equal in their capacity to respond to floods. In other words, floods do not impact everybody in the same way – and this is particularly true for the Terai region of Nepal. Compared to the rest of the country, most communities in the Terai are more conservative and the Hindu caste system influences people’s socioeconomic relationships more strongly. In the study area, the few high-caste persons in the village were mostly landowners and moneylenders. Poorer, lower-caste people are therefore often dependent on the higher castes for survival because of their lack of access to assets. Important differences exist in social vulnerabilities between wealthier and poorer people and (high and low castes) and among different age groups. Small children and elders are the most vulnerable groups during floods because they may not be physically fit enough for rapid and urgent movement. Gender vulnerability is also more pronounced in the studied districts as women in the Maithali culture, which predominated in the villages, mainly stay and work at home. However, variations can be found among different castes and socioeconomic levels and within each household, especially following increased male migration. More and more men are working outside the village



Julie Dekens

**Figure 4: Woman with baby in front of a small elevated house, Phoolparasi VDC, Sarlahi District**

or the country and more women must undertake work outside their homes.

### Poverty spiral

*“Our houses that collapsed were better than the new ones!” (Dalit women’s group discussion Deuri VDC, Dhanusha District)*

*“We have been living here on the riverbed for 22 years. Before we used to live in a safer place than this, but we took a loan from a rich person in the village. Because we couldn’t pay it back we lost our land and had to shift here to this vulnerable spot.” (Ram Chandra Yadav, Singhyahi VDC, Mahottari District)*

*“The people of this yard used to have lots of land! I used to have seven bigha of land [1.5 bigha = 1 ha] and 80% of my land was close to the river. Some people have lost all their land, some 50%..., it depends.” (Gropi Shah, Piparyia VDC, Sarlahi District)*

Households know how their own vulnerability to floods has been changing over time. Every year a flood might damage people’s houses and/or cultivable land. Progressively their purchasing and adaptive capacities decrease, especially for the poorest among them who have fewer resources to fall back upon than others; and, what is more, those who do not have access to land are compelled to buy bamboo to rebuild their houses.



**Figure 5: Dalit women's group discussion Deuri VDC, Dhanusha District**

If they do not have cash, they are forced to take loans from moneylenders in the village and to pay interest rates ranging from three to five per cent per month. Every year it becomes more difficult for them to rebuild their houses and they enter into a spiral of poverty. Their houses, as much as themselves, become even more vulnerable to the next flood. Each new flood weakens their houses and worsens their health and general economic circumstances. In most cases, the floods may lead to organisational adaptations but no or few structural adaptations: the floods cause the poor to become poorer.

Social relationships, and especially caste arrangements, are an important element evolving from this case study that help

in the understanding of local knowledge. The caste, social, and economic contexts are important issues to be noted in any checklist that implementing organisations might use. Because poor and wealthy and lower and higher castes are so interdependent, measures should focus not only on 'the poorest of the poor' but on the entire system, including the interrelations between different economic groups, different castes, and different social groups. Further, most communities are facing multiple stress factors. In the eastern Terai of Nepal, the two main natural hazards most communities have to cope with are floods and fire – together with political and economic stress, for example, at the time of the study, the role of the Maoist movement. Focusing only on one stress factor might give a false picture because households and communities are making decisions and are adjusting their practices according to the combination of stresses they face. The process of pauperisation and its linkages with natural hazards are complex. Populations affected may not always be from a 'poor group' and a specific event may contribute to a change in their status. The time factor is another important element to consider. A household with 10 young children could be poor today, but might become wealthier later on, if and when the 10 children contribute income and manpower to the household (human assets).

### Box 1: Did you ask? Observation and experience of floods

**History of floods** – What do people know about the history of floods in their locality, e.g., when and where did the last flood occur? What was the water level of the last exceptional flood? How many people died? What damage was caused by the flood? How do people understand and interpret the situation or the landscape from their knowledge and/or previous experience of floods?

**Nature of floods** – What do people know about the nature of floods in their locality, e.g., onset, origin, velocity, and types of rain? To what extent does local knowledge vary or not, according to different types of floods (normal versus abnormal floods; flash floods versus riverine floods)?

**Vulnerability assessment** – What are people's understanding of their own vulnerability (e.g., in pre-disaster situations) and of the factors that influence it? Are they now living in a more vulnerable dwelling than before? Why? What happened? Do people have different priorities now than before and how do these influence their vulnerability to natural hazards? To what extent are people able to identify the problems and to what extent are they able to solve them on their own initiatives? How does disaster change, increase, and/or create new, vulnerable groups (i.e., emerging vulnerability or vulnerable groups)?

**Socioeconomic and other contextual factors** – How do social relationships (age, gender, class, caste, physical ability, and ethnicity) influence local knowledge of and practices in flood preparedness? How do the caste arrangements influence people's ability to adapt to floods? How do the floods affect different economic and social groups such as women, children, and elders? Who benefits from the floods? Is it only the wealthiest households (i.e., those who have land in different places) who can benefit from the flooding or do the poorest also manage to receive benefits? Can you describe how people gain new land, lose old land? How do the individual and collective historical, cultural, and religious backgrounds influence people's perceptions of natural hazards and responses to natural hazards? Did rich people become 'poorer' because they were living in a flood-prone area or were they able to maintain their status. Did the sociocultural milieu provide richer people with access to goods and services denied to those poorer?

**Multiple stress factors** – What other natural hazards and stress factors do the community face and how might they influence local knowledge on disaster preparedness?



## Chapter 4

# Anticipating Floods

**P**eople manage to anticipate floods by observing and interpreting local, environmental warning signals. They also manage to identify safe places for humans and cattle, time thresholds – for storing firewood and food in advance, removing important belongings and leaving the house – and critical actors in the community who can support them because of their special skills, knowledge, and/or position within the community.

### Local environmental warning signals

*“We know that if it rains heavily and continuously flooding could ensue. But sometimes it does not rain here and we still get floods. When we see black clouds on the mountains we also know that floods might come.”* (Ram Ekbal, 52, Dalit, Pipariya VDC, Sarlahi District)

*“Before the flood we noticed a sound like a bus travelling at high speed.”* (Byagiya Devi, Singyahi VDC, Mahottari District)

*“There is a specific sound of the river when the flood is coming. It is like a whistle because of the speed of the water coming down.”* (Ram Ekbal, 52, Dalit, Pipariya VDC, Sarlahi District)

*“Sometimes before the flood, we can see floating wood, snakes, and dead animals in the water.”* (Ram Ekbal, 52, Dalit, Pipariya VDC, Sarlahi District)

*“Fifty-two years ago, a big flood occurred here. Along with the flood, a rhinoceros came into the village and killed one person.”* (Lakhan Raut, elder, Phoolparasi VDC, Sarlahi District)

*“Before the flood comes, the water is muddy and there is a specific smell.”* (Byagiya Devi, 70, Singyahi VDC, Mahottari District)

Local knowledge is a knowledge of the heart and senses (listening, seeing, smelling, tasting – e.g., taste of muddy water). People are strongly connected to their local environment and often notice local, environmental signs of impending floods.

They generally understand those warning signals and become more alert. In some cases, they can predict that a flood is coming by observing such signals. These observational skills provide the basis for local meteorological and hydrological knowledge and are often effective in helping save lives.

## Safe places for humans and cattle

*“A lot of people came to save their lives and belongings at my place, because it is slightly higher up here than elsewhere. There are two other places like this in the village where people go during floods. One includes a common ground (pathway) between fields and houses that are also slightly more elevated than the rest.”* (Laxmi Thapa, Singyahi VDC, Mohattari District)

*“During the rainy season we move all our important belongings to the house of a particular person. He is rich and he spends most of his time in Kathmandu. His house has a large courtyard and it is safe from floods. It can accommodate the 30 to 40 families who are the most vulnerable to floods. We take wood, rice, pulses, and our clothes over there. Nothing of importance is left in our houses so theft is not a problem.”* (Gropi Shah, Pipariya VDC, Sarlahi District)

*“We are not allowed to touch people from higher castes, so it is a big problem when we are in the shelter with others during floods.”* (Dalit women, Pipariya VDC, Sarlahi District)

*“Nobody leaves the village during the floods but people move to safe places like the school and the VDC office.”* (Ram Prasad, VDC President, Phoolparasi VDC, Sarlahi District)

Local communities generally know where the safe places are from local observation and experience. Without any special training; they use their mind maps to identify safe places, routes, and locations in their surroundings. High and safe places known about and used by the villagers include elevated private houses or courtyards, elevated common grounds, and safe public buildings (e.g., VDC offices, schools – most schools are in safe places and are made of brick).

## Time thresholds

### Removing important belongings

*“People are always ready to run away and to take money and gold to safe places when the rainy season begins.”* (Pipariya VDC, Sarlahi District)

*“Since the 1993 flood, people have been taking their belongings away two-three months before the rainy season.”* (Pipariya VDC, Sarlahi District)

### Leaving the house

*“When it starts raining regularly and when it is raining a lot higher up in the mountains, people become alert but no one*

*leaves the house. We leave our houses when the water starts to overflow.”* (Ramkailash Roy, village teacher, Shreepur VDC, Sarlahi District)

*“At the beginning of the rainy season, children and women are left in safe places and men and elders stay at home to look after the house until the flood comes.”* (Ram Ekbal, 52, Dalit, Pipariya VDC, Sarlahi District)

*“If the flood comes at night we run away, if it comes in the day we wait to see if it is low or high.”* (Ram Ekbal, 52, Dalit, Pipariya VDC, Sarlahi District)

### Storing food and firewood

*“We start storing food one month before the rainy season.”* (Wife of Ram Prasad, VDC President, Phoolparasi, Sarlahi District)

*“We start buying kerosene, mustard oil, and so on 2-3 months in advance. We have to borrow money and the interest rate is 3% per month.”* (Women’s group discussion, Bin community, Laxmipur, Sukchaina)

### Comments on time thresholds

When is it time to collect all important belongings and bring them to safe places? How far in advance should people start to collect food and firewood? When should people start

constructing elevated repositories to protect their belongings? When is it time to leave the house? These are some of the questions each household needs to answer. **Although most of these simple strategies might seem ‘common sense’ or ‘universal knowledge’, it is important to recognise that people have ‘bounded rationality’; that is, people’s rationality is limited to their own information and beliefs, e.g., ‘running away’ when the water starts rising might not always be common sense depending on religious and cultural beliefs and practices.** Ultimately, decision-making about time thresholds for flood preparedness varies among households not only depending upon their perception of floods but also depending on their own vulnerability (e.g., if the household has a pregnant woman, sick person, elders, children) and their ability to influence it (e.g., social networks in safe places, access to safe places). One hypothesis from the field study is that the wealthiest people store food much in advance of the poorest who have less spending power and who need more time to gather the same basic food requirements.

### Critical actors and skills

Some community experts or stewards and/or some specific social groups have key skills that are not known to every community member and which can be useful for flood preparedness. This local, specialist knowledge is different from local, everyday knowledge. It includes knowing how to swim, knowledge related to carpentry and bamboo weaving

(e.g., construction of elevated platforms), communication skills (ability to speak in public and convey messages), and others. Social memory is a key aspect in building flood-resilient communities. It consists of a reservoir of diverse individuals, resource users, and other actors with different and overlapping roles within and between critical groups. 'Critical groups' are the

actors ensuring key functions in the community; for example, knowledge carriers and retainers like elders, interpreters and sense makers, stewards and leaders, change agents, networkers and facilitators, and followers and reinforcers (Folke et al. 2002).

### Box 3: Did you ask? Anticipating floods

**Early warning signals** – How can local people manage to anticipate or identify environmental warning signals of floods? What do people observe, hear, and sense before a flood occurs? Do people have traditional or local weather forecast systems?

**Time thresholds** – How do communities and households prepare for the rainy season? Do they store additional food, firewood, and medicine? When and how do people know that it is time to leave their houses, to remove all important belongings, and to store food and firewood? Where do people go? What do they take with them?

**Safe places for humans and cattle** – Where do people run and who runs away - is it the women and children, is it the people without property, etc.? How do local people identify safe places for humans and cattle?

**Critical actors and skills** – Who does what within the community? Who knows what? Who has the relevant knowledge about floods? Who has specific skills that can directly or indirectly contribute to improved disaster preparedness? How can these skills be nurtured? How can these skills be passed on from one generation to another? To what extent does the lower caste or casteless people have knowledge about disaster preparedness that high castes do not have and vice versa; and to what extent is this knowledge shared (nor not)?

## Chapter 5

# Adapting to Floods: Technical Strategies

**A**ccording to Sunita Pandit (Piparyia VDC, Sarlahi District) – and this is also valid for most households, “accommodation, houses falling down, cooking food, and health problems, including toilets, are the biggest issues women face during floods.” In order to cope with these issues, people have developed various structural and other technical strategies over the years. The strategies include both short-term and long-term strategies related to house construction and protection measures for walls, elevated stores, drinking water and transportation, and measures taken to divert streams.

## Houses

### Combining materials for house construction

“Before the 1993 flood, houses were made out of mud and bamboo but now more houses are made of brick. [...] Even people with two-storey houses leave their homes during the rainy season.” (Sunita Pandit, Piparyia VDC, Sarlahi District)

“Since the major 2003 flood more houses have their bases made out of bricks and the rest of the house is still made out of mud.” (Ram Ekbal Yadav, Jhauwa Tole, Bhaisarawa VDC, Makanpur District)



**Figure 6:** Walls of a local house made out of dried pulse plants, Kaitarait VDC, Dhunusha District

*“Why invest in our houses? They will be washed away anyway. We don’t do anything in particular to our houses before the rainy season. Before the 2003 flood we started building brick houses but now we have stopped. We are waiting for the construction of an embankment before we invest in our houses again.”* (Ram Kishan Giri, Sukchaina, Laxmipur VDC, Sarlahi District)

### Locating houses in safe places

*“When we bought this piece of land [where the house has been built] it was already like a pond without water. The land here was even at a lower level than the road. We knew that the place was vulnerable to floods but we already had a little bit of land here and the land was cheap too.”* (Eklas Devi Yadav and Manaki Devi Yadav, Katarait VDC, Dhanusha District)

### Raising the house plinths

*“We don’t build houses on elevated wooden pillars because of the scarcity of land and because it requires a specific type of wood which is expensive. Most people elevate the foundations of their houses by building them on the top of one layer of mud. It is quite labour intensive because you have to transport lots of mud.”* (Raj Jumar Yadav and Ram Ratan Yadav, Deuri VDC, Dhanusha District)

*“We raised our house after the 2003 flood, the biggest flood in the last 10 years.”* (Eklas Devi Yadav and Manaki Devi Yadav, Katarait VDC, Dhanusha District)



**Figure 7: Old (left) and new elevated house (right) after the major 2003 flood, Katarait VDC, Dhanusha District**

*“Before the big flood in 2003, our house was at ground level. After that event, we raised the foundation of our house like this with two levels of mud. One of my sons, who works in Saudi Arabia, got the idea. He didn’t see this kind of house anywhere else but the flood is coming on and on in this village, so from our own experience we thought that building two layers would be best. There is only one house like this in the village. Many people would like to have the same type of house but they cannot afford it. This house is much more expensive than others because it requires a lot of labour. In total, it took two years and one month to build it, whereas a normal house*



**Figure 8: Mud house with two elevated mud plinths (see arrows), Katarait VDC, Dhanusha District**

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takes about 15 days to one month of labour. The first step is to construct the first elevated layer or ground base. This ground base is made out of mud and the outside layer only is a mixture of mud and rice or wheat by-product. It is then left for one year so that it becomes compact and solid. Then the second elevated layer is built. After another year we finished the house in about one month. If you have your own wood, this type of house will cost about 60-70,000 NRs, if not, then it can cost around 100,000 NRs.\*” (Dakhani Devi Yadav, 70, Katarait VDC, Dhanusha District)

“We don’t have enough money to raise our houses! If we had money we would try to make good homes, raised above ground level, and made out of bricks, and we would try to get involved in business.” (Women group discussion, Bin community, Deuri, Dhanusha District)

“The plinths of our houses used to be raised on a mud platform, but you cannot notice it now because the flood has released some new sediment which covered our elevated plinths. The ground level is rising constantly because of the sediment deposited by the floods so that every year our houses will need to be raised according to the new level!” (Belhi village, Sarlahi District)

“We don’t raise our houses because we feel safe now with the embankment.” (Shreepur VDC, Sarlahi District)

\* In 2006, US\$ 1 = 73.60 Nepali Rupees (NRs)

## Comments on houses

Families adjust their houses to floods differently according to their perception of floods (e.g., the creation of an embankment may create a feeling of safety and therefore influence how people build their houses) and their socioeconomic status. Commonly, houses are made of mud and bamboo, and sometimes a combination of mud, bamboo and the stalks of a local pulse plant. Less often houses are made of mud, bamboo, and wood. Mud walls generally need to be replaced every year in flood-affected areas. Most of the roofs are made of straw or tiles. Some people strengthen and protect the wall foundations using mud or bamboo fences (which also protect against cattle), and many put wood, plants, straw, or mud in front of the house to prevent water seeping in. In some places people use beams to support walls in the rainy season.

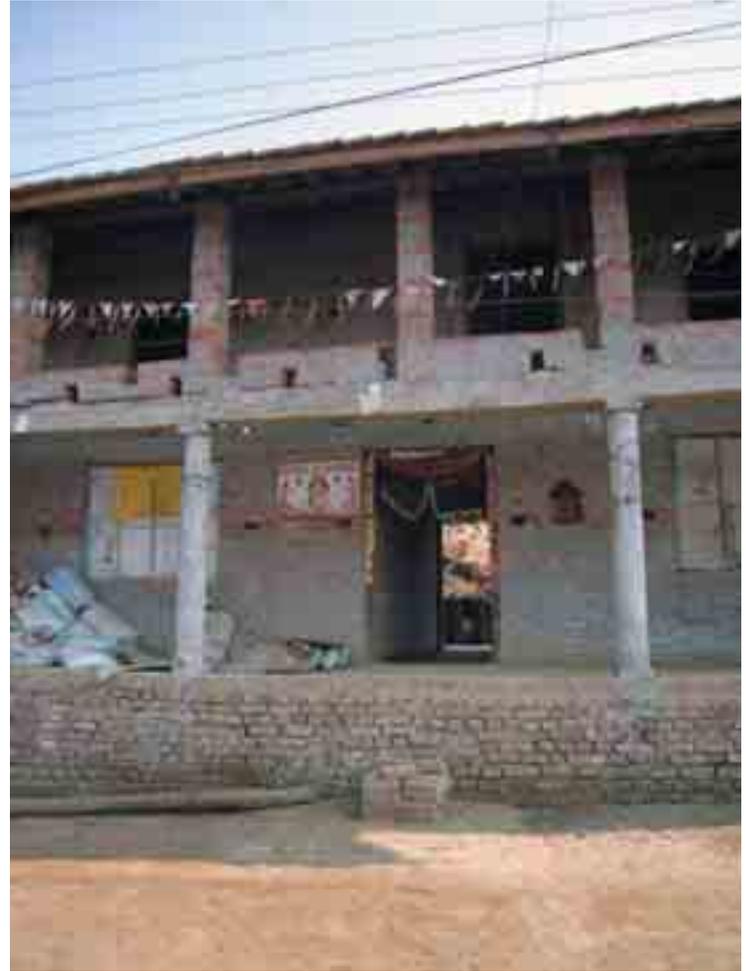
Nowadays, wealthier households build brick houses, as they are considered safer than mud houses. Some with less money build the foundations with bricks and the rest out of mud. In many cases, people have realised that their homes are not in a safe place but they cannot afford to construct better homes and/or to buy land in a safer area. People understand that raising the level of their plinths can protect them from floods. However, even an apparently simple measure such as elevating the plinths is not affordable for every household.



**Figure 9: Strengthening and protecting walls and wall foundations: a) foundations protected with piled up mud, Katarait VDC, Dhanusha District; b) foundations protected with a bamboo fence and mud, Katarait VDC, Dhanusha District; c) wall made of bamboo, mud, and dried pulse plants supported by a wooden beam, Seurai VDC, Dhanusha District**



**Figure 10: Mud house with brick plinths, Bhaisarawa VDC, Rautahat District**



**Figure 11: Elevated brick house, Katarait VDC, Dhanusha District**

## Storage

Three major types of local, indigenous structure are used to store food and keep other important belongings like land and citizenship documents, clothes, and gold in places elevated above the normal flood level. They are grain stores, locally called ‘kothali’ or ‘berhi’ in Maithali or ‘bhakari’ in Nepali; multipurpose platforms, locally called ‘machan’; and circular mud-made repositories, locally called ‘chakka’ (which means wheel or circular object in Maithali and Nepali). These structures can also be found in many non flood-prone villages, because they are traditional structures built for different protective reasons. Elevated grain stores, for example, are made not just for floods but for air circulation to prevent rot and to control insects and other vermin. In flood-prone areas, they contribute indirectly to flood preparedness. In some cases, villagers mentioned that slight modifications in design have been added with specific adaptations to the rise in water levels following the last exceptional flood event.

### Grain store (‘kothali’)

Households can build various types of grain store depending upon their assets to ensure their food security on a yearly basis – including during difficult times such as the flood season. The number and size of grain stores indicate the wealth of the household and are examples of great economic disparity. A kothali is a store erected on posts with the main opening at the top and, in some cases, a smaller opening on the side.

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**Figure 12: Elevated grain stores, Bhaisarawa VDC, Rautahat District**

Different materials are used to build the store (bamboo, mud, or a mixture of bamboo and mud) and the posts (mud or wooden pillars, or more rarely a brick platform). The shape of the store can vary (round or rectangular), as well as its size and location (small ‘kothali’ are kept inside whereas large ‘kothali’ are built outside the house and have thatched roofs or, less commonly, a corrugated iron roof). In some cases, grain is also stored in a slightly elevated closed wooden room in the house itself.

*“Our grain stores are traditional and have always been the same. They are always slightly elevated from the ground*



**Figure 13: Different types of grain store: a) Outside grain store with a brick base, Phoolparasi VDC, Sarlahi District; b) grain store made of bamboo inside a house, Singyahi VDC, Mohattari District; c) grain store made of mud and poles inside a house, Singyahi VDC, Mohattari District**

against water or humidity and animals like mice and rats. After the major 2003 flood, people started to increase the elevation [of grain stores] a little bit more.” (Ram Erkal Yadav, Jhauwa Tole, Bhaisarawa VDC, Makwanpur District)

“The person who has land also has food stores!” (Pipariya VDC, Sarlahi District)

### Multipurpose platform (machan)

‘Machan’, or platforms, are commonly used in the region. They vary in terms of the nature and quality of materials used (e.g., different types of bamboo or wood), the size and elevation of the platform (it varies according to the purpose and the household income), its location (e.g., inside and/or outside the house, or inside the kitchen; and sometimes it can take up the entire house), its purpose (e.g., used as a watch tower to guard against wildlife in the fields, used to store straw for cattle and firewood, used to keep small cattle and other belongings safe, used as a place to sit above the water, used for cooking during floods), and its lifetime (some machan are only built temporarily before the rainy season, in other cases they are built permanently as part of the house, furniture, and set up). In some cases, beds are placed on top of one another to serve as a temporary machan. Generally, the heights of machan tell stories about the level of previous floods and as such indicate the perceived safe heights in different places.



Figure 14: Bamboo machans outside a house in Rautahat District (top) and inside a kitchen in Dhanusha District (bottom)



**Figure 15: Big wooden machan inside a house, Phoolparasi VDC, Sarlahi District.**

*“We construct machan before the rainy season so that people can sit above the water. The maximum that people waited here on the machan was 10 hrs” [this place is a little more elevated than other places in the village – Author]. Piparyia VDC, Sarlahi District)*

*“During the flood, by covering the machan with mud, we can cook food there.” (Sushila Mahto, Shreepur VDC, Sarlahi District)*

*“During floods we stay in the machan, we don’t leave the house. A machan is expensive and people may have to borrow money to buy bamboo or wood. Everybody can build a machan. Specific skills are not required but good, strong machan like this one are built by carpenters from outside [the village] with strong wood.” (Ram Kishan Giri, Sukchaina, Laxmipur VDC, Sarlahi District)*

*“Machan are not always safe!” (Belhi village, Sarlahi District)*

*“Fifty-two years ago we had a flood that brought a hailstorm in May. It was not raining here, but it was raining in the mountains. People used to watch their crops day and night (taking turns) against wildlife from machan made out of bamboo (15-20 feet). Fifty-two years ago, my grandfather was at the top of the machan and the flood came with hail and sleet, so my father gave a signal. Three people climbed up the machan. The river at the time was 25-30 metres away from the machan.*

*The Snake and the River Don’t Run Straight*

*The flood came and broke down the machan and four or five people were washed away. Only one person survived because someone pulled down a bamboo to save him. Everybody in the village knows this story.*” (Ram Ekbal, 52, Dalit, Pipariya VDC, Sarlahi District)

*“I had a machan (a large one in the house) but it has been washed away so now I think that it is not the proper way. Plus I have other alternatives; I go to the school. I don’t want to take risks. However, before the rainy season starts I build a machan in case a flood comes suddenly. I also build machan in safe places like at the school or at the VDC office, to store feed*



**Figures 16: Decorated walls of a house in Mohattari District**

*for my cattle.*” (Ram Chandra Sah, landowner and politician, Laxmipur VDC, Sukchaina, Sarlahi District)

*“Machan are safe during normal floods.”* (Women’s group discussion, Bin community, Laxmipur, Sukchaina)

### **Circular mud repository (chakka)**

Chakka are circular mud repositories built around the main wooden pillar(s) of a house at around one and a half metres above ground level. In most cases, the repository forms a circular plate-like object. Small items can be kept there safe from children’s hands and away from water. These mud-made



**Figure 17: Small ‘chakka’ outside a house in Katarait VDC**



**Figure 18: 'Chakka' with an unusual 'pigeon hole' design, Katarait VDC, Dhanusha District.**

repositories also provide alternative storage in areas where there is not enough wood available to build a machan or other storage unit. Chakka also serve as decoration (most houses in Maithali villages are decorated with drawings and paintings and relief). In some households, small chakka are also made around small wooden pillars outside and these also give additional storage space for general use and during floods in particular. Hanging baskets kept outside can also be used to store food and small belongings safely.

*"This is a traditional Maithali structure and is not found in every house. Only old women know how to make it. A chakka takes 15 days to make. First, the woman has to collect mud and mix it with water and rice husks and straw. If mud is not available close to the house, the men help her collect it. [In the Maithali culture, women mainly stay at home and are responsible for all indoor activities – Author] The mixture is then applied to a main wooden pillar inside the house. On the first day, the base of the repository is built on the wooden pillar and is then left to dry for one day. During the following days, additional layers are added one after another as each layer dries."* (Eklas Devi Yadav and Manaki Devi Yadav, Katarait VDC, Dhanusha District)

*"Nowadays, people prefer to use cement rather than wooden pillars because it is stronger and easier to build. [...] It is not possible to make chakka in houses with cement pillars."* (Dakhani Devi Yadav, Katarait VDC, Dhanusha District)

## Stream control, drinking water, and transportation

*“Four months ago we built another stream channel with a tractor to limit bank erosion and protect our fields, but it did not work out, it did not divert the water.” (Jivachha Yadav and Pupal Yadav, Singyahi VDC, Mahottari District)*

*“A few years ago, we used to make embankments using plastic sand bags. Now PRERANA [a local NGO] in consultation with the elders of the villages came up with the idea of making embankments using local materials. Vertical bamboo is planted into the river [which is] filled up with sand. At the top of the embankment, grass is planted to consolidate it.” (Ram Prasad, VDC President, Phoolparasi, Sarlahi district, Action Aid)*



**Figure 19: Embankment made out of bamboo constructed by a local NGO using local knowledge and local material. Phoolparasi VDC, Sarlahi District**

*“Since people on the other side of the river built an embankment, the stream has shifted from their place to ours!” (Shreepur VDC, Sarlahi District)*

Stream control and diversion are limited at the local level. Local embankments and other attempts to change the course of the river may simply displace the problem to another area. Local embankments are also limited because of the lack of male labour and poor availability of bamboo.

Access to drinking water is another key issue. All the villages have manual water pumps, most built with government funds and others by NGOs or on a private basis. Access to and benefit from the water pumps varies within the village from household



**Figure 20: Water pump raised on a mud and brick platform, Katarait VDC, Dhanusha District**

to household. In some cases, the water pumps are built higher up from the surrounding area in safe places. In other cases, the water pump is flooded for a few days. Sometimes, the villagers raise the water pumps with mud or with bricks after a major flood event. Some water pumps that used to be raised cannot be used anymore during floods because the sediments brought by floods regularly raise the ground level.

Transportation of goods and movement, in general, are major issues during floods, hampering access to food and health facilities among other things. Some villages can stay completely isolated for a few days or weeks; at times villages are surrounded by streams.



**Figure 21: Boat built with local materials (wood, bamboo, and metal containers) to cross the Jamuni River during the flood period. Note a shrine (temple) in the background. (Deuri VDC, Dhanusha District)**

#### **Box 4: Did you ask? Technical adjustment strategies**

**House construction and location** – Why do people build their houses in vulnerable places? Is it because of lack of knowledge or lack of options? What are the main obstacles people face in building their houses in safe places?

**Food storage** – How do people store food, especially for the rainy season? When do they start storing food? Where? What kind of food? For how many days or months can they rely on the food stores?

**Multipurpose platforms** – What do people use to keep themselves and their small livestock above the water and to store important belongings during floods? Who knows how to build these platforms? What materials are required and how much do they cost?

**Stream control, drinking water and transportation** – What are people doing at the community level to control the stream? Are they building embankments as a community? How do people get drinking water during floods? What are they doing in advance to secure access to drinking water? How did people manage to move outside the village during previous floods?

## Chapter 6

# Adapting to Floods: Non-structural Strategies

**N**on-structural strategies include measures related to spatial and social mobility, food security, micro-finance arrangements, natural resource management, and beliefs and attitudes towards change. People who have no assets (land, livestock, and so on) have fewer options or strategies to rely upon than those who are wealthier. Most of these mechanisms have been established for people to cope with stress of all kinds and not just for flood preparedness. All of these coping mechanisms can add social and economic resilience.

## Spatial and social mobility and diversity

*“After the 1993 flood, people lost their land and had to work outside in foreign countries like India and Qatar to survive.”* (Sunita Pandit, Pipariya VDC, Sarlahi District)

*“Two years ago we did not expect that the rainy season would start so early, so all our belongings were washed away. Since that event, we shift all our belongings to safe places every year. Children and women move to safe places whereas men and elders stay at home to look after things until the flood comes.”* (Ram Ekbal, Dalit, Pipariya VDC, Sarlahi District)

*“As soon as heavy rain starts, we run away!”* (Belhi VDC, Sarlahi District)

*“The most vulnerable people (pregnant women, ill people, and elders) move out of the village during the rainy season.”* (Ram Ekwal Roy, village leader and big landowner, Shreepur VDC, Sarlahi District)

*“Pregnant women leave the place and they move all the expensive belongings away to their parent’s place or neighbours.”* (Chandrakula Thakur, Deuri VDC, Mahottari District)

*“Once we put our important belongings with one of our neighbours in a safe spot but they never returned them to us!” (Chandrakula Thakur, Deuri VDC, Mahottari District)*

*“No one allows us to stay at their place and wherever our relatives are they suffer from the same problem as us! [...] We are neglected by the government and within the village itself! Whenever any type of aid arrives in the village it is captured by the rich people in the village! There is no fight, no protest because we lack education.” (Women group discussion, Bin community, Deuri VDC, Mahottari District)*

Leaving the house together with children and elders just before the flood is the first basic measure that people follow. Few households can afford to move out of the village permanently. The most common or widespread response, however, is for men to seek jobs outside the village. Seasonal and permanent migration are common strategies to help people cope with different kinds of stress, including natural hazards, and thus provide social and economic resilience. Men go out to make money to advance their families economically and perhaps socially, and, in the process, thus may help buffer some of the effects of flooding. It enables households to compensate for the loss of income caused by flood damage to agricultural land. In this context, remittances (money sent back to the family in the village by those working outside) contribute to livelihood diversification and are a mechanism for (social and economic) risk sharing and providing insurance against floods. This is one

form of livelihood diversification, (defined here as a portfolio of activities together with social support capacities; Hussein and Nelson 1998).

Social safety nets also play a crucial role for temporary relocation as a flood coping mechanism. In some households, the most vulnerable members move out of the village to their relatives during the most critical months or weeks of the year. In other cases, people can also move to their neighbours because they are located in safer places than they are. However, the poorest of the poor may not be able to rely on their relatives as they too face economic constraints. This means that in general there



**Figure 22: Fisher community, Katarait VDC, Dhanusha District**

is less social and spatial mobility for poorer people than for the better off. Low-caste people may also not be accepted in the houses of people of higher caste regardless of economic status. 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 influenced by the caste system. Discussions with mostly lower caste poor people showed a lack of trust within some villages caused by the asymmetry of power and wealth between different social groups.

## Food security

### Collecting food for humans and livestock

*“We reserve dry fish for the rainy season because it is a difficult time. Before the rainy season we can obtain loans from others in the village to buy food in advance [such as mustard oil, salt, spices, beaten rice] from the market. The interest rate is 5% per month.”* (Women’s group discussion, Bin community, Deuri VDC, Mahottari District)

*“We start drying fish two to three months before the rainy season. We also dry vegetables and make ‘mustard’<sup>2</sup>.”* (Women group discussion, Bin community, Laxmipur, Sukchaina)

*“We start storing food in June/July. There is no fixed date; it depends when the continuous rain starts – looking at the*

<sup>2</sup> A mixture of pulses, potatoes, and rice, locally called ‘mustard’

*clouds or rainy season.”* (Chandrakula Thakur, Deuri VDC, Mahottari District)

*“People who have land in high places shift their cattle to those places.”* (Jeevan Roy, Deuri VDC)

*“During the flood we build machan near our livestock where we can put straw and by-products of rice or wheat for them to eat. We start collecting straw and rice and wheat by-products two months before the rainy season.”*

*Feed for livestock [straw, rice and wheat by-products] is stored in safe places [school etc]. We also bring the livestock to safe places.”* (Ram Kishan Giri, Sukchaina, Laxmipur VDC)



**Figure 23: Mango pickles**



**Figure 24: Dried pumpkin**



**Figure 25: Dried fish and 'mustard'**



**Figure 26: Fermented and dried green vegetables ('gundruk')**

*“We put some food on the roof of the school for a few days (4 to 5 days). Many people are doing this and there is no fighting for space.”* (Ram Chandra Sah, big landowner, Laxmipur VDC, Suckchaina)

*“We start storing food for cattle 2 to 3 months in advance. Large livestock [buffaloes, oxen] stay in the water; small livestock [goats, chickens] are kept inside.”* (Women’s group discussion, Bin community, Laxmipur, Sukchaina )

### Collecting and storing firewood

*“Women start collecting firewood from April and keep it inside their houses. They also start preparing cow dung in November and start collecting wood from their own land and dry leaves from coconuts.”* (Chandrakula Thakur, Deuri)

*“Thick wood is stored outside and small wood is kept inside on machan.”* (Sushila Mahto, 65, Shreepur VDC, Sarlahi District)

*“Two to three months before the rainy season, they start collecting more leaves and wood.”* (Sumitra Devi Yadav, wife of big landowner, Phoolparasi VDC, Sarlahi District)

*“We collect firewood one month in advance and keep it inside the house. We collect the wood in the jungle across the river. The alternatives to collecting firewood are to buy straw and to collect green grass and leaves [to dry]. Before the rainy*

*season, we also collect more sugar, salt, kerosene, and clothes from the big market across the river. How much we can buy in advance depends on each household’s income.”* (Sunita Pandit, Pipariya VDC, Sarlahi District)

### Comments on food security

People have learned to adjust their agricultural and food calendars to weather patterns, including to the flood season. Short-term strategies such as food buffers or stores, preservation techniques, and careful timing help people to prepare for and survive the floods. Women’s group discussions in the villages show that food commonly reserved for the rainy season, including the flood season, includes most of the following: dried vegetables, such as pumpkin, cauliflower, radishes, eggplant, potatoes, and green vegetables; dried fish (especially for the Bin community); and pickles (e.g., mango). Dried food is stored in plastic bottles or bags. Apart from drying food, most households collect or buy food for the family and feed for the cattle before the rainy season. Basic food items include: rice, flour, pulses, salt, sugar, spices, mustard oil, kerosene, and, more rarely (for the better-off) additional medicines for people and cattle. The poorest households have to borrow money from moneylenders in the village to buy food in advance. The willingness to create food buffers against crisis, including flood crisis, attests to people’s forward-looking capacity regarding food supplies.

## Natural resource management

### Restructuring cropping patterns and landholdings

*“We planted bananas after the flood because we can get short-term benefit out of it. We don’t plant trees because the flood can come anytime again and wash them away. Banana trees grow faster and we can benefit from them after one year already. Also bananas can be harvested all year around. Banana cultivation is new here. We don’t plant peanuts here because people think that they do not grow well, it is not very profitable and they are more difficult to keep safe from children and cattle.”* (Ram Prasad, big landowner, Phoolparasi VDC, Sarlahi District)



**Figure 27: Banana plantation (left) close to the river bed (right) in flood-damaged fields (front) which used to support rice cultivation, Shreepur VDC, Sarlahi District.**

*“If we plant sugarcane we can harvest it after one year and it will be able to produce for about two years. We sell it directly to the factory which was built about 20 years ago. Rice is mainly a subsistence crop. Banana cultivation is new here and bananas are sold to the local market.”* (Ram Ekwel Roy, village teacher and big landowner, Shreepur VDC, Sarlahi District)

*“We know that bananas and peanuts are suitable for this soil but we don’t have the market for it. We cultivate sugarcane because the factory is very close by and we can sell it to them directly. Plus peanuts can be destroyed by a small amount of water.”* (Ram Ekdal Yadav, Bhaisarawa VDC, Sarlahi District)

*“Very few people here have to buy rice. Some have to because they only plant sugarcane.”* (Ramkailash Roy, Shreepur VDC, Sarlahi District)

*“After the flood 13 years ago, we noticed that in the place where bamboo was growing, there was very little damage so we decided to plant banana trees there because bamboo takes a little more time to grow than bananas.”* (Action Aid, Phoolparasi VDC, Sarlahi District)

*“I have bought land little by little in different places. When I buy land I pay attention to the soil fertility, the location of the land in relation to the river [it has to be safe from floods], and the price.”* (Ram Chandra Sah, big landowner, Laxmipur VDC, Sukchaina)

Due to recurrent floods and the deposition of sandy sediments on the fields, land use is progressively changing along the affected river beds. Paddy is destroyed if it gets overinundated. After the floods, most of the fields that used to be suitable for rice cultivation are now used for growing sweet potatoes, sugarcane, banana trees, peanuts, vegetables, or watermelons. Along the river bed, trees such as bamboo and mango are planted and in uncultivable areas, trees such as sisoo, simal, and khair. The cultivation of sugarcane and/or bananas depends on the village's access to markets. Banana cultivation is more recent than sugarcane cultivation in this area. By switching to sugarcane and/or banana cultivation, the wealthier people manage to turn change into opportunity. As landowners, they are flexible enough to adapt. The sediments deposited on fields by the floods also provide nutrients indispensable for cultivation. Rich landowners often manage to benefit from the floods, whereas those who do not have access to any assets cannot turn change into opportunity. Most landowners are progressively forced to switch from relying mainly on subsistence crops (rice, wheat, pulses, and millet) to cash crops in areas affected by floods. These changes increase their dependence on the market and they tend to be more short-term than long-term in focus, because uncertainty is high in these areas as new, devastating floods can happen every year. Highly uncertain environments, such as land close to the river bed, do not encourage people to take risks or to make long-term investments.

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**Figure 28: Riverbank farming with rahar, Deuri VDC, Mahottari District**

At the same time, cropping patterns are changing following floods, and access to and benefit from the land affected by floods are also changing. As mentioned previously, the poorest households might be forced to sell land. In the process and indirectly, some landowners may then be able to obtain and rely on dispersed landholdings. Relying on dispersed landholdings is an efficient risk-spreading strategy against floods (but also pests and landslides in other contexts). If floods damage some fields, the landowner can still rely on other fields located elsewhere.



**Figure 29: Trees planted on an embankment, Deuri VDC, Mahottari District**



**Figure 30: Mud on the base of young trees, Deuri VDC, Mahottari District**

## Regulating access to grazing land and firewood

*“I have a goat and if my goat enters somebody else’s field they will charge me 200 NRs. Lots of fights are happening all the time over the stealing of wood.”* (Dalit women, Deuri VDC, Dhanusha District)

Access to natural resources, including grazing land and firewood, is important because it will determine how a household can manage its cattle, whether they have to buy firewood from the market, or whether they have to travel long distances or not to get firewood. During the rainy season, in general, and during the flood season in particular, these informal rules will influence the level of preparedness of households to natural hazards.

## Adopting soil conservation strategies

Some farmers also adopt soil conservation strategies to reduce the impact of floods, for example planting pulses, (‘dal’ ‘rahar’ ‘rarahi’, ‘kurthi’) and vegetables at the top of embankments (and more generally around fields). Rahar (rarahi) is a multipurpose pulse. The grain is eaten and its roots (ca 2ft long) help conserve the soil. It is planted during the rainy season and harvested in February. Other approaches include planting trees (e.g., ‘behaya’, bamboo, ‘sissoo’, ‘vicks’) and raising the embankment by the sides of the fields and close to the river bed for soil conservation and protection. Mud is also put at the base of young trees to protect the roots from water.

The Snake and the River Don’t Run Straight

## Other strategies and attitudes

### Learning from past mistakes and events

*“We had a flood during the night a year ago. Everything got washed away. Now we are more alert [than before]! We learned that we should put our belongings in safe places. One person completely moved out of the village.”* (Ram Ekbal, 52, Dalit, Piparyia VDC, Sarlahi District)

*“We made a channel for irrigation purposes for the community. This channel progressively increased and now it is the current stream! We learned that we should take advice from specialists.”* (Sukchaina, Laxmipur VDC, Sarlahi District)

*“Fifty years ago, the river was flowing close to Naya Tole (in front of the current settlement) about two km from here. After constructing an irrigation channel in Naya Tole, the stream started to flow towards Shreepur Tole and we lost our land.”* (Ramkailash Roy, village teacher, Shreepur VDC, Sarlahi District)

### Building upon institutional linkages and community initiatives

*“We managed to get this embankment (large sand and stone embankment along the river bed) from ‘Jalutpanna prakop Niyanttran’ in 2005 through a village request. One engineer from this village works in the organisation and that’s how we managed to build the embankment. The engineer still has a*

*house in the village and he comes here on a regular basis.”* (Shreepur VDC, Sarlahi District)

*“We build irrigation channels and embankments for the community using stones and mud. We collect the money among ourselves. One person per household has to participate; otherwise the household has to pay a fine. Now we are also thinking of planting trees alongside the river bed.”* (Jivachha Yadav and Pupal Yadav, Singyahi VDC, Mahottari District)

### Micro-finance arrangements

*“We don’t have much money so we don’t manage to stock food. During the floods, we can borrow food from others with no interest. If we borrow money we have to pay 3% interest per month.”* (Sushila Mahto, Shreepur VDC, Sarlahi District)

*“How can we save money? We can’t even pay for our food!”* (Women’s group discussion, Bin community, Deuri VDC, Dhanusha District)

### Comments on strategies and attitudes

Staying awake and alert is probably the most common strategy people adopt during the rainy season. (*“When it rains heavily and continuously, we stay awake all night.”* Ram Chandra Sah, landowner, Laxmipur VDC, Sukchaina) Other skills that need to be nurtured and encouraged include the capacity to learn from past mistakes made in flood events and to build upon existing institutional linkages. On the former point, learning is a key

aspect of community resilience to natural hazards. It can help households and communities adapt to floods through trial and error and continual readjustments. In a community, only a few persons might learn from past mistakes, but such people can be key message carriers within the community. These key actors (e.g., 'innovative farmers') need to be identified so that they can be used in the community to spread the lessons learned to others. On the latter point, 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 the village boundaries; professional networks; and political networks). A few people have access to influential networks outside the community boundaries. The quote here reveals how the professional network of a villager enabled the villagers to give voice to their flood issues better than would have been the case had there been no network. It might be important to investigate how people are embedded in various networks and how those networks can be best used. It is also essential to investigate people's attitudes towards money and business. In the study area, micro-finance arrangements, such as micro-credit and savings are limited, because of lack of assets. Furthermore, only a few people might have entrepreneurial skills in the community. This means that improving access to micro-credit and savings may not always transfer into actual improved benefits from micro-finance depending upon people's mentality, past experience, and history. As suggested elsewhere (e.g., Dekens 2005), entrepreneurship may need to be taught.

### **Box 5: Did you ask? Non-structural adaptation strategies**

**Spatial and social mobility** – What do people's social networks look like? What are their relationships with their relatives and their neighbours? Where are their relatives located? How do communities and households try to spread the impacts of floods among their assets (e.g., physical, economic, social assets)? Do they have different livelihood activities? Do they also rely on cash-earning activities?

**Food security** – Are people growing food that is specifically kept for emergency purposes? Do they have specific food storage or drying techniques?

**Natural resource management** – Do landownership disputes arise from the loss of land due to floods? What are the local adjustment strategies? Are they equitable? Do people have landholdings in different locations?

**Other attitudes and strategies** – What indicators are there that people learned from previous flood events? What are the various networks (e.g., family, social, professional, political) people are embedded in and how can villagers use them for disaster preparedness? What are people's attitudes to and backgrounds in business activities? Do they have micro-finance arrangements and entrepreneurial attitudes or backgrounds?

## Chapter 7

# Communicating About Floods

**K**nowledge generation in itself will not be sufficient to build adaptive capacity in social-ecological systems (Folke et al. 2002, p373). Generating knowledge does not mean that knowledge is understood, memorised, and used. In other words, knowledge generation is different from knowledge assimilation. In many societies based on oral traditions, past events, including flood crises, are embedded in memory through storytelling, songs, poems, proverbs, worshipping activities and ceremonies, rituals, and so forth. Various studies in anthropology and human ecology (e.g., Folke et al. 2002; Berkes 1999) have shown how rituals and taboo are the transformation of social memory into practical resource and ecosystem management.

Traditionally, songs and poems are an important part of the Nepali and Terai culture. Men used to compete with improvised songs and the winner was able to take a woman instantly as his wife! Some of the songs collected here 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., machan), 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).

Worship, story telling, songs, and proverbs not only help people to remember past events but also help them to convey messages in an attractive and convincing manner. Often, local singers or composers are key knowledge carriers and change agents who play a vital role within the community in terms of building awareness. Local songs and proverbs also help to turn abstract events into something more vivid and concrete. Indeed, the younger generation may not have yet faced a major flood and therefore it is difficult for them to fully 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 TV) and livelihood diversification (getting jobs outside the village).

## Worship and Sacrifice

*“We make sacrifices to get rid of the floods (a small temple stands close to the river bank) in January or February because we have more free time and money at that time of the year.”*  
(Kishun Devi Yadav, 70, Katarait VDC, Dhanusha District)

Religious and spiritual beliefs and practices help people to make sense of life, including crisis events such as floods, and to deal with the uncertainties related to it. As such, worship and sacrifice are also important psychological coping strategies which help people to exteriorise their anxiety.

## Songs and Poems<sup>3</sup>

### Transmitting experiences from place to place

Although most people were shy in the beginning and had to be convinced about the importance of their knowledge, they often felt very proud and showed lots of interest in listening to their own voice afterwards. Songs and proverbs can provide a

<sup>3</sup> All the songs have been translated from Maithali by Pradeep Singh and Vijay Khadgi. The transliterated originals are in the Annex.

great platform for building local people’s awareness on natural disasters and for external organisations to understand better the history of previous hazards and how it is perceived and transmitted within the community and between generations (Shreepur VDC, Sarlahi District).

*Have mercy Mother Ganga<sup>4</sup>, the world is flooded  
So much trouble you gave us, now we cannot endure it.  
Suddenly waters came and flooded the fields, houses,  
buildings, flooded everything.  
Some were sleeping, some were awake, and some were  
talking.*

*When the waters came at midnight, nobody knew what to  
do.*

*Every inch of the Mother Land is crying Ram<sup>5</sup>  
Run-run Lord Krishna! We are dying Lord Ram!<sup>6</sup>*

Song narrated by Ramu Thakur Brahmin, 70,  
Shreepur VDC, Sarlahi District

Ramu learned this song from an Indian book he bought after a major flood in Shreepur about 52 years ago. Other elders in the village also know this song.

<sup>4</sup> Goddess of Water in the Hindu religion

<sup>5</sup> Ram is the name of a Hindu God. According to the mythology, Ram was the husband of Janaki or Sita, the daughter of Janak, who was the King of Janakpur, the major town in Danusha District.

<sup>6</sup> Krishna is a Hindu God.

## Transmitting experiences to other generations

*The flood of 1966 did unexpected things.  
When floods came to Lakhandehi (river), they went to Sundarpur.<sup>7</sup>  
When diarrhoea affected water, people consumed the same water.<sup>8</sup>  
Then people became intoxicated<sup>9</sup> and resorted to fighting.  
Some broke their jaws and some broke their heads.  
Salt, blood, and law, all became cheaper.<sup>10</sup>  
When in 1966, floods came to Bheem River.<sup>11</sup>  
Son and father were harvesting seeds.  
Daughter and mother were fetching water.  
Bheem River's floods drowned both of them.  
From the other shore, Kheru could only beat his chest.<sup>12</sup>  
The flood of 1966 did unexpected things.*

Song narrated by Ram Ekbal Sah,  
Piparyia VDC, Sarlahi District

<sup>7</sup> Name of a village close to Pipariya VDC in Sarlahi District

<sup>8</sup> Water is everywhere; people excrete in and consume the same water. Indeed latrines and toilets are still an exception in the villages.

<sup>9</sup> Sick, but also the term connotes a sense of madness (the expression is often used to describe a drunken person).

<sup>10</sup> Salt in Hindu society symbolises an important survival item one can obtain from working relationships. It is equivalent to 'bread' in other cultures. "I have eaten your salt" is a colloquial expression meaning that you are employing me. The sentence means that employers-employees, masters-servants relations ('salt'), blood relations ('blood') and local laws ('law') have less or no value due to the impact of floods.

<sup>11</sup> Small tributary river

<sup>12</sup> Kheru (common masculine local name) could only mourn them



**Figure 31: Recording local people's songs, especially with the elders, was very successful during the documentation process.**

Ram Ekbal Sah learned this poem from the late Rudal Saho, a famous local singer from Piparyia who composed the song after a major flood in 1966. The villagers used to sing this poem during the village elections and any other important events to raise people's awareness. The poem captures the range of socioeconomic impacts of the flood at village and household levels. Impacts include health, livelihood, equity, and gender issues. The poem describes how the flood brings water-borne diseases and how people suffer from lack of drinking water and from diarrhoea. The salt brought by the flood damages the fields and the land loses its economic value. The fight for



**Figure 32: Ram Ratan Yadav showing his personal song and poem book related to ‘the politics and bad habits of the villagers’, Deuri VDC, Dhanusha District**

limited resources often turns into violence, hampering the law and local order. The death of the mother and the daughter denotes how women are more often the victims of floods than men.

There are many more songs like these, covering such wide-ranging topics as political turmoil, personal loss, and all and any of the difficulties village people face – including floods and other disasters. They give a considerable insight into issues of concern, as well as being a form of oral history.

### **Pleading for survival**

The following song illustrates the tragic situation of the people who have no other option than living close to or in the river bed. In this context, survival is the leitmotiv and this call for survival is addressed to the villagers themselves as much as to the government. They do not see any future unless the government builds a dam. During the floods, people suffer from hunger, bad health, transportation issues, and damage to their homes. Because the government does not intervene, they are forced to continue building their houses in this vulnerable spot (“We will build our homes in the stream”).

*We built houses in the stream, so that somehow we can survive.*

*We need to survive, O, we need to survive!*

*Children are hungry, and ask for food;*

*But our stores are empty the whole year*

*How to manage survival, O, how to manage survival?*

*Government of Nepal, there is no future for us.*

*Please build a dam across the river so that we can survive somehow*

*We will cut bamboo and build machan<sup>13</sup>  
and put our children there.*

*We will spend the monsoon there, we will survive anyhow.*

*In Saawan,<sup>14</sup> our children are sick.*

*There is no way to come and go.*

*The river has drowned our homes, how can we survive.*

*We should survive, O, we should survive.*

*We will build our homes in the streams, we will survive somehow.*

Improved song composed by Hulas Giri, Suckchaina,  
Laxmipur, Sarlahi District, 2006

<sup>13</sup> See previous chapter

<sup>14</sup> Literally, 'the watery month', the month of the year in the Nepali calendar that receives most precipitation, from mid-July to mid-August.



**Figure 33: Hulas Giri improvising a song on flood issues and how they are affecting the village (Suckchaina, Laxmipur, Sarlahi District)**

## The nature of the rivers

*'Hardinath Jaladhar' (the helpful lake) was its initial name*

*It used to help people with irrigation and drinking water.*

*Now it has become a 'Jallad' (the executioner)*

*Doing the job of chasing away and killing people.*

Narrated by Ram Ratan Yadav, Deuri VDC, Dhanusha District (translated from Nepali)

*This is the very nature of the river,*

*Take off your clothes and cross the river.<sup>15</sup>*

*Wake up, wake up farmer brother,*

*The Jalaidh (River) flood is troubling us.*

*Sons and daughters are starving to death.*

*Pick your 'tokar'<sup>16</sup> and spades and get ready.<sup>17</sup>*

Narrated by villagers, Annapati, Katarait VDC, Dhanusha District

<sup>15</sup> Take off your clothes and overcome your fear

<sup>16</sup> Baskets/buckets for transporting sand

<sup>17</sup> Call for mitigation work among villagers (cooperation)

## Proverbs

*Living near enemies and building houses near rivers are never wise.*

Quoted by different villagers

*The river and the snake never run straight.*

Narrated by Ramkailash Roy and Bijay Thakur, Shreepur VDC, Sarlahi District

This proverb is well known by elders and youths in both Shreepur and Belhi VDCs in Sarlahi District.

### Box: Did you ask? Communicating about floods

What are the local stories about previous flood events? Who knows these stories in the community: both elders and young people? Do people in the village know local songs, proverbs, and poems about past natural hazards?

Part 4

# Conclusion



## Chapter 8

# Discussion

The general purpose of this report is to provide inspiration and ideas to implementing organisations to help them understand and identify local knowledge, practices and contexts in relation to disaster preparedness. For this purpose, a case study was undertaken in the eastern Terai of Nepal to document local knowledge on flood preparedness in nine villages. The case study revealed that, over time, local people had generally developed considerable local knowledge and practices on flood preparedness.

### Lessons learned

Based on daily observation of their local surroundings, experience of past and recurrent floods, and the internalisation of certain practices over generations, people in the eastern Terai of Nepal have been able to reduce human losses from floods as well as the economic, environmental, social, and psychological impacts. Local knowledge and practices in flood preparedness that are particularly vivid in the area include people's capacity to do the following.

1. **Describe their experience** of different types of floods, the location of previous floods, the water level of previous floods, changes in water levels, changes of river paths and in river size that occurred in their own locality, and changes in their physical and social vulnerability to floods.
2. **Identify and interpret early warning signals** of floods based on environmental indicators, weather interpretations, smells, sounds, location and types of rain, and the unusual appearance and movement of wildlife.
3. **Identify where and when to run (or stay)**, where the safest and fastest escape routes are, when to move key belongings, stay awake, leave the house, and store food and firewood.
4. **Adopt various technical and structural, and non-structural measures of adjustment** to floods especially those related to house construction (combining different materials, increasing the plinths, consolidating and protecting walls), elevated food stores and multipurpose platforms to keep

food, small livestock, and people themselves away from water; adopting new cropping strategies (e.g., riverbank cropping, tree planting); using social networks; and adjusting to the stress related to recurrent floods through what is often interpreted from a western perspective as ‘fatalism.’

**5. Transmit information** related to past floods through songs and proverbs.

The potential applications of local knowledge to improving disaster preparedness in the eastern Terai of Nepal could especially capitalise on the five key elements above. This knowledge could help implementing organisations to understand local environmental variations; identify the most vulnerable individuals, households, groups, and key actors that could act as knowledge reinforcers within the community; build upon local technical strategies that are cost efficient and use local materials and skills; and build upon local ways of communicating for awareness building on flood preparedness.

## Challenges

This case study reveals the diversity and complexity of local knowledge, practices, and contexts. Different actors, castes, and social groups have different knowledge about flood preparedness. The study also reveals that in general the poorest get poorer while the richest may even benefit from

floods. However, in some cases and under specific conditions, disasters can also offer unexpected opportunities for the poor, as demonstrated in a case study focusing on households’ coping strategies after Hurricane Mitch in Northeastern Honduras (McSweeney 2005). It does not mean that the poorest have less knowledge, but that they have fewer options. This highlights the importance of focusing on socioeconomic dimensions and questions of equity within a community. Challenges emerge from the inherent complexity, diversity (e.g., sociocultural and historical aspects), power relations, and so on hidden behind what is still too often conceived as a homogenous ‘community’. Too often a gap between office and field staff creates barriers for information flow because decision-making is somehow separated from field experience. Both office staff and field staff need to spend more time in the field and to interact more often with one another and with the different (and sometimes conflicting) members of ‘a community’ to be able to respect, understand, and account for the complexity and diversity of local contexts. A communication gap also exists between communities and government officials. Disaster preparedness communication tools formulated at the national or district levels, such as official warning messages or hazard maps, need to incorporate local references so that they are understood and trusted by the community.

Some practices are aimed directly at reducing the impacts of floods while others contribute to building up the general resilience of the household and/or the community and

therefore indirectly contribute to improving community-based flood preparedness. Many practices described in this report have become part of day-to-day life. As such, the people themselves, together with internal organisations, tend to be so familiar with the practices that they often do not connect them to flood preparedness and/or they take the practices for granted. Competition (versus cooperation) between different development organisations and rigid planning schemes also lead to them ignoring local knowledge. Rigid planning means that there is little flexibility within organisations to incorporate learning from the field. Most examples presented in this case study are very context specific; some might be used elsewhere, some might be used as the basis for discussion.

## Local knowledge as a tool for change

Most approaches to disaster management tend to focus on people's vulnerabilities and on what people do not know. The

focus on local knowledge and practices provides an entry point to try and reverse this tendency. It enables internal and external organisations to explore what are people's strengths and what they actually do know. As such, understanding, accounting for, and respecting local knowledge, practices, and contexts can become a tool of change. First, it can help to adapt external knowledge to local contexts and integrate the 'users or beneficiaries' into projects (Visser 2006). As Hutton and Haque (2003) put it: *"Little effort has been made to achieve an accurate understanding of how people of different cultures perceive, interpret and respond to natural hazards. [...] Western conceptualizations of natural hazards, human vulnerability and poverty cannot be uniformly imposed on divergent cultures and societies"*. Second, a better understanding of local knowledge can also help to assess which local knowledge can still be relevant and should be disseminated or transmitted to others (Visser 2006). We hope that this report will help to promote change at the level of individual professional practice or at the organisational or sectoral levels.

# Summary of the Key Findings

OBSERVATION			
	Knowledge, practices, beliefs	Local functions	Strengths, opportunities advantages
History and nature of floods	<ul style="list-style-type: none"> <li>• Experience of different types of floods, location of previous floods, level of previous water levels, change in water levels, changes of river paths and in river size that occurred in their own locality</li> </ul>	Instrumental	<ul style="list-style-type: none"> <li>• Detailed information related to the nature and history of floods in people's locality based on past experience, daily observation, and monitoring of the local surroundings</li> <li>• Landscape interpretation</li> </ul>
Evolution of vulnerability to floods	<ul style="list-style-type: none"> <li>• Social and gender vulnerabilities: people are not equal in their capacity to respond to floods</li> <li>• Process of pauperisation: the flood contributes to making the poor poorer</li> </ul>	—	<ul style="list-style-type: none"> <li>• Information related to the perceived evolution of people's physical and social vulnerability to floods and the factors related to it</li> </ul>
	Weaknesses, obstacles, constraints	Potential applications	
History and nature of floods	<ul style="list-style-type: none"> <li>• Prior experience forgotten due to resettlement or frequency of natural hazards</li> </ul>	<ul style="list-style-type: none"> <li>• Better understanding of local variability/specificities and processes</li> <li>• Understanding of local perceptions of natural hazards</li> <li>• Information can be useful for hazard mapping, survey, and other inventories combined with conventional knowledge</li> <li>• Part of the process of data 'triangulation'</li> </ul>	
Evolution of vulnerability to floods	<ul style="list-style-type: none"> <li>• Complexity: various factors at play and/or acting simultaneously or not. For instance, 'poverty' is relative and the time factor needs to be taken into account. Every other factor being the same, a family with many children will be more vulnerable to floods than when the children have grown up and are able to work.</li> </ul>	<ul style="list-style-type: none"> <li>• Understanding local perceptions of floods together with other stresses</li> <li>• Understanding how people's vulnerability to flood hazard is changing over time</li> <li>• Identification of vulnerable groups and individuals</li> </ul>	

ANTICIPATION			
	Knowledge, practices, beliefs	Local functions	Strengths, opportunities advantages
Early warning signals of flash floods	<ul style="list-style-type: none"> <li>Ability to identify and interpret early warning signals of floods based on environmental indicators, weather interpretations/ predictions, smells, sounds, location and types of rain, unusual appearance and movement of wildlife, etc.</li> </ul>	Instrumental Psychological	<ul style="list-style-type: none"> <li>Rapid assessment</li> <li>Trust</li> <li>Cost effective</li> <li>Ability to save life</li> </ul>
Time thresholds and emergency measures	<ul style="list-style-type: none"> <li>Knowledge of when to run (or stay), when to start storing food and firewood, build elevated platforms, move important belongings, stay awake, leave the house</li> </ul>	Instrumental	
Escape routes and safe places for humans and cattle	<ul style="list-style-type: none"> <li>Knowledge of where to run (or stay), where are the safest and fastest escape routes, and where to build houses</li> </ul>	Instrumental	<ul style="list-style-type: none"> <li>Few people die from floods. Floods mainly affect agricultural land and property (buildings)</li> </ul>
Critical actors and skills	<ul style="list-style-type: none"> <li>Ability to trust local guides' advice and predictions (e.g., elders)</li> </ul>	Instrumental Psychological	<ul style="list-style-type: none"> <li>Trust, respect</li> </ul>
Weaknesses, obstacles, constraints		Potential applications	
Early warning signals of flash floods		<ul style="list-style-type: none"> <li>To combine with other 'modern' techniques and information</li> </ul>	
Time thresholds and emergency measures	<ul style="list-style-type: none"> <li>Prior experience forgotten</li> <li>Bounded rationality: people's rationality is limited to their own information and beliefs. For instance they may not run away when the water rises because they fear that their belongings are going to be stolen by others</li> </ul>	<ul style="list-style-type: none"> <li>Recognise the differences between local knowledge and common sense: 'running away' when the water starts rising for instance is not always 'common sense'</li> <li>Understanding and accounting for people's 'bounded rationality'</li> </ul>	
Escape routes and safe places for humans and cattle	<ul style="list-style-type: none"> <li>Risk of thieves</li> <li>Some castes are not accepted in the same place as other castes</li> </ul>		
Critical actors and skills	<ul style="list-style-type: none"> <li>Loss of traditional knowledge and decreasing trust in it from younger generations due to change in education system</li> </ul>	<ul style="list-style-type: none"> <li>Reviving the place of traditional knowledge and skills in school curricula</li> </ul>	

ADAPTATION			
	Knowledge, practices, beliefs	Local functions	Strengths, opportunities advantages
Technical adaptations	<ul style="list-style-type: none"> <li>Houses: combining materials for house construction, increasing the plinths, consolidating and protecting walls</li> <li>Storage: grain storage, multipurpose platforms, circular mud repositories</li> <li>Stream control, drinking water, transportation</li> </ul>	Instrumental	<ul style="list-style-type: none"> <li>Use of local material (e.g., banana, bamboo, sand) and local skills (e.g., carpenters)</li> <li>Food security</li> <li>Most of the time effective to decrease the impacts of floods and cost efficient</li> </ul>
Social capital	<ul style="list-style-type: none"> <li>Ability to find psychological and financial and technical support from relatives and neighbours</li> </ul>	Instrumental Psychological Sociological	<ul style="list-style-type: none"> <li>Collective security system through cooperation, strong social support networks or system</li> <li>Reduce sense of people's helplessness</li> <li>Social and psychological assurance</li> <li>More men working outside the village which provides more cash and therefore increases the access to assets for the family</li> </ul>
Spatial and social mobility/diversity	<ul style="list-style-type: none"> <li>Dispersed landholdings</li> <li>Economic diversification</li> </ul>	Instrumental	<ul style="list-style-type: none"> <li>Having landholdings located at different places contributes to spread the risk of losing assets from natural hazards</li> </ul>
Food security	<ul style="list-style-type: none"> <li>Collecting food for people and cattle</li> <li>Collecting and storing firewood</li> </ul>	Instrumental	–
Natural resources management	<ul style="list-style-type: none"> <li>Restructuring cropping patterns and landholdings</li> <li>Regulating access to grazing land and firewood</li> <li>Adopting soil conservation strategies</li> </ul>	Instrumental	<ul style="list-style-type: none"> <li>Ability to turn change into opportunities</li> </ul>
Other strategies and attitudes	<ul style="list-style-type: none"> <li>Learning from previous mistakes and events</li> <li>Building upon institutional linkages and community initiatives</li> </ul>	Psychological	<ul style="list-style-type: none"> <li>Reduce sense of people's helplessness</li> </ul>

Adaptation cont.....		
	Weaknesses, obstacles, constraints	Potential applications
Technical adaptations	<ul style="list-style-type: none"> <li>• Deterioration of natural resources which means, for example, that people have to go further away to get firewood and/or bamboo or they have to buy it from the market.</li> <li>• Labour intensive techniques</li> <li>• Even simple strategies such as elevating house plinths are not affordable to every household</li> </ul>	
Social capital	<ul style="list-style-type: none"> <li>• Weakening of the collective security system due to increase of individualism as men are starting to work outside the village and to earn cash, and also maybe the ability to rely upon external help</li> <li>• Internal power relations/tensions between different social groups and castes as to who get the benefits from external help</li> <li>• Risk of getting indebted by taking loans with high interest rates from local money lenders</li> </ul>	<ul style="list-style-type: none"> <li>• Reinforcement of people's self confidence</li> <li>• Identification of vulnerable groups, households, and individuals</li> </ul>
Spatial and social mobility/diversity	<ul style="list-style-type: none"> <li>• Diversification strategies might be useful on an ad-hoc basis only</li> <li>• Mainly wealthy households have dispersed landholdings</li> </ul>	
Food security	–	
Natural resources management	<ul style="list-style-type: none"> <li>• The poorest do not have land so mainly the wealthier households benefit from the floods</li> </ul>	<ul style="list-style-type: none"> <li>• Often this knowledge is held by one or two innovative farmers in the village who are willing to test new ideas and techniques. There is a need to identify these innovative people and use them as key knowledge carriers within the communities.</li> </ul>
Other strategies and altitudes	<ul style="list-style-type: none"> <li>• Increasing dependence on external help, and ability to blame and hold the government responsible for the disasters?</li> </ul>	

## COMMUNICATION

	Knowledge, practices, beliefs	Local functions	Strengths, opportunities advantages
Communicating about past hazards	<ul style="list-style-type: none"> <li>• Stories from local religious leaders, elders and family members</li> <li>• Proverbs, songs and traditions</li> </ul>	<ul style="list-style-type: none"> <li>• Instrumental</li> <li>• Psychological</li> </ul>	<ul style="list-style-type: none"> <li>• Local stories, songs, and proverbs enable knowledge transfer among people in the community and between different generations.</li> </ul>
	Weaknesses, obstacles, constraints	Potential applications	
Communicating about past hazards	<ul style="list-style-type: none"> <li>• Local singers are disappearing due to the spread of new technologies such as radio and television</li> </ul>	<ul style="list-style-type: none"> <li>• Better tailor government coping mechanisms and communication with local cultural perceptions, values and traditions and therefore increase trust with external organizations</li> <li>• Better understand and respect and account for local practices and believes</li> <li>• Try to capitalise on cultural practices and values where they are strengths and attempt to moderate them where they may be obstacles (Bankoff 2004)</li> </ul>	

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**\*Details of personal communications (in the order in which they appear in the text)**

1. Page 14, Personal communication by email, James Gardner, Professor Emeritus, Natural Resources Institute, University of Manitoba
2. Page 16, Personal communication by email, Ken MacDonald, Professor of Geography at the University of Toronto, Scarborough, Canada

## Annex

# Songs, Poems, and Proverbs in Maithali

## Songs

Transmitting experiences from place to place

*Daya karu Ganga Maai, Duniya dahatba,  
Itana dukh dela Ganga ab na sahatba.  
Achanak me Paani aail khet sab dahatba,  
Ghar-Dwar Makan sab dahatba,  
kehu sutal kuhu uthal kugu bataitr ba,  
Aadh raat me paani aail kuchho nai dujahata ba.  
Rowa-rowa Dharti mata kari mero Danua Ram,  
Daud-daud Krishna Bhagawan, Chhutgel pranwa Ram.*

*Narrated by Ramu Thakur,  
Shreepur VDC, Sarlahi District*

Transmitting experiences to other generations

*66 saal ke adrakh kamal kake gal,  
Lakhandei me Baadh aail ta Sundarpur me chail gel.  
Jab Jhad- phiraba sab jhada phire gel, ta lote-lote dhhar  
ke pi gel.  
Jab aokra nasa lagal ta lota se maraa-mari bha gel,  
Kewkro phutal loln ta kekro kapar phuta gel.  
Aa noon,khoon kannon sab sasta bha gel.  
Jab 66 saal ke dahar me Bheem Nadi me Baadh aagel,  
Baap-Beta dunu milake Beeya ukhare gel,  
Beti-Matari dunu milake Panpiyai leke gel,  
Bheem Nadi ke Baadh dunu ke dahaite chal gel.  
Kheru us paar se Chaati pitate rahagel.  
66 saal ke adrakh kamal kake gel.*

*Narrated by Ram Ekbal Sah,  
composed by Late Rudal Saho in 1966, Piparyia VDC,  
Sarlahi District*

## Pleading for survival

*Dhaara me Gharaba banaib, ki jaise bhi gujjar chalaib.  
Gujjar chalaib ho, gujjar chalaib.  
Baal-bachcha bhuke kanai chhan,  
Kothli lekin saal bhar khali rahai chhai.  
gujjar kaise chalaib ho gujjar kaise chalaib.  
Nepal Saarkar hamani ke thikana nai khe,  
Nadi par bandhawa banaib, jaise bhi gujjar chalaib.  
Baans kaati Machan banaib,  
Uhe par Baal-bachcha rakhaib,  
Barsat uhe par kataib, gujjar jaise bhi chalaib.  
Saawan Mahina ame bimar Baal-bachcha ,  
kahi aaye-jaye ke na rasta.  
Nadi se Gharawa dahaib, gujjar kaise chalaib.  
Gujjar chalaib ho gujjar chalaib.  
Dhaara me gharawan banaib, jaise bhi gujjar chalaib.*

*Composed and narrated by Hulas Giri,  
Laxmipur VDC, Sarlahi District*

## Nature of the rivers

*Hardi nath Jaladhar thiyo pahile ko naam,  
Sichai, peune paani ko gardathiyo kaam.  
Ahile yo Jallad bhayechha,  
Maanchhe marne, bhagaune kaam gardaichha.*

*Narrated by Ram Ratan Yadav,  
Deuri VDC, Dhanusha District*

*Ai Nadi ke aehe byabahar ,  
Khola kapada bha jo paar.  
Uthha-uthha bhaiya kisaan,  
Jalaidh badh karaichha hairan,  
Dhiya-Putra sab bhuke maraichhan,  
Tokar- Kodari lake howa taiyar.*

*Villagers, Annupati, Katarait VDC, Dhanusha District*

## Proverbs

*Nadi aur shaap sojh hokar nai chalai hai.*

*Narrated by Ramkailash Roy and  
Bijay Thakur, Shreepur VDC, Sarlahi District*

*Vairi tar ke baas aur Nadi par ke chaas, Aekar koi thikana  
nain khe*

The Snake and the River Don't Run Straight



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ISBN 978 92 9115 077 4