

LIVING ON THE EDGE

IN THE NEPALESE INDRAWATI RIVER BASIN

A study on water-induced stress and hazards and the factors that determine the resilience of Himalaya communities



Master thesis

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“The people of the community think that God was not able to give rain. If even God is not in our favour, it will become much harder in the future.”

– Bhimsen Majhi, villager of Arubote

ABSTRACT

Exacerbating climate variability, population growth and land use changes make the occurrence and severity of water-induced stress and hazards increasingly problematic. Communities in mountain regions in the global South are particularly vulnerable to ecological disturbances since their livelihood directly depends on the natural resource base. With an agricultural cycle that is increasingly uncertain, it is urgently required to identify the factors that determine the resilience of these communities, and what the current resilience gaps are.

For this research, a case study has been conducted in six communities of the Indrawati river basin in the Nepalese Himalaya. A wide variety of community members and representatives of local, district and central-level institutions has been consulted with the aim to characterise the landscape of institutions that are vital in adaptation efforts to water-induced stress and hazards. Special attention has been given to three components:

- The sensitivity of mountain communities and their livelihood strategies,
- The perception of community members towards ecological change processes,
- The role of institutions, their services and interventions in shaping the *manoeuvring space* of mountain communities and thereby increasing their resilience.

The institutions that, with their services and interventions, influence mountain community resilience are diverse in number and kind. While some institutions engaged in natural resource management, others contribute to the provision of *gateway systems* that, once households have access to them, widen their opportunities to autonomously adapt and be resilient in the face of the adverse effects of water-induced stress and hazards.

Diversity in institutions that provide basic systems like financial services and marginalised group empowerment programmes is seen as beneficial. Diversity in institutions involved in natural resource management is however seen as a challenge. The sectoral approach in which the water sector is managed at present is giving rise to situations in which increasingly scarce resources are not treated as such. While within the framework of climate change adaptation, many new *projects* are launched in Nepal, the IWRM principle does not receive the due attention it needs. To ensure that planned adaptation efforts will not miss their relevance to foster the long-term resilience of mountain communities, the *institutional structure* of natural resource management institutions requires urgent review.

Keywords: water-induced stress and hazards, resilience, vulnerability, adaptation, institutions, mountains

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LIST OF ABBREVIATIONS & ACRONYMS

ADB	Asian Development Bank
CBA	Community-Based Adaptation
CCNN	Climate Change Network Nepal
CCP	Climate Change Policy
CDO	Chief District Officer
CHHE	Caste Hill Hindu Elite
CIDD	Central Irrigation Development Division
COP	Conference of the Parties
CRM	Climate Risk Management
DANIDA	Danish International Development Agency
DDC	District Development Committee
DFID	UK Department for International Development
DIO	District Irrigation Office
DoHM	Department of Hydrology and Meteorology
DoI	Department of Irrigation
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
DSCO	District Soil Conservation Office
DSCWM	Department of Soil Conservation and Watershed Management
DSWC	Department of Soil and Water Conservation
DWIDP	Department of Water Induced Disaster Prevention
DWRC	District Water Resources Committee
DWSS	Department of Water Supply and Sanitation
ECHO	European Commission for Humanitarian Aid
FAO	Food and Agriculture Organisation of the United Nations
FMIS	Farmer-Managed Irrigation System
GHG	Greenhouse Gas
GoN	Government of Nepal
HDI	Human Development Index
ICIMOD	International Centre for Integrated Mountain Development
IMF	International Monetary Fund
INGO	International Non-Governmental Organisation
IPCC	Intergovernmental Panel on Climate Change
IRD	Integrated Rural Development
ISET	Institute for Social and Environmental Transition
IWMI	International Water Management Institute
IWRM	Integrated Water Resource Management
LAPA	Local Adaptation Plan of Action
LDC	Least Developed Country
LSGA	Local Self-Governance Act
MA	Millennium Ecosystem Assessment
Masl	meters above sea level
MCCICC	Multi-stakeholder Climate Change Initiatives Coordination Committee
MDG	Millennium Development Goal

MoAC	Ministry of Agriculture and Cooperatives
MoE	Ministry of Environment
MoEST	(former) Ministry of Environment, Science and Technology
MoFSC	Ministry of Forests and Soil Conservation
MoHA	Ministry of Home Affairs
MoI	Ministry of Irrigation
MoLD	Ministry of Local Development
NAPA	National Adaptation Plan of Action
NARC	Nepal Agricultural Research Centre
NEC	Nepal Engineering College
NEPAP	Nepalese Environment Policy and Action Plan
NGO	Non-Governmental Organisation
NPC	National Planning Commission
NRCS	Nepal Red Cross Society
NRUG	Natural Resource User Group
NWP	National Water Plan
PPCR	Pilot Project on Climate Resilience
PRA	Participatory Rural Appraisal
PRSP	Poverty Reduction Strategy Paper
SAP	Structural Adjustment Programme
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme
VDC	Village Development Committee
WB	World Bank
WECS	Water and Energy Commission Secretariat
WM	Watershed Management
WRS	Water Resources Strategy
WWF	World Wildlife Fund

LIST OF NEPALI TERMS AND MEASUREMENTS

<i>Dalit</i>	Untouchable low caste
<i>Gaau:</i>	Community
<i>Gagri</i>	Traditional water container
<i>Gunda</i>	Mafia-like local groups
<i>Khola</i>	Stream
<i>Kuwa</i>	Underground water source
<i>Mool</i>	Natural spring
<i>Nadi</i>	River
<i>Ropani</i>	Land measure (20 ropani equals 1 hectare)

Nepali calendar – Bikram Sambat (BS)

A Nepali month falls in between two months of the Gregorian calendar.

<i>Baisakh</i>	- April to May	<i>Kartik</i>	- October to November
<i>Jestha</i>	- May to June	<i>Mangsir</i>	- November to December
<i>Ashar</i>	- June to July	<i>Paush</i>	- December to January
<i>Shrawan</i>	- July to August	<i>Magh</i>	- January to February
<i>Bhadra</i>	- August to September	<i>Falgun</i>	- February to March
<i>Ashoj</i>	- September to October	<i>Chaitra</i>	- March to April

Nepali year to Christian year: Subtract - 56 Years - 8 Months - 15 Days

Christian year to Nepali year: Add - 56 Years - 8 Months - 15 Days

The last week of August 2011 AD is the second week of Bhadra 2068 BS

PREFACE

Do not wait; the time will never be *just right*. Start where you stand, and work with whatever tools you may have at your command, and better tools will be found as you go along.

- Napoleon Hill

We can only know what we learn from a project or process when we have arrived at the end of it, look back and realise how much it has given us. This research has occupied my mind intensively for the last ten months. It has brought me new insights, of which many go beyond the scope of the research questions. The best learning moments turned out to be those when things unfolded differently than hoped. New ways of thinking are then expected from a person to still bring the process to a good ending. This master was above all a process of learning-by-doing and taking action independently, with quite some situations that forced me to move beyond my comfort zone. With the various moments of ‘exposure’ in the field, I feel that I have become more realistic about development thinking as well as the world around me.

Within the framework of the research master I have been able to live in two distinct mountain regions, the Andes and the Himalaya. These two research opportunities were enriching for me personally as well as academically. The more I dig into the study of climate change adaptation in the global South, the more it intrigues me. In my efforts to study this matter, I often forgot that this research was not supposed to be the masterpiece of my life. Hence, I first of all realise that in this study I have taken the time of many people. I am tremendously grateful to all of them, from the community to the central level, for having given their time to share ideas, and in so doing, making a contribution to my education. I hope that this document does justice to all the insights that were provided by these persons.

My special gratitude goes to Prof. Dr. Annelies Zoomers. In the last two years we had many discussions that have slowly shaped my research objectives and ambition. I experienced these conversations as very stimulating and enriching. Annelies has encouraged me to improve my skills and over time has taught me to trust and have faith in the decisions I make myself. From her, I have received ample of space and support to have such different research experiences.

In Nepal, I would like to show my gratitude to Prof. Dr. Dhruva Pant, with whom I have had a number of stimulating discussions. This research would not have been possible without the help and dedication of MSc. Pratibha Duwal. Having just finished an environmental science master at Tribuvan University in Kathmandu, she agreed to go into the field for several weeks in a row, walking from community to community and living with the people. I can say that for both of us this has been a very special and unique experience, with cultural clashes at the start but a good friendship in the end.

I am also grateful to Mr. Hem Rai, my Nepali teacher who, with great patience, spent many hours to teach me the basics of his language. These classes have given me great pleasure in especially the first months of my stay and have helped me to have simple conversations with the farmers in the field. This has given me the ability to better identify myself with them.

Finally, I would like to thank my parents and sister as well for always being supportive about the decisions I make. That means more than anything.

1. INTRODUCTION

“When the century began, neither human numbers nor technology had the power radically to alter planetary systems. As the century closes, not only do vastly increased human numbers and their activities have that power, but major, unintended changes are occurring in the atmosphere, in soils, in waters, among plants and animals, and in the relationships among all of these. The rate of change is outstripping the ability of scientific disciplines and our current capabilities to assess and advise.”

The Brundtland Report, 1987

Humanity will have to face a number of alarming changes and threats in the twenty-first century of which poverty and the fulfilment of basic human needs are considered major challenges (Turrall et al., 2011:5; Hoffman, 2011:1; Padgham, 2009:4; Amede, 2007:15). At their foundation lie direct drivers, such as exacerbating climate variability and land use changes, and underlying processes like population growth and increased consumption patterns (Mountain Forum, 2008). It is vital to acknowledge that change is multi-dimensional in nature and that change in climate variability is an additional stress on the existing vulnerability spectrum of human settlements (Sperling et al., 2003:8). It can worsen the prevalence of hunger through direct negative effects on production. It is widely acknowledged that climate change takes place at an alarming rate and that this is the greatest challenge human society has ever faced (Douma & Hirsch, 2007:4). Due to its increased frequency and severity, adverse climate variability has become a source of concern to both developed and developing nations (Dulal et al., 2010:621).

Observational evidence shows that regional changes in climate have altered biophysical systems in many parts of the world, through the shrinkage of glaciers, changes in rainfall frequency and intensity, shifts in the growing season, and shifts in the distribution of plants and animals in response to changes in climatic conditions (Sperling et al., 2003:2). Water is a finite and vulnerable resource and a fundamental resource to sustain life, development and nature (Pandey et al., 2011:480). Water is a source of services, but also of hazards. The growing stress placed on the resource is threatening its continuous supply to ecosystems and people in the world’s watersheds. The distribution of water resources is likely to become increasingly skewed in the forthcoming years, resulting in either a too much (flooding) or too little (drought) of water. Changes in temperature, precipitation levels and the incidence of extreme weather events have as a consequence the retreat of global glaciers, snow melt, flooding, drought, and cyclones. In a warmer world, a smaller fraction of precipitation will fall as snow, and the melting of it will occur earlier, leading to shifts in the runoff maximum to winter and early spring (Mountain Forum, 2008). Intensifying climate variability and extreme weather events seriously affect crop yields and livestock, which form the basic livelihood assets of subsistence communities (Klatzel et al., 2009:8). This trend is expected to affect the lives and livelihoods of hundreds of millions, if not billions of people (UNFCCC, 2007:5). It is estimated that a reduction of water supplies during the dry season and intensified flood events will affect up to one-sixth of the human population, predominantly in the Indian sub-continent, parts of China (over 250 million people) and the Andes (up to 50 million people) (Macchi & ICIMOD, 2010:12).

This trend will affect human settlements all over the world, but especially in the world’s *hotspots* where vulnerability to drivers of environmental change is higher and socio-economic costs considerably greater (Klatzel et al., 2009:4). It thus becomes increasingly important to develop an ability to determine and assess the underlying factors of vulnerability and adaptive capacity of communities, as well as resilience differences between them. Furthermore, there is also a need to identify the measures that support effective adaptation to social-ecological change. Adaptation to the adverse consequences of water-related stress and hazards is a field

of growing interest to international development communities (Klatzel et al., 2009:10). At the heart of discussions on vulnerability and adaptation to climate variability is the question of a too little and too much of water, including the role of traditional and new water management institutions. Another salient field of study is migration. A better understanding of the role of migration and remittances in enabling autonomous adaptation is needed (ISET, 2008:14).

Countries in the global South are generally assumed to face far worse consequences in comparison to the temperate northern hemisphere countries (Aase et al., 2010:228), due to their geographic exposure, economic importance of climate-sensitive sectors like agriculture, low income and weak institutional adaptive capacity (Heltberg et al., 2009:89). Developing countries do not have the required funds to carry out large-scale climate change adaptation initiatives nor the technical ability to warn communities or implement policies to cushion the shock after the impact (Dulal et al., 2010:621). Poor communities depend on climate-sensitive livelihoods such as agriculture, forestry and local water supplies, which are likely to suffer disproportionately from increased climate variability when adequate institutional capacity is lacking (Dixit & Moench, 2010:2). They are endowed with few resources and less able to buffer themselves against the adverse consequences of environmental change and are likely to bear the greatest burden in terms of loss of life and endowments (Kabat et al., 2003:v).

Countries in the global South will face a double challenge. More disasters means increasing recovery costs and for some regions, reduced yields make it harder to recover from these disasters. Climate change stresses the ongoing process of attaining wellbeing as the delivery of some basic conditions such as clean drinking water, healthcare, and energy security will be increasingly difficult to deliver (Dixit & Moench, 2010:104). Serious repercussions are expected on the livelihoods of rural communities that strongly rely on ecosystem services. The increasing degradation of agro-ecological systems erodes the key productive resources of farmer communities and affects livelihoods that greatly rely on utilising these resources (Shiferaw et al., 2009:602). The degradation of water resources gradually diminishes the capacity of individual farmers and communities to make critical investments needed to reverse the situation, reducing opportunities to address nutritional necessities and depleting the ability to buffer shocks. Environmental change is an additional stress that limits the adaptive capacity of communities in an already fragile environment. This rises great concerns of social justice since the impacts fall disproportionately on people that have least resources to cope with it (Heltberg et al., 2009:90) and unless urgent steps are taken to enhance the adaptive capacity of poor people, it may result impossible to meet some of the Millennium Development Goals by 2015 (Sperling et al., 2003:13).

Within the context of the global South, there are differences in vulnerability to water-induced stress and hazards among various biophysical environments. The challenges are highest in developing regions that represent the intersection of widespread poverty and fragile ecosystems, such as arid and semi-arid areas and highland regions. Livelihoods in mountain areas are an example of a *hotspot*, being more susceptible to change than livelihoods on the plains (ICIMOD, 2008:16). Indications exist that changes in temperature are taking place at a higher pace at higher altitudes than in the lowlands, a trend that may further increase the existing inequalities between high- and lowland (ICIMOD, 2010). The fact that one degree temperature rise at sea level corresponds to a rise of two degrees in the world's highest mountains suggests great change in the region's bio-physical environment, including its glaciers. The adverse consequences of increased climatic variability are already noticeable and have their impact on water resources upon which these mountain communities depend (Amatya et al., 2010:69). Mountain regions are particularly vulnerable to change as a result of their high relief, steep slopes, shallow soils, compression of climatic zones and landscape fragmentation (Macchi & ICIMOD, 2010:5). Mountain areas are very diverse from a socio-

cultural perspective. Weakening ecosystem services in mountains have consequences for livelihoods in heavily populated downstream areas since more than half of the world's mountain areas play a vital role in supplying water downstream.

Box 1 Freshwater and ecosystem services

The Earth's ecosystems provide food, freshwater, fuel wood and genetic resources that help shape human wellbeing (Dixit & Moench, 2010:29). Human societies have taken for granted the services provided by ecosystems. In recent decades, however, awareness has grown about the complexities that underlie this continuous provision of environmental goods and services (Opschoor, 2007:22). These ecosystem services can be divided in a few categories:

- *Provisioning services*: Fresh water, food, timber and fiber;
- *Regulating services*: Affecting climate, floods, disease and water quality; and
- *Cultural services*: Providing recreational, spiritual and aesthetic benefits.

Next to provisional services, ecosystems help to regulate and moderate the impacts of inter-annual rainfall variability and hazards like floods, drought and cyclones. Since local ecosystems are nested within a larger macro-level ecosystem, any disturbance in the smaller parts can create imbalance in the whole ecosystem. Contemporary trends like population growth and land-use change contribute to ecosystem deterioration. Comprehensive understanding of ecosystem services and interlinkages between ecosystem functions and human and natural disturbance is salient to avoid damaging the balance that enables an ecosystem to be healthy.

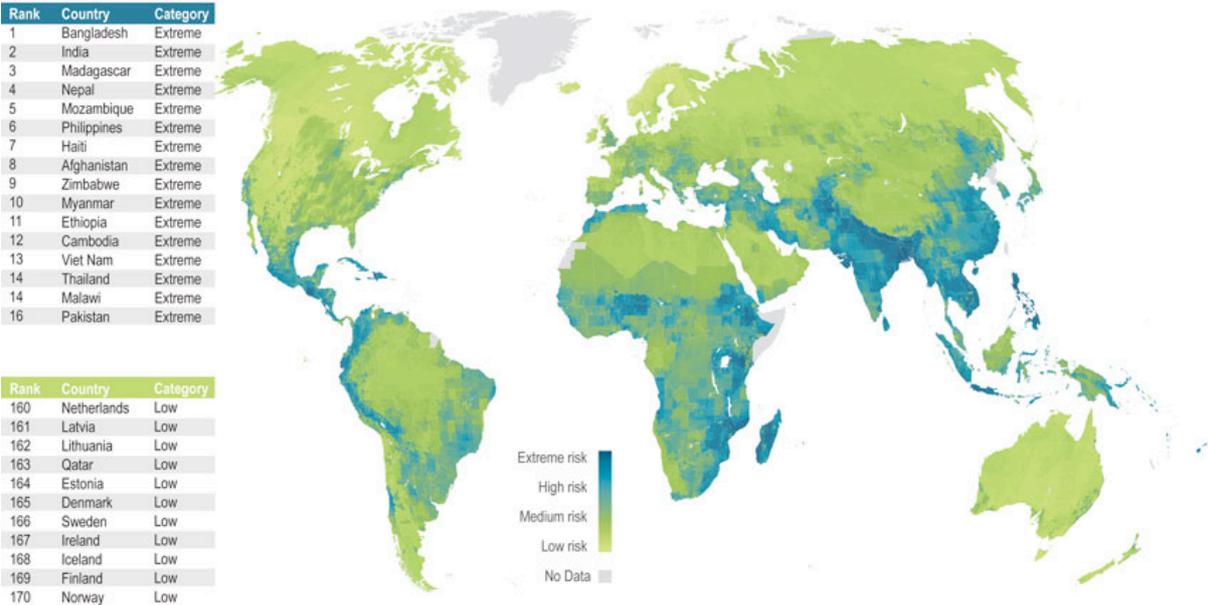
Social systems in especially the global South primarily depend on a continuous availability of ecosystem goods and services (ISET, 2008:86). Those segments of society that directly depend upon ecosystem services are the first to feel the consequences of this deterioration. At their fundament social systems require continuous access to freshwater, which is the main driver of all aquatic and terrestrial biodiversity as well as provision of ecosystem services (McGray et al., 2003:31). The freshwater environment is shaped by the hydrological cycle, which in some regions has become extreme and erratic (UNCED, 1992:18.1). Erosion of ecosystem services leads to vulnerability since for all living beings, water scarcity means survival and no water at all means death (Folke et al., 2002:440). Healthy ecosystems and services will become increasingly important to support adaptation as the climate becomes less predictable. Unless action is taken to mitigate the decline in ecosystem services and increased vulnerability of the water cycle, societal costs will be substantial (Dixit & Moench, 2010:31).

Mountains are an important source of water and energy, and their mountain and hillsides hold a rich variety of biological diversity (UNCED, 1992:13.1). Due to their vertical dimension, various climatic systems can be found over a short distance, each with their own habitat diversity. About 10 percent of the world's population depends on mountain resources and a much larger share draws especially on their water. Mountains are, however, highly vulnerable to human and natural ecological imbalance and can rapidly change when out of balance. The Himalaya is the largest mountain system in the world and is often referred to as the 'water tower' of South Asia (Amatya et al., 2010:69). The region provides water to over 1.3 billion people. As global temperature rises, climate patterns become increasingly erratic, which will adversely affect the livelihood of hundreds of millions of people in South Asia (Dixit & Moench, 2010:3). Climate change impacts are beginning to be felt in a number of ways, but most critical are those impacts that affect water resources. Due to the unequal distribution of these resources, agricultural systems and food security are directly affected by increasingly

extreme water stress and hazards and changing monsoon patterns (Bartlett et al., 2010:1). The combination of extreme storms, prolonged droughts, population growth and persistent poverty will place a massive pressure on ecosystem services and further limit agricultural productivity in the region.

This research focuses on the resilience of mountain communities located in one of the world’s ‘climate frontiers’ where the effects of climate change are most felt, the Nepalese Himalayas (Gum et al., 2009:26). Communities in this area are ‘living on the edge’ in the sense that climate vulnerabilities turn the agro-ecological system increasingly fragile. *Map 1.1* shows that Nepal is the fourth country in the world to experience the worst impacts of intensifying climate variability and change. As global temperatures increase, climate patterns become more increasingly variable and the livelihood integrity of millions of people in South Asia alone becomes an issue of growing concern (Dixit & Moench, 2010:3). The main challenge arises from the rate at which natural stress and hazards are occurring, in combination with pressure on land, water and other resources from a growing population and economic development (Klatzel et al., 2009:3). As a result, livelihoods become difficult to sustain and local coping strategies are losing their efficacy (ICIMOD, 2008:2). To address these changes there is a need to better understand community resilience and the factors that determine the capacity to cope with, and adapt to, water-induced stress and hazards.

Map 1.1 Countries at greatest and lowest risk of the effects of climate change



Source: *Maplecroft, 2010*

The Himalaya region has always been a place where disaster risk reduction and adaptation have been part of people’s rich cultural identity, food security, livelihoods and landscape (ICIMOD, 2008:2). The rapid changes put pressure on subsistence communities to respond at an increasingly rapid pace and in more innovative ways. It seems that the effects of current climate variability and change increasingly go beyond the capacity of these local strategies to cope with these hazards (Tanner & Mitchell, 2008:1). Existing vulnerabilities can exacerbate when environmental change harms interlinkages between livelihoods and ecosystem services (Dixit, 2010a). Development interventions in the field of water management thus need to play

a greater role, placing the social-ecological sustainability of mountain systems of the South central on the development agenda.

This research strives to identify the factors that shape the resilience of mountain communities in the global South and gives special attention to the role of institutional arrangements to influence the *manoeuvring space* of rural livelihoods. As a starting point, a thorough literature study is presented in chapter two that sets up a conceptual framework to link the resilience, vulnerability and adaptation notions, and improve understanding on institutional functioning. With the aim of testing the elements that are considered to be important for the resilience of rural communities to water-induced stress and hazards, a case study is conducted in six communities of the Indrawati river basin in the Nepalese Himalaya. An extensive overview of the research methods followed for the case study is formulated in chapter three, and Nepal's social-ecological development context is set in chapter four. To determine community sensitivity and exposure to change, chapter five characterises the livelihood system of rural communities, followed by the perception of the inhabitants with regard to social-ecological changes. Emphasis is placed on the livelihood strategies that are applied autonomously by the community members as a result of social-ecological change perceptions. As social-ecological change often exceeds the adaptive capacity of traditional livelihoods, new non-agricultural livelihood strategies are discussed, together with the changes in practices that arise when their importance increases. Of key concern are the informal and formal institutional arrangements at the community level that either foster or inhibit adaptation in the context of change. Local institutions, including their services and interventions, are discussed that touch both on natural resource management, as well as on the broader socio-economic situation of rural households, as both influence the adaptive capacity of rural households. Finally, chapter six offers an examination of the influence that national-level adaptation institutions and their policy frameworks have on the *manoeuvring space* of rural livelihoods.

2. THEORETICAL CHAPTER

“If human-environment interactions can be described as the core concern of geographic inquiry, environmental hazards then become the geographers’ analytical equivalent of wars and revolutions for understanding the processes influencing the core concerns of the discipline.”

- Mustafa, 1998

This chapter gives an overview of the theories and insights that have been developed over the past decades related to the concepts of *resilience*, *vulnerability* and *adaptation* (or *adaptive capacity*) within the context of environmental change. Emphasis is given to theories that focus on central the position of vulnerable communities within social-ecological systems in which human-environment interactions stand central. The chapter aims to improve understanding of the stress factors and processes that determine resilience and adaptation to adverse conditions, with particular emphasis on the social and institutional dynamics of social-ecological systems.

2.1 Resilience

Resilience theory has particularly gained great importance from the late 1980s onwards, as an overarching concept in the analysis of human-environment interaction and the way in which humans are affected by processes of environmental change (Janssen & Ostrom, 2006:237). The notion emerged in the field of ecology. C.S. Holling (1973) was the first to introduce *resilience* in relation to the stability of ecological systems. The Resilience Alliance has defined resilience as “the capacity of a system to tolerate disturbance without collapsing into a qualitatively different state that is controlled by a different set of processes. A resilient system can withstand shocks and rebuild itself when necessary”.

A system approach

Resilience theory places human-environment relations central. Humans ultimately depend on the wide variety of services that ecosystems provide (Arrow et al., 1995:520). This close relation has bestowed the insight that all life is interconnected within one social-ecological system that cannot be seen as separated (Walker & Salt, 2006:31). Changes in one domain of the system will inevitably have consequences to the other domain, although both domains are characterised by different processes. The ecological system refers to biophysical processes, while the social system consists of rules and institutions that regulate the use of resources and encompasses systems of knowledge and ethics. However, the social-ecological system view reflects the idea that social structures are an integral part of nature so that any distinction between the two is arbitrary (Adger, 2006:268). The ecological domain is extremely dynamic, causing constant surprise events like storms and droughts. Changes in the natural environment are often associated with a sudden loss in ecosystem services and a reduced capacity to support the social system. What is optimal in one year is not necessarily optimal in the next. In this world, it is at least as salient to manage entire systems to enhance their resilience, as it is to manage the supply of specific ecosystem services.

The focal point of resilience theory is to study the capacity of a system to absorb disturbances while still retaining its basic functions and structure (Walker & Salt, 2006:1). Resilience refers to the magnitude of disturbance a system can absorb before it changes to a substantially different state in which the capacity to self-organise is altered (Adger, 2006:268). Prosperity in a system results from the balance between the pressures placed upon it and system capacity to cope with them (Mitchell et al., 2003:7). The response of a system to disturbances depends on its current state, its particular context, its connections across scales, and the persistence of relationships between its components. The building blocks of resilience thinking are:

1. *Thresholds*: Social-ecological systems can exist in more than one ‘stable state’, in which the pressures placed upon the system and the capacity to cope with them is balanced. This idea can be linked to extreme ecological events like floods. When a stress or shock is too overwhelming for the human system to cope with, the system’s ability to adapt greatly deteriorates, which may even lead to passing a threshold and disintegration of the system. When a threshold from a familiar to an unfamiliar state is passed, uncertainty about the consequences for both ecological and social systems increases. Resilience is thus a measure of the magnitude of disturbances that can be absorbed before a system that is located in one stable (or equilibrium) state flips to another stable state (Arrow et al., 1995:521). A salient question is how much change can occur in a system without the ball rolling out of the basin (Walker & Salt, 2006:54). It is often assumed that ecosystems respond to gradual change in a smooth way, but sometimes there are drastic shifts, leading to unpredictable changes.
2. *Adaptive cycles*: This core idea is best explained by seeing a system as moving through four phases: rapid growth, conservation, release and reorganisation. Natural disturbances like droughts and floods tend to be traumatic and disintegrating, but they also make new beginnings possible. Opportunities for innovation, new ideas and different ways of doing and thinking often emerge after severe disturbance (Walker & Salt, 2006:88). A static state does not foster a resilient system. To be resilient, a system needs to engage in learning, experimentation and locally developed rule making that embraces change. In other words, diversity and vitality are a fundamental aspect of resilience.
3. *Modularity*: This notion describes the way in which different components of a system are connected. Strong connection means that shocks can travel rapidly through the social-ecological system. Systems with subgroups of components that are strongly linked internally, but loosely connected to each other have a modular structure. The degree of modularity allows individual modules to keep functioning when other loosely linked modules fail. In this way the system as a whole has better chance to absorb shocks by increasing the capacity to self-organise (Walker & Salt, 2006:121).
4. *Tightness of feedbacks*: This determines how quickly and strongly a change in one part of the system is felt and responded to in other parts. Social networks play a major role in determining this tightness. As feedbacks lengthen there is a higher risk to cross thresholds without noticing on time. To foster modularity and improve feedback tightness, open and flexible institutions, as well as a multi-level governance system are required (Folke et al., 2002:437).

The bottom line of resilience thinking is that there is no such thing as a sustainable ‘optimal’ state of either an ecosystem or social system. In relation to this, past natural resource policies have committed two fundamental errors:

- First is the idea that ecosystem responses to human use are linear, predictable and controllable (Folke et al., 2002:437).
- Second is the assumption that human and natural systems can be treated as independent.

System management needs to be able to face surprise, unpredictability and complexity, since natural and social systems behave nonlinearly, show marked thresholds in their dynamics and are strongly coupled. Resilience theory describes why and how systems can change from adaptive and functional systems that provide goods and services, into systems that are maladaptive and dysfunctional (Walker & Salt, 2006:140). A sole focus on economic growth to eradicate poverty, disconnected from the complex dynamics of the natural resource base will not lead to sustainable solutions. A decrease in rural community vulnerability requires also an increase in the resilience of the ecosystem and its services (Sperling et al., 2003:16).

Self-organisation

When massive transformation is inevitable, resilient systems contain the components needed for renewal and reorganisation without sacrificing ecosystem service delivery. Nevertheless, human failure to respond to natural disturbances can trigger adverse consequences like decline in food production (Heltberg et al., 2009:90). Management that uses rigid control mechanisms to control the condition of social-ecological systems can erode resilience and promote collapse. Management that fosters resilience is flexible and open to learning. This adaptive management views policy planning as a set of experiments that are designed to reveal the processes that build and sustain resilience without narrowing future development options (Folke et al., 2002:439). This type of policy needs to create platforms of flexible collaboration and participation by resource users. A critical management question is to identify the local and river basin-scale strategies that maintain a balanced land-use mosaic, surface and groundwater systems in ways that sustain critical ecosystem functions (Dixit & Moench, 2010:110).

Agency is the main difference between ecological and social systems facing adaptive pressure (ISET, 2008:84). Humans can strategise and respond proactively as well as reactively to observed or projected environmental changes. The benefit for the social system is that it can change its practices according to ecological change and thereby remain within the carrying capacity of the ecological system upon which the social system ultimately depends. Diversity of opportunities and the nature of institutions are important to maintain the resilience of a social-ecological system (Folke et al., 2002:438). The more variations available to respond to shocks and stresses, the greater the ability is to absorb. The constraints and opportunities individuals perceive and act on are influenced by social position and governance structure.

Related theories and notions

Adger (2006:269) states that there is no universally accepted way to conceptualise social-ecological linkages. A few examples are:

- *Common property resource theory*: focuses on social, political and economic organisations in the social-ecological system, with institutions as mediating factors that govern the relationship between the two components (Dolsak & Ostrom, 2003).
- *Adaptive management*: this is the science that explains how social and ecological systems learn through trial and error. It deals with the unpredictable interactions between the social and ecological components that evolve together (Berkes & Folke, 1998).

Resilience is connected to the notion of *flexibility*. Bateson (1972:348) defines flexibility as the upper and lower thresholds of variables that together make up a system. Flexibility is lost when a system moves close to its upper or lower limit of tolerance (Aase et al., 2010:229). When one component of a system is exploited to its limits, the system's space of manoeuvre is likely to be seriously reduced. Resilience is also strongly linked to *sustainability*, being synonymous with a system that can endure (Kabat et al., 2003:90). In short, sustainability was introduced by the Brundtland report in 1987. Its much-quoted sustainable development definition is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987:24). Human activities are sustainable when the life-support ecosystem upon which they depend is resilient (Arrow et al., 1995:521). The main concern for sustainability is that population growth and expanding human demands place an ever-increasing pressure on natural resources, creating competition, conflicts and exhaustion (UNCED, 1992:10.1). If human requirements are to be met in a sustainable manner in the future, it is essential to resolve these conflicts and manage natural resources and societal impacts more effectively.

The theoretical insights presented in the remainder of this chapter have the aim to facilitate understanding on the characteristics of resilience. Since the notion is defined by the capacity of a system to absorb disturbances while still retaining its basic functions and structure, two main themes deserve attention. Firstly, a system's vulnerability needs to be focus of research. Secondly, a system's adaptive capacity to these disturbances needs to be studied.

2.2 Vulnerability

The concept of vulnerability is crucial to understand how social relations and institutional structures are affected by natural disturbances (Dixit & Moench, 2010:18). The study of vulnerability finds its origins in the fields of natural hazards and poverty (Janssen & Ostrom, 2006:237). Natural hazard scholars, especially geographers, have particularly focused on the vulnerability of communities to the impacts of environmental and climate change from the 1990s onwards. However, a variety of traditions and disciplines have used the term, including economics, anthropology, psychology and engineering. Vulnerability is the degree to which a system is susceptible to, and can cope with the adverse impacts of this change (Kabat et al., 2003:91). Social-ecological systems are subject to a diversity of vulnerabilities. The notion offers a tool to describe states powerlessness and marginality of social-ecological systems or their components, and to guide analysis of the actions needed to improve wellbeing through disaster risk reduction.

The frequently quoted IPCC definition of vulnerability is “the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is the function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity” (IPCC, 2007:20). In this context, the vulnerability of a system is the function of exposure, sensitivity and adaptive capacity.

- *Exposure* is a function of the socially determined physical location of communities at risk, together with the decision and societal structures that shape the community situation. It is the degree of environmental stress imposed on a group or individual.
- *Sensitivity* is the degree to which a group or individual has access to infrastructure to cope with the consequences of environmental stress.
- *Adaptive capacity* is shaped by the degree of institutional capacity to manage natural resources in the prospect of increasing environmental stress (land use and rights, as well as watershed management).

Vulnerability is influenced by the construction or erosion of the elements of social-ecological resilience, the ability to absorb shocks and self-organise before, during and after a shock or stress. Adger (2006:270) suggests two theories that relate to human use of environmental resources and to environmental risk. These are social-ecological system resilience thinking and the literature on livelihood vulnerability and poverty. Research on vulnerability to climate change impacts and risk incorporates the full range of research traditions and furthers the development of system vulnerability analysis, which has a high degree of complexity due to the diversity of actors and multiple stresses. In general, focus is placed on endowments and entitlements that enable groups and persons to face the impact of social-ecological change (Tellam, 2007:16).

Not every social-ecological system has the same *vulnerability spectrum*. Certain systems, so-called hotspots, have a higher likelihood, or susceptibility, to experience adverse impacts than others. In these geographies, change tends to be more destructive (Acreman et al., 2003:50). Here, the frequency and severity of adverse natural events can exhaust the social system, which needs to rebuild its assets at shorter intervals (Heltberg et al., 2009:94). This may prove impossible for especially the most vulnerable, who will need to devote more of their already

limited resource to cope with adverse shocks and stresses (Sperling et al., 2003:7). Hotspots can be countries, regions or communities where environmental stress is relatively high and/or the ability to cope and adapt to change is relatively low. The advantage of identifying hotspots is the fact that institutions can devote more of their scarce human and financial resources to a limited number of regions and communities.

The two paradoxical faces of vulnerability are on one side, the state of ‘powerlessness and endangerment’ (see Hewitt, 1997) and the ability of social-ecological systems to adapt to changing circumstances (Adger, 2006:274). Vulnerability can be interpreted as powerlessness of communities to influence decisions that determine their exposure to hazards (Mustafa, 1998:301). This state of defencelessness and insecurity causes a household or group to suffer when it is exposed to shocks and stresses. Vulnerability is a dynamic phenomenon and often in a continuous state of flux. Its measurement must thus always reflect social processes as well as material outcomes leading to an integration of the shocks and stresses experienced by a social-ecological system, the response of the system and the capacity for adaptive action (Cutter et al., 2003:243). It is observed in ISET (2008:11) that the climate change community has little research experience with the social, economic and institutional dynamics that contribute significantly to vulnerability. However, there are numerous theories that can contribute to create a better understanding of the *vulnerability spectrum*. In continuation, the Disaster Risk Reduction field is elaborated, which will then be enriched by contributions of the capabilities approach, the sustainable livelihoods approach and political ecology.

Disaster Risk Reduction

The value of DRR in resilience thinking has been widely recognised (Van Aalst et al., 2008:166). Its main field of inquiry is the study of hazards that can cause a serious disruption of social system functioning (Sperling et al., 2003:37). Disasters tend to place a great burden on the social system by taking human and animal lives, destroying property and infrastructure and hinder social and economic development, especially of the poor and marginalised (Dixit & Moench, 2010:8). Disasters also tend to destroy habitats and disrupt ecosystem services, making human populations that depend on them more vulnerable, thereby undermining basic development goals. Climate-related disasters can be categorised in rapid-onset events and slow-onset events (Dixit, 2010a). Hazards that arise suddenly, and whose occurrence cannot be predicted far in advance, trigger rapid-onset disasters, which include storms, landslides, avalanches and floods. The warning time before they strike ranges from a few seconds or minutes (landslides) to a few days (storms and floods). Literature on slow-onset disasters has greatly focused on drought and its consequences of water and food scarcity, and livelihood loss. These hazards can take months or even years to become evident. Phenomena whose cumulative impact may not be felt for decades but can result in slow-onset disasters are rising temperatures, forest fires, sedimentation, and accelerated melting of snow and glaciers. They may also contribute to an increase in rapid-onset events like erratic rainfall and flash floods.

Making a distinction between the two types of disasters can be regarded artificial. Hazards will not lead to disasters in systems with little or no vulnerability. Nor will disaster occur in vulnerable system when there are no hazards (Moench & Dixit, 2007:200). Disasters occur only when and where natural extremes and social systems interact and where violent shocks and stresses take place that surpass a threshold. Disasters are deeply embedded in a given social context, being a symptom of group marginality, fragility of system and exposure of systems (Dixit, 2010a). Poverty and inequality considerably contribute to vulnerability. They are the result of an inability of communities to gain access to life-supporting assets, while other communities actually have secured the conditions for a stable and productive livelihood (Opschoor, 2007:22). Overcoming poverty is as much about changing social relations as

about improving the capabilities, assets and endowments of the poor. The problem does not end with the hazard since it tends to take a heavy toll on the assets that form the livelihood basis, and in terms of physical strength of groups and individuals (Mustafa, 1998:303). When hazard impacts are disintegrative, human systems are stressed beyond the threshold of their coping capacity, adversely influencing their ability to recover.

Traditional hazard-related research has largely focused on ‘top-down’ technical solutions where communities had no interaction with researchers and were informed by them to change behaviour to adjust to risk (ISET, 2008:98). In many cases, the goal is to ensure the protection of structures or assets to suffer minimal or no damage during events of specific magnitude (Dixit & Moench, 2010:17). This traditional approach placed low priority on the social factors that contribute to vulnerability within groups. Its limited success allowed for new ways of thinking. Behaviouralist analysis, particularly by geographers like Gilbert White, Robert Kates, and Ian Burton has enriched the DRR field by shifting from a focus on technocratic engineering towards disaster risk *governance* (Mustafa, 1998:289). Some have tried to bridge the gap between physical and social perspectives on vulnerability by proposing the concept of ‘vulnerability of place’ where biophysical exposure intersects with political, economic and social factors (Dixit & Moench, 2010:18). Since households and institutions do not operate in a social vacuum, it is necessary to study the way in which they are embedded in social and political structures, since it is these structures that often produce the fundamental causes of vulnerability, but also of resilience. The direct strength of institutional structures when placed under stress is referred to as hard resilience while the ability of systems to absorb and recover from the impact of disruptive events without fundamental changes in function or structure is called soft resilience. To better understand the socio-economic and political aspects of vulnerability, the capabilities approach is discussed in the following. Two key concepts of this approach are endowment and entitlement. The sustainable livelihoods and political ecology approaches are used to deepen understanding of both concepts.

Capabilities approach

Elements derived from entitlement theory have contributed greatly to frame vulnerability in the analysis of social-ecological systems (Adger, 2006:269). According to Sen (1984:497) the poor in developing countries depend greatly on the natural resource base due to the fact that they are deprived of their entitlements and necessities of life. Sen was the first in introducing the entitlement notion in 1981, in the context of famine (Sharma, 2006:555). While some famines are triggered by extreme climate events, such as drought and floods, vulnerability researchers have shown that food insecurity is more often the cause of social factors (see Sen, 1981:129; Swift, 1989; Bohle et al., 1994; Blaikie et al., 1994). This entitlement failure that leads to famine, and that arises from the social realm of institutions, class, social status and gender was the focal point of Sen’s research. His research contested the idea that shortfalls in food production through drought, flood, or pest, are the principal cause of famine. Hazards are essentially mediated by institutional structures. Capabilities and vulnerabilities are not necessarily at opposite ends of the disaster spectrum, since high vulnerability does not inevitably equal low capacity (Dixit & Moench, 2010:22).

Endowments and entitlements are fundamental resources required by every community to enable them to achieve a sustainable livelihood. Endowments, or assets, are the combination of all resources legally owned by a person that conform to established norms and practices (Dulal et al., 2010:627). They are broadly understood to include productive assets (human, natural, physical, and financial assets) as well as social and political assets (Heltberg, 2009:91). Entitlements are ‘the set of alternative commodity bundles that a person can command in a society using the totality of rights and opportunities that he or she faces’ (Sen,

1984:497). It entails all possible combinations of goods and services that can be legally obtained by a person using endowment, including all capital assets of households and communities. These entitlements include both the access to resources as well as democratic rights, such as having a say in resource management (Mustafa, 1998:291). It is important to understand that human poverty is much more than just income poverty. People are also poor because their access to opportunities and choices is largely denied (UNDP, 2009:41). The poorest segments of the social system are particularly vulnerable to adverse events, as well as ill treatment by institutions at multiple levels due to their exclusion from voice and power (Opschoor, 2007:3). Voicelessness and powerlessness are thus characteristics of poverty. Sen explains vulnerability to food insecurity as being determined by a number of linked economic and institutional factors, thus being a consequence of human activity that can be prevented by modified behaviour and by political interventions (Adger, 2006:270). Entitlement is different from endowment since it refers to the state of existence of a person. It refers to a state of *being* rather than *having* (Opschoor, 2007:13). Entitlement failure seriously contributes to human suffering when the impact of shocks and stresses on social-ecological structures are not well taken care of.

Sustainable livelihoods approach

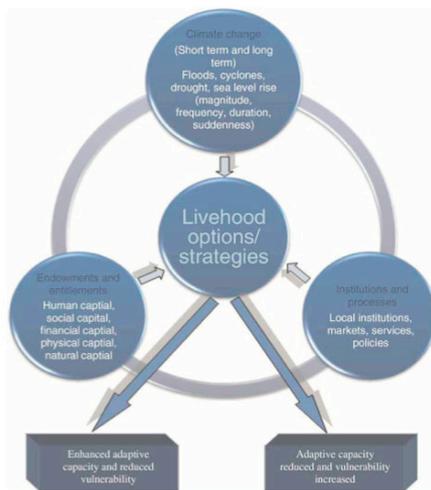
In an attempt to deepen understanding of entitlement failure, the sustainable livelihoods tradition tends to consider the entire social-ecological system (Adger, 2006:272). This theory is deeply rooted in development economics and focuses on the different types of assets that shape a livelihood together (Chambers & Conway, 1991). The concepts are widely used in the context of development assistance and poverty alleviation. A sustainable livelihood refers to the wellbeing of a person or household and includes the entitlements, endowment and activities that lead to this wellbeing. According to Heltberg and colleagues (2009:92), the extent to which households experience vulnerability depends on their asset portfolio, asset allocation and livelihood strategies, next to being shaped by the policy, institutional, and structural context which falls outside household control. Livelihood status is essentially about the ability to capture and build-up sufficient endowment to flourish (ISET, 2008:85). The sustainable livelihood approach emphasizes the varying access of each household to a bundle of 'capitals' or assets as a determinant of livelihood success (Van Aalst et al., 2008:167). These assets can be categorised in human, natural, physical, financial, social and cultural capital. In the following, they are explained.

- *Human capital* refers to the level of education and productive skills of people. It enhances human capabilities in the sense that higher levels of education improve available livelihood options and adaptive capacity (Dulal et al., 2010:627). It includes knowledge and skills (education levels), labour competencies, health and attributes that facilitate the creation of personal, social, and economic wellbeing. Human capital influences the availability and distribution of resources across the population, the structure of institutions, the ability of decision-makers to manage information, public perception of the significance of exposure and the implementation of effective adaptation options.
- *Natural capital* refers to natural resources such as soil, water, air, forests, biodiversity and environmental services, like the hydrological cycle and the services used for livelihoods. Maintaining the productivity of the natural resource base is very important (Dulal et al., 2010:628).
- *Physical capital* is needed to engage in effective productivity. Within this category fall assets such as land, infrastructure, livestock and equipment used in production. Households with limited or no physical capital are at risk of non-productiveness (Dulal et al., 2010:628). Subsistence farmers need land for agriculture, pastures for livestock and wood for cooking and construction. Physical capital also includes infrastructure, communication

systems, energy supply and management, technology transfer and early warning systems (Eakin & Lemos, 2006:10).

- *Social capital* is linked to human capital and emphasizes the relationships and networks between individuals and groups. It determines the robustness of local coping networks, as well as social mobilisation and the density of institutional relationships (Eakin & Lemos, 2006:10). Political capital falls within this category, being the modes of governance, leadership legitimacy, participation, decentralisation, and decision-making capacity.
- *Financial capital* plays an important role in determining livelihood opportunities and strategies. It is the binding factor that pulls the other capital assets together in creating livelihoods. Financial capital determines the access to financial and insurance services from banks and microfinance institutions, which can greatly reduce the vulnerability of the poor to environmental and socio-economic shocks and stresses (Dulal et al., 2010:630). Financial resources enable households to fall back on their savings after a disaster and replace what has been lost.

Figure 2.1 Livelihood framework



Source: Dulal et al. (2010:625)

Table 2.1 Aspects of vulnerability

Physical/Material	<ul style="list-style-type: none"> ■ Hazard prone location of community settlements ■ Access to infrastructure (roads, disaster-proof shelter) ■ Access to information, communication services ■ Access / control of productive resources (credit, land)
Social/Power	<ul style="list-style-type: none"> ■ Personal endowments (skills, knowledge, literacy, time) ■ Institutional structures (family, community, power relations) ■ Governance and decision-making (conflict resolution)
Psychological/Attitudinal	<ul style="list-style-type: none"> ■ Resistance towards change ■ Dependency, trauma (or lack of social/physical mobility) ■ Lack of self-autonomy

Source: Dixit & Moench (2010:22)

As can be concluded with this theory, the poorest households are most at risk to change since their capital diversity is lowest and highly oriented to change-sensitive sectors. Livelihood resilience depends on the interaction between risks, assets, and the policy and institutional context (Heltberg et al., 2009:91). Social system vulnerability is thus not purely ecological in nature. Environmental change is just one of the many challenges that need to be faced and is often not viewed as the most pressing one to address (Van Beek et al., 2003:36). It is expected that when climate variability and change increases, extreme weather events will occur with higher frequency and intensity. It is however difficult, if not impossible, to make a distinction between human-induced climate change and natural climate variability. Assessing to what extent drought or intense precipitation is 'normal' and to what extent it can be attributed to human-induced climate change is impossible (Douma & Hirsch, 2007:12). However, what is important is that current trends of environmental and climate change have to potential to dramatically exacerbate the wide range of already existing vulnerabilities, making them very relevant in determining the resilience of social systems (Klatzel et al., 2009:3).

Box 2 Vulnerability in mountain communities

The vulnerability of mountain communities in the global South to water-induced stress and hazards is a salient research theme today. As has yet been stated, water resources are highly vulnerable to changes in temperature and precipitation. A reduction in their total amount or a shift in their distribution pattern can lead to serious impacts on the overall development prospects of subsistence communities (Mitchell et al., 2003:7). To get an idea of the nature of their vulnerability, a short overview is presented of characteristic environmental, socio-economic and political factors that are frequently discussed in the literature and that mount up to determine the resilience of mountain communities.

- *Environmental factors:* Mountain regions are ecologically fragile and vulnerable to changes in land-use and climate patterns due to their rugged terrain with steep slopes and shallow soils (Macchi & ICIMOD, 2010:5). However, the particular characteristics of mountains contribute to the presence of various climatic zones over short distances, and landscape fragmentation that mounts to their biophysical diversity.
- *Socio-economic factors:* The vast majority of mountain communities in the global South has livelihoods based on agriculture and thus directly depends on the local environment. Due to their isolation, mountain communities tend to suffer disproportionately from poverty and lower levels of development. The poor accessibility of communities, and the higher cost of delivering basic services to them, causes situations of unequal access to services like healthcare, education, social safety nets and physical infrastructure (Dulal et al., 2010: 622). According to Macchi and ICIMOD (2010:9) around 40 percent of the mountain population in the global South is estimated to be vulnerable due to food insecurity, which tends to increase with elevation and isolation. At higher altitudes, where the environment is harsh and suitability for agricultural production is limited, pastoralism is the main livelihood strategy. Multiple livelihood strategies are reported to influence vulnerability. Examples are agricultural expansion on steep slopes, encroachment of forests, and livestock pressure on grazing lands (Sharma, 2002:426). Furthermore, high dependency on natural resources means that in case of water-induced stress and hazards, such as drought and floods, livelihood assets can be easily affected (Dulal et al., 2010:627). Demographic changes, due to population growth and feminisation of agriculture, add up considerably to socio-economic vulnerability (ICIMOD, 2010).
- *Political factors:* Due to their isolation, mountain communities tend to be cut off from the urbanised parts of society (ICIMOD, 2010). Access to political power and representation tends to be marginal since decisions tend to be made in a far away capital where the needs of poor communities are frequently overlooked or at best underestimated (Van Beek et al., 2003:35). Political factors of vulnerability include the extent to which political systems are able to address local needs and carry out their tasks in the face of social or ecological shocks and stresses. The political system can have an important role in improving local livelihood opportunities but it often does not consider building on existing capacities to respond (Klatzel et al., 2009:11). Responses may then not be able to influence the real causes of vulnerability, leaving people in a vicious circle of coping, without moving them forward on a path of increased resilience.

Political ecology

It is widely noted that vulnerability to environmental change does not exist in isolation from broader institutional arrangements of resource use and is related to power and control (Adger, 2006:270). This thinking is greatly shaped by the work of Blaikie and colleagues (1994), which explains that vulnerability is largely driven by deliberate human actions that revolve

around the distribution of power. The work of Burton and colleagues (1978/1993) summarises decades of research on flood management and natural hazards, and demonstrates that all types of natural hazards have different impacts on different groups in society. The political ecology theory (also called human ecology) studies these impacts by focusing on the access and control over natural resources, often determined by historical arrangements, and the implications this has on people's vulnerability to hazards. Hewitt (1997:141) named this a 'human ecology of endangerment'. The disproportionate concentration of resources in the hands of certain individuals or groups is likely to have adverse consequences for those who live in the margin.

Special attention needs to be paid to vulnerability differences within groups since poverty can be greatly defined as a social condition of chronic insecurity that results from malfunctioning economic, ecological, cultural and social systems that inhibit certain groups to build the necessary capacity to adapt (Opschoor, 2007:2). It is observed that vulnerability varies strongly within groups due to differences in the access and ability to benefit from natural resources, information and education (Klatzel et al., 2009:8). Social differentiation, exclusion and discrimination stem from formal and informal policies and institutions (Heltberg et al., 2009:91). The poorest groups are often discriminated and socially marginalised. Examples of this differentiation and exclusion are according to gender, caste, ethnicity, refugees, bonded labour, and disabilities. External socio-political factors contribute considerably to hazardous situations as well (Mustafa, 1998:290). Institutional root causes of poverty generally include the absence of appropriate institutional arrangements for resource use and management, a lack of markets, lack of alternative sources of income, lack of surplus (and thus an incapability to invest), and a lack of knowledge (Opschoor, 2007:11).

The incidence of vulnerability within social and ecological systems often does not stand central in decision-making (Adger, 2006:277). As a result, adaptive actions primarily reduce the vulnerability of those best placed to take advantage of governance institutions, rather than reduce the vulnerability of the marginalised. It can be argued that an unequal distribution of vulnerability to natural shocks and stresses, like climate variability and change, thus essentially exacerbates pre-existing inequalities when principles of equity are not integrated (Adger, 2006:274). Access to natural resources generates security, and thereby contributes to the resilience of groups (Opschoor, 2007:15). Sustainable security requires secure access to productive assets, which are often common property in nature. From this perspective, Ostrom (2003) has contributed to better understand how institutions influence resilience by governing collectively shared resources and adapting to changing conditions.

2.3 Adaptation

Adaptation is about changing behaviour in response to a change in circumstances. It does not only mean protecting against negative impacts, but also taking advantage of any benefits (Dixit & Moench, 2010:99). Adaptation is about the capacity to shift strategies and develop resilient systems that are sufficiently flexible to enable vulnerable communities to respond to change. Particularly in the last decade, the issue of adaptation to climate change has risen on the agenda of researchers, practitioners and decision-makers in a variety of fields (McGray et al., 2007:5). The main reason is the consensus that increasing climate change has the potential to greatly undermine economic development and social wellbeing. It is considered vital that any effective development planning process takes climate variability and change into account. At its core, adaptation is about the capacity to shift strategies as conditions change, with the aim to develop livelihood systems that are resilient and sufficiently flexible (ISET, 2008:6). Interventions that facilitate adaptation particularly need to identify the key barriers that inhibit communities from adapting successfully to changing circumstances (Jones, 2010:1). Capacity

to shift strategies is a function of access to assets, infrastructure, knowledge, communication, economic systems, and institutional arrangements (ISET, 2008:82). Two processes drive adaptation in social systems. The first is selective pressures (both social and ecological in nature) and the second is agency-driven innovation. Actors adapt to experienced pressures within the limits of their capacities, perceptions and priorities (Dixit & Moench, 2010:13).

The scientific field of adaptation to environmental variability dates back to the early 1900s and finds its roots in anthropology (Janssen & Ostrom, 2006:237). At present, the notion is mostly used in the study of human-induced climate change impacts. Early approaches to climate adaptation took a top-down perspective, in which focus was placed on Global Climate Model (GCM) scenarios and sectoral impact approaches (Van Aalst et al., 2008:165). Climate change was socially constructed as a pollution problem and the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol paid great attention to the reduction of greenhouse gas (GHG) emissions. Despite the fact that research has shown beyond reasonable doubt that anthropogenic GHG emissions are already changing the Earth's climate, international commitment to date to seriously cut their emission has been insufficient. Attention has therefore increasingly focused on issues of how to cope with climate change, and adaptation has increasingly been given a central role in international responses. In finding methods to foster adaptation the shortcomings of GCM scenarios soon became apparent, despite their potential to further theoretical understanding on potential climate change impacts. This has stimulated the search for adaptation methods that work from the bottom-up (Van Aalst et al., 2008:167).

Adaptation implies adjustment of livelihood strategies in response to actual, perceived or expected environmental change that brings forth water-induced stress and hazards. While the notion adaptation emphasises a process or action, the resilience community commonly uses the term adaptive capacity to describe a system or resource attribute. The degree of adaptive capacity present in a social-ecological system greatly determines its resilience. It describes the capacity to shift strategies and develop systems that are resilient yet sufficiently flexible to enable communities to respond to, and learn from change (NCVST, 2009:72). According to the Intergovernmental Panel on Climate Change adaptation encompasses the “adjustments in natural and human systems in response to actual and expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2007). It involves shifting strategies and changing the structure of livelihoods, infrastructure, and economic and governance systems, in ways that respond to emerging opportunities and constraints in new environments (Moench, 2010:976). The ability to make these fundamental changes stands central in any adaptation process.

From coping to adaptation

In ecological sciences, a species is well adapted to its environment when it is able to ‘thrive’ in it (Moench, 2010:976). Adaptation is thus not merely about coping or surviving, but about doing well in a specific context. Coping is reactive in nature and is about acting in response to observed climate impacts. Adaptation on the other hand is proactive and focuses on anticipating future climate change through the reduction of risk (Douma & Hirsch, 2007:6). Traditional coping strategies are backward looking and based on historical experience and observation (Sperling et al., 2003:7). However, changing patterns of climate variability can show significant deviations from historical experience, causing the effectiveness of coping strategies to be reduced significantly. A vast variety of institutions have therefore started to design and implement proactive adaptation strategies. Doing this adequately requires tailored information on likely future changes at the local level. In general, such information is not available or accessible to those who need it most, being the poorest segments of society.

Moving from coping to adapting requires the right enabling conditions to foster responses that can take root and develop sustainably and constructively (Klatzel et al., 2009:8). A stress or shock is able to trigger adaptation and represent a *window of opportunity* to implement new strategies (Amundsen et al., 2010:276).

The process of imagining the future enhances adaptive capacity by establishing networks and exploring vulnerabilities and sources of innovation in a system. The ability to adapt to upcoming challenges ultimately depends on human choices (Walker & Salt, 2006:109). These choices do not necessarily entail changes in the livelihood system to build resilience. In the same way, adaptation strategies can include radical change in resource use without this being a symptom of a lack of resilience (Adger, 2006:278). A distinction needs to be made between planned and autonomous adaptation. When conceptualised with the analogy of an iceberg, the gigantic submerged invisible part represents autonomous adaptation, while the tiny visible part is planned adaptation (NCVST, 2009:73). While autonomous adaptation takes place at the household and community level, being short-term and spontaneous in nature, planned adaptation includes strategies and actions, mostly initiated by external institutions on a long term and path-dependent basis.

Figure 2.2 The shift from coping to adapting



Source: Klatzel et al., 2009:7

Planned adaptation

Planned adaptation refers to the policies, strategies, programmes and projects implemented by governments, NGOs and donors to address the impacts of environmental change (NCVST, 2009:73). This includes infrastructure construction, capacity building and disaster risk reduction planning that has the aim to increase resilience (Bartlett et al., 2010:8). Mostly planned adaptation is a response to predicted impacts on the ecosystem and hydrological system by applying natural resource and water management practices (Dixit et al., 2009:27). Planned adaptation entails the introduction of more sustainable agricultural techniques that are less water intensive, rehabilitation of water infrastructure and expansion of storage and irrigation capacity. Historical work on climate adaptation has taken a global, large-scale, and sector-based approach (Klatzel et al., 2009:4). Adaptation measures, however, are scale-dependent and can vary from the household and community level, to the watershed, regional, national and international level (Kabat et al., 2003:viii). Responses will depend on regional differences in biophysical geography, governance- and livelihood systems, infrastructure, resource availability and accessibility, and the prevalence of local knowledge.

In the climate change adaptation discourse, great concern is paid to water resource impacts. However, the hydrological cycle should not be the sole focus of planned adaptation. A focus is needed on enabling autonomous adaptation processes by supporting the development of flexible, resilient, and accessible social and physical infrastructure systems (Bartlett et al., 2010:8). This can also entail the creation of greater access to markets via infrastructure like roads, electricity and telecommunication. A wide variety of interventions can be carried out to build community resilience. Special focus is placed on creating diversity in livelihood options and the building of local self-organisation capacity. Adaptive capacity of communities is shaped by the opportunities to spread risk, which are determined by a combination of external factors, endowment possessed and the ability to use it to acquire entitlement (Dulal et al.,

2010:622). Planned projects that promote adaptation focus primarily on community-based strategies and have been heavily promoted by governments with the support of NGOs and local institutions (ISET, 2008:26). Their aim is to expand livelihood options, which basically means an investment in the capital assets or entitlement expansion. Most adaptation work focuses on:

1. The improvement of models and collection of climate and economic data for refining projections of climate change and their likely impacts
2. National planning activities that focus on the climate proofing of existing areas of activity, mostly infrastructure, like the construction of flood defence and drainage systems, reservoirs, wells and irrigation channels, and
3. Community-based initiatives that involve local agriculture, disaster risk reduction, ecosystem management and livelihood related interventions (ISET, 2008:58).

In conducting planned adaptation interventions, careful attention needs to be paid to properly include the poorest households (Sperling et al., 2003:17). Discussion with politically powerful groups can lead to large-scale infrastructure and technological solutions that neglect the needs of those who most need support to adapt.

Autonomous adaptation

While much focus is placed on planned adaptation at the national level, the vast majority of adaptation efforts occur locally and are autonomous in nature. This includes the actions that rural households and communities undertake on their own to respond to both opportunities and constraints brought by environmental change processes (NCVST, 2009:72). While most planned adaptation has a long-term planning horizon and is path-dependent, autonomous adaptation is short-term and occurs spontaneously as people respond immediately to the social, political and institutional stresses (Dixit et al., 2009:27). Given the diversity of barriers to adapt successfully in an autonomous way, special focus needs to be placed by planned adaptation efforts to overcome these restrictions (Jones, 2010:6).

Since time immemorial, high priority has been given by subsistence communities to reduce risk and build buffers through environmental management (Walker & Salt, 2006:xi). Models on how to deal with the local environment are omni-present. It is this everyday understanding that contains a lot of accumulated experience and wisdom on the functioning of the local life-supporting ecosystem (ICIMOD, 2010). Their strong human-environment relationship has coupled these communities directly to the local ecosystem and shaped their culture (Rotarangi & Russell, 2009:209). Subsistence communities have shown great flexibility in designing the means of survival that reduce risk, increase adaptability and minimise potentially irreversible loss of livelihood (Douma & Hirsch, 2007:6). Communities have learned to always take steps to build-in their own insurance through their planting and cropping strategies, so that one failure will not prove to be a catastrophe (Pandey et al., 2011:480). Their strategies are based on a range of mechanisms to ward off risk wherever possible with the purpose to maximize wellbeing (Klatzel et al., 2009:8). This has included their willingness to diversify into different ways of cultivation, livestock rearing, agricultural labour and migration (Dulal et al., 2010:622). These strategies to cope with change vary between geographical locations, socio-cultural settings and livelihoods (Van Beek et al., 2003:44).

In the DRR literature, autonomous adaptation is seen as a key response to hazard risk that is often undertaken proactively by individuals to improve their quality of life (ISET, 2008:11). Households and community institutions are the traditional responsible to manage climate risks (Heltberg et al., 2009:95). Environmental change is a considerable additional stress in social systems that are vulnerable, urging communities to focus on reducing existing vulnerabilities that will be exacerbated and strengthen their overall adaptive capacity. Even though the poor

may have limited resources, they also have the capabilities to adapt to change and address adverse livelihood impacts (Opschoor, 2007:9). However, processes of environmental and climate change have created new ecological and socio-economic realities at the local level that overwhelm many community institutions to a certain extent (Moench, 2010:976).

Climate change is a *covariate* risk, meaning that it affects entire communities at the same time. This is significantly different from *idiosyncratic* risk that affects individual households through for example loss of employment or illness (Heltberg et al., 2009:94). Many traditional risk-sharing mechanisms based on social capital tend to fall short as climate variability may fall outside of the range within which traditional strategies can function (Macchi & ICIMOD, 2010:18). Furthermore, various processes of change like globalisation, communication, higher participation in labour market and remittance flows, and feminisation of agriculture have also altered previously geographically limited communities towards the prevalence of trans-local livelihoods. The strategies that rural communities apply to remain resilient include changes in agricultural practices and technological choices, diversification of livelihood systems, access to financial resources as micro-insurance and micro-credit, migration towards urban areas, and remittances.

Migration and mobility have become a vital livelihood strategy that decreases the dependence of households on their direct surroundings and climate-sensitive livelihood components. To understand the nature of current autonomous adaptation strategies particular attention needs to be paid to rural-urban linkages (ICIMOD, 2008:19). Having a clear picture of the role of migration and the factors driving it will be central to identify efforts that can assist vulnerable communities (ISET, 2008:66). Understanding the thresholds of human behaviour to shocks and stresses, most importantly when temporary migration becomes permanent or when livelihoods are transformed, can improve projections of potential response and the ability to plan the appropriate institutional responses. It requires more research to understand the situation of currently missing assets that enable migration of particularly the poorest segments of society. The role of remittances in adaptation (climate proofing of infrastructure and livelihood diversification) is also important to understand the potential of interventions that foster autonomous adaptation, including the degree to which remittances can serve as sources of social protection.

The changes that have taken place in the community tend to go accompanied with a decline of community-based resource user institutions, and horizontal networks of support give way to vertical linkages based on power and patronage (ISET, 2008:26). This brings great inequality to the communities and makes the support of autonomous adaptation more complex. As is the case with development in general, the effectiveness of supporting strategies may only become clear after a fair amount of time. Still, local agency-driven innovation is highly important, ranging from investments in education and livelihood diversification, to migration at the household level (Dixit & Moench, 2010:14). Providing frameworks that enable communities and households to design their own adaptation strategies can greatly contribute to resilience. According to Bartlett and colleagues (2010:8) the word autonomous is misleading to some extent since the availability of many autonomous adaptation options depends directly on the access to systemic factors that enable people to take advantage of opportunities. Planned adaptation can help develop infrastructure and support systems that are resilient in the face of climate change impacts and that help households to switch strategies, or facilitate autonomous adaptation. The provision of these baseline systems is urgently required and directly links autonomous adaptation to national level planning. More investigation is needed to better understand the parameters of both the autonomous and planned adaptation approach (Dixit & Moench, 2010:104).

Maladaptation

Not all responses to change are a process of adaptation (Klatzel et al., 2009:8). Maladaptation refers to activities that increase vulnerability to stresses and hazards. Maladaptive actions and processes often include planned development policies and measures that deliver short-term gains or economic benefits but lead to exacerbated vulnerability in the medium and long term (Jones, 2010:5). People can become victims of inappropriate development. Some responses are merely short-term coping strategies and are not sustainable on the long-term. Community-based coping mechanisms and external development efforts are maladaptive when they actually increase the sensitivity or exposure of a community (Douma & Hirsch, 2007:10). Measures that are said to only provide short-term relief are the installation of expensive pumping systems to irrigate agricultural fields, or the selling of livestock and purchase of fertilisers when water is scarce. Many rural areas have been provided with small-scale water supply systems that are only based on current realities and ignore the implications of increased climate variability since many of the springs that fed the systems have dried up (NCVST, 2009:44). The risk about path-dependent adaptation strategies is the fact that they can easily turn maladaptive when they are based on miscalculated environmental change assumptions. Since planned interventions trigger patterns of change that are difficult to reverse, they can create path dependencies that are maladaptive on the long-term (Pandey et al., 2011:481). It has been observed by Lam & Ostrom (2010:2) that systems that have received major external assistance tend to become totally dependent on the help. To prevent maladaptation, it is highly important to include certain elements that particularly focus on the institutional aspect. Increasing diversity and expanding opportunities for autonomous adaptation is key to avoid maladaptation. The ability to learn from experience will also help to avoid maladaptation (Sperling et al., 2003:xi).

Development-adaptation continuum

Development is a process of directed change and therefore strongly related to adaptation (Mustafa, 1998:292). Development actors have woken up to the reality that environmental change inhibits the development of social systems. This recognition is embodied by efforts to mainstream adaptation into existing programmes and projects (McGray et al., 2007:5). Adaptation includes in many cases 'regular' development interventions. It is often integrated into natural resource management, disaster risk reduction and sustainable development efforts (Janssen & Ostrom, 2006:238). Many strategies and activities that help reduce vulnerability to a changing environment are the same ones used to address non-environmental change problems. The distinction between development and adaptation is thus often difficult to make. Efforts to mainstream adaptation into development efforts imply that adaptation is something new, while reliance on existing development efforts to support adaptation suggests that the two are one and the same. This raises challenging questions on what really constitutes climate change adaptation.

McGray and colleagues (2007:17) have made great efforts in clarifying the messiness and diversity of approaches characterising adaptation. An important thing to realise is that the relationship between adaptation and development is not an either/or consideration. It would not be adequate to approach adaptation as standing separate from other ecological concerns that also impact on the development opportunities of the poor (Sperling et al., 2003:1). How adaptation relates to development varies across circumstances. Roughly two perspectives can be distinguished. One focuses more on creating response mechanisms to specific impacts associated with environmental change, and the other focuses on reducing vulnerability by building capacity that can help to deal with a wide range of impacts. In many instances, adaptation falls between the extremes of vulnerability and impact. One way of framing this diversity is as a continuum between 'pure' development activities on one side and explicit

environmental change measures on the other. As can also be observed in *Figure 2.4*, four types of adaptation can be distinguished (McGray et al., 2007:18-22):

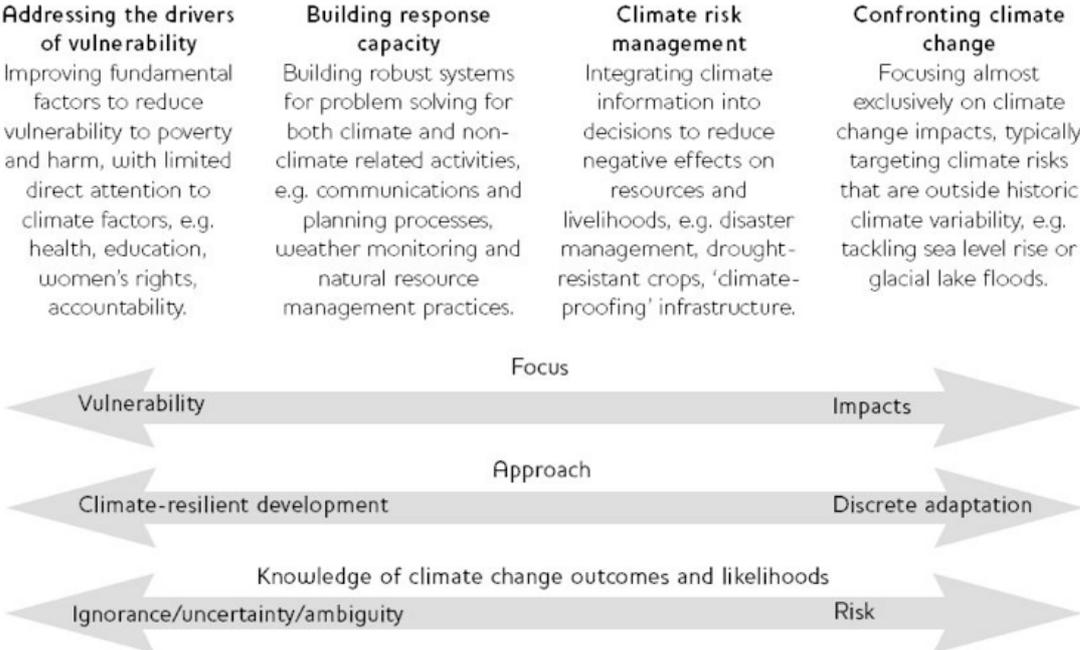
- *Addressing the drivers of vulnerability*: These activities focus on human development through poverty reduction and also address other shortages of capacity that make people vulnerable to harm, regardless of the causing factors. These activities buffer households and communities from sources of harm by focusing on capacity building that empowers people's ability to take action. Very little attention is paid to specific issues such as climate change during these interventions.
- *Building response capacity*: In this zone of the continuum, adaptation focuses on building resilient and robust systems of problem solving in the context of high levels of uncertainty. These capacity and institution building efforts provide the foundation for more targeted actions at the local level. Examples include the development of communication systems and planning processes, as well as improved mapping, weather monitoring and natural resource management practices. The interventions occur in sectors that are of more direct relevance to environmental change. However, the extent to which activities are targeted towards specific impacts is limited.
- *Managing climate risk*: When adaptation efforts focus more specifically on hazards, an important framework for action is provided by *climate risk management* (CRM). This refers to the process of incorporating climate information into decisions to reduce negative changes to resources and livelihoods. The CRM approach encourages the management of current climate-related risks as a basis for the management of more complex, longer-term risks associated with climate change. The approach depends greatly on the availability of climate information, and is enhanced when climate change predictions can be made with higher certainty and precision. However, when initiatives are made too concrete based on risk assessments that turn out to be inaccurate, maladaptation is likely to be the result.
- *Confronting climate change*: For a small set of examples, actions focus almost exclusively on addressing the impacts associated with climate change. These actions target climate risks that clearly fall outside historic climate variability and convincingly are the result of anthropogenic climate change. These actions are characterised by radical and costly efforts that fall outside of the well-understood set of practices of the development 'comfort zone'. Examples are efforts in the Himalayas to prevent harms from glacial lake outburst floods.

The bulk of experiences focuses on the messy middle of this continuum and builds capacity to manage environmental change risk (McGray et al., 2007:23). Lower levels of capacity and certainty require greater investment in addressing underlying causes of vulnerability. It is then essential that development measures revolve around no-regret strategies that are adequate regardless of the direction and magnitude of change (Aase et al., 2010:229). Higher levels of certainty about changes in the environment can improve the effectiveness of efforts to target specific impacts. Regions that face specific social-ecological impacts and have access to adequate climate information can still choose from a wide range of responses. Creating communication infrastructure can even then be a proper strategy to improve the adaptive capacity (Moench, 2010:976).

A number of capacity building activities have great relevance across the whole development-adaptation continuum (McGray et al., 2007:29). There are interventions that help to build community self-reliance by capacitating community self-managing institutions to take control of their development destiny. This capacity depends on the nature of underlying systems such as communication, transportation, organisation, knowledge management, finance, governance and livelihoods (Dixit & Moench, 2010:70). There is a need for the various spheres of society to collaborate in the provision of services. For example, the expansion of communication systems and financial services are established by the private sector, using business models.

Accessibility to geographical information, whether this is the mapping of flood risks, soil moisture, poverty indicators, watershed boundaries or other parameters greatly increases the resilience of regions. The capacity to convey geographic information is needed, given the location-specific nature of environmental change processes. Basic national statistical data also plays a fundamental role in most vulnerability assessments larger than the community level. The systems that gather and manage this type of information need to be funded. The dissemination of this information and awareness creation plays an important role for fair and effective public participation in adaptation decisions (Heltberg et al., 2009:94).

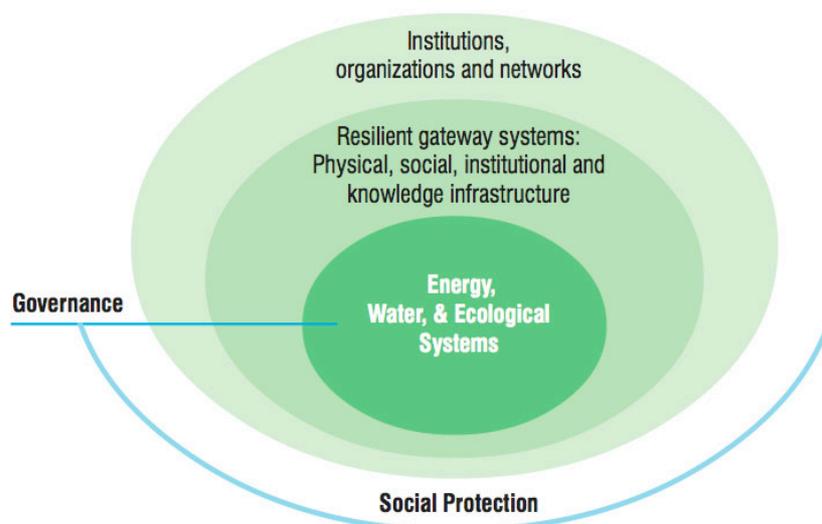
Figure 2.3 Development-adaptation continuum



Source: Adjusted from *Tanner & Mitchell (2008:2)*

When focusing on no-regret strategies at the local level, it is salient to research the factors that enable and constrain adaptation, especially when every household is vulnerable in different ways (ISET, 2008:97). Most research has focused on planned adaptation efforts that are ad hoc and uncoordinated at different scales and levels, rather than on long-term climate resilient development. Attention tends to neglect the need to create conditions that enable and support autonomous adaptation processes. Planned adaptation can only be successful when it is able to proactively identify and respond in a flexible way to emerging constraints and opportunities, and enable autonomous adaptation processes by supporting the development of resilient and accessible social and physical infrastructure. A third essentiality is to establish social protection systems capable of improving impacts on vulnerable groups that face particular constraints in adapting. Autonomous adaptation depends on the systemic factors that enable households to take advantage of opportunities available in new environments and foster their ability to shift strategies when conditions change (ISET, 2008:iii). To study how formal institutions can support autonomous adaptation and provide a safety net when autonomous adaptation proves to be maladaptive is salient. A model that conceptualises the important components that foster autonomous adaptation is shown in *Figure 2.4* and consists of four spheres, which are explained in the remainder of this paragraph.

Figure 2.4 Autonomous adaptation framework



Source: ISET, 2008:83

1. *Ecosystem services*: This sphere deals with the condition of basic land and water resources along with the productive ecosystems supported (Dixit & Moench, 2010:109). The variety of decisions households can make depends on the availability of freshwater for drinking and irrigation purposes, basic energy, and other natural resources (ISET, 2008:85). The presence of these ecosystem services is the foundation for higher spheres like gateway systems and institutions.
2. *Gateway systems*: According to Moench (2010:985) communities tend to be resilient when they have access to a variety of entitlements. This consists of a complex interaction of dynamic natural, social, economic and political systems (Dixit & Moench, 2010:13). The Institute of Social and Environmental Transition has identified a number of systems that function as *gateways*, in the sense that households are enabled to shift strategies (ISET, 2008:7). These systems or entitlements that encompass social and physical infrastructure are described in detail in Table 2.2. The nature of these systems has major influence on the *manoeuvring space* of rural households when climatic conditions change. The actual ability to reduce vulnerability to disasters depends on the integrity of these systems. When they are weak or fail, adaptive behaviour of households, like livelihood diversification, is highly constrained. When functioning properly, these systems represent a fertile ground on which both planned and autonomous adaptation efforts can be successful.

Table 2.2 Gateway systems that enable adaptation

System	Details
Communications	This system is important to provide access to diversified information, including weather and hazards information. The nature of a communication system influences the ability of information to go in and out of an affected area. It influences a proper dissemination of knowledge related to climatic threats and practices. The presence of local radio stations and cell phone networks increases the potential of information flows and the likelihood that communities will be more aware of key events related to water-induced stress and hazards. They foster the creation of early warning systems that give farmers more preparation time to reduce risk. Providing accessible and low-cost, but technically robust communication systems can serve as a core part of resilient and adaptive livelihoods. Cell phones also enable people to develop social networks, access market information and engage in other activities that build productive livelihoods. They also foster the creation of early warning systems that give farmers more preparation time to reduce risk.

Infrastructure	Central to resilience is a system that can ensure mobility under all, including extreme, conditions. The nature of a transportation system influences the ability of goods and services to go in and out of an affected area. A salient characteristic of the system is the extent to which it is natural hazard proof. It also determines the ability of farmers to sell their products to the market. This system encompasses all types of physical infrastructure, including trails, roads, water supply, and focuses in particular on the degree to which such infrastructure is vulnerable to disruption by disaster. It also deals both with flood-resilient and drought resilient infrastructure like embankments as well as water capture and storage facilities. The robustness of the system determines the ability to maintain livelihoods under extreme conditions and the ability to protect assets.
Finance	This system helps to reduce risk through the access to banking, credit and insurance products before, during and after extreme events. Various formal and informal institutions can provide micro-credit and crop insurance, like cooperatives, local self-help groups, and informal moneylenders. Increasing pressure on traditional risk sharing strategies (borrowing from family, friends and local networks) and the exploitative nature of moneylenders during disasters makes the access to formal financial institutions for credit and insurance also very important. Financial capital can trigger behavioural changes, helping famers to cultivate drought or flood-resistant species, increased crop diversity, and access seeds and equipment more rapidly after natural stress or hazard. It can also enable community members to acquire initial capital for migration purposes.
Education	This system capacitates households with the basic education required to access multiple job and skill markets, along with the necessary analytical skills. This enables households to diversify and incorporate non-agricultural components into their income-generating strategies. This can include knowledge about construction and other non-agricultural activities but also agricultural activities, including improved farming strategies obtained by training that allow agricultural livelihoods to be more resilient. Farmer field schools and awareness creation activities are thus central components in the education system. Education, particularly specific hazard information brought by external institutions, can help households to better understand risks and shift livelihood strategies when necessary.
Knowledge generation, planning and learning	The education system forms the fundament of this system, which incorporates more proactive elements and deals with the social and scientific basis required to enable learning from experience. This allows households to proactively identify hazards, analyse risk, and develop responses that are tailored to local conditions. Impacts will also depend on the degree to which vulnerable populations are able to obtain, correctly interpret and act on advance warning of upcoming flood and storm events.
Organisation and representation	This system encompasses the ability to access diverse public, private and civil society organisations and voice household and community concerns to them. A central component of this system is thus the building of linkages and relationships between the community and local institutions. Next to the link with extra-community institutions, this system also deals with internal organisation within community resource user groups. The ability to participate in these community-based organisations and access the managed resources greatly influences household resilience. This also deals with the ability to self-organise following disturbances as well as during more linear and controlled trends of environmental change.
Economic diversification	This system stands at the fundament of the above gateway systems. Economic diversification deals with the strategies applied to spread risk by relying on the various gateway systems. When these systems are robust and able to deliver their benefits, households are more likely to be successful in accessing a broader range of alternative livelihood options. This includes the ability to migrate and obtain access to agricultural and non-agricultural sources of income outside drought- and flood-affected areas.

Source: *Dixit, 2010, ISET, 2008, and Dixit & Moench, 2010*

3. *Institutions and networks*: The third sphere is embodied by the institutions and social networks that govern both the natural resource base and gateway systems and are key in the generation and transfer of new knowledge related to resource management, DRR, land use planning, migration support, and development of agricultural strategies. This sphere will be elaborated in the next paragraph.

4. *Governance and social protection*: The institutional sphere necessarily raises questions of access to endowment and entitlements. This greatly depends on how all the above systems are governed. The governance dimension deals with existing patterns of vulnerability that are created by gender, social exclusion and poverty and equitable access to resources and systems (Dixit & Moench, 2010:9). Due to inequitable access, regulated by existing policies and institutions, considerable livelihood damage can result even from modest changes in natural systems (Heltberg et al., 2009:89). The development of social protection and safety nets capable to address the needs of those who face major adaptation constraints will be a major factor determining future patterns of poverty. The factors that determine access to gateway systems will be among the most important elements in social protection (ISET, 2008:70).

Community and household capacity to shift strategies in face of environmental and climate change is determined by the four above-mentioned spheres. Together, they consider the diversity of factors that reduce vulnerability in fundamental ways (Dixit & Moench, 2010:8). A number of barriers can be identified that prevent communities and households from effectively adapting to environmental change. In the climate change literature, three broad categories of limitations and barriers can be distinguished (Jones, 2010:2).

- *Ecological and physical limitations*: comprising natural limitations to adaptation, ranging from ecological constraints to ecosystem thresholds. When sustainable development is placed central, a salient concern is to know at which point ecosystems are no longer able to provide their services and sustain livelihoods.
- *Human and informational limitations*: including knowledge, technological and economic restrictions. There are various spatial and temporal uncertainties associated with forecast modelling, and low levels of awareness among policy-makers on climate change impacts, as well as a lack of financial resources and assistance to facilitate adaptation interventions.
- *Social barriers*: these barriers comprise psychological, behavioural and socio-institutional elements that determine how individuals and societies react in the face of water-induced stress and hazards, be it in the form of prolonged drought, heavier and uncertain rainfall or rising temperatures. These components of adaptation are often neglected within the wider adaptation debate. According to the IPCC, these social and cultural limits to adaptation are not well researched to date (Jones, 2010:2). These limitations prevent individuals or groups from seeking the most appropriate forms of adaptation. Key aspects lie with the structure and organisation of social institutions that are the 'rules of behaviour' that govern belief systems, norms and behaviour, and organisational structure. These institutions are diverse and can be observed as local farmer collectives, indigenous knowledge institutions, or collective ownership rights to forest resources. They determine to a large extent people's behaviour when they are faced with the threats of social-ecological change. Current academic insights particularly focus on the effects of gender, caste, ethnicity, age and class (Jones, 2010:6). It is salient to take proactive steps to overcome the barriers to adaptation. Awareness, education and empowerment stand central to overcome social barriers, address institutional restrictions in behaviour and entitlement, and alter restrictive and maladaptive perceptions, norms and cultural constraints.

2.4 The institutional aspect of adaptation

The inherently applied nature of climate change adaptation has the consequence that much of the burden of action lays not with science, but with governments, development organisations and communities (Eakin & Lemos, 2006:7). Adaptation is inherently a social process that requires collective action, since vulnerability processes are strongly linked to the institutional landscape of the population that faces hazards. These hazards thus form the direct outcome of the social, economic and political processes that shape everyday life (Mustafa, 1998:292).

Institutional arrangements determine whether or not populations, especially vulnerable segments of society, are able to take advantage of *gateway systems* to shift strategies (ISET, 2008:6). Institutions are fundamental in supporting autonomous adaptation, and in sustaining households when attempts of autonomous adaptation fail. It is these institutions that make resources available to address hazards, that arrange the distribution of resources across the system and that shape available coping strategies (Adger, 2006:277). Successful adaptation relates to governance that is able to create equitable resource access and control. This section thus focuses on the role and ability of institutions to effectively address hazards by creating an enabling environment within which communities can increase their resilience.

Institutions have always had a central role in regulating social systems. The need to control, regulate and distribute water for irrigation and food production has often been the main reason for societies to organise (Van Beek et al., 2003:31). Institutions adapt to changing conditions. However, the rate at which institutions adapt often lags behind the rate of change in social and ecological systems (Dixit & Moench, 2010:110). When social-ecological pressures increase, the reliance on existing formal and informal resource management institutions decreases. Modernisation and globalisation have put indigenous institutions for resource management under pressure (Opschoor, 2007:15). There is a need to better understand the incentives that make local resource user institutions to adopt improved land and water management technologies, bringing to the centre stage the role of markets and policies to stimulate farmer innovation (Shiferaw et al., 2009:604).

Globalisation has brought administrative reform in practically every country that complicates decision-making processes (Eakin & Lemos, 2006:8). An important global trend has been the decentralisation of resource control and management to the local level, giving a stronger role to local communities in the management of their resources (Opschoor, 2007:17). Political decentralisation brings governance closer to the people and fosters their participation in decision-making, efficiently using funds in accordance to the needs and priorities of communities (UNDP, 2009:79). However, decentralisation also requires the development of new skills of the local government with few resources. Decentralisation and the shrinking of the state are only a few of the many changes that have implications on local capacity building. To deal with the difficulties, new forms of governance, the emergence of new development partners, technologies that improve administrative efficiency, enhanced flows of information and knowledge and the construction of social capital through enhanced civil participation can all contribute positively to enhance institutional capabilities (Eakin & Lemos, 2006:17). The government remains the most important institution for the poor since every other actor needs to work within that structure (Dulal et al., 2010:631).

Multi-scale adaptation governance

Since most autonomous adaptation occurs at the local level, the role of meso-level institutions is particularly important (ISET, 2008:98). Local authorities form part of the national network of government institutions and can function as the crucial bridging institution between local needs and national strategies. Adaptation governance across scales requires the identification of institutional mechanisms that can facilitate effective horizontal links between different departments and vertical links between local, meso, and national levels, and the exploration of how meso-levels of government can facilitate gateway systems that enhance adaptation. It is highly needed to understand how different levels of governance influence and interact with each other and how these processes lead to efficient interactions between governance levels (Amundsen et al., 2010:288).

The resilience of one scale strongly depends on the dynamics of systems at higher and lower scales (Walker & Salt, 2006:90). During severe hardship a community may or may not get

help from higher scales. Many studies have therefore argued for a combination of local and national level activity, in which the national government prioritises the policy foci, while the local levels organise their own planning and implement national policies (Amundsen et al., 2010:277). In this multilevel governance framework, national governments need to give a clear role to local governments through setting goals, creating regulations and financing adaptation processes. Without national authorities giving clear political signals, local governments will find it more difficult to develop effective adaptation policies. Increasing resilience depends on an active government with a fundamental role in protecting vulnerable groups and guiding development processes towards greater equity. It is salient to create an enabling institutional environment that expands sustainable livelihood opportunities and reduces vulnerabilities to stress and hazards (Opschoor, 2007:19).

Most literature on adaptation strategies has urged for the formulation of national adaptation planning (Ghimire et al., 2010:225). Within this context, special funds and strategies have been targeted at the least developed countries through mechanisms of the Climate Change Convention to develop National Adaptation Plans of Action (NAPAs) (Adger, 2006:277). Around fifty NAPAs have been developed and implemented using the guidance of the Least Developed Countries Expert Group (LEG) (MoEST, 2010:7). They form the primary instrument to mainstream adaptation into the national development agenda and contribute to poverty reduction and community resilience. NAPAs provide a process to identify priority activities that respond to urgent and immediate adaptation needs (ISET, 2008:99). These actions widely include human and institutional capacity building. Top priorities for most NAPAs are related to water and agriculture, focusing on the construction and improvement of reservoirs, irrigation and the distribution and education in the use of drought-tolerant food crops and methods. Since government resources in these countries are scarce, support for adaptation requires well-targeted approaches (Ghimire et al., 2010:226). The current push to formulate National Adaptation Plans of Action seems to miss the opportunity to propose adaptation projects for community or local level institutions (Heltberg et al., 2009:95). According to Agrawal and colleagues (2008:7) only 20 percent of NAPA projects incorporate local institutions as the focus of adaptation projects, and even less identify local institutions as partners in facilitating adaptation. Furthermore, it is essential that the eradication of social barriers is mainstreamed in planned adaptation interventions like the NAPA and Pilot Project for Climate Resilience.

Water sector paradigm shifts

Adaptation practices have changed over time, from predominately *hard* structures towards more *soft* solutions (Van Beek et al., 2003:32). In recent years, more holistic and landscape wide approaches of land management are promoted that have placed water resources at the centre (Shiferaw et al., 2009:603). The idea of participatory, integrated and sustainable water management has strongly inspired local policy-makers to implement new institutions that adopt the river basin as the management unit (Eakin & Lemos, 2006:14). Watershed Management (WM), which is tightly linked to Integrated Water Resource Management (IWRM), has become dominant in especially mountainous countries (Pandit et al., 2007:67). It entails the improvement of land and water management with a strong link to local livelihoods (Bhandari & Gurung, 2008:8). The IWRM principle entails that water must be viewed from a holistic perspective, incorporating all the different users. Water resource management, like other development efforts, need to reduce the incidence of poverty and provide people with access to safe and adequate drinking water to ensure good health standards, and increase agricultural productivity and food security (WECS, 2005:9). The principle views water as an economic and social resource, arguing that it needs to meet firstly the basic needs before being allocated to those sectors offering the highest returns, by all times protecting the integrity of ecosystem

services (Dixit, 2006:11). Water resources are best managed on a basin scale since water and land resources at this scale are strongly interrelated and form a fundamental planning entity. The inherent interdependence among water, soil, and land use makes river basin planning a complex task. Though complex, IWRM has been universally accepted as a tool to manage tasks related to sustainable water resources development.

During the 1992 United Nations Conference on Environment and Development, the need for new institutions like watershed development committees was recognised. Governments were urged to adopt management systems that place environmental components in the middle, with planning tools that focus on ecosystems and watersheds, and that allow the integration of both developmental and environmental goals through sustainable livelihood systems and the strengthening of land governance systems (UNCED, 1992:10.7). Identified priority activities were stated to be the protection and conservation of sources of freshwater supply, flood and drought management, protection of mountain slopes and riverbanks (UNCED, 1992:18.85). The implementation of the principles requires an enabling environment and the formulation of appropriate water sector legislation. This needs to clearly define the role of central and local level government institutions in river basin management, and management instruments such as water resources assessment, water allocation and conflict resolution (WECS, 2005:8).

According to Achouri and colleagues (2005:13) many watershed management programmes have failed due to too much focus on natural resources conservation. WM programmes have often been designed with little attention to human activities and the priorities and needs of the people. They were frequently limited in span and scope, and lacked long-term commitments needed to address underlying causes and management issues. Major constraints of watershed development are the willingness and capacity of national governments to act. Still, watershed management needs to be recognised as one of the most important mechanisms for effective adaptation (Achouri et al., 2005:24). Community development needs to be a fundamental part of integrated watershed management with a strong focus on training the local inhabitants who are directly involved in implementing development activities.

Since water is a common pool resource, divergence of interest is likely to emerge when heterogeneous groups, who have different degrees of access to, and control over the resource, share it (Adhikari & Lovett, 2006:427). Inequality in wealth is generally perceived as the most likely type of heterogeneity to hinder successful collection action in situation where users may not have the same interests in regulating the use of common pool resources. Differences in wealth are evident in the extent of land and livestock holdings, or the amount of alternative income opportunities available to community members, which influences the presence or absence of exit options (Moench, 2010:976). When conflicts between the wealthy and those with less endowment arise, local management institutions weaken. It is the inclusion of vulnerable segments of society in decision-making structures that is a vital to increase their resilience (Adger, 2006:277).

Local level institutions

The nature of social institutions determines how individuals and households adapt to water-induced stress and hazards (Jones, 2010:1). Totally top-down government structures may be efficient in the short term, but they tend to fail when the circumstances under which they were developed change. Messy institutional structures perform better in these circumstances (Walker & Salt, 2006:148). Solutions to problems like climate change are difficult to recognise because of complex interdependencies in the systems affected. When trying to solve one aspect, other problems are revealed or created. In this case, a proper understanding of the local context is very salient and elegant top-down solutions do not solve the problem (NCVST, 2009:90). Analysis tends to focus either on bottom-up approaches that emphasise

community perspectives and processes or on top-down approaches that emphasise the role of high-level actors. Actually, there is a need to adopt a balanced approach with reflexive learning across different scales (Dixit & Moench, 2010:96). Unless people have the capacity and are given the space to make decisions and act, it will be difficult to achieve effective adaptation. Local institutions play a major role in designing adaptation plans (Dixit & Moench, 2010:94). Natural resource user groups and cooperatives determine the poor's access to technologies, assets, credits, seeds, insurance, healthcare and markets. An understanding of these institutions and their rules is important to have an idea of the social dynamics that underlie adaptive responses to environmental change. This is because institutions facilitate the process of helping affected communities to adjust by fostering access to social safety nets and negotiate with external support organisations (Dixit & Moench, 2010:105). Some of the systems that facilitate a strategy switch fall within the domain of the market. By promoting their services, market actors can help the adaptation process, particularly in strengthening the access and delivery of climate-related information and incubating non-agriculture based micro enterprises. Involvement of actors from the state, market and civil society are important for successful adaptation at the local level.

An increasing focus is placed on community-based adaptation (CBA), recognizing the ability of local communities to best understand and respond to the complexity of local change processes (Jones & Rahman, 2007:17). CBA is about the community making choices that are not imposed on them from the outside. CBA supports and develops informed autonomous adaptation to climate variability, by involving local stakeholders as well as development and disaster risk reduction practitioners (Jones, 2010:7). It builds on existing cultural norms, while addressing local development issues that help to alleviate climate vulnerability. An important governance principle is *representation* that provides a solid foundation to make adaptation prioritisation and fair trade-offs (McGray et al., 2007:27). Community members need to take an active role in defining their needs. Community-based institutions tend to be well informed to identify the needs and possibilities for adaptation (Douma & Hirsch, 2007:16).

This chapter has made an attempt to provide an overview of the insights that have been gained to date on the notions of *resilience*, *vulnerability* and *adaptive capacity*. The introduction has clarified that to foster the ability to adapt to social-ecological change is becoming increasingly important. Institutions play a key role in this endeavour. This research will focus on whether and how institutional arrangements, both formal and informal and at various levels, help to co-determine the resilience of rural communities in the Nepalese Himalaya. The next chapter will provide a detailed overview of the research objectives, together with an explanation of the methodology used.

3. RESEARCH METHODOLOGY

The issue of adaptation to water-induced stress and hazards is subject to much debate. It is noted however, that a research gap exists when it comes to the institutional arrangements that influence both autonomous and planned adaptation (ISET, 2008:10). Few studies have focused on the factors that foster and inhibit autonomous adaptation of rural communities themselves. Instead, most efforts concentrated on planned adaptation processes. Knowledge about the risks that are faced by poor communities and households is required, as well as ways to effectively lower household vulnerability (Heltberg et al., 2009:89). For this there is an urgent need to link higher-scale policies and processes to these autonomous adaptation efforts. Focus has to be placed on the institutions that facilitate a diversity of gateway systems to rural households through which communities are enabled to address social-ecological impacts.

3.1 Aim of research

This research strives to obtain an insight in the nature of rural livelihoods in the Nepalese Himalaya and the perception of community members to social-ecological change. This study is needed to determine community sensitivity and exposure to change. Emphasis is placed on the household strategies that are applied as a consequence of these community perceptions. Of key concern are the informal and formal institutional arrangements at the community level that either foster or inhibit effective adaptation in the context of change. Focus is placed on practices of reciprocity and agricultural livelihood strategies that community members apply to spread risks associated with climate variability. As social-ecological change often exceeds the adaptive capacity of traditional livelihoods, new non-agricultural livelihood strategies are discussed, together with the changes in practices that arise when their importance increases.

This research places central the agency of community members to adapt autonomously, at the same time recognising that rural livelihoods are an outcome of a complex reality of both planned and autonomous adaptation processes, with strong links between the two. Therefore, both adaptation processes will receive attention. A last, crucial focal point is an examination of the influence national-level adaptation institutions and their policy frameworks have on the *manoeuvring space* of rural livelihoods.

3.2 Research questions

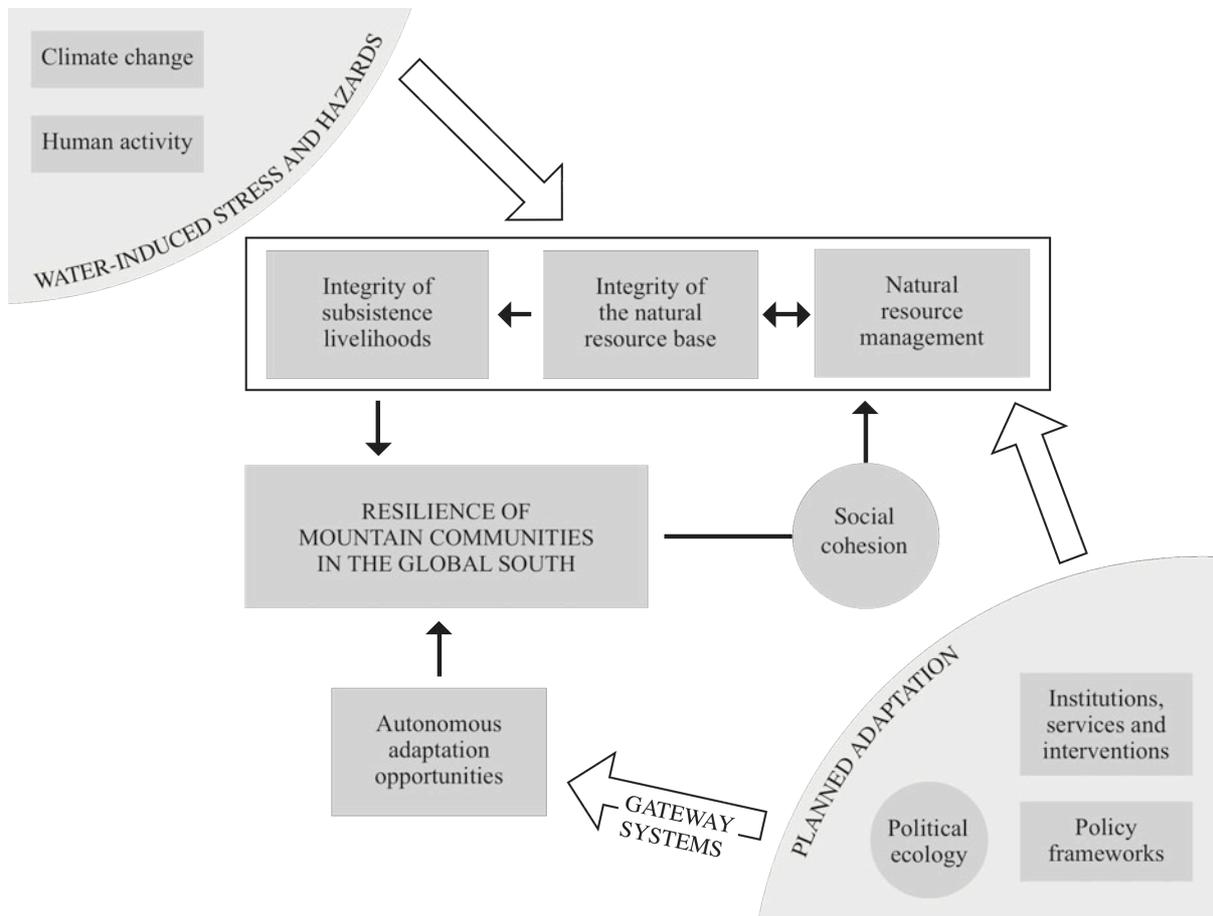
The central research questions are: What are the factors that determine the resilience of rural communities to water-induced stress and hazards in the Nepalese Himalaya? How is adaptive capacity determined by community- and household-based strategies, and what is the role of institutions, their services and interventions? What challenges can be observed that inhibit expanding the *manoeuvring space* of rural livelihoods in the face of water-induced stress and hazards? To facilitate an answer, the central research questions are divided into four themes:

1. *Rural livelihoods and environmental change perception*: How is the rural livelihood system connected to the ecological system? What are the main changes in the natural environment as perceived by community members and what is their relative severity? What is the nature of this change over time? What are the effects of water-induced stress and hazards and what do changes in their severity mean for agriculture-based livelihoods?
2. *Agricultural strategies and collective action*: What practices of reciprocity exist at the community level? What agricultural strategies do community members apply to spread risks related to climate variability? What practices of collective action are present to ensure effective maintenance of the productive infrastructure? What is the significance of these practices and has this changed over time? What livelihood strategies do households apply outside the agricultural sector? What perceived benefits do non-agriculture income sources

bring? How can community level institutional arrangements and social networks be characterised and have they changed?

3. *Institutions, services and interventions*: What natural resource user groups and institutions exist and how do they ensure an adequate management of the natural resource base? What types of institutions can be identified in the case study area and what services do they offer rural households? What are the current effects of these interventions and what does this imply for community resilience? What households in the case study area do not benefit from interventions?
4. *Policy frameworks for adaptation*: What institutions at the national level are responsible for adaptation to the effects of water-induced stress and hazards, and climate change? How can their mandates be characterised to work with adaptation issues? What new climate change initiatives can be observed? To what extent does coordination take place between ‘adaptation’ institutions and has this changed over time?

3.3 Conceptual framework: the *manoeuvring space* of mountain communities



An increase in the severity and frequency of water-induced stress and hazards brings a range of risks like decreasing crop yields, reduced drinking water access and migration (Heltberg et al., 2009:94). The challenge is to explain the adaptive capacity of a system with the influence that institutions and governance processes have on the social-ecological context.

3.4 Approach and methodology

This research follows a methodology along participatory and qualitative lines that stresses the importance of household and community strategies that act to adapt to social-ecological

change and emphasize the importance of institutional arrangements in the adaptation process. The Community Risk Assessment (CRA) and Vulnerability and Capacity Assessment (VCA) approaches are applied to study the impacts and effects of social-ecological change on rural livelihoods. Participatory Rural Appraisal (PRA) tools are used to assess vulnerabilities and community risk priorities by promoting the active participation of community members (Van Aalst et al., 2008:166). Putting the perception of community members central in research is vital, since it is upon this perception that households make their everyday decisions (NCVST, 2009:33). These decisions shape livelihoods and institutional arrangements at the community level. Adaptation measures are likely to be more effective when they have input from those who are affected by climate change and best placed to manage risks (Sperling et al., 2003:25). The examination of perceived trends in determining household and community vulnerability is central to CRA. This approach not only focuses on trends related to climate variability and change but also takes into account the whole spectrum of social-ecological changes the community is subject to (Van Aalst et al., 2008:172). Next to climatic and environmental processes, these changes are demographic and socio-economic in nature. The CRA is not future oriented, but based on observation of current change risks and how communities cope with them. This approach also examines adaptation strategies and policy frameworks at different scales. On the basis of this existing knowledge, the characteristics of community adaptive capacity can be determined. The methodology gathers different types of information by applying various techniques. The tools that have been applied in the communities include:

- *Transect walks and direct observation*: A small number of community members is asked to guide the researcher through the community surroundings, to record important natural and infrastructural features in the area. Special emphasis is placed on features that influence vulnerability (water-induced stress and hazard sites), features that represent farmer and non-farmer livelihood strategies, and features that show interventions from outside. Photos are taken of all these sites to facilitate reporting. During the walks questions related to land use are asked.
- *Focus group discussions*: A group meeting of at least ten community members is organised in each community to function as a platform for different participatory tools. All responses of community members during the conversation are written down on a sheet to facilitate the group process. The following techniques are used:
 - *Community characterisation*: A first request is to characterise the community context. The following issues are asked: the present number of inhabitants and households, the distance to the closest market, whether there is access to irrigation and how many households benefit from it, the top five mostly cultivated crops, the top five mostly owned animals including average herd size, the top five most important income sources (both agricultural and non-agricultural), the top five most popular migration areas.
 - *Environmental risk mapping*: Community members are asked to name all environmental change problems, after which they are asked to put these problems in order of severity. This method shows the exposure of communities to environmental stress and hazards.
 - *Historical changes in seasonal calendar*: This tool is used to show the differences in the start and end of the monsoon season between two periods. This is asked for the present as well as for the time that community members considered rainfall patterns to be normal. This allows a more concrete insight in the environmental change processes that have occurred in this part of the Himalaya. Subsequently, the occurrence of livelihood-centred activities is asked, such as planting and harvest times. This is equally done for the past and the present to show possible shifts in these activities.
 - *Risk spreading strategies*: This tool aims to identify the coping and adaptation strategies that the community applies to spread the risk of climate variability. It shows the ability

of communities to reorganise and minimise loss of livelihood resources. The strategies may include crop diversification, cultivation in different agro-ecological zones, spread of agricultural fields, practices of reciprocity and exchange with other communities.

- *Community resource institutions and collective action*: Community members are asked to identify the tasks they carry out collectively related to the operation and maintenance of productive infrastructure. It is asked whether resource user groups are present and whether their rules and regulations are formal or informal. When resource user groups are present, how many households do participate in and benefit from these groups? How can the present community work be characterised compared to the practices done in the past? Has it increased or decreased and why?
- *Scheme of effects*: This tool aims to identify the consequences environmental, demographic and socio-economic changes have had on community livelihoods in recent years.
- *Inventory of external institutional support*: This tool aims to obtain an overview of all the external institutions that were and are carrying out their programmes and projects in the community. This needs to go accompanied with a perception of the quality of interventions. Is the implemented infrastructure still in use, does it have a positive or negative effect on the community, and is there a difference within the community of households who benefit and those that do not? Were these interventions implemented in line with community practices, and demanded by community members?
- *Key informant interviews*: In each community, three persons, being the community leader, a middle class farmer, and a poor community member (without access to irrigation) have been interviewed to acquire in-depth knowledge of risks and changes, and the complex reality of community practices and institutions that deal with resource management and collective action. It was strived to find a class and gender balance in every community. Thus, at least one woman was interviewed in every community. The interviews will give special attention to the formal and informal institutional arrangements present at the community level. The methods of Lam & Ostrom (2010:19) are taken as a guideline to examine the resilience of community regulations with the aim to identify the capacity gap. A number of interviews are conducted also with institutions that operate in fields that are related to adaptation. *Appendix I* shows the interview lists.
- *Gateway system survey*: In close collaboration with the Institute of Social and Environmental Transition a survey is designed to identify the enabling and constraining factors that determine the adaptive capacity of rural communities in the Indrawati River basin. This survey is based on a theoretical framework that is still being under construction. 14 households have been selected in each community (84 in total). To be certain of capturing the diversity of situations within the communities as well, the top 7 (high status) and bottom 7 households (low status) have been selected for the survey. These households have been selected according to the perception of the community members, for which a social map has been drawn with a small group of inhabitants. The sample includes both high and low-caste households.

A distinct shortcoming of particularly the institutional analysis at the local level is the fact that very little use could be made of written material. Particularly at the district and village level, policy documents of the wide variety of institutions tend to be exclusively available in Nepali. This institutional analysis is thus primarily based on the interviews conducted with the executed members of each institution, with the help of a translator.

Triangulising local perceptions

It is necessary to observe whether perceptions that have been collected at the community level fit within broader climatic data (Van Aalst et al., 2008:173). This triangulation has been

done for the Global Climate Model projections for the Himalayan region. The lack of systematic and accurate meteorological observation is seriously constrained in Nepal, making a comparison of community level perceptions with local climatic data virtually impossible. Available information is often inconsistent and data about water sources and hydrology is only exists for a few locations in Nepal (Dixit et al., 2009:7). The fact that reliable local climatic data is absent makes an insight into the perceptions of community members to social-ecological change more salient for policy frameworks focused on adaptation.

Ethical considerations

Two important ethical considerations were made while conducting this fieldwork. Firstly, prevailing power relations within the research area are in need of careful consideration, be it between low- and high castes, women and men, and rich and poor. Efforts were made to find a balance between these groups while conducting the research. However, due to the short time span of the research, it was not possible to stay long enough in each community to get a thorough understanding of the local nuances of power. This needs to be taken into account. Secondly, this thesis has been written without serving the direct needs of any institution or intervention. The primary reason for its conduction is academic in nature. The research outcomes will thus not have direct benefits for the communities involved. The outcomes might facilitate the implementation of the Indrawati Sub-Basin Project, since the same micro-catchments have been selected for this research. The academic nature of this research has been explained to the community members prior to any involvement, thereby adhering to the guidelines of informed consent.

3.5 Defining the research area

This Master Thesis serves the purpose of obtaining an initial understanding of the dynamics of rural mountain communities that are *living on the edge* with respect to social-ecological change processes that affect rural livelihoods. Research is conducted in the Indrawati basin that falls within the Middle Mountain and High Mountain regions of the country, located in the Sindhupalchowk and Kavrepalanchowk districts. The Government of Nepal's Water and Energy Commission Secretariat (WECS) and the World Wildlife Fund have jointly started a pilot project in June 2010 to implement the National Water Plan (2005) in this river basin. For a map that shows the priority micro-catchments as selected by the WECS/WWF Indrawati Sub-Basin Project, please see *appendix 2*. It has been acknowledged by both institutions that when this research on the adaptive capacity of communities focuses on communities in the same micro-catchments as the project, benefits can be derived for its implementation. While engaging in this alignment, great importance is paid to the required academic preconditions linked to the selection of communities.

Selection of communities

The selection of communities is based on the search for heterogeneity of community types in the same river basin. This allows the observation that the *vulnerability landscape* within the same river basin can be very different when physically, economically and culturally diverse communities are taken. The Indrawati Sub-Basin Project guides the selection of communities to the extent that three micro-catchments are selected that are prioritised by WECS and WWF as well. Within the micro-catchments an *archetypal livelihoods* approach is followed, based on the understanding that in different locations in the river basin, the rural population depends on different livelihoods and water availability situations with each their own vulnerabilities (Van Aalst et al., 2008:175). Selecting both high- and low-caste, as well as mixed rural communities also fosters heterogeneity. Six communities are selected with the aim to capture the greatest possible diversity in water-induced stress and hazard characteristics and social-ecological change processes. To minimize complexity, an attempt was made to select valley

and hill communities that are located within the same Village Development Committee in each micro-catchment. This was possible for three of the four micro-catchments. The micro-catchments and communities that have been selected are from south to north:

- the Sipaghat micro-catchment: *Thadokol* (valley) / *Devisthan* (hill)
- the Sahare-Baghmare micro-catchment: *Arubote* (valley) / *Acharyatol* (hill)
- the Tipeni micro-catchment: *Tipeni* (valley) / *Okrani* (hill)

Figure 3.1 The location of the six communities in the Indrawati basin (East is up)



Source: *Google Earth, 2011*

3.6 Scientific and societal relevance

The distinction that is made between autonomous and planned adaptation is relatively new within the academic adaptation debate. Various institutions are involved in the identification of the elements that determine the adaptive capacity of rural communities in the global South and the ways in which planned adaptation can facilitate autonomous adaptation. This research aims to contribute by providing the case study of Nepal. As was observed in the introduction, Nepal is the fourth country in the world that is vulnerable to the effects of climate change. The Nepalese Himalaya thus represents a kind of climate change frontier where large segments of the poor society ‘lives on the edge’ in the face of social-ecological change. From a scientific perspective the country offers an interesting case in the study of autonomous and planned adaptation strategies to water-induced stress and hazards in vulnerable mountain communities. The insights obtained can give direction to policy frameworks that foster the development of autonomous adaptation strategies. The institutional challenges that need to be faced in this endeavour can serve as a valuable contribution to a better understanding of community adaptive capacity in other mountainous regions of the global South.

4. DEVELOPMENT CONTEXT OF NEPAL

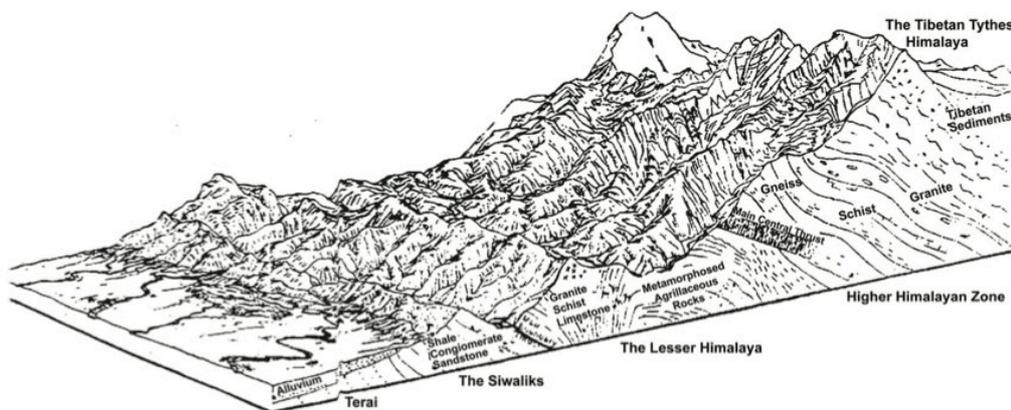
Resilience, vulnerability and adaptation are notions that are fundamental to understand how rural communities in the global South can adjust to changes in their natural environment. To grasp the nature and context of autonomous and planned adaptation processes, it is important to carry out a case study. This research focuses on the Indrawati River basin in the Nepalese Himalaya's. To obtain a deeper understanding of the situation in the basin's communities it is necessary to sketch the social-ecological context. This chapter serves the purpose of clarifying the context in which the research has been conducted, which greatly determines the adaptive capacity of the communities.

4.1 Physical background

Nepal is a mountainous country located at the fringe of the Himalaya, between India and Tibet (China), covering an area of 147.181 km² (Poudel, 2005:122). The altitude ranges from 60 meters above sea level (masl) in the south to more than 8848 masl in the north over a distance of 160 kilometres. Five main ecological belts can be distinguished according to altitude. The Terai (<900m), the Siwalik Hills (900-1200m), the Middle Mountains (1500-3000m), the High Mountains (3000-5000m) and the High Himalayas (>5000m) (NCVST, 2009:47). About 59% of the total land area consists of steep to very steep slopes, 22% is moderate to steep and 19% is plain (MoEST, 2008:11). The Nepalese Himalaya is considered to be the youngest mountain system in the world, making it relatively unstable and susceptible to human activity (De Berdt & Singh, 2009:2).

Nepal is one of the most water-abundant countries in the world with about 6.000 rivers flowing within its borders (Bartlett et al., 2010:2). They provide a dense network of rivers with steep mountain valleys. The river systems drain their water from the north to the south, where they end up in the Ganges. The four major river systems are the Karnali, Mahakali, Narayani and Saptakosi (De Berdt & Singh, 2009:3). The medium rivers that originate in the Mahabharat range are the Babai, Bagmati, Kamala, Kankai and West Rapti. The minor river systems that originate in the Siwalik range have little water during the dry season, but cause flash floods during monsoon. River are rain-fed as well as glacier-fed. The latter one is especially the case for the four major river systems. 3.252 glaciers can be identified on Nepalese territory, with a total area of 5.323 km².

Figure 4.1 Physiographic regions and major geological formations of the Nepalese Himalaya

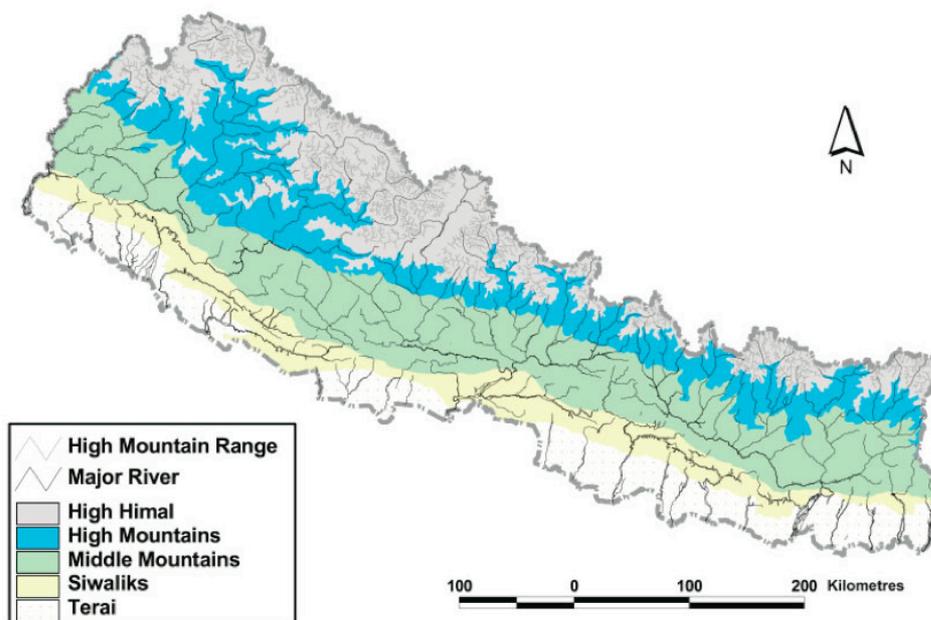


Source: Ministry of Environment, 2008:9

Nepal's climate is greatly affected by the Himalaya mountain range. While most of the country has a subtropical monsoon climate, the orientation of mountains and deep valleys are responsible for a number of micro-climatic regimes that are found within short distance from south to north (Singh et al., 2004:7). The Terai plains are subtropical whereas the Siwalik hills are warm and temperate. The river valleys in these hills are subtropical while cool temperate in the higher ridges. The mountains between 3.000 and 4.000 meters are alpine, and above 4.000 meter there is an arctic climate.

In general, there are four precipitation seasons. A wet season between June and September, a post-monsoon period with little precipitation between October and November, the cool dry winter season between December and February with occasional snowfall in the High Mountain and Himalaya regions, and a hot, dry pre-monsoon season between March and May (NCVST, 2009:45). The highly varied topography over short distances cause Nepalese rainfall patterns to be inherently complex, varying greatly over short distances. Precipitation is greatly influenced by the South Asian Monsoon System (SAM), but the relationship between the timing and volume of monsoon rainfall, and the mountain landscape is poorly understood (Dixit, 2010a). Since the withdrawal of the monsoon typically begins from the west, this part of the country experiences the shortest monsoon season. Mean annual precipitations range from 250 to 4.500 mm, with more than 80 percent of the total precipitation occurring during the monsoon season between June and September (Chalise & Khanal, 1997:325). The monsoon arrives from the south and therefore the southern areas receive more rain than the north while the heaviest precipitation falls in the Siwalik Hills. Since about 80 percent of the precipitation falls within four months of the years, and much falls during a few extremely intense rainfall events, most of it flows quickly through the watershed during flash flood events (Klatzel et al., 2009:3). According to Dulal and colleagues (2010:626) the complexity of Nepal's geography and the seasonality in rainfall are combinations that add to the country's tendency to suffer extreme climate-related events.

Map 4.1 Physiographic regions and drainage network



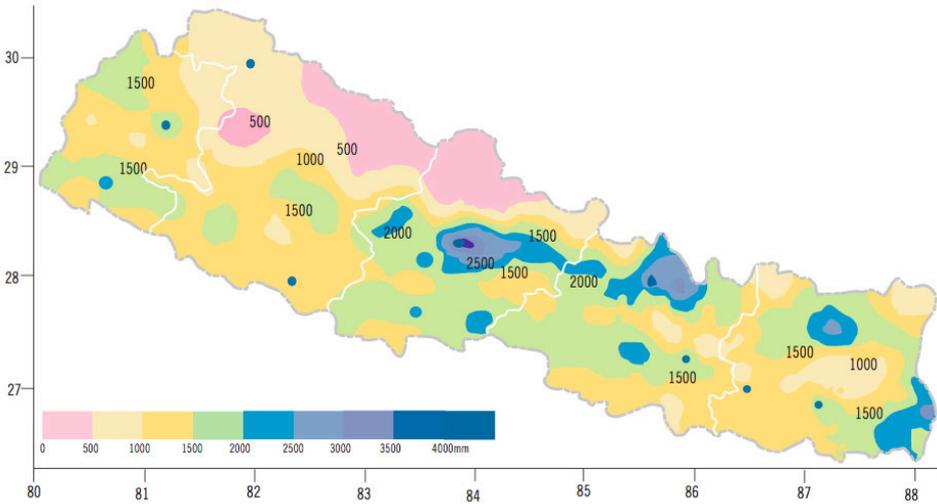
Source: *Ministry of Environment, 2008:10*

The 2007 IPCC Fourth Assessment Report is characterised by a 'Himalayan gap', due to the few scientific studies conducted in this region and the unreliability of collected data (NCVST,

2009:33). The Middle Hills of the Himalaya is an area where scientific information on climate change impacts is very limited (ISET, 2008:vi). The topographic complexity of Nepal makes projecting climate changes more difficult than usual. However, a few studies do suggest that the impacts of climate change will be considerable. GCM projections indicate a potential temperature increase of 0.5-2.0°C, with a multi-model mean of 1.4°C by the 2030s, rising to 3.0-6.3°C with a multi-model mean of 4.7°C by the 2090s (NCVST, 2009:46). There is very little differentiation in projected multi-model mean temperature changes in different regions. The GCM outputs also suggest that extremely hot days (the hottest 5% of days in the period 1970-1999) are projected to increase by up to 55% by the 2060s and 70% by the 2090s. Extreme hot nights (the hottest 5% of nights in the period 1970-1999) are projected to increase by up to 77% by the 2060s and 93% by the 2090s. To evaluate biases in the models is very difficult due to the lack of sufficient station data, in terms of timelines, geographical distribution and quality. GCM outputs do not have sufficient spatial resolution to provide information on changes across different elevation zones (Bartlett et al., 2010:4).

In a study based on an analysis of temperature trend from 49 stations for the period 1977-1994, Shrestha and colleagues (1999) found a consistent and continuous warming in the period at an annual rate of 0.06°C. Another study by Practical Action (2009), using data from 45 weather stations for the period 1996-2005, indicated a consistent and continuous warming in maximum temperatures at an annual rate of 0.04°C (MoEST, 2010:8). Unlike temperature trends, precipitation data for Nepal do not reveal any significant trend. For 2090, the scenario of monsoon rainfall projected by the models varied from 52 percent reduction to 135 percent increase (Dixit & Moench, 2010:4). This results from poorly understood monsoon dynamics, complex topographic characteristics and limited data available. Due to the great inter-annual variation of rainfall, any observed trends are very uncertain and can be part of a natural cycle. Analysis of data from 166 stations across Nepal from 1976-2005 reveal an increasing trend in annual rainfall in eastern, central, western and far-western Nepal (MoEST, 2010:8). The warming is found to be more pronounced at higher altitude regions like the middle-mountain and Himalaya, while the warming is significantly lower or even lacking in Terai and Siwalik regions (De Berdt & Singh, 2009:7).

Map 4.2 Annual precipitation distribution¹



Source: NCVST, 2009:48

¹ Based on 67 climate stations from 1971-2005 and 337 precipitation stations from 1998-2005.

With the predicted temperature rise in the Himalayan region, the line of snow accumulation will rise from its current 5700 masl to 6300 masl, implying a loss of two-thirds of the glaciated area. The hydrological implication is that river discharge will fall dramatically on the long run, when low-lying glaciers disappear (Aase et al., 2010:230). A number of non-climate factors, including rapid population growth and economic development, also cloud the effects of climate change. Nevertheless, there are general trends that have been triangulated with ground level observations that give a basic framework of identified changes, including glacial melt, changes in precipitation patterns, and increasing water stress (Bartlett et al., 2010:4).

4.2 Societal background

Nepal is one of the least developed countries. According to the Nepal Living Standard Survey 2003/04, nearly a third of the population (31.8%) lives below the poverty line (Dulal et al., 2010:623). In the 2010 Human Development Report, the country ranged 138 with an HDI value of 0.428. The country has an average income of US\$1.201 that is characterized by wide income disparities (UNDP, 2010a:145). It is considered the poorest country in South Asia and the twelfth poorest country in the world. The 2005/06 Fourth Household Budget Survey by the Nepal Rastrya Bank showed that an average Nepali household earns NPR 27,391 per month, which translates to just over two dollars a day per person (NCVST, 2009:68). The median income is, due to relatively high inequality, lower than the average. In 1957, the population of Nepal was 9.4 million (WECS, 2005:33). In a forty-year time period (1961-2001) Nepal’s population has grown by 13.8 million, to 23.2 million people according to the latest census (2001) (Singh et al., 2004:15). The population increase rate remains at 2.24 percent a year and the estimated population for 2007 was 26.4 million, with an average life expectancy of 63.7 years (MoEST, 2008:10). 7% of the population is living in the mountains, 44% in the hills and 48% in the plains (Poudel, 2005:121). Administratively, the country is divided into five development regions (Eastern Development region, Central Development region, Western Development region, Mid-western Development region and Far-western Development region). At the local level, there are 75 District Development Committees, 3914 Village Development Committees and 58 municipalities.

Map 4.3 Nepal Administrative Division



Source: Ministry of Environment, 2008:11

When dividing the country in the various ecological zones, there are significant differences in wealth distribution. This difference can be observed in *Map 4.4*. Poverty is most prevalent in the mountain areas, where over 63 percent of the population is poor, against 50 percent in the hills and 37 percent in the plains (Sharma, 2006:558).

Map 4.4 Human Development Index across eco-development regions (2006)



Source: UNDP, 2009:34

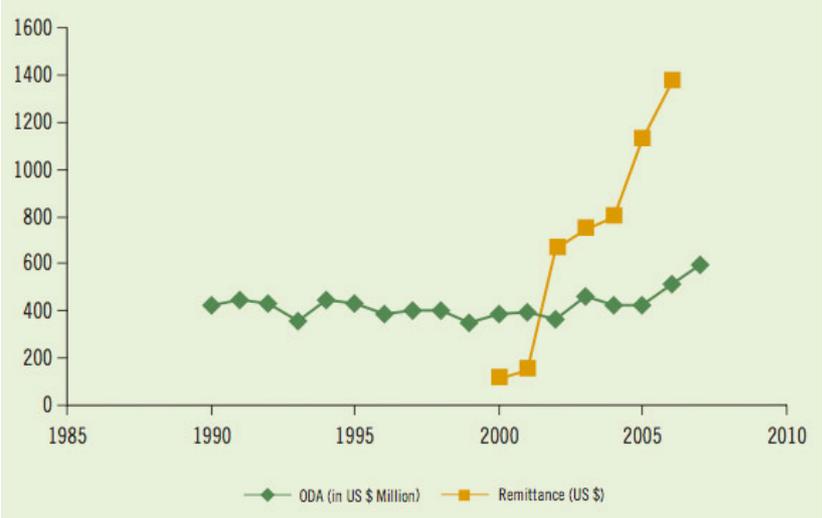
At present, Nepal stands at a turning point in its political history. The country is undergoing multiple transitions. From monarchy to republic, from authoritarianism to democracy, from a heavily centralised and hegemonic to a decentralised and participatory system of governance, and from a state wholly pervaded by one religion to secularism (UNDP, 2009:84). It is salient to understand the recent history of Nepal since it is in this turbulent political landscape that government agencies try to succeed in delivering their services to the population and development work takes place. To this end, *Appendix 3* provides a brief overview of Nepal’s history since 1950. Alongside the countless socio-economic, environmental and geophysical constraints and challenges, the long history of institutional failures and instability currently greatly complicates the development process and will hinder any effective adaptation, either planned or autonomous (Bartlett et al., 2010:19).

Economy

Around 66 percent of Nepal’s population is engaged in agriculture, which contributes just 36 percent to the nation’s GDP. In 1987-1988, this share was almost 50 percent. During the same period, the contribution of the service sector has increased from 35 percent to almost 50 percent (NCVST, 2009:74). The trend in Nepal is to import manufacturing products. Being a landlocked country, Nepal cannot afford to bring transport large amounts of raw material input for industry. Meanwhile, export is constrained by its neighbours, which both are on the fast track to industrial development. The marginal employment prospects, in combination with the decade long Maoist insurgency have caused a widespread migration of mainly young Nepalese to labour markets in the Gulf States, Malaysia and South Korea, in addition to the traditional destinations in Indian cities. The cause of this is that a sizable amount of foreign exchange is remitted (NCVST, 2009:82). According to a 2008 World Bank study, the share of remittances in Nepal is 16 percent of its GDP. Nepal has the 14th highest share of remittances in the world and has the highest in South Asia (Bangladesh at 8.8 percent and Sri Lanka at 8.7 percent). The average Nepali household receives almost twice its income from the agricultural sector. Some studies suggest that 1.3 million Nepali’s are registered as migrant workers with

the government, while another one million may be unregistered. This flow of remittances has been a driver for services demand (Sharma, 2006:563). People are gradually shifting away from farm-based to other livelihoods. Migration is a major source of access to jobs with remittances forming a substantial part of the income base. This has catalysed great changes in farming systems that reduce their resilience to climate change (ISET, 2008:25).

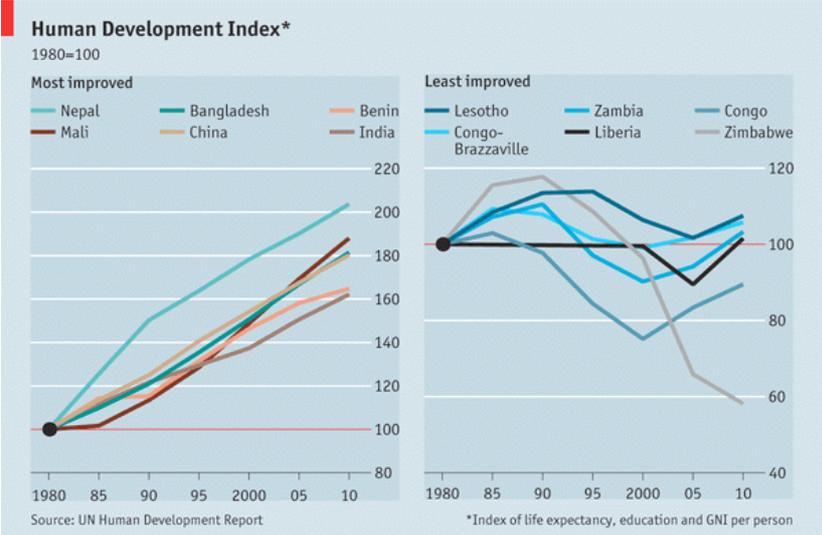
Figure 4.2 Remittance flow, against ODA



Source: NCVST, 2009:83

Nepal has made steady progress in reducing poverty in the past decade. Poverty incidence is estimated to have declined to 31 percent in 2004, from 42% in 1996 (ADB, 2010). Despite political hardships and a slowly growing economy, the UN Human development Index (HDI) shows that Nepal has made notable progress on the Millennium Development Goals (MDGs), by making progress on social and human development indicators, like life expectancy, infant and maternal mortality rates, and adult literacy (The Economist, 2010). The country is on track to achieve the MDG targets of improving poverty incidence, gender disparity in primary and secondary education, child mortality, and maternal health by 2015. In figure 4.3 it can be observed that Nepal is the world’s country that has most improved its HDI.

Figure 4.3 Changes in human development Index



Source: UN Human Development Report, 2010

Inequality

Nepal is endowed with a rich and vibrant socio-cultural setting. The country has a total of 103 caste and ethnic groups speaking 92 languages. Caste, ethnicity, language and religion are the major sources of cultural identity (UNDP, 2009:18). There are a wide variety of factors that determine inequality and exclusion in this diverse context. Since Hindus make up about 85 percent of the population, the Hindu caste system influences various aspects of Nepali life (Jones, 2010:4). Firstly, there are unequal gender relations that are embedded in traditional socio-cultural structures and that define formal and informal rules for women's participation related to opportunity, decision-making, access to resources, and control over them. Secondly, caste differences due to social stratification by the hierarchies stipulated by the *Muluki Ain*, the national code of 1854 that characterised the *dalit* as untouchables (Raiz & Basu, 2007: 130). Thirdly, caste and ethnicity differences resulting from the norms and socially defined practices of dominant caste groups. Caste plays a deeply rooted role in determining how individuals can react to climate stress, variability and change. Even though formally outlawed in 1962, the caste system dominates culture, society and economy today, and has significant implications for the capacity of particularly lower castes to adapt.

Nepali society is divided along caste, linguistic, and geographical lines. The ruling class has been dominated by a small segment of society. The high caste Hindu elite (CHHE) consisting of Brahmin and Chhetri groups overwhelmingly dominate key positions in politics, academia, civil society, and industry while comprising 30.89 percent of the population (according to the 2001 census). The CHHE and Newar constitute 37.2 percent of the population but in 1999 held more than 80 percent of leadership positions in all the important areas of governance (Riaz & Basu, 2007:133). The traditional nationalities (36.21 percent), 'untouchable' Hindus (14.99 percent) and the Madhesi plain people (22.30 percent) together constitute two-thirds of the population but are considered to be the marginalised groups (Lawoti, 2008:377). Within Nepal's caste and ethnic groups, poverty is low among Newars as well as Brahman/ Chhetri (14 percent and 18 percent respectively) and a high among of *dalit*, Muslims and hill ethnicities, whose rates hover between 41 percent and 46 percent. Anecdotal evidence suggests high degrees of inequality within each caste and ethnic group as well (UNDP, 2009:45). Poverty is most significant among landless households, and households with illiterate heads or with larger families.

4.3 Social-ecological interaction

The ecological system and livelihoods are closely linked in Nepal. A great diversity of studies emphasize the high dependence on natural resources in Nepal. While many studies give very different percentages, agriculture forms a significant livelihood component to more than 80 percent of the economically active population (ADB, 2010). Ecosystem services are vital to raise livestock and cultivate crops (De Berdt & Singh, 2009:4). The great diversity in altitude and precipitation has given Nepal equally diverse climatic and ecosystem conditions, from tropical to alpine, which support a highly diverse array of cultures and livelihoods. These range from the Sherpa transhumance traders and yak herders, to the culturally diverse farming communities of the hills and Terai (NCVST, 2009:31). Each social system is shaped a way to best take advantage of the opportunities that specific microclimates and local ecosystems provide and respond to the constraints they impose on livelihoods (Dixit, 2010a). According to De Berdt & Singh (2009:6) ecosystem services are increasingly under pressure as with a growing population more people make use of the natural resource base.

The majority of Nepal's population are poor farmers that rely on rainfall and occupy small parcels of land (Gum et al., 2009:ii). Very few rural households are able to produce sufficient food for the whole year. Over three quarters of them produce exclusively for their own consumption and less than 1 percent produces exclusively for sale (Dixit, 2010b:3). Due to the extreme geography only about 17 percent of the country's total land area is suitable for agriculture, on which the crop intensity varies from one to three crops each year. According to Singh and colleagues (2004:12) the population density on cultivable land (seven persons per hectare) is among the highest in the world. Farmer landholdings are extremely small, with less than 100,000 farmers owning more than 0.3 hectares of cropland and the vast majority farming on less than 0.5 hectare (Bartlett et al., 2010:3). Agricultural land tends to be highly fragmented and the potential for expansion is very limited due to relief, climatic conditions and soil fertility conditions (Chalise & Khanal, 1997:326). The high dependence on natural resources seems to further exacerbate poverty and environmental degradation since farmers feel compelled to encroach into marginal lands and forests to fulfil their basic need for food (Pandit et al., 2007:68). Nepal is thus largely a managed landscape in which most of the land is cultivated or used for livestock and forestry. Most cropland is carved out in the hillsides by building terraces. The *Terai* plains have the largest share of total cultivable land (59%), followed by the hills (23%) and the mountains (4%) (Singh et al., 2004:12). While around a quarter of the cultivable land lies in the hills and mountains, they are home to over 50% of the population (Sharma, 2006:556). The pressures of population growth and rapid economic development are high in the entire Lesser Himalaya. Over the last four decades, great changes in land use and land cover have unfolded, with a significant expansion of cultivated land into steep slopes and flood prone valley areas (UNDP, 2011:2).

The main productive systems are those of irrigated rice (*khet*), rainfed agriculture (*bari*), livestock production, and forestry (Singh et al., 2004:13). Rainfed agriculture accounts for 64% of the total cultivated land, which in majority takes place on the terraced hills slopes. Each farmer tends to own four or five small plots that are unconnected, to reduce the risk of potential natural hazards (Regmi, 2008:13). The farming system is characterised by a strong link with livestock raising (Regmi & Paudyal, 2009:7). Livestock that largely depends on forest-based fodder facilitates most nutrient movement to the farming system. The demand on forest to meet fodder needs increases at higher elevations, being 19% for the *Terai*, 52% for the *Siwalik* and 75% for the mountains (Singh et al., 2004:15). However, traditional practices of organic fertilisation are declining. Although the proportion of farmers using chemical fertiliser is still low, this is increasing (MoEST, 2008:13). The maintenance of soil resources is critical for the performance of Nepal's small-scale agriculture (Acharya et al., 2008:530). Crop productivity is significantly lower than in the rest of South Asia (Bartlett et al., 2010:2). Prior to 1980, Nepal fulfilled its domestic cereal needs, but since population growth outpaced agricultural productivity Nepal is forced to rely on food imports.

Water sector development, specifically irrigation, drinking water and hydropower, is expected to contribute to sustainable growth in the agriculture sector, with the aim of reducing poverty in line with national goals (WECS, 2005:4). Just around 24% of the arable land is irrigated, mostly in the *Terai*. Some irrigation is existent in the middle hills and mountains, but this is primarily limited to small-scale surface irrigation and micro-irrigation. More than 70 percent of the irrigated areas in Nepal are Farmer-Managed Irrigation Systems (FMIS). About 15,000 systems are operated and managed by farmer user groups. In the remaining areas, systems are transferred to water user associations that are concerned with their management. The distribution of irrigable land varies greatly between agro-ecological zones. Irrigable land counts for 24 percent of cultivated land in the mountains, 34 percent in the hills and almost all cultivated land in the *Terai* region (WECS, 2005:33). Irrigation facilities expansion is vital to

meet food security requirements. Besides improved varieties of seeds, fertilisers, credit facilities and access to market, irrigation water is the main input to increase crop productivity (Dixit, 2006:8). However, the majority of the total cultivable land is rainfed and the feasibility of accessing irrigation is greatly restricted in many agro-ecological zones (MoEST, 2010:26).

Next to cases of agriculture-driven encroachment in certain hotspots, a series of studies in the Middle and High Mountain areas has brought to the light trends of de-intensification and abandonment of fields due to low economic returns of rainfed agricultural crops and increased outmigration of labour force (MoEST, 2008:13). Many households leave agriculture not only because they prefer to do something else, but also because agriculture results less profitable. Chalise and Khanal (1997:326) observed that for most Nepalese farmers the farm does not provide enough cash to improve their livelihood. As it has been for decades, seasonal migration continues to be a common autonomous response to local livelihood adversities. It is an example of the adaptation options that are provided by the market (Dixit et al., 2009:27). This seasonal migration ensures year-round food security. Rainfed agriculture is increasingly unable to meet the growing demand for food in rural areas, making people more reliant on the purchase of food from local markets, bought with money earned in the city. Migration is an autonomous response to diverse economic, political and environmental factors that makes a significant transition away from the agricultural sector and vulnerable natural resources. Due to these pressures there has been a trend of male migration from the rural areas to urban centres (Bartlett et al., 2010:3). The increase in seasonal and permanent migration to the city and other countries since the mid-1990s has resulted in a great shortage of agricultural labour on the countryside (NCVST, 2009:4). It also has a great impact on natural resource management and social-ecological balance. Fields that were previously managed by the application of community labour force for terracing measures now face landslide problems due to poor maintenance (MoEST, 2008:14).

Singh and colleagues (2004:16) state that there is a critical point where the combination of increased inputs and labour requirements means that agriculture cannot compete with non-agricultural income generating activities. The average agricultural growth rate between 1994/95 and 2000/01 stood at 2.48 percent, while the non-agricultural growth rate was 10.44 percent (WECS, 2005:2). According to Poudel (2005:121) wages have doubled from US\$0.67 (NRs.50) per day in 1990 to US\$1.33 (NRs.100) in 2000, with this trend likely to be continued in the twenty-first century. In the same period however, the prices of agricultural products have only increased around 50%, leading to a decrease of agricultural labour input. In marginal agricultural areas, off-farm investments have become more worthwhile than on-farm ones making out-migration and off-farm jobs have become significant options that influence rural strategies, with strong incentives to quit the farm. Particularly young people are reluctant to do farm work (ADB, 2010).

Agriculture still remains the dominant and largest sector of the economy and various success stories exist in the rural areas. One is linked to the promotion of livestock rearing and milk production, a livelihood that greatly benefits women in household with seasonal male migrants (Dixit, 2010a). The government of Nepal has acknowledged the importance of community participation in resource management, particularly in forest management. By the end of 2007, a total of 14,337 registered Forest User Groups existed in the country. About 1.65 million households managed 1.22 million hectares of community forest (20.5 percent of the total forest area) (De Berdt & Singh, 2009:27). The community forestry programme is successful in the middle mountains where deforestation is reversed by strengthening natural resource management.

4.4 Environmental change impacts

Difficult to predict extreme climate variability is an inherent part of life in the Himalayas. Due to the frequent occurrence of different natural hazards and the low level of development and institutional dysfunctionality, Nepal is a disaster hotspot (Dixit, 2010b:4). This is induced by Nepal's mountainous context, poverty rates, population pressure, reliance on small-scale agriculture, weak economy, lack of alternative livelihoods, poor physical infrastructure and low levels of social sector development. The degree of vulnerability can greatly differ within districts due to great differences among the population and lack of access to basic services and social protection mechanisms. These differences are also evident between and within communities (Jones, 2010:5). Data from the Ministry of Home Affairs shows that more than 4,000 people died in the last ten years due to climate-induced disasters, like floods, landslides and drought, causing a total material loss of US\$ 5.34 billion (MoEST, 2010:13).

There is evidence that water-induced stress and hazards are increasing both in frequency and intensity (Dixit & Moench, 2010:7). The impacts of climate and environmental change will have profound and widespread socio-economic impacts since agriculture is the mainstay of the economy (Dulal et al., 2010:623). The Ministry of Environment (2010:12) suggests that more than 1.9 million people are highly climate vulnerable, while 10 million are increasingly at risk with climate variability likely to exacerbate in the future. Intensifying water stress and hazards are considered a major impediment to achieve the Millennium Development Goals, as it will prevent communities from rising above the poverty line (Gum et al., 2009:2). Rural households are likely to suffer increased loss of infrastructure and shelter from flood events, loss of productivity from increased incidents of malnutrition and disease, social disruption, displacement from extreme weather events, and loss to build capacity (De Berdt & Singh, 2010:6). Furthermore, the lack of comprehensive research in the areas of agriculture and water resources is perceived to seriously limit the ability to make appropriate national policy recommendations (Regmi & Paudyal, 2009:4). Data on the impacts of climate change on livelihoods in Nepal is limited as the endeavour to determine livelihood impacts is complicated by the diverse topography and different habitats within small distances (De Berdt & Singh, 2009:23).

While more water-induced disasters are expected in the Himalayan region, still very little is understood about how climate change will affect the hydrological cycle in the Himalaya (Dixit et al., 2009:3). Environmental change has yet triggered striking changes in livelihood opportunities (Nadeem et al., 2009:1). Trends that are observed in all parts of Nepal are:

- *Changes in temperature:* Significant warming, particularly at higher elevations, is leading to reductions in snow and ice coverage. Days become hotter and cold waves in winter are decreasing. Main concerns are that winters are getting warmer as temperatures have been rising for the last fifteen to twenty years (Gum et al., 2009:9). The issue of glacier melt in the Himalaya is much-debated and a key concern since many of Nepal's rivers get their dry-season flow from the melt water of over three thousand glaciers (Dixit, 2010b:2).
- *Decrease in precipitation:* Changes are observed seasonal weather patterns. The onset of winter rains is delayed, while increases in climatic variability and the frequency of extreme events is observed. People report the monsoon to last for fewer days than usual and to fall with much greater intensity, often in combination with hailstorms that destroy crops just before harvest (Gum et al., 2009:9). This causes the water to quickly wash downhill without penetrating the soil. In recent years more rainfall is expected during the later stage of the monsoon. Snowfall is decreasing in amount and shifting in the timing of occurrence.
- *Increasing unpredictability:* Nepal normally has a fairly predictable summer monsoon from May/June to September. Community members now report greater unpredictability in the arrival and intensity of the summer monsoon. The monsoon is perceived to be delayed

and lasts for less time. Seasons are changing and rainfall is more intense. Interpretation of these community perceptions needs to occur with caution since over the last thirty years, rainfall variability has depended on the geographic location (Gum et al., 2009:13). Many feel the seasons are shifting, changing the period in which people plant and harvest. This causes uncertainty about what will grow when.

- *Increasing water scarcity*: Rivers and streams are drier and there is a notable increase in the lack of drinking and irrigation water (Dixit & Moench, 2010:31). Adverse impacts on mountain ecosystems affect the food and livelihood security of populations depending on those resources. Water shortage is further exacerbated by population growth and an almost complete lack of water harvesting, storage and collection practices. Reduced river flows due to less rainfall and glacial retreat will make it harder to irrigate crops and provide water to the communities. It is also likely to substantially reduce electricity supply, since Nepal relies on hydropower for more than 90 percent. Nearly all power stations are ‘run of the river’ systems that do not use storage facilities and are thus vulnerable to variable river flows. The power cuts of up to sixteen hours a day during the dry winter season will likely to further increase (Gum et al., 2009:5).

These climate change impacts are the cause of a wide array of environmental changes. Rising temperatures have led to the expansion of agro-ecological belts into higher altitudes and an increased length of the growing period for some crops in the mid-hill and high mountain areas (MoEST, 2010:26). There have been changes in the behaviour of key crops and invasion of undesirable plant and pest species (NCVST, 2009:43). High hill animal herders have reported decline in fodder and forage production, which has augmented the prevalence of livestock parasites due to a loss of animal health. Decreased soil moisture availability due to changes in rainfall and temperature have resulted in early maturation of crops, crop failures and reduced crop yields (Dulal et al., 2010:623). Delays in rainfall often cause many crops not to mature enough for a good yield (Bartlett et al., 2010:7). Delays in the monsoon set back paddy transplantation, which is Nepal’s staple food. A decline in paddy and other vegetable protein yields can thus have a significant impact on food security. The projected increase in rainfall variability suggests that Nepal will face immense challenges as seasonal drought increases. An example is the 2008/09-winter drought when food insecurity was severe. While most monitoring stations received less than 50 percent of normal rainfall, 30 percent did not receive any precipitation (Dixit, 2010a). Even though single drought events cannot be attributed to climate change, they demonstrate situations that in the future are predicted to become more frequent (Gum et al., 2009:iii).

After this characterisation of the Nepalese context, focus is now placed on the Indrawati river basin, where a case study is conducted in six communities. The aim is to better understand the sensitivity, exposure and adaptive capacity of rural communities and the differences between them that can be found within small distances. Special focus is placed on the characterisation of rural livelihoods, the perception of inhabitants towards changes in the natural environment and, the practices that communities apply to better ensure a sustainable livelihood, and the existing institutions that together shape the *manoeuvring space* of rural communities in the Nepalese Himalayas.

5. LIVELIHOODS IN THE INDRAWATI RIVER BASIN

This chapter is the first out of three that present the results of the case study. Six communities were selected in the Indrawati river basin, located in the Mountain Region of the Nepalese Himalayas. Their diversity in caste, ethnic, biophysical and socio-economic context gives an idea of the great variety of social backgrounds that can be found in rural Nepal. This chapter places emphasis on the sensitivity of rural livelihood strategies and the extent to which the communities are exposed to water-induced stress and hazards. Focus is placed on what the perception of community members is towards changes in their natural environment. The last paragraph of this chapter discusses the new livelihood strategies rural households apply, both agricultural and non-agricultural in nature as a response to continuous social-ecological changes. These autonomously applied strategies greatly determine the extent to which rural households are vulnerable to changes in the natural environment like climate change.

5.1 Social-ecological context

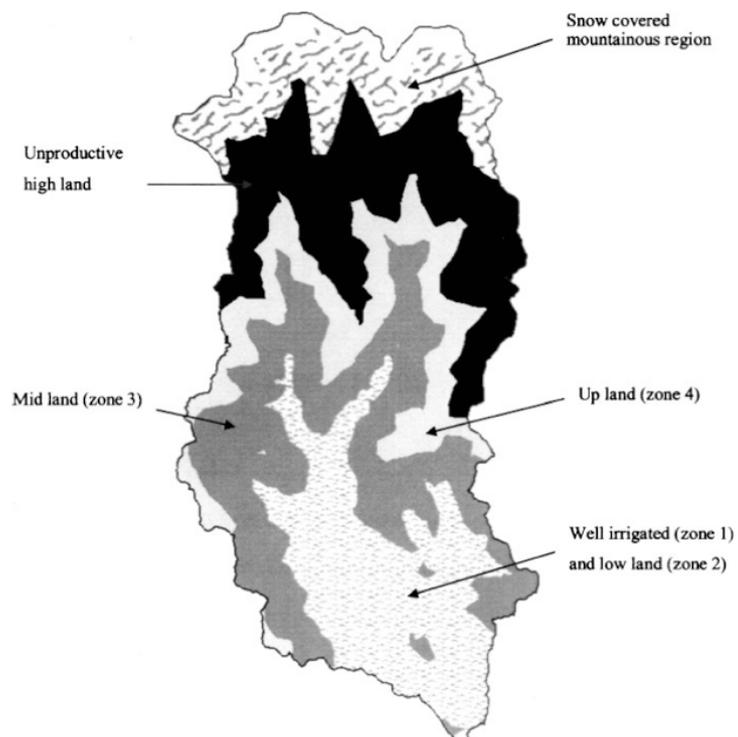
The Indrawati River is one of the seven tributaries of the Saptakosi River (Koirala, 2001:27). The basin has extreme height differences. The river originates in the Mahabharat Range at an altitude of 5,863 masl and discharges into the Sun Koshi River in the Siwalik region at 626 masl (Rajkarnikar, 2000:7). The length of the Indrawati is about 59 kilometres and the total surface of the catchment area is 1240km². The major tributaries of the Indrawati are the Melamchi, Larke and Yangri *kholas*. The landscape consists of rugged hills and mountains with flat valley bottoms for agriculture (WWF, 2010:iii). The high-altitude areas are difficult to access due to their steep land surface, deep gullies and fragile geology. The downstream low-altitude lands are either cultivated or occupied by human settlement.

Map 5.1 Indrawati River network



Source: Sharma, 2002:427

Map 5.2 Classified crop-zone coverage



Source: Shrestha et al., 2004:3066

The average annual precipitation varies from 1,128 mm at low elevation (Dolalghat) to 3,874 mm at higher elevation (Sarmathang) (Sharma, 2002:427). Rainfall patterns are characterised by high spatial variation. The average annual potential evapotranspiration is 954 mm. The temperature ranges from about 5°C to 32.5°C and the average relative humidity varies from 60% in the dry season to 90% in the rainy season. (Bhattarai et al., 2002:8). The Indrawati basin's climate zones range from alpine to sub-tropical. Snowfed and rainfed streams are both important sources of water (Shrestha et al., 2004:3062). The Indrawati is of a perennial type. The monsoon rainfall, however, is the major inflow source and causes high fluctuations. Land use differs across hill slopes, foothills, and river belts (Koirala, 2001:28). Acquiring a reliable estimate of the land cover is difficult since various studies provide very different numbers.

Figure 5.1 Above: Indrawati river near Tipeni (upstream)
Below: Indrawati river near Thadokol (downstream)



The Indrawati catchment is located in the Central Development Region of Nepal (Karki, 2005:2). The basin mainly falls within Sindhupalchowk district (43.4 percent of the district territory falls within the basin) and some part of Kavrepalanchowk (10.5 percent of the district area) (Rajkarnikar, 2000:6).

Map 5.3 Districts that form part of the Indrawati basin



Source: Sharma, 2002:427

The Indrawati basin can be characterised by a strong agricultural base. Around 90 percent of the basin's population is subsistence farmer (Pant et al., 2008:6). The natural resource base is therefore a fundamental asset to sustain the livelihood of the community members. Despite the importance of agriculture, the performance of this sector is found to be rather bleak and affected by many problems. Only 12 percent of households own more than 1 ha of farmland, mostly in the unproductive higher altitudes (Pant et al., 2008:6). Land scarcity has a direct impact on food production. In the hill regions of Nepal, land size is measured in *ropani*². The vast majority of households own less than one third hectare of land. The sons of a household inherit the land. In recent decades, the size of households has expanded considerably and more male family members now heir. This is a root cause for land fragmentation. Another reason is that people seek land that has access to irrigation, which is more expensive. Land located further away from the community is cheaper and thus mostly owned by those that have less capital. Almost all inhabitants claim to own the land they cultivate. This ownership has been registered by the Survey Department a few decades ago. It is stated multiple times that especially the people who came in contact with the surveyors have been able to register a lot of land, while a great number of people who did not know about the survey became almost landless. Land ownership was traditionally managed by the *guthi*, an informal community institution, and people used the land according to their need. Currently, substantial differences in land ownership can be observed between communities, often running along caste lines. In multi-caste communities, this division between castes is also evident.

"We owned guthi land, with no property right. Most people living in the bazaar have registered land now. When the Survey Department came to the area about thirty years ago, the elite group registered as much land as possible and received land ownership. We uneducated people were unaware about the visit of the surveyor." – villager of Thadokol

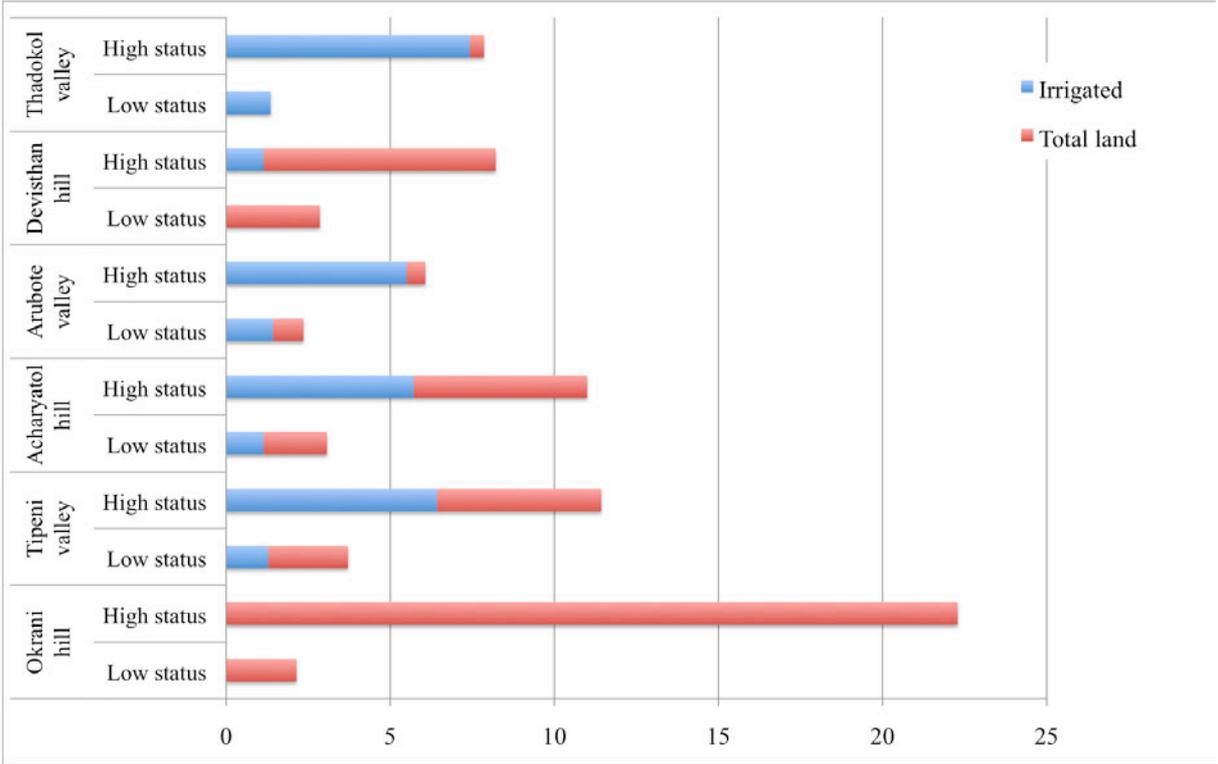
"The people who are rich buy land close by, but poor people have to search further away for it. Most of the people prefer to have land in the valley where paddy production is high. In previous times when the people were poor they could not buy much land from the Baun caste. They only bought some small parcels with a low cost." – villager of Arubote

Land, forest and water form the basic components that maintain a subsistence livelihood. Creating a better understanding of the challenges farmers need to face to sustain traditional livelihoods requires an analysis of these two components. Graph 5.1 makes the differences in land endowment between and within communities evident by showing the average land size of the seven highest and seven lowest status households in each community. What is most evident is that the differences within communities are greater than differences between communities. Shown is also the average endowment of fields with access to irrigation. In

² 1 hectare equals 20 ropani.

practically all communities, high status households are endowed with a larger proportion of irrigated fields, which means that this group is overall less vulnerable to experience food scarcity than low status households, taking into account that irrigation is one of the major inputs for the creation of a resilient and continuous agricultural cycle. However, this also needs to be placed in perspective by taking into account that the measurement is in ropani. It then becomes evident that only in Okrani, the high average land size reaches above 1 hectare per household, while the vast majority of households has less than 0.5 hectare for their subsistence. In all communities, the poorest seven households are endowed with less than 0.25 hectare of land. A number of households even does not own any land and depends on work labour in or outside the community.

Graph 5.1 Average land size of highest and lowest 7 households in each community³ (n=84)



Source: field survey

According to Shrestha and colleagues (2004:3062), it is predominately the poor or minority caste groups that suffer from water shortage in the Indrawati basin since they tend to own lands in *bari* and do not have access to the limited irrigation facilities. Non-irrigated lands bring forth considerably poorer crop yields than well-irrigated land in a similar climate zone and altitude. Poor yields are mostly blamed on the lack of irrigation that forces farmers to select less productive crops that are sustainable in rainfed agricultural land (Shrestha et al., 2004:3062). Within irrigation schemes, problems also tend to be manifold. Many irrigation channels are damaged due to soil erosion and poor maintenance leading to increased water losses (Rajkarnikar, 2000:20).

In the Indrawati communities, only a small number of households can secure enough food for the whole year. Most families produce enough food to consume during six months of the year. The food situation varies greatly between and within communities, depending on family size, land size and access to irrigation as the main determinants. It is stated that a family of five

³ Measured in ropani. 1 hectare equals 20 ropani

persons that owns ten ropani of land can be self-sufficient year-round and sell some products to the market. In the case households cannot produce enough food, additional food is bought from the market. The financial resources needed to obtain the food are earned through work labour activities.

When focus is placed on the six case study communities, a division can be made between single-caste and multi-caste communities. Arubote (Majhi), Acharyatol (Acharya) and Okrani (Sherpa) are predominately single-caste communities while Thadokol, Tipeni and Devisthan are multi-caste settlements. Tipeni and Thadokol are valley communities that have received a substantial amount of migrants from uphill in the last ten years. Valley communities have experienced a rise in the number of households, as a result of population growth, but also due to migration from the hill communities to the valley where better service conditions exist. Next to better services and livelihood opportunities, migration to the valley has also been triggered by the decade-long Maoist insurgency that lasted till 2006. There was considerable migration to accessible areas as insecurity was greater in isolated areas where the Nepali army could not reach easily. Downward migration has increased pressure on valley land, as people started to rely more on the agricultural land in the riverbank. Valley communities are best connected to the paved road that runs along the river up to Melamchi Bazaar, after which it continues along the Melamchi and Indrawati streams as an unpaved track.

Table 5.1 Community characteristics

	Thadokol [valley]	Devisthan [hill]	Arubote [valley]	Acharyatol [hill]	Tipeni [valley]	Okrani [hill]
Altitude (masl)	715	1270	875	1330	955	2265
Number of inhabitants	700	145	250	150	360	150
Number of households	150	20	38	30	72	28
Population	Growing	Decreasing	Growing	Growing	Growing	Decreasing
Distance to market	10 min	120 min	30 min	45 min	0 min	150 min
Caste diversity	Multi-caste	Multi-caste	Single-caste	Single-caste	Multi-caste	Buddhist
Social cohesion	Strong	Weak	Weak	Strong	Weak	Strong

Source: *Focus groups*

With the exception of Thadokol, agriculture and livestock rearing remain primarily subsistent. The cropping pattern varies across communities between the lower and higher parts of the basin. In the valley, farmers harvest three crops a year (main season paddy, wheat/potato, and spring paddy), whereas the communities at higher altitudes (>1400 masl) can only grow two crops (main season paddy, wheat/potato) (Pant et al., 2008:7). Where irrigation facilities are present, rice is grown in two seasons, the first during the monsoon (July till December) and the second cultivation during spring (April till June). When irrigation is absent, as is the case in most hill communities, the cropping pattern is different and reduced to two crops each year. On this *bari* land, which constitutes over 80 percent of the cultivated land in the hills, maize and millet are the predominate crops (Koirala, 2001:29).

Table 5.2 Most cultivated crops

	Thadokol [valley]	Devisthan [hill]	Arubote [valley]	Acharyatol [hill]	Tipeni [valley]	Okrani [hill]
1	Rice	Maize	Rice	Maize	Rice	Potato
2	Potato	Millet	Maize	Rice *	Maize	Maize
3	Maize	Ginger	Millet	Millet	Potato	Wheat
4	Vegetables		Wheat	Wheat	Wheat	Radish
5	Wheat		Mustard	Mustard	Millet	Mustard

* in the valley

Table 5.3 Mostly owned animals

	Thadokol [valley]	Devisthan [hill]	Arubote [valley]	Acharyatol [hill]	Tipeni [valley]	Okrani [hill]
1	Buffalo	Goat	Buffalo	Goat	Goat	Buffalo
2	Goat	Buffalo	Pig	Buffalo	Poultry	Cow
3	Cow	Cow	Goat	Cow	Buffalo	Goat
4	Poultry		Cow	Poultry	Cow	
5			Poultry		Pig	

Source: *Focus groups*

The agricultural system stands in close connection with livestock and forest resources. The sloping mountain terrain is predominately used for forest, fodder and grazing of community-owned animals. Livestock rearing is a central component of the subsistence livelihood and provides three main benefits: manure, milk and meat. Traditionally, soil fertility is maintained by using animal manure as organic fertiliser. Other animal products, like milk and meat, are mainly for household consumption. Goats and poultry are mainly raised for their meat, while cows and buffaloes are kept for their milk. The workforce of buffaloes is also used to plough the fields during plantation. Cows are not used for this heavy labour due to their religious significance. Open grazing practices do not occur at more cultivated, lower altitudes, and the animals are raised on one fixed place in front of the house. Food for the animals thus needs to be collected from the forest, forming a considerable daily activity for households. Animals are mostly reared for the daily necessities of farmers, not for business purposes.

Figure 5.2 Animals raised in front of the house, in Arubote



The forest is indicated to be very important to obtain daily basic needs like firewood, fodder, grass and litter. Inhabitants state they cannot live without the forest. All households in the observed communities cook with firewood. Forest resources are also needed to feed livestock. The scarcity of fodder is an important constraint to increase organic fertiliser provided by livestock. Forest resources are not only indirectly used as fertiliser (fodder for manure) but also directly, by creating compost with litter that maintains soil fertility. Next to the benefits for households, forests are also recognised to be essential to stop landslides and conserve water sources, significant functions to maintain the social-ecological balance in the area. In the last decades however, forest resources have been decreasing as the trees were cleared to make way for agricultural land and to fulfil in other household needs.

“The forest is directly linked with livestock farming. If we have a good forest then we can rear more livestock. If it is degraded we cannot take much fodder or grass from here and that makes it harder to sustain livestock.” – villager of Acharyatol

“In the past, the forest was very dense. We were afraid of the wild animals in this forest. But with an increasing population, the forest has degraded to meet the needs of the community. Forest has been converted into farmland, especially in these hills.” – villager of Arubote

Figure 5.3 Above: Trees in the agricultural fields whose leaves are used for fodder
Below: Compost (fermented leaves and litter) forms a key source of fertility



Water availability is characterised by higher seasonality (Pant et al., 2008:7). Overall, the Indrawati basin is rich in water resources. When focus is placed on the local level however, certain water scarcity *hotspots* can be identified since the spatial distribution of water is not the equal (Shrestha, 2000:108). A division between water scarce and abundant communities cannot be made based on their location either uphill or in the valley but depends on different factors. Physical location, land use, population density and drinking water services delivery are a few important determinants. Water scarce communities are Devisthan (hill), Acharyatol

(hill) and Arubote (valley). Devisthan's drinking water situation seems to be most severe. Only at 15 minutes walk of the community an ancestral source can be found that gives water year-round, although its volume decreases considerably during the dry season. Then, the amount is not sufficient to meet community needs. The water pipe that has been supplied to the community gives water for about 1 hour a day. During the dry season the inhabitants of Devisthan need to walk for two hours every day to fetch water. The severity of socio-ecological change impacts depends on the capacity and speed of the farming community to adjust to a new cropping pattern suitable to low levels of water supply (Pant et al., 2008:6).

Figure 5.4 Waiting for drinking water that is supplied through a water pipe in Devisthan



“Water supply came because in the past years we had extreme water scarcity, especially during Jetha and Ashar. The small water pipe is still not sufficient for all. Facilities have increased but the main problem remains water.” – villager of Acharyatol

“The water is very scarce in the community. We use to go to the forest because in the forest there are small underground sources that can be used for drinking water. We have to dig for them. When water is scarce everyone looks for it. During the night we use to make underground sources with hard work. The whole family is involved in fetching water. There is not the sufficient amount of water that used to be here in the past.” – villager of Devisthan

There are different techniques that are used for water supply. In Acharyatol and Devisthan, a tube supplies water. Here, rotational arrangements often exist to distribute the water equally among community members. In water abundant communities like Thadokol (valley), Tipeni (valley) and Okrani (hill) outdoor taps are the most common distribution method. While all households have some form of drinking water supply, access to irrigation is more exclusive. Fields that are located near the intake of an irrigation system tend to have sufficient water but plots that lie at the end of irrigation systems are rarely provided with enough water. In Arubote, few households have access to irrigation, despite being located in the valley. Most farmers depend on rainwater, which leaves much of the land fallow.

“Fluctuating weather has created a dilemma for the farmers. The agricultural practices have remained the same but the weather changes have led to an up to 40 percent decrease in yields. People move towards areas with better accessibility to water for farming purposes, mostly to the valley. After the rain, we start working on the bari. Many grow Millet since it is resistant to drought and the seeds are quite accessible and cheap. The yield is very low, but we are compelled to grow it. It is more useful to grow millet compared to keeping the land fallow.” – villager of Acharyatol

Since generations, farmers apply coping strategies that reduce vulnerability to a too much and too little of water, and natural resources in general. Coping mechanisms are designed around, soil erosion, drought and flood events, and increasingly around the lack of land resources. The most prevalent institutional arrangements are informal in nature and deal with collective action in which households need to give free work labour to carry out a variety of natural resource management activities that benefit the whole community. Most of the measures form an investment in the resilience of the agricultural cycle. Work that is conducted collectively includes the development and maintenance of irrigation infrastructure, drinking water supply works, terrace maintenance and construction of flood protection walls, houses and roads. To obtain irrigation water from the Indrawati river and the *khola*, dams need to be constructed to increase the water level and divert the resource. This collective action is regulated by informal rules that are established and supported by tradition and oral agreement. It is a widespread rule that all households need to deliver at least one person whenever the situation asks for it. Collective irrigation canal maintenance is a common tradition in valley communities. After each flood, dams need to be repaired at the intake to heighten the water level. Similarly, land in the hills needs to be re-terraced shortly after a landslide event. Next to the tradition of free work labour for collective benefits, households unite and exchange work labour for individual benefits. The exchange of work labour (*parma*) is mainly carried out during plantation and harvest and consists of a small number of families who unite to help each other in the field.

“We have parma during the plantation and harvest of maize and millet since this needs a lot of hard work. We prioritize the work according to the needs. If I plant maize first then I will get help first. The person that plants next receives help next. Those who plant latest receive labour latest but they too are helping by the people who received help first. [...] We also do community work for the construction of houses. The women carry the stones and the men construct the walls. Everyone gives free work labour for construction activities.” – villager of Arubote

5.2 Environmental change impacts

One aim of this research is to learn whether and to what extent communities in the Indrawati basin perceive changes in their natural environment. A better understanding of how these changes can influence traditional subsistence livelihoods is urgently required. In *table 5.4*, the environmental problems mentioned by community members are ranked according to their perceived severity. The problems mentioned are various, although certain trends are observed. They relate to challenges of water scarcity (**red**). Drought impacts both the agricultural cycle and drinking water supply. Next are problems of water abundance (**blue**) at certain times of the year, causing flooding, riverbank erosion and landslides that are triggered by intense rainfall. A third trend is the sharp increase of diseases and pests in both crops and livestock (**green**). All communities face this risk but in different degrees.

Table 5.4 Environmental risk severity mapping

	Thadokol [valley]	Devisthan [hill]	Arubote [valley]	Acharyatol [hill]	Tipeni [valley]	Okrani [hill]
1	River deepening	Drought	Flooding	Pest / disease	Landslides	Depredation
2	Air pollution	Pest / disease	Soil degradation	Drought	Pest / disease	Deforestation
3	Flooding	Improper rain	Drought	Drinking water	Drought	Strong wind
4	Drought	Drinking water	Landslides	Landslides	Flooding	Drinking water
5	Riverbank erosion	Landslides	Pest / disease	Deforestation	Soil degradation	Pest / disease
6	Pest / disease	Deforestation	Deforestation	Strong wind	Depredation	Soil moisture

Source: *Focus groups*

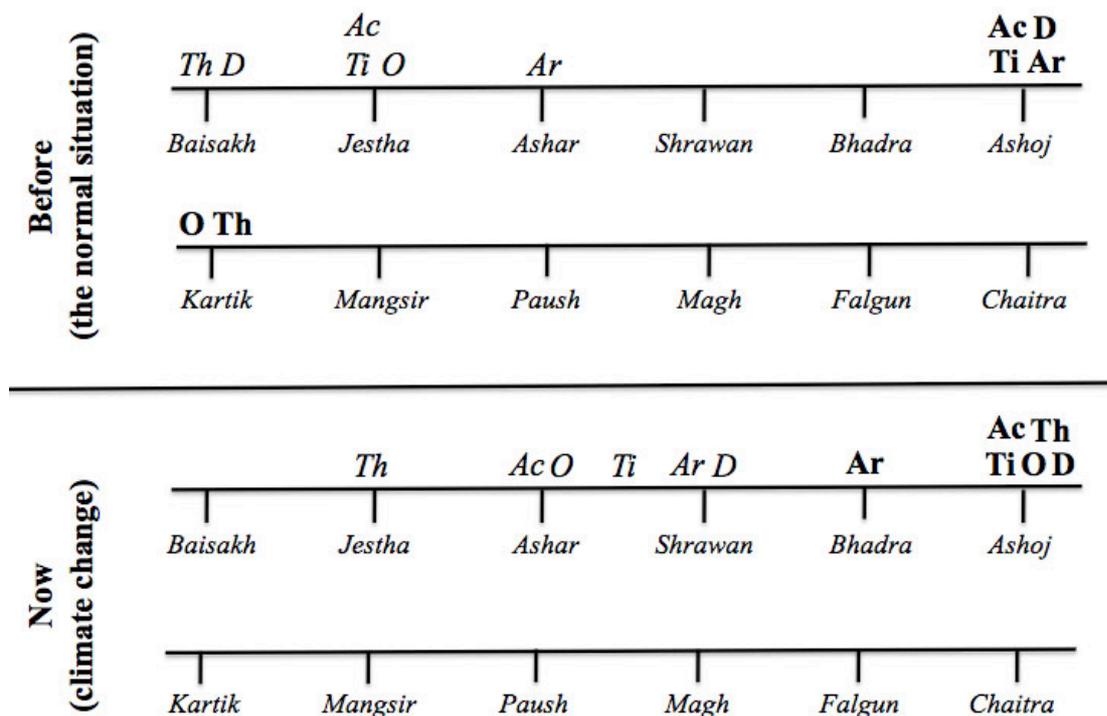
A widespread observation relating to changes in the natural environment are alterations in rainfall and snowfall patterns. The perception of community members is that the monsoon is delayed and the total number of days with rainfall has decreased. Community members

observe a gradual decrease in rainfall quantity and the amount of snow in the high Himalaya. In different communities people express their concern that the snowline in the mountains has been rising sharply. While twenty years ago the mountains were completely snow-capped, people nowadays see barren mountains with patches of snow. This snow layer is perceived to have decreased more than 30 percent. In the Sherpa community of Okrani, the inhabitants used to receive snow, but for about twenty years this has not happened. As a consequence of less snow, the water level in the snowfed Indrawati has gradually decreased. The speed with which the river used to flow has slowed down by about a third, even though some say that the river only has half of the amount of water it used to have about twenty years ago. In Tipeni it is mentioned that in the past, inhabitants were not able to cross the river because it had so much water, while now this is possible without any danger.

“In the past, we could see the snow fall in the upper villages, but for about twenty years we have not received any snowfall. There is no snow in the Himalayas, so how we can expect it here? We used to play with snow in Okrani during our childhood. Now we have to move far away to see the snowfall.” – villager of Okrani

“About ten years ago there was a big volume of water in the Indrawati. The water level is decreasing gradually. In the past we were not able to cross the river even in the dry season, but now we can cross the river very easily. This may be due to changes in the rainfall pattern and a lack of snow in the mountains.” – villager of Tipeni

Figure 5.5 Precipitation calendar



Legend

Thadokol = Th, Devisthan = D, Arubote = Ar, Acharyatol = Ac, Tipeni = Ti, Okrani = O

X = Start of the rainy season

X = Start of the dry season

Source: Focus groups

In all communities, farmers share the perception that the number of rainy days decreased gradually in the last fifteen years and the length of the dry season increased simultaneously. Although the focus groups (figure 5.5) mention different months for the start of rainfall, it is

clear that the rainy season has shortened. Less rainfall is received during Ashar and Shrawan, the traditional plantation months. It is perceived that rainfall has decreased by about 25 percent. These changing weather patterns directly impact on the daily life of the community members and especially on the households without access to irrigation. Increasing rainfall variability has put an additional pressure on the farming system. In various communities it is perceived that long rainfall events do not occur anymore and rain only falls occasionally. Particularly in the last five years, drought has been severe and long lasting. Recent years show that there can be periods of up to three months without one rainfall event. Farmers that fully depend on rain will only start sowing when rainfall starts. They need at least one rainfall to sow the maize seeds. If this does not come plantation is delayed. This results in a shorter growing season, taking into account that the monsoon ends in the same month as before. The availability of water resources has decreased with changing rainfall patterns, with direct consequences for drinking water and irrigation supply.

“In this area there were about twenty water sources. Now it has decreased to ten. The ancestral water source has dried. My grandmother says that not during her life, nor in the ancestral period she has seen or heard that this well dried. There used to be irrigation in bari to cultivate mustard. Now we are not able to grow due to a lack of water. That some of the wells have dried is like an amazing fact for us. It feels very strange and we ask ourselves what is happening?” – villager of Bahunepati

“More than ten years ago, we had rainfall three times each month. Even during the cold winter days we received rain. Now, we do not have such rain. We were not able to grow maize and millet because of a lack of rain. You can see these fallow lands that are very dry. If we have rain, this area would be very green and we would be so happy. More than ten years ago we knew the right time to plant maize and millet. Now, we sow maize on this fallow land but when the rain does not accompany us the seeds go dry and are lost. The crop yields were very good. They could sustain the whole year. We even used to sell the surplus” – villager of Devisthan

It is widely mentioned that rainfall used to be proper and timely with a certain frequency. Days with much rainfall occurred every fifteen to twenty days while small amounts of rain fell every week. The rain that used to fall was good for the crops, since it was of low intensity. Due to this low intensity the ground was able to recharge adequately. This rainfall pattern with certain predictability in rainy days does not exist anymore. Instead, rainfall has become more erratic, intense, and unpredictable. Farmers state that it often does not rain when they expect and need it for their crops, while it rains during times they need the weather to be dry, like during harvest. Especially in the past five years, the rainfall and hailstorms have occurred during the harvest period in the Indrawati basin. In some cases, farmers had to cope with hailstones just before harvest. This event that is increasingly frequent can destroy up to half of the crop yields. The intensity of precipitation has increased, and this torrential rainfall is less beneficial for the crops. Intense rainfall also washes away the fertile topsoil in the hills. Another consequence is an increase in landslides when it rains.

“Rainfall only falls occasionally while a long time ago rainfall used to occur for a whole month. Now, there is no rainfall so people are thin. How to irrigate and get food? Due to a lack of water the plantation of millet and maize dies and rice plantation is not as good.” – villager of Arubote

“The rainfall pattern has changed very drastically. Last year we sowed the seeds of maize during Ashar. Actually, it should have been sowed two months before during Baisakh. But there was no rainfall. Most of the people did not have food to eat that time. We had to eat the food that normally is for livestock. We had to eat this ‘khole’ for three months that year. We are very afraid that more severe conditions are going to hit this area. We cannot say when it rains. We have not received proper rainfall in the last ten years and it is becoming worse every year.” – villager of Devisthan

The concept of changing rainfall patterns seems to be difficult to grasp. Farmers were used to a fixed precipitation pattern. Farmers mention to carry out the same agricultural practices as their ancestors have done and that little has changed. The start of the rain marks the start of

the planting season. Some farmers, however, sow the seeds during the traditional plantation time in the hope that the rain will accompany them. When this is not the case the seeds dry in the field. Although the variation between years regarding the start time of rainfall is notable, a general trend can be observed of farmers having to take greater risk in agricultural practices. This increased risk is accompanied by a decrease in crop yields. When rains are untimely the harvest can be reduced by a quarter up to a half. In an agricultural context that is characterised by marginality this is very significant. People are unable to harvest the same yields as before, since a smaller proportion of the yield ripens due to a shorter growth season. Rice cultivation is particularly vulnerable to inadequate access to water. Paddy seeds are planted in separate beds where the saplings first mature. From there they are transplanted into the farmland for the second stage of growth. For high yields it is crucial that the rice plants are transplanted before they grow to big but this requires sufficient irrigation water. In years with inadequate rain and low water availability it happens that rice cannot be transplanted on time. Planting new seeds is not possible since the plants need one month to grow before the second growth stage. In Acharyatol, an untimely rice plantation is claimed to cause a 50% decrease in yields.

“Ten years ago, small rainfall started falling at the beginning of Baisakh. This rainfall had a special value to us. It was named ‘the rain for sowing maize’. After this rain, the small plants need rain at Ashar. During this month it starts raining in good years. From this month onwards, the rain does not stop until Ashoj. Plantation starts one or two days after the first rains in Shrawan. In Mangsir we harvest rice. This is the same as before.” – villager of Arubote

“When drought occurs we can only wait for the rain. Gradually the rainfall pattern is changing. In the same way we are not able to change the crop pattern. We expect rain in Ashar and we make the seed bed for paddy. When the rainfall comes later the bed is of no use and it is too late to make a new bed. Only God knows what to do in this condition. Due to the high pressure of plantation that needs to happen on time, we are unable to send our children to school. They have to work in the farmland. Due to changes in rainfall they need to help the family.” – villager of Tipeni

Figure 5.6 Rice saplings being prepared for transplantation and the second growth stage



Perception about the starting point of this climate change differs among farmers, who indicate that it has been a slow and gradual process with harsh conditions becoming increasingly severe. Particularly the elderly state that in the last fifteen years the environment has changed gradually towards more water scarcity, higher temperatures, erratic precipitation, less water in the Indrawati, and less snow in the Himalaya. The last five years are especially different to what the inhabitants have been used to previously.

Next to changing weather patterns, farmers indicate a trend of increasing temperatures in both the summer and winter season. Emphasis is placed on the increase in maximum temperatures during the dry Baisakh and Jestha months, and an increase of minimum temperatures during Magh and Paush. Dry month temperatures especially increase when the monsoon rainfall is delayed. The winter season is not perceived to be as cold as it used to be and the number of cold days has decreased. The higher temperatures are also perceived to be shifting to higher altitudes, as can be observed in Okrani where the temperature used to be more temperate than at present. In Tipeni, the lower amount of water has decreased the capacity of the Indrawati to provide the community with a temperate climate. Some farmers perceive that the moisture evaporates more rapidly from the soil as well.

“When we used to rear our livestock in the hills, we never felt as extremely hot as these days. In the winter season, it was so cold that we needed to have thick cloths. But now we do not feel so cold, so we wear our normal cloths. The Majhi have a saying that even when we put seven layers of cloths on our body it is still too cold during the winter season. Now, this expression remains invalid.” – villager of Arubote

“The temperature has increased on this altitude. It has increased simultaneously with changes in the rainfall. Ten years ago, it used to freeze frequently in Baisakh. Now, there is no frost and snowfall anymore. We also had pleasant weather in the summer season, but the hotness has shifted towards the upper areas as well. I think this area is going to be like the valley. About four years ago, the mosquito has started to appear in our community. We had not seen this before. There is also a lack of snow in the Himalayas. In the past the mountains used to be completely white and no rocks could be seen from here. Now, only the summits are white.” – villager of Okrani

Too little water

Water scarcity has increased in the last fifteen years. In all communities, decreasing water availability is observed and mentioned as a growing concern for the inhabitants. Stories exist of communities that in the past used to have enough water for irrigation in *bari*, while now they do not even have enough drinking water. It is indicated that many sources are now not even seen during the monsoon season. In the mind of many people however, especially those with access to irrigation, this decrease has not yet reached alarming levels. It is particularly the people that already had restricted access to water resources who notice the changes better. The main sources of drinking water and irrigation are *mool* (spring sources) *khola* (streams) that originate in the hills. Causes for their drying are drought, increased evapotranspiration, deforestation and road construction. The latter two damage the recharge of water sources.

“When the dry season starts this kuwa goes drying. Then we have to go to the streams near the Indrawati. We have to dig for a well to get water. That is a two hours walk from here. Yearly, we have a six months long water scarcity. We have to spend a lot time to fetch water. This time can be utilised for other income generating sources. Most of the children are forced to carry water early in the morning.” – villager of Devasthan

“For a proper plantation we must use the irrigation canal to increase the yields. Water sources should be used in a proper way. As the rainfall amount decreased, the alternative source became the irrigation system. The canal is used more than in the past.” –Environmental Conservation Group representative, Lagarchhe

Existing drinking water supply and irrigation works are insufficient to maximise the benefit of water sources for the communities. Although irrigation canals and drinking water facilities are developed the amount of water flowing through them has decreased and is insufficient for all community members. In the past, irrigation canals would be connected to every farm, but now that is not the case because agricultural land has been expanded into marginal and difficult to irrigate lands. Irrigation water is scarce in especially the hills. Even in the valley situations of water scarcity exist, since irrigation facilities are highly inadequate to cultivate all the land on

the riverbank. This can very clearly be observed in Arubote, where significant extensions of land cannot be cultivated year-round, although the river flows next to it.

Figure 5.7 Fields near Arubote that cannot be irrigated due to a lack of water in the *khola*



“There used to be water in every source but now they have dried. There was a queue always but at least we had water for all members. We had more than five main sources. Now it has decreased to one upon which we all depend. Each day I get only two gagri⁴ as I am very old. More than ten years ago, there was no shortage in drinking water supply. We had a kuwa⁵ that was nearby from where we took the water from the kuwa and from the frequent rains we collected water for our livestock. The kuwa dried and low drinking water supply makes our situation more problematic.”
– villager of Devisthan

“Before there used to be snow-capped mountains. We had an ancestral prediction that said that when there is a lot of snow in the mountains, the yields will be good. Now there is less snow and the yields are decreasing. The intensity of the sun has increased and the water in the soil has gone down. This has led to less water in our sources. The intense rainfall does not recharge the ground water. Before there were seven sources of water. Now there are only two left.” – villager of Okrani

A worrisome trend in all communities is the increased incidence of crop pests and livestock diseases. Pests and diseases have increased compared to ten to fifteen years ago. In crops, the most prevalent pest is *kumre*, while diseases in livestock are *namle* (coughing), diphtheria and diarrhoea. New types of diseases are emerging that did not exist in the Indrawati basin in previous times. Farmers state that with proper rainfall pests never created great problems. While agricultural practices are not very different from before, yields are very different. On the other hand, not all farmers show great concern about the increase in pest. To deal with this, many farmers have started using chemical pesticides. This has increased the agricultural input cost. A main concern is that when only organic fertiliser is used, yields are much lower.

“Pest in crops is widespread. Especially soybeans are completely covered by the black pest and no bean can be cultivated. Before, we did not have such a pest problem. We used organic fertiliser and the production was very high. Now, even we use organic fertiliser together with chemical fertiliser but pests are holding back the production.” – villager of Devisthan

“Due to changes in the environment the crops have pests and animals diseases. The yields have decreased and crops are severely affected. This may be due to the fact that there was no rainfall for a long period. It is believed that if we have rainfall we do not have such kind of disease. In the past there was no disease in maize and millet but recently they were affected.” – villager of Tipeni

⁴ 1 gagri equals 20 litres

⁵ Underground spring

Too much water

Next to drought as a slow onset hazard, rapid onset hazards like floods and landslides also prevail along the Indrawati. The problem of flooding, landslides and intensifying hailstorms can be observed in the communities. Flooding is mostly caused in the southern, lower part of the Indrawati basin after it rains intensively in the upper basin. Multiple community members state that floods used to be much worse than they are at present due to a decrease in the amount of river water. Floods affect the farmland in the riverbank. They wash away the fertile land and physical infrastructure, and deposit big boulders in the riverbank. The farmland is particularly affected when the river changes course, washes away great amounts of land and destroys the irrigation systems in the valley. To restore the farmland for cultivation requires a lot of work labour and forms a heavy burden on collective action. However, as the water level in the river is not what it used to be in the past, the main threat of floods is not the Indrawati but the various *kholas* that grow rapidly after intense rainfall. Small floods come each year and last for about two to three days. These floods can take away trees and small patches of farmland, but do not affect settlements since these are located on higher grounds. Four years ago, the Dar *khol*a seriously affected Thadokol and people had to flee with their livestock while the two bridges of Melamchi Bazaar and Thadokol were destroyed.

Figure 5.8 Recent landslide near Tipeni



It is indicated that the incidence of landslides has decreased as a consequence of much drier conditions in the valley. That precipitation has gone down is thus not always perceived to be such a problem, even though this gives new problems like dried sources.

“Four years ago a big flood took away big parts of the hill, killed a lot of fishes in the river, and destroyed the Sipaghat and Melamchi bridges. When intense rain falls during monsoon, landslides and soil erosion are very common in this area, although it used to be worse. With less rainfall there are less landslides. The original name of this village is ‘Baguwa gaau’, meaning ‘flowing village’. When intense rainfall starts, landslides become more frequent.” – villager of Arubote

“Rain would fall continuously during two months. Now, we do not receive this rain. Instead, once every six months we receive intense rainfall, which increasingly brings hailstones. Two years ago, hailstones caused a 90 percent decrease in the potato and vegetable yields. Intense rainfall has caused the washing away of the topsoil but this is reclaimed by using lots of organic fertiliser, like manure and composted litter. If this is not done there will be more pests and the potato rot in the field. Twenty years ago we did not have pest problems. Now in both plants and animals.” – villager of Okrani

The human factor

Environmental change is certainly not purely ecological. It is a synergy of both ecological and human factors, with the latter at times being more significant. Natural resource degradation can often be deduced to practices of water and soil management. For example, the occurrence of landslides is perceived to have increased due to the conversion of forest area into cultivated land as well as an improper construction of physical infrastructure in the hills. A worrisome development problem with the potential to further constraint water availability is the presence of the sand mining industry. In recent years, eight sand mining companies were established along Indrawati that take out sand from the river to facilitate the construction boom in nearby Kathmandu valley. Sand mining in the riverbank is decreasing the river level gradually and is stated to increase the probability of river course alteration. The sand mining also has adverse effects on the river ecology. In Arubote, the Majhi traditionally depend on fishing and here it is stated that most fish in the river have died due to natural habitat destruction.

Figure 5.9 Sand mining industry near Arubote



“The river environment is degraded and the flow of water has become uncontrolled. It can now flow in any direction. In the past, there were beds in the river so the water used to flow smoothly. The crusher now take away lots of material and the river is deepening.” – villager of Bahunepati

“The irrigation infrastructure, which was constructed recently is not working properly as the water level of the river is not the same. As the river level goes down the dams that we construct for irrigation do not work anymore. If the river deepening continues then we need to construct an intake upstream. We cannot afford that. The excavators help us now to construct the dam but once they go to another place who will help us then? When we go to the crusher industry asking not to extract more sand, they do not hear our voices as they are powerful and wealthy. They even come to harm us if we insist.” – villager of Thadokol

The river level has lowered about 1,5 meter since the mining began eight years ago, and starts to have serious consequences for the possibilities to irrigate the fields located next to the river.

The sand mining industry seems uncontrollable due to the absence of tied rules at the national and district level. It is indicated that more than four hundred truckloads of sand and stones are driven to Kathmandu valley each day. This exploitation, in synergy with changing rain- and snowfall patterns, has caused the number of harvests in many parts of the valley to decrease from three to two times a year due to a lack of irrigation water. In the last three years, the problem has become particularly severe due to an increased activity of the industry.

“The deepening of the Indrawati River due to the sand mining leads to most of the farmland in the valley remaining fallow due to a lack of irrigation systems. The riverbank farmland remains dry. If in the near future these activities are still carried out, harsh conditions will emerge and it will be very hard to restore again.” – villager of Acharyatol

“Today it is very difficult to bring water from the Indrawati due to the water level decrease. Before it was easy since the water level and the farmland were more or less on the same level.” – villager of Arubote

5.3 Dwindling community-based strategies

Various changes in the social-ecological system of the Indrawati basin can be distilled. The main drivers of change are population growth, economic development and climate change. They fundamentally touch upon the integrity of traditional livelihood systems. In recent years, changes have occurred in collective action and *parma* in the community. In the communities, there is less willingness to contribute free work labour to actions that focus on the agricultural sector, in which benefits are increasingly marginal and uncertain. In Arubote and Tipeni for example, irrigation canal maintenance work used to be conducted collectively. Households have however expressed their dislike that labour contributions need to be made while not everyone benefits from water supply. Many fields are located at the tail end of the canals where water seldom reaches, since the streams are progressively drying. Changing weather patterns seem to have influenced *parma* as well in a negative way. It is indicated that previously, there used to be a one-month gap between the first rains and plantation of crops. Due to a delay in the monsoon however, plantation needs to occur as soon as possible after the first rains to minimise the decrease in yields. This has led to a situation in which the whole community needs workforce at the same time. Rotational exchange of labour is thus less effective since everyone want to be helped first. This has increased dependence on the workforce of all household members, including children who are not to be able to attend school during plantation time.

Apart from ecological factors, social factors are also very significant in causing changes in community-based practices. The fact that farmers have obtained other income sources besides agriculture makes collective action commitments in the agricultural sector less reliable. While in the past collective action and *parma* were purely based on workforce input and exchange, they are gradually more characterised by monetary transactions. The diversification of income sources in the community has triggered the cost of work labour to increase. For farmers with rainfed fields, the cost of hiring work labour has become higher than the benefits, especially when the rains are not accompanying. This hike in work labour costs causes much rainfed land to remain fallow. The solidarity between community members in doing collective action decreases since households increasingly focus on non-agricultural income sources. It is mentioned several times that people become more individualistic and social bounds are less tight. People think for the development of their own household instead of community-wide development.

“People are not able to participate in community work because they are increasingly involved in paid work labour for the family. The youth are migrating. Parma is becoming harder nowadays. Because the youth are migrating we are not able to sustain it. This results in more and more land remaining fallow.” – villager of Acharyatol

“When dry conditions prevail the yields will decrease. At the same time, the labour costs remain the same. This creates a dilemma for us. If we plant, we will not get a proper production. If we do not plant, then what can we eat in the future. If the rain does not fall at a proper time, then it causes problems for the farmers.” – villager of Tipeni

*Figure 5.10 Above: Dam at an irrigation intake in the Sahare khola near Arubote
Below: Fallow agricultural land in Okrani due to switches in livelihood*



This chapter has tried to characterise the traditional livelihoods in the Indrawati basin. The close relation between livelihoods and natural resources has made clear that households are *sensitive* to changes in the ecological system upon which they traditionally depend. In the second part, the *exposure* of rural communities to changes in the natural environment has been discussed. The trend that livelihoods that are based on ecosystem services are becoming less reliable and beneficial causes traditional practices to diminish in importance, as could be observed in the last part of the chapter. Whether and how households adapt to this change exposure is subject of the next chapter.

6. ADAPTATION FROM A GATEWAY PERSPECTIVE

During the last decades, and particularly in recent years, the social-ecological system of the Indrawati basin has shown considerable dynamics. Many new threats and opportunities have emerged that determine the possibilities of the rural communities to shape sustainable livelihoods. Economic development has added new dimensions to the *manoeuvring space* of farmer households, while changes in the weather pattern has imposed new adversities on the agricultural cycle. In this dynamic environment it is urgently required to systematically analyse the adaptive capacity of communities in the global South. Since these communities stand very close to the natural resource base, they are very sensitive to ecological and climatic changes once they are exposed to them.

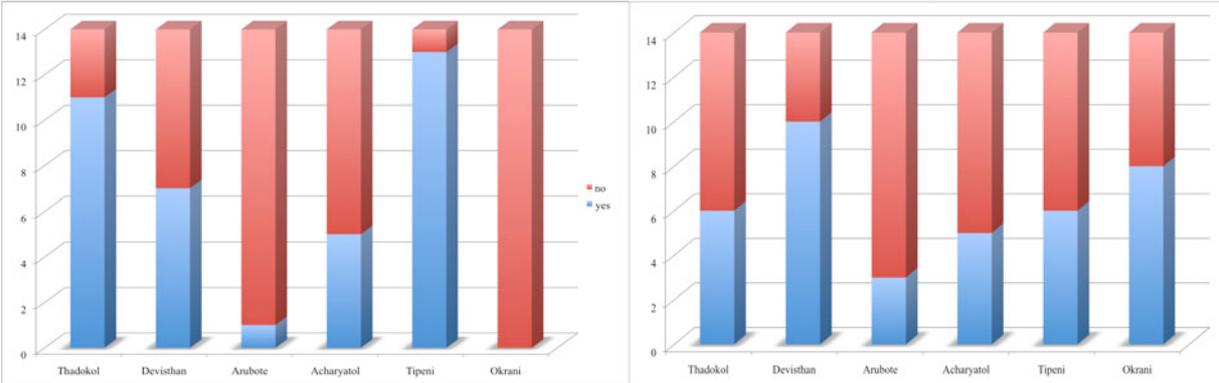
This chapter makes use of the gateway system theory that is developed Dixit & Moench (2010). According to this theory, communities tend to be resilient when they have access to a variety of gateway systems that enable households to switch strategies (Moench, 2010:985). These systems are communications; infrastructure; finance; knowledge generation, planning and learning; organisation and representation; and economic diversification. By means of a systematic discussion, this chapter aims to provide initial understanding of the adaptive capacity of the case study communities, and differences between them. The gateway approach has the potential to observe possible resilience gaps in the communities.

Communications

A first gateway system is communication since it is important for resilience to provide access to diversified information, including weather and hazard information. The presence of radio, television and cell phone networks increases the potential for information flows and the likelihood that communities are more aware about the adversities of water-induced stress and hazards. Graph 6.1 shows the endowment of televisions and radios in the 14 households of each community. Fundamental for these communication devices is energy supply. This is present in all communities, except Okrani where households can recharge their radios with solar energy, while televisions are completely absent. Other communities with a low share of households that possess a television and radio are the low-caste valley settlement of Arubote and high-caste hill settlement of Acharyatol. Television endowment is highest in the valley communities of Thadokol and Tipeni, where many households have been able to improve their living standard compared with the hill communities. It is indicated that televisions and radios are mainly used to watch the news. The weather forecast is almost never watched in a targeted way but people become aware as it is shown directly after the news. People however indicate that the weather forecast has a very low accuracy.

Graph 6.1 Television endowment

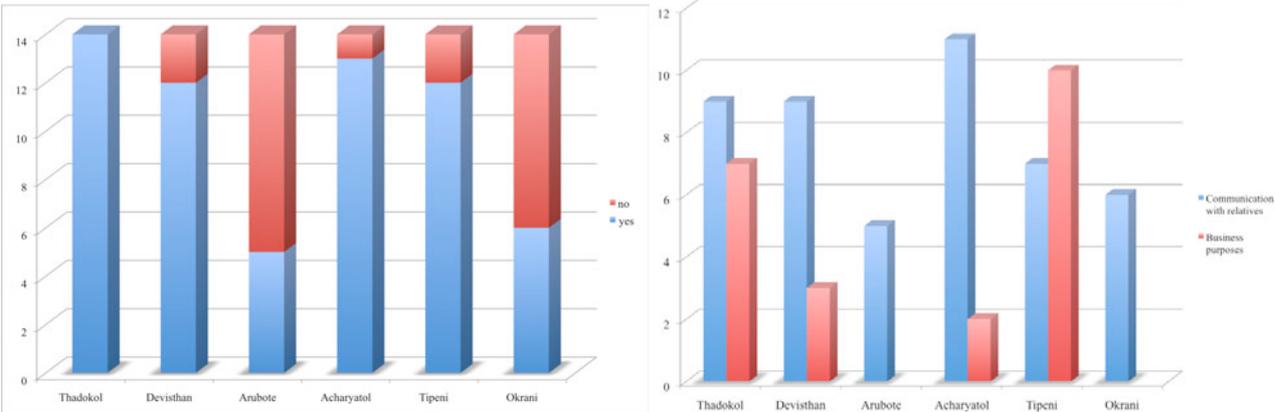
Radio endowment



Source: field survey

Access to a cell phone can decrease the economic vulnerability of communities by offering opportunities for alternative livelihood opportunities. Phones enable people to develop social networks, access to market information and engage in other activities that build productive livelihoods. *Graph 6.2* shows that cell phone endowment is very high in four out of six communities, with Arubote and Okrani being the exception. It also shows the frequency with which surveyed households mention a particular cell phone function. While cell phones primarily serve the purpose of communication with relatives in most communities (mostly relatives that migrated outside the valley for work labour), cell phones are much used for business purposes in the valley settlements of Thadokol and Tipeni where a considerable business sector has emerged. Cell phone access facilitates business interactions and enables community members to build non-agricultural livelihoods.

*Graph 6.2 Left: Mobile phone endowment
Right: Frequency of named mobile phone functions per community*



Source: *field survey*

Infrastructure

A second gateway is an infrastructure system that can ensure mobility under all conditions, including the extreme. The nature of the transportation system influences the ability of goods and services to go in and out of certain areas. This affects both the business opportunities of a locality, –like whether agricultural products can be sold to the market– and the response it can receive during emergencies. With regard to physical development, road infrastructure is a visible improvement in the Indrawati basin. In all communities, road construction is seen as the most positive change, which has opened many other possibilities for community development. Roads have made it easier to move to and from the market, although the number of buses running in the hills is very low. The paved roads constructed in the valley have been the main reason for the emergence of business activities in communities like Thadokol, Melamchi Bazaar and Tipeni. Road construction has been a great priority of all the communities in recent years, since it has a good impact on other development programmes. It is seen as the fundament for further development as it opens possibilities to connect and trade with particularly Kathmandu valley. While the paved valley road is in place for several years, the hill roads that are constructed now increasingly give way to small business uphill as well. The advantage that valley communities have had over hill communities is thus gradually being equalised. In Thadokol and Tipeni it is also mentioned several times that the new road construction in the hills has reduced the business potential of the valley communities, since goods are directly transported to the hill communities. An exception is Okrani, which has not been facilitated with a road.

Figure 6.1 Recently constructed road in the hills near Acharyatol



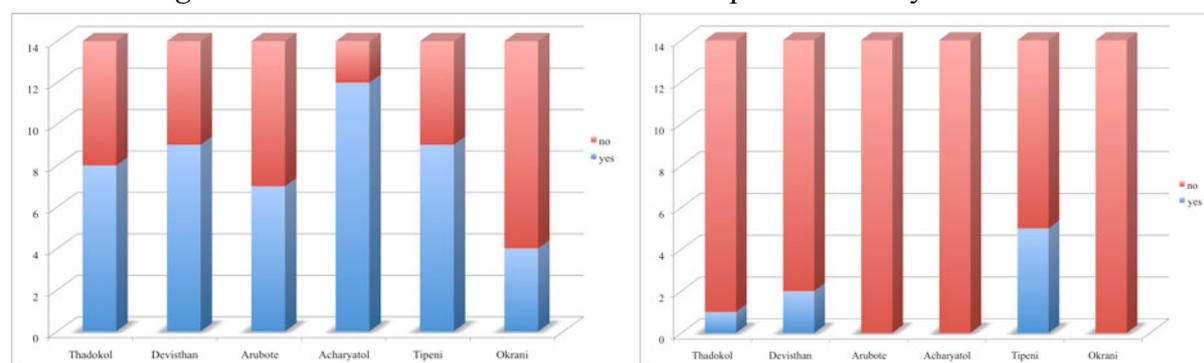
Due to the mountain topography a massive investment in infrastructure is required. Not only the expansion of roads, but also water infrastructure is problematic in the hill and mountain region since it is hard to provide large storage and irrigation facilities when accessibility to water becomes increasingly variable in this rugged context (Su et al., 2009:4). While drinking water facilities have been brought to each community, they are highly insufficient in at least three of the six communities (Devasthan, Arubote and Acharyatol), making households quite vulnerable to drought. This water shortage increases the urgency for farmers to switch their livelihood strategies towards income sources that are less climate sensitive.

Finance

Access to credit, insurance and banking products greatly reduces the risk of suffering, since they offer a safety net during times of hardship. Credit allows households to be more resilient by rebuilding their livelihood after their assets have been destroyed by water-induced stress and hazards, and opens the way to engage in new income generating activities by provision of a starting capital. It can thus trigger behavioural changes and help farmers to cultivate with improved agricultural input products and enable household members to acquire initial capital for migration. Graph 6.3 shows the share of households that has access to credit and insurance. What is very clear is that there is still a great inaccessibility to insurance services, while credit tends to be accessed by more than half of the households in each community.

Graph 6.3 Left: Households that have taken a loan per community

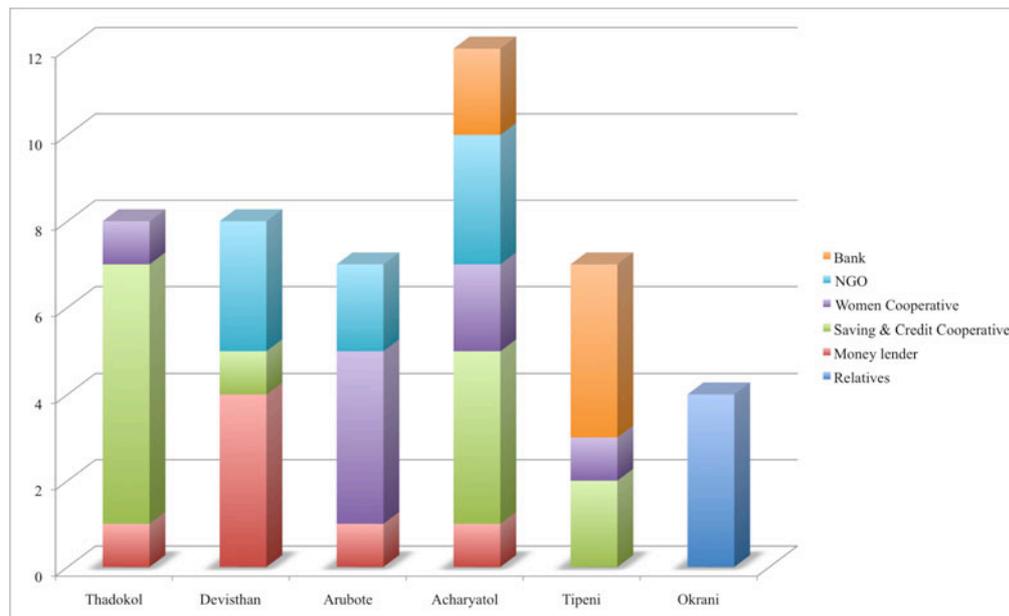
Right: Households that have taken insurance per community



Source: field survey

A diversity of formal and informal institutions, such as moneylenders, cooperatives and banks provides micro-credit. *Graph 6.4* depicts the amount of households in each community that make use of the services of various types of credit institutions. Great differences are observed between communities. Informal loan taking arrangements are particularly high in Devisthan and Okrani. While traditional risk sharing strategies (borrowing from relatives) still exist in Okrani, the share of households that take a loan from an informal moneylender is still high in Devisthan. Other communities have been able to access formal credit institution services.

Graph 6.4 The various sources from where community members have taken loans



Source: *field survey*

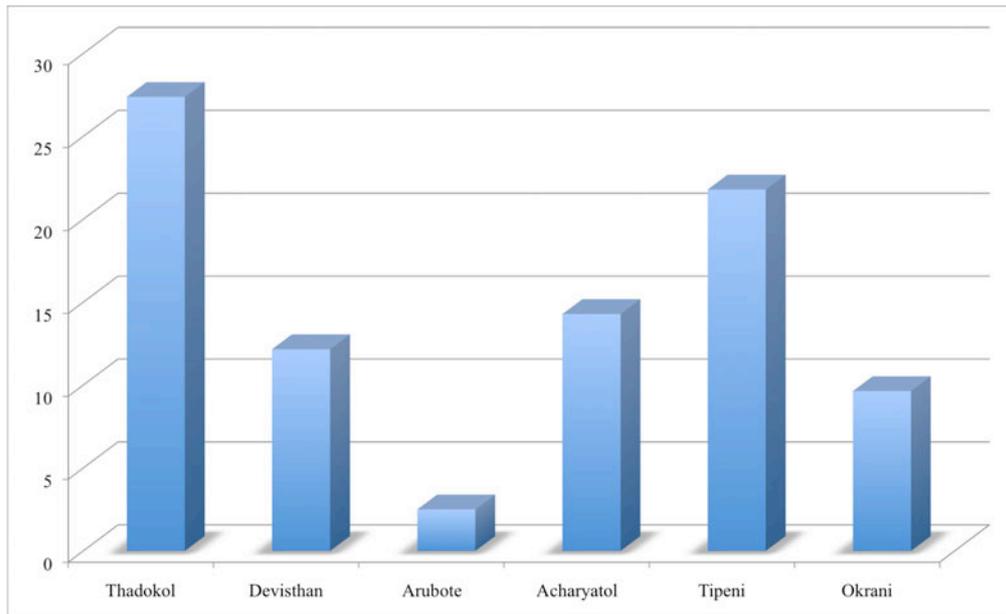
Education

Apart from access to financial services, a community's education level is also a considerable determinant for adaptation success. Good education gives people the skill to analyse change processes, better understand risk and shift livelihood strategies when necessary. It enables people to diversify and strengthen income by incorporating both non-agricultural components and improved farming strategies. Farmer field schools and awareness creation activities, both for income diversification and disaster preparedness, are indicated to be key components of the education system. The education level is also turns out to be a major determinant of the idea of progress and vision people have for the development of the own community.

“At least the people are unified for the community's development. Whatever we want to develop in the community, we will have to do it by ourselves. Before, we did not have such a concept of the direction we wanted to go towards.” – villager of Acharyatol

Access to education has provided a great change in a number of communities. It is frequently indicated that money earned with new income sources, is invested in the education of the children. Education can be seen as one of the new needs that farmers regard fundamental for the success as the family. As a consequence, the number of people that have obtained a School Leaving Certificate has grown explosively in some communities. Many schools have been constructed, which has sharply decreased the time children need to walk to school every day. However, although removed from one another by short distances, great changes can be observed in the education status of the six communities. *Graph 6.5* shows clear differences between communities by depicting the percentage of the total number of household members in each community that were found to have obtained a School Leaving Certificate.

Graph 6.5 Percentage of total number of household members per community with a SLC

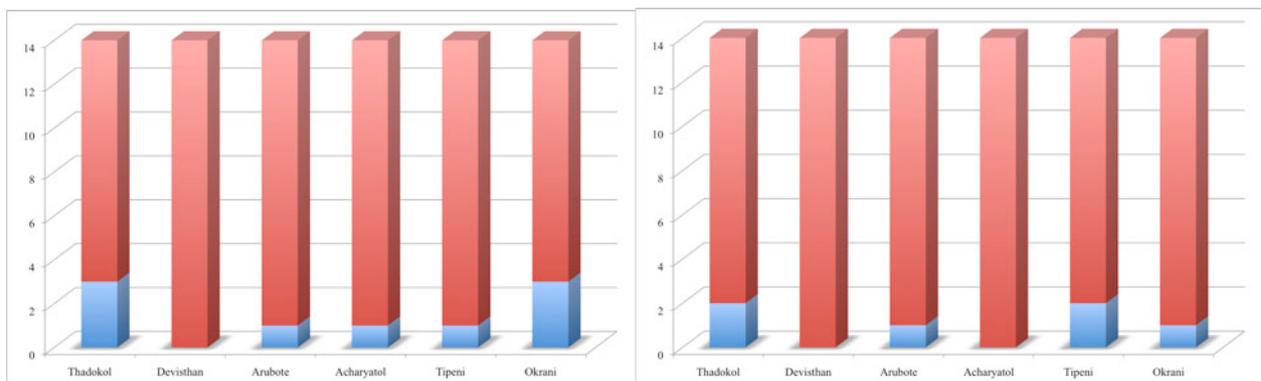


Source: *field survey*

The education status of Arubote, but also Okrani and Devisthan is worrisome. While the community members of Thadokol and Acharyatol have a clear aim of where they want to direct the community, members of Arubote and low status members of Tipeni state that they do not know what the future can bring and what they can do, other than continuing traditional livelihoods. It is indicated to be difficult to send children to school when parents have enjoyed little education and do not see the importance of their children receiving it. Persons that are little educated have few opportunities outside farming and construction work. In general, this is the case in low-castes. Livelihood and awareness trainings are considered a salient part of education. Graph 6.6 shows both the households that indicate to have followed training in income generation and in hazard awareness. This number is for all communities surprisingly enough dramatically low, since trainings are offered by a variety of cooperatives and NGOs.

“The education has developed compared to the past but the number of children attending school is very low. Parents never give money for education fees. Yearly the schools open for 180 days but the students come to school about 25 days. The concept the people in this community have is that they only need to go to school during exam period.” – teacher of Arubote

Graph 6.6 Left: Households that indicate to have followed training on income generation
Right: Households that indicate to have followed training on hazard awareness



Source: *field survey*

Knowledge generation, planning and learning

Education is a crucial prerequisite to foster learning and self-analysis processes and enables households to adapt to social and ecological livelihood threats. Impacts on livelihoods depend on the degree to which vulnerable populations are able to obtain, correctly interpret and act on exposure to livelihood adversity. The concept of changing agricultural practices to make the agricultural cycle more resilient to climatic adversities turns out to be difficult to grasp for most farmers. In general, farmers feel that they are powerless to deal with adverse weather conditions. It is frequently stated that to cope with drought, landslides or floods, they depend on the grace of God, and the only thing they can do is wait, see and pray. Community members have all experienced severe conditions in the past and the food scarcity situation has been high since by times it rained barely during a whole year. Nevertheless, some farmers acknowledge that certain crop types (maize, millet and wheat) have benefits related to their drought resistance. It is stated that especially maize can properly withstand short dry periods, after which it re-starts the growing process when it rains again after a dry period.

“Most of the people believe in God, so they will start praying to God. With the changes in the weather, the plantation time has changed. People stay inactive and wait for the rain to come. We do not know whether it is good or bad but we wait for the rain and only then start our activities. If the rain does not come during Ashar and starts in Shrawan then we will only start plantation during Shrawan. Despite that we know seeds need to be planted during Ashar, we have abandoned to do that.” – villager of Acharyatol

“We have not been able to change agricultural practice. The problem is that we are unaware about the types of crops that can be grown for an effective production. If God wants, he can give good yields by giving rain at a proper time.” – villager of Tipeni

Crop diversification is also seen as an adequate strategy to spread risk. This demands a certain amount of land and most people state their land is too limited to be able to plant various crops. In most communities, instead of diversification, a de-diversification of crops can be observed. It used to be very common in the past to plant different crops in the same field, like maize with soybeans on the side. It is indicated that due to soil quality deterioration it is not possible to plant many crop types anymore. In recent decades a trend of soil degradation has occurred, directly caused by the application of chemical fertiliser, but indirectly driven by population growth and increasing pressure on the soils, in combination with less favourable climatic conditions.

“No crops are diversified in the field. We have tried to grow soybeans and other plants in the same field but there was not any production. I think that due to soil quality degradation different crops are not able to grow together. In the past we had high production with multiple crops in the same field. With the growing of maize, soybeans were planted on the side as well as some vegetables. These bean types have been slowly diminishing. The species of vegetable are not there anymore to show our children.” – villager of Acharyatol

“We had crop diversification in previous times. We used to grow soybean, maize, and junalo, all in the same field. But now we do not, because of the absence of rain and the pests that are creating problems.” – villager of Devisthan

Another example to spread risk is cultivation in various agro-ecological zones. In a few communities, households own fields in both the hill and valley. The practice is observed in Thadokol, Acharyatol and Tipeni. In the valley communities of Thadokol and Tipeni, many migrants who came down from uphill still own fields in their place of origin, and cultivate these lands two times a year. Acharyatol is a hill community, but being high-caste, the members traditionally own fields in the valley as well. Okrani is the only hill community that exchanges goods with the valley (potatoes for rice). Less isolated settlements have already established strong links with the market and obtain their food through monetary transaction instead of exchange. Hill communities buy goods in Thadokol, Melamchi Bazaar and Tipeni.

Thinking about how to cope with the effects of drought seems to be too abstract for many farmers. Farmer knowledge related to improved agricultural techniques is not widespread and the construction of irrigation canals uphill and in the valley seems very difficult without external assistance. Measures that address landslides and flooding seem more tangible to conceptualise. The predominant measure that is taken is the construction of stonewalls to minimize the effects of flooding or landslides. Still, it is largely stated that actions undertaken by the community are far from adequate to cope with the damage caused by water-induced stress and hazards. As natural hazard control goes beyond community capacity, individual household measures that are applied during drought and after a landslide or flood are increasingly important. This often turns out to be finding temporary work labour. Informants indicate that in the past, farmers would go to the house of richer community members during severe conditions to do work labour in exchange for food. Stories of disadvantaged farmers having to work the whole day for one meal are manifold. There are also cases of farmers who had to sell their farmland to sustain their family. Others sustained by taking credit, while not all households were able to repay their debts. Conditions were particularly severe in the hill communities. The present situation of land and water scarcity increasingly induces the need for households to engage in income generating sources outside the subsistence base.

“Drought and floods are natural and we cannot say when it occurs. We are very unaware about how to combat drought. Since we are not educated I do not know how to deal with it. If drought prevails, we can only wait and see. It is easier to prepare for floods and landslides. If there is a landslide the government must help to construct gabion walls and reforestate the slopes. [...] After the flood we protect the farmland with piles of stone, but this do not work properly. Every two years we have to make new ones.” – villager of Tipeni

Farmers apply individual strategies to maximise the agricultural output. This is needed since family size has grown and households have to feed more people with the same land. Next to rainfall, good crop yields depend on the amount of fertiliser and workforce input. The major problem is a lack of access to more productive land while the population has increased. In search of ways to increase the productiveness of their land, farmers have started to use chemical fertilisers and pesticides. It is even stated by farmers that a lower amount of water is compensated with a greater use of chemical fertiliser. Many farmers indicate that they feel compelled to use this, even though the costs are high. This has created a situation in which the input costs increase while yields remain the same. Furthermore, at present fertiliser is used haphazardly without balanced input of different nutrients, leading to soil quality degradation, which is attributed to the lack of knowledge on the effects of fertiliser and its ability to change soil composition. Farmers indicate that soil degradation now prevents them from increasing yields even with the use of chemical fertiliser. In the past a small amount of chemical fertiliser would give high yields, but now it needs to be used in a high dose, but even then the yields are indicated to be remain low. Nevertheless, it is stated that chemical fertiliser is a priority need for farmers since without it, production is even less. Therefore, despite the knowledge farmers have about the adverse consequences of chemical fertiliser, they still use it to have higher yields on at least the short-term.

“In the past we used to get good yields with just organic inputs. Now, to produce the same yields we need a lot of input, such as chemical fertiliser and pesticides. To compensate for less rainfall we have to use more chemical fertiliser. The yields are the same but the input costs are increasing day by day. The problem is that due to an excessive use of chemical fertiliser the quality of the soil has degraded and pests have increased. Ten years ago we did not have pests.” – villager of Tipeni

“Chemical fertiliser is the present need of the farmers and they stopped livestock rearing. That is why the demand of chemical fertiliser is high. The decrease in livestock has lead to a decrease of organic fertiliser. Every household rears one buffalo and a few goats. Not sufficient to fertilise the land. To increase the yield they add chemical fertiliser because farmers have to sustain the family. Farmers do not think about the long term effect of this.” – Lagarchhe Saving & Credit Cooperative executive member

Economic diversification

The above gateway systems together shape the landscape within which the diversification of income sources takes place. Agriculture remains one of the key sources of livelihood in all communities, and in some places like Thadokol, a modest commercialisation of agricultural products like potatoes and vegetables has taken place. As they cannot be conserved and need to be consumed within a short time span, money is particularly earned by selling these crops. Selling livestock products like milk forms a relatively new but growing income source. It is however stated that ecological conditions and demographic pressure create a lot of pressure on farmers to diversify income sources into the non-agricultural sector.

Income opportunities greatly differ between communities. New income sources have emerged in especially the settlements along the road, like in Tipeni and Thadokol, where a business sector has emerged that provides the valley and hill population with services. Employment in health posts, schools, sand mining and hydropower are also concentrated in the valley. The development process of the last decade has resulted in more individualistic livelihood strategies that are increasingly trans-local in nature. As a result of communication and infrastructure improvement, rural households are increasingly capable to benefit from income opportunities outside the community. Seasonal migration and remittances are increasingly important to bridge the gap of the dry season and cope with dwindling yields.

“The main occupation in the community is agriculture but due to insufficient land most of the people have started with alternative sources of income. Many have opened a shop. Those who are low caste are totally dependent on agriculture to have food. Those who are from a higher caste can depend on different alternative sources like livestock and shops.” – villager of Thadokol

“Our main source of income is fishing. In the past there were lots of fishes in the river but this has decreased with 75 percent. With the income of fishing, fertiliser and other household needs are bought. Crops are for household consumption. It is hard to make a living here but in Kathmandu it is even harder since there all goods need to be bought. At least here we have maize. Soil quality is not good in this area and only a few crops can be cultivated.” – villager of Arubote

Table 6.1 Most important income sources

	Thadokol [valley]	Devisthan [hill]	Arubote [valley]	Acharyatol [hill]	Tipeni [valley]	Okrani [hill]
1	Agriculture	Agriculture	Fishing	Agriculture	Business	Agriculture
2	Business	Livestock	Agriculture	Livestock	Agriculture	Work labour
3	Livestock	Work labour	Livestock	Work labour	Employment	
4			Work labour	Remittances	Livestock	
5					Remittances	

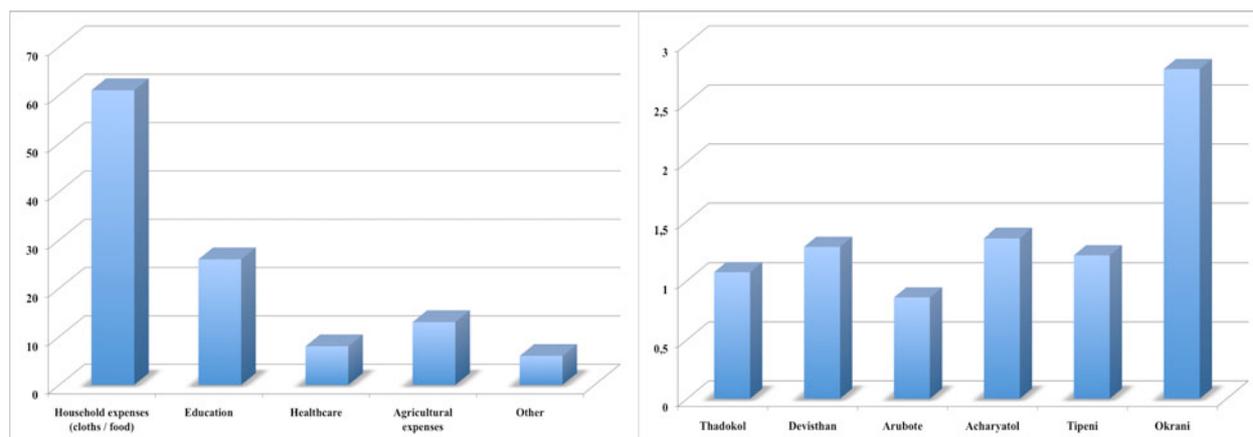
Source: *Focus groups*

A first migration wave in the Indrawati valley was the move from hill communities to the valley. The emergence of services and infrastructure in the valley has caused a considerable migration to valley communities and an abandonment of marginal rainfed lands that form a meagre basis upon which livelihoods can be sustained. At present, a common income strategy found in all communities is migration to nearby urban areas, like Banepa, Bhaktapur and Kathmandu to find work in predominately the construction sector. It is almost exclusively men that conduct this work, meaning that women often stay behind with the children. More than half of the household heads migrate temporarily to Kathmandu every year for several months in a row. This labour has made it easier to sustain a rural livelihood than before as risk can be better spread. When a family has small children, the head of the family moves out for work labour, while in families with older parents the children are burdened with the task to migrate and send remittances.

“The whole community consists of people who migrated from different hill communities. Farmers migrated because that there was less production and few opportunities to uplift their income. In the hills they have to depend on rainwater, whereas in this area there is fertile land where water is accessible and the road is present. Many people sold their land in the upper hills and with the money bought small plots of land in this area.” – villager of Thadokol

“You can see the area is completely dry and waits for the rain to come. We do not have enough food, so the youth needs to work hard for the family. Most people try to have better opportunities by migrating to the city and sustain their lives more easily. While going to these places we have to search for a job at least for two or three days.” – villager of Devasthan

Graph 6.7 Left: Frequency with which remittance use is mentioned (n=84)
Right: Average number of members per household that migrate each year



Source: field survey

Graph 6.7 shows the number of times that community members have named a particular use for the remittances they receive. It can be observed that remittances are especially used for the household expenses, of which the most important is the purchase of food. A second important use is education in case families have young children. The predominance of fulfilment of basic needs indicates that work labour outside the community is of key importance to sustain the livelihood of many rural households. The graph shows the average number of household members per community to migrate outside the basin as well. An exception is Okrani with more than double amount of household members living outside the community. Also when observing the main destination of migrants, Okrani forms a special case. People from this community migrate to Bouddhanath, a Buddhist settlement in Kathmandu, while many migrated abroad. It is indicated that the main reason for migration is not only done to provide remittances for those that stay behind, but to improve living standards and widen working possibilities. Particularly the youth migrates to the urban areas. Due to much higher prices in the city, it is hard for people to improve their living standard and send remittances back home. Especially hill inhabitants have more incentives to migrate while in valley communities households have enough alternative activities to stay.

Table 6.2 Most popular migration areas

	Thadokol [valley]	Devasthan [hill]	Arubote [valley]	Acharyatol [hill]	Tipeni [valley]	Okrani [hill]
1	Kathmandu	Kathmandu	Melamchi	Kathmandu	Kathmandu	Bouddhanath
2	Banepa	Bhaktapur	Kathmandu	Chitwan (Terai)		USA
3	Chitwan (Terai)		Sarlahi (Terai)	Melamchi		Japan
4	Bhaktapur					Lebanon
5						Israel

Source: Focus groups

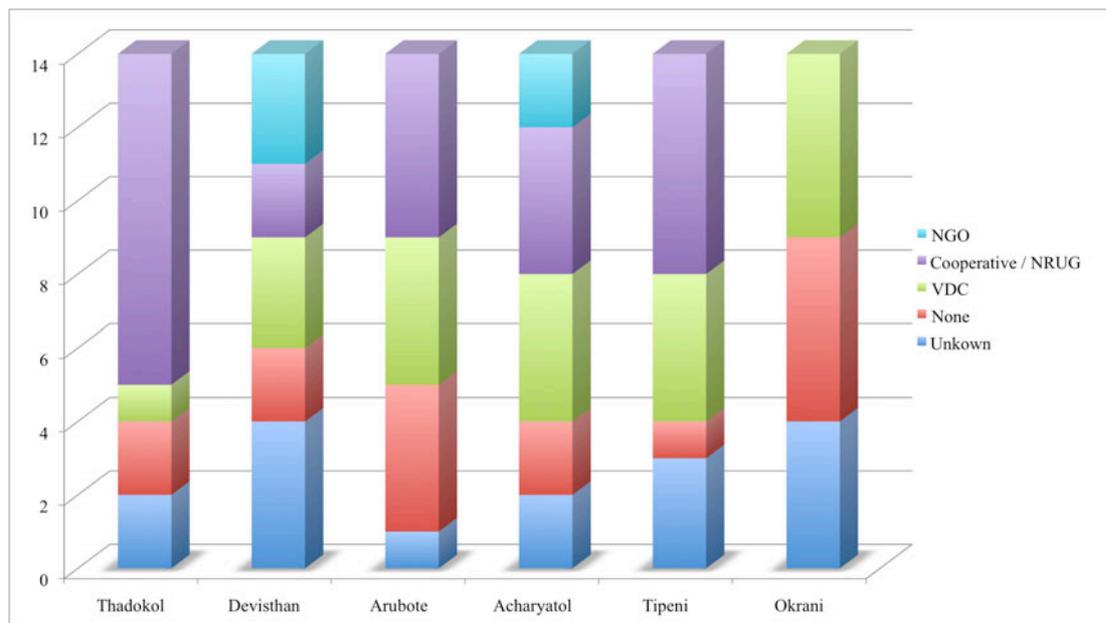
“People went abroad and came back with good stories. Community members that live outside help their family. Half of the people is abroad and 30 percent does business in Bouddhanath, like carpet manufacturing and Tankha painting. To migrate, we make use of our own network. First, a sister of my wife went to Kuwait. She told that the work is very good and the income is quickly earned, so my wife went as well. She does housekeeping work. Not everyone has access to remittances. Those people need to do more work labour to sustain.” – villager of Okrani

Organisation and representation

Local organisations are instrumental to give income diversification opportunities and augment agricultural livelihood resilience by supporting the systemic factors that are essential to improve livelihood strategies. The ability access diverse public, private and civil society organisations and voice concerns can greatly facilitate the shaping of a sustainable livelihood. For this, building linkages between the community and local institutions is urgently required. The ability to participate in local organisations and access services and managed resources greatly influences household resilience, especially when an institution can provide support during an emergency. The more connected a community is to local institutions; the better its ability is to respond adequately to social-ecological shocks and stresses.

Particularly worrisome when discussing *organisation and representation* is the position and vulnerability of marginalised groups, like low-caste and women. The access to social safety nets like credit and government support has traditionally been influenced by caste and gender (Jones, 2010:4). In the Indrawati case study however, it is observed that special institutions are established for marginalised groups, which have a positive impact on their position of these groups in society. Great differences between high-caste and low caste groups still exist, but barriers that prevent the inclusion of lower caste in the social system have been greatly reduced. Access to institutional representation and support has improved as awareness has increased. While the organisational aspect will be discussed in the next chapter, brief attention will be paid to representation. This is done by focusing on household satisfaction towards the different types of institutions, as well as an observation of what type of institution stands closest to the household, seen from a community perspective.

Graph 6.8 Institution that best adheres to household needs during an emergency

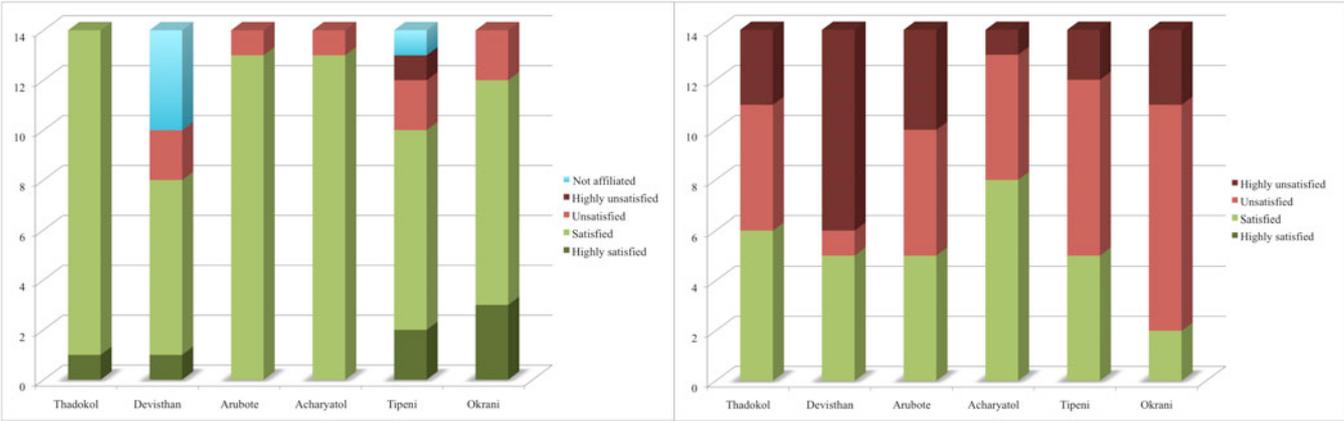


Source: field survey

Graph 6.8 shows per community what institution the community members perceive to be best adhering to their needs during an emergency. The institutions that are named fall within the categories of VDC, cooperative and NGO. However, two other categories are also named frequently. A significant amount of households indicate to be unaware about any institution that can address their needs during an emergency, while another portion states firmly that there are no institutions that function as a social safety net in times of need. The VDC is named by a third or less of the households in all communities, while this institution ultimately is *the* political representative body of the community. Particularly in Thadokol, Tipeni and Arubote the frequency with which cooperatives are named is high. In five of the six study communities, these civil society organisations have a share of a third or more in adhering best to household needs. Okrani, as many times, forms an exception when compared with the other communities. The institutional diversity here is very limited and the portion of households that state not to know which institutions can help, or even indicate an absence of such type of institutions is high.

A tool to measure whether the households that are either affiliated to, or that fall within the administrative territory of an institution, are properly represented is an observation of the satisfaction of communities towards them. On the left graph 6.9 shows household satisfaction regarding the services of local organisations, which can be natural resource user groups and cooperatives. On the right is shows satisfaction about VDC services. Clear differences can be observed between the two satisfaction measurements. The proportion of households that is satisfied with the services of local organisations is much higher than satisfaction about VDC services, since there is an overall feeling that the VDCs do not work adequately at the community level. At the same time, the interventions that are carried out by the VDC are not always, and not everywhere, appreciated as a real support.

Graph 6.9 Left: Household satisfaction regarding the services of local organisations
 Right: Household satisfaction regarding VDC services



Source: field survey

VDC offices implement basic development plans and thereby create a basis for income source diversification and increased prospects for autonomous adaptation. The context in which the VDC operates is however characterised by corruption, ineffective governance and general political instability. Barriers that hamper sustainable poverty reduction relate to non-existent elected local bodies and limited delivery of basic services (MoEST, 2010:35). First of all is there a lack of financial resources. VDC representatives indicate that many problems require to be solved with only little funding. This makes it very difficult to satisfy all communities within the same VDC. Poor households frequently accuse the VDC to be biased towards high-caste communities, as they are higher educated and can thus better raise their voice. Low-

caste households also tend to feel shy to ask for help in the VDC. It is widely perceived that the response of the VDC is much better when people are educated and assertive, while for the marginalised the relation is much harder. VDC representatives indicate that poor communities are helped in many ways, particularly with education. The problem is that the marginalised often do not experience this as support that comes from the VDC.

“The people think that only when we buy one bora of rice for each household they are supported. We are helping to improve their future. Children bring important social changes in the family and community. Road construction and education bring behavioural and socio-economic development. We have made schools but the kids are not send to school. If we distribute scholarships then only they will go to school.” – Shikhapur VDC representative

“The VDC response is very slow or not at all. We tell them about the problems we have in our community but this enters in one ear and goes out from the other. When a budget comes, this is very minimal. They are very much biased in favour of the elite group.” – villager of Devisthan

Despite the many problems and resentment that accompany the development process, it is indicated that many positive institutional changes have unfolded in the Indrawati basin in recent years. The institutional diversity and particularly the number of institutions has greatly increased, meaning that more services and interventions can be delivered that together widen the possibilities for rural households to develop and be resilient. The next chapter will provide an in-depth analysis of the institutional context of the Indrawati basin.

“As awareness increases there is more active participation. Now, there are many cooperatives that empower women, and participation is increasing day by day. About fifteen years ago, there were four members to allocate the budget in the village assembly. Now we have more than a hundred people participating each year.” – Deupur VDC representative

7. INSTITUTIONS, SERVICES AND INTERVENTIONS

The previous chapter focused on possibilities that rural communities have to autonomously adapt in the face of social-ecological shocks and stresses, through the lens of the gateway perspective as presented by Dixit & Moench (2010). The adaptive capacity of communities greatly depends on the institutional arrangements present at both the community and basin-level. Institutions shape the *manoeuvring space* in which households build livelihoods that are resilient to social-ecological shocks and stresses, by improving access to a variety of gateway systems. In the last decade, numerous institutional changes have altered the vulnerability of rural household. It is salient to better understand whether and how institutions, their services and interventions affect community resilience, especially as vulnerability is characterised by an uneven distribution of endowments and entitlements among the communities.

In this chapter better understanding is provided related to the role of institutions in increasing the adaptive capacity of communities. Salient questions are what kinds of institutions are present in the communities, since when they are active, what services and interventions they provide, and whether these activities find resonance with the needs of the communities. It is important to observe whether these interventions are in harmony with each other and whether they are equitably spread among the communities. In this endeavour it is above all needed to identify possible resilience gaps and which vulnerabilities still exist.

7.1 Local institutional arrangements

Institutions at the local level are key to provide rural livelihoods with the possibilities to build resilient livelihoods. In the household survey conducted among eighty-four inhabitants of the six communities, a question was to which institutions the households are affiliated, and the benefits that are derived from this affiliation. This was done to get a proper understanding of the possibilities farmers have to make use of the services these institutions offer, and with them improve livelihood options. This has created a list of twenty-four non-governmental institutions of various types. The categories within which they fall are:

- Natural Resource User Group (4)
- Dairy Cooperative (2)
- Saving & Credit Cooperative (6)
- Women Cooperative (7)
- Animal insurance Cooperative (1)
- Non-Governmental Organisation (2)
- Low-caste Group Association (1)
- Guthi (1)

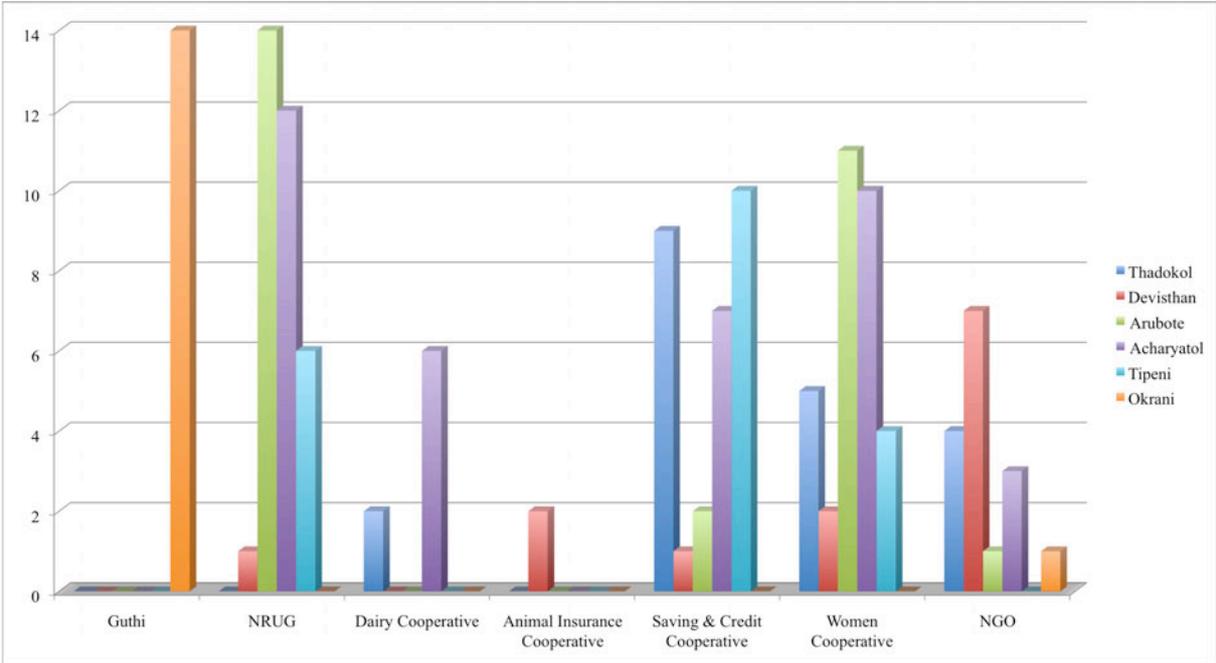
With each of these institutions an interview was organised to learn about their institutional structure, services and interventions. Apart from this, interviews have been organised with three VDC officials that represent the six communities. The fact that households in the six communities are affiliated to twenty-five unique organisations characterises a social context that is institutionally diverse. In this chapter, an overview is provided of the services and interventions these institutions conduct.

Whether institutions are successful in service delivery depends largely on the social cohesion within communities. While communities like Thadokol, Acharyatol and Okrani show signs of strong social cohesion; Devisthan, Tipeni and Arubote clearly lack a sense of common purpose among households. In the latter context, collective action has less chance of success. Next to social cohesion however, it is institutional diversity and thus the diversity of services that shapes the resilience of rural communities. As observed in *graph 7.1* there is a large difference in the variety of institutions and the number of affiliated household per community.

It is the synergy of social cohesion and institutional diversity that determines adaptive capacity. While in all communities a diversity of institutions is present, Okrani is the only community that still has a strong presence of a traditional institution. Here, all households are affiliated to the *guthi*, which is indicated to be particularly important for religious purposes. It however forms a strong platform for collective action as well. Okrani, being the most isolated community of the sample, is an example of a community that has strong social cohesion, despite absence of institutional diversity. In continuation, the different types of institutions will be discussed, together with their fostering and inhibiting factors in positively influencing the adaptive capacity of rural communities.

“With the Guthi we mobilise people to get things done. We offer free work labour to those in need. During an emergency, all persons help. Even the community members that live in Kathmandu have contributed in road construction and drinking water supply. Everyone is asked to contribute according to their possibilities.” – villager of Okrani

Graph 7.1 Institutional diversity and affiliated households per community (n=84)



Source: field survey

Natural Resource User Groups and Water-related Institutions

Livelihood strategies depend fundamentally on the availability of freshwater for drinking and irrigation purposes, basic energy and other natural resources. Natural Resource User Groups stand close to the agricultural livelihood as they manage water and forest that are vital for the agricultural cycle. The most prevalent group in the Indrawati basin is the Community Forest User Group (CFUG). Next to this, a number of collapsed Drinking Water User Groups (DWUG) and one Irrigation User Group (IUG) are identified. Next to the user groups, other institutions are active in natural resource management as well. These are mostly district and central government agencies that implement their interventions in a relatively isolated and short-term way in the basin. The most significant of the interventions that address water-induced stress and hazard issues are also discussed under this NRUG sub-heading.

In chapter five it could be observed how closely rural livelihoods are connected to the forest. The agricultural cycle depends on the forest for fertiliser, either directly with composed litter or indirectly through animal manure. A proper management of the forest is thus key to sustain

the agricultural livelihood. The CFUG manages forest resources through local governance and has become a good example of a robust local institution⁶. This is a result of great attention that has been paid by the GoN and the donor community to the forest sector in the Himalaya. Without CFUGs, extensive deforestation has taken place in the past as community members obtained forest resources without regulation. After a long process of population growth and gradual deforestation the importance of forest management was realised to guarantee the sustainability of agriculture-based livelihoods. Due to population growth and thus the number of forest users, sharing the limited forest resources is increasingly difficult, making forest management increasingly salient. At present, CFUGs maintain the forest by asking a monthly contribution and in return members can collect fodder and grass for free and firewood at a reduced price. By restricting the extraction of forest products to certain dates, the CFUG can guarantee a sustainable use and integrity of the forest. Fair prices are vital to ensure an equitable access to the forest for all. However, poor households state to have insecure access.

“After the first CFUG failed, the forest could be accessed freely by the villagers for many years, and massive deforestation occurred. Then we felt the need to conserve the forest again. The initiation procedure for this newly formed forest user group was started with the help of the DDC. The legislation of this CFUG is in the process of development.” – Rakse Chapleti CFUG executive member

Table 7.1 Natural resource user groups

<i>NRUG name</i>	<i>Foundation</i>	<i>Location</i>	<i>Members</i>	<i>Activities</i>
Bagmara Chapleti CFUG	2054 BS	Shikhapur VDC	- 200 households	CFUGs ask a contribution of mostly NRs. 10 a month. All rules (wood prices, extraction dates, sanctions) related to forest management are discussed among the members.
Rakse Chapleti CFUG	2056 BS	Shikhapur VDC	- 300 households	
Hariyali CFUG	2058 BS	Lagarchhe VDC	- 110 households	
Shituwa IUG	2064 BS	Thadokol	- 150 households	Irrigation canal maintenance

Formal CFUGs also have institutionalised sanctions that aim to prevent illegal activities in the forest. A main problem is the lack of financial resources to address activities that increase the pressure on forests, particularly encroachment by farmland. Illegal encroachment is stated to be rising in the forests along the Indrawati (UNDP, 2011:11). Executive members frequently express the necessity to clearly demarcate the forest boundaries and discourage the conversion of forest into farmland. A second impediment for properly functioning CFUGs is the fact that the groups are not professional but based on voluntary service. As the executive committee of the user group changes every three years, new forest management trainings are required to be provided by the District Forest Office, while the office lacks the capacity to do so. This causes situations in which user groups have few technical skills to manage the forest. What really complicated the matter is the fact that community members do not always have time since there are many other community works that also demand attention, not to mention sustaining the livelihood. Since every district office that manages the natural resource base, creates its own user group, the pressure on farmers increases and often leads to situations where they cannot attend important meetings, as they have to dedicate their time to sustain their livelihood.

“Forest encroachment is increasing day by day, but we cannot stop it. If we would have poles then it would be easier to make a demarcation and conserve the forest. We have a map of the community forest, but we are not able to do a lot with the map. A poles system is best since the local people can understand it. Since most forest lies near cultivated land the people encroach it slowly. We are not able to make poles due to a lack of funds.” – Hariyali CFUG executive member

⁶ Interview: Mr. Pokharel – District Forest Officer, Sindhupalchowk

Other NRUGs are organised around water, which tend to be informal due to relative water abundance. Social customs and cultural traditions form the basis of local management practices that are shaped through mutual agreement and informal negotiation. Farmers tend to be only willing to invest and manage the natural resource base when there is a clear threat of deterioration or conflict. However, according to Pant and colleagues (2008:12) local water institutions are in an evolving process and increasing water scarcity may trigger situations in which people want to take care of previously unmanaged water sources. Water conflicts in and between communities are particularly severe during the dry season, often with households that have a lot of livestock or a large family size. While some households do not have sufficient water for personal uses, others take a lot of water to sustain the livestock. Similar to drinking water, conflicts over irrigation water occur every year in the dry season. Irrigation water users that are close to the intake of the canal tend to have adequate water supply throughout the year while tail-end users experience seasonal water scarcity. As communities are relatively small, rules are informal and conflicts solved by discussion and social pressure. How well a community is able to manage water resources depends on social cohesion and the ability of the user group to mobilise external resource for water resources development.

Figure 7.1 Water tank in Okrani collects and distributes water that originates from the forest



“When resources are available in a high amount their importance decreases but when resources are scarce they become important and people want to conserve them. People feel that water is decreasing now. When it is not properly utilised then the water will disappear. That will affect us and be harder for the community. In the past we did not have such drinking water facilities but we had at least water sources.” – villager of Acharyatol

“Yearly we have conflicts because of water scarcity. Some people bring a big gagri and some bring a small gagri. Those people who bring a small gagri want more water afterwards, but those who have a big gagri say that it is their own fault to bring a small one, and do not allow them to take more. [...] There is no person who can manage this conflict.” – villager of Devasthan

Community members mention that although water sources have decreased, drinking water facilities have increased from the end of the Maoist uprising in 2006 onwards. When discussing water resources management however, focus lies on external institutions rather than CBOs. Both governmental and non-governmental institutions provide water schemes for household and irrigation purposes. Many water tanks and supply systems have been constructed that divert water from relatively far-away sources. This has prevented that in most communities

situations of acute water shortage have emerged in the face of changing rainfall patterns. It is however mentioned that proper water management is required to ensure its availability. Still, the functioning of water user groups heavily depends on external institutions. Construction of water supply infrastructure is seldom undertaken without external support as user groups have little capacity to undertake autonomous action. In the management of water schemes, a clear lack of local leadership is observed. This is an important factor for the passive and collapsed nature of many DWUGs and IUGs. External institutions create user groups for water supply scheme implementation, after which the user groups soon disintegrate when the responsibility to maintain infrastructure is handed over. Farmers state that water supply is increasingly problematic and most are unsatisfied with the functioning of informal water user groups.

Table 7.2 Natural resource management institutions that are active in the Indrawati basin

<i>Institution name</i>	<i>Location</i>	<i>Activities</i>
District Water Supply & Sanitation Office (DWSSO) Covers Sindhupalchowk district Linked to the DWWS	Chautara	- Provision of drinking water supply schemes and sanitation facilities. - Provision of pre-construction training (tank and supply scheme) and post-construction training (maintenance of scheme and user group management)
Central Irrigation Development Division Office (CIDDO) Covers Sindhupalchowk and Kavrepalanchowk district Linked to the DoI	Dulikhel	- Interventions: 1.) medium irrigation projects 2.) non-conventional irrigation projects 3.) maintenance work. - Project criteria based on water availability, market access, geographic stability, willingness of farmers to contribute, economic rate of return.
District Soil Conservation Office (DSCO) Covers Sindhupalchowk district Linked to the DSCWM	Chautara	- Works with an integrated catchment approach, combining water, land and livelihood management with the aim to restore the environmental balance and improve agricultural productivity. - Projects: water reservoir construction, water source conservation and slope stabilisation techniques - Catchment prioritisation criteria are natural resource degradation and population pressure.

“The DWUG was created to carry out drinking water activities and effectively manage financial resources during the time that a specific budget was released for this purpose. The main reason for the collapse of the group was a conflict. The project donors were not able to work properly and left while the project was still not finished. We have not been able to develop a new proposal as the user group turned passive. Water is regarded as an important issue, but we do not have funding to make water supply effective.” – villager of Acharyatol

The Shituwa canal, located in Thadokol, is the main irrigation project found in the case study. It was constructed by the CIDDO between 2062-2064 BS, diverts water from the Indrawati and irrigates an area of about 1,000 ropani. It has enabled farmers in the area to cultivate crops during the four dry months as well when the small Dar *khola* decreases in volume. With the irrigation canal the agricultural cycle has become year-round with four cash crops a year for the market in Kathmandu (80%) and Tibet (20%). It is the only irrigation scheme in which a functioning user group is observed. The IUG in Thadokol is an exception, since there is an irrigation leader who is able to maintain a good relation between the users of the canal and who knows to greatly reduce conflicts among farmers. He shows that with negotiation major conflicts can be prevented and collective action maintained. The IUG operates by collecting NRs. 100 each year per *ropani* to maintain the canal and construct a dam at the intake site to divert the water from Indrawati. Water resources in other valley communities like Arubote are not sufficient to cultivate the farmland on the riverbank due to river deepening. This river deepening has adverse effects for the Shituwa irrigation canal as well. The intake will have to

be prolonged about 500 meters upstream within a few years as the river level continues to decrease. Unfortunately, this endeavour seems to go beyond the capacity of the user group to conduct while due to a lack of funds the CIDDO also cannot take care of it⁷. This seriously decreases the sustainability of the new irrigation canal.

“Now that we have the irrigation canal most of the people cultivate paddy and potato, while we used to leave the land fallow. About three years ago it was very easy to irrigate the farmland with water from Indrawati. When the sand industry started excavating, the water level decreased. Every year, we have to make a new dam for the irrigation intake as the water level is going down and the monsoon flood destroys the dam.” – villager of Thadokol

“We receive about sixty applications for irrigation projects each year. Some were constructed but became dysfunctional due to a landslide. For maintenance we have very little money. For ten projects we do only have NRs. 1.1 million, while NRs. 23 million is required. There is a real lack of funds.” – Ramesh Aryal – Irrigation Development Division Chief

Figure 7.2 Irrigated fields of Thadokol, facilitated by the Shituwa Irrigation Canal



According to government statistics, water resources are delivered to 82 percent of the population of Sindhupalchowk⁸. However, in reality this number is much lower since many constructed water supply schemes become dysfunctional due to a variety of reasons, such as leakage in the scheme, deforestation and road construction at water source sites. It is indicated that it will be increasingly difficult to cope with the effects of drought, as the amount of water in the water supply schemes diminishes gradually due to the drying of sources. In Devasthan and Acharyatol there is a great lack of water in recent years. Although various institutions are occupied with supply scheme construction, this infrastructure is not necessarily sustainable when other techniques are not applied simultaneously, such as targeted conservation and management of water sources as well as rainwater harvesting techniques. The obstacle is a lack of financial resources while the demand for irrigation canals is high. Farmers try to maintain and even stretch the irrigated agriculture frontier in both the hills and the valley. In the latter, irrigation becomes increasingly problematic due to less water in the streams and the deepening of the river. It is stated that more use needs to be made of modern technology like electrically driven pumps to ensure a year-round access to water resources in the valley. However, as Nepal faces an energy crisis it seems unrealistic this will be feasible soon.

⁷ Interview: Mr. Ramesh Aryal – Central Irrigation Development Division Chief, Dulikhel

⁸ Interview: Mr. Janak Adhikarki - District Water Supply and Sanitation Officer, Sindhupalchowk

Next to slow-onset water-induced hazard interventions like drinking water and irrigation supply that aim to widen the access to increasingly scarce water resources, a number of rapid-onset hazard interventions are conducted as well in the Indrawati basin. These interventions focus on the adverse effects of landslides and floods caused by intense rainfall. A noteworthy project is the Indrawati Corridor Project conducted by the DWIDP, which constructs gabion walls along the riverbank to protect the agricultural land against flooding. Protective walls are a clear need of the valley communities and vital to foster agricultural livelihood integrity, since traditionally constructed stonewalls are too fragile to give a sustainable answer to the returning floods. Corridor is neither the first nor the only project that builds gabion walls along the Indrawati. However, this is a multi-year project that aims to address the entire basin valley, while many other projects are very small and isolated.

Table 7.3 Rapid-onset hazard prevention institutions that are active in the Indrawati basin

<i>Institution name</i>	<i>Location</i>	<i>Activity</i>
Department of Water Induced Disaster Prevention	Lalitpur (Kathmandu valley)	<ul style="list-style-type: none"> - Indrawati Corridor Project - Construction of protective infrastructure to prevent the loss of farmland along the riverbank and fix the flow of water in one direction. - Mainly active in the area of Thadokol and downstream where the economic return rate is high. - Project characterised by a lack of transparency and conflicts between local political parties.
United Nations Development Programme Nepal (support of ECHO)	Lalitpur (Kathmandu valley)	<ul style="list-style-type: none"> - Regional Climate Risk Reduction Project in the Himalayas - Aim: establishment of community-based DRR committees and community and district level capacity for emergency response. - Implementation modality: Activities at the national (MoHA, DoHM, DSCWM, WECS), district (CDO, DSCO, NRCS) and community level with the aim to create interaction between the three levels. - Creation of school-based eco-clubs with the aim of disseminating water-induced hazard information to the communities.
Nepal Red Cross Society	Kathmandu	<ul style="list-style-type: none"> - School-based Disaster Risk Reduction Project in ten communities of Sindhupalchowk. - Management of sub-stations for immediate emergency relief by the rescue of people and distribution of essential materials.

More gabion walls are necessary as excavation of river materials by the sand industry makes the river course increasingly unstable⁹. While the Corridor project was carried out, various conflicts between local political leaders and therefore the project could not be executed according to the aims and within the proposed timeframe¹⁰. However, not in all VDCs there is adverse political activity. In Thadokol people were found to be more collaborative, which made it easy to work. As a result, most efforts and money ended up in this community for the first project phase, justified by the great amount of farmland in this area. It is stated to be difficult to include marginalised communities in the project due to a lacking motivation of community members and insufficient capacity to understand the project objectives.

“The Corridor project started recently but the work was not satisfactory. There is lots of conflict between political parties that has delayed the work. Every political leader wanted to have the project in his own hands.” – villager of Arubote

⁹ Interview: Mr. Deepak KC - UNDP

¹⁰ Interview: Mr. Ananta Kumar Gajurel - DWIDP

Figure 7.3 Gabion wall constructed by the Indrawati Corridor project near Arubote



Another central level intervention related to rapid-onset hazards is the Regional Climate Risk Reduction Project in the Himalayas, carried out by UNDP. The objective is to build capacity and strengthen institutional structures for emergency response at the community level through the establishment of registered Community-based Disaster Risk Reduction Committees (UNDP, 2010b:3). A second objective was to strengthen DRR capacity at the district level. A few workshops were organised where community, VDC and DDC participated together with the aim to strengthen connections between these levels. A number of challenges can be listed related to this intervention. Being a pilot project, the implementation period was just seven months. Hence, the project was conducted rapidly and not in a place where it would have been more adequate¹¹. In the Indrawati basin, DRR has not been observed to be a priority of the people. As DRR does not seem to be a real need of the communities, the relevance of the committees can be a problem, especially since the motivation of the communities was further reduced due to the absence of hardware interventions, like gabion walls.

A NGO that conducts similar activities at the community and district level is the Nepal Red Cross Society that has various sub-stations that focus on disaster response activities, like the rescue of people during disaster events and distribution of plastic tents, cloths, and food. One sub-station is located in Thadokol. To operate them, the NRCS has local volunteers that help in times of need and distribute the rescue materials. Next to this, the NRCS carries out an awareness programme related to natural hazards. Tipeni is one of the ten Sindhupalchowk communities that received the School-based Disaster Risk Reduction Programme in 2067 BS. Students were learned how to take care of injured people and what to do during natural hazards, with the idea that they spread this information to the community.

Next to the above-mentioned projects that almost exclusively work in the field of natural resources or water-induced disaster management, there are other institutions that also carry out water-related interventions. They all contribute to the sustainability of the farming system and reduce the adverse effects of too much and too little water. It goes however beyond the scope of this study to name them all. Nevertheless, the major institutions related to this theme are identified here. Next to the institutions that directly focus on improving the balance between the social and ecological system, either by managing natural resources or reducing

¹¹ Interview: Mr. Deepak KC - UNDP

the adverse effects of water-induced hazards, many other institutions in the socio-economic sphere exist that contribute to a wider *manoeuvring space* for rural households and that address the *vulnerability spectrum* of specific vulnerable groups. Most importantly, these institutions are cooperatives that have been established particularly over the last decade.

Cooperatives

The present Interim Constitution of Nepal considers the cooperative sector to be one of the pillars for national development (NEFSCUN, 2011). Five types of cooperative societies are identified in the Indrawati case-study communities. These are the Dairy, Animal Insurance, Agricultural, Saving & Credit, and Women cooperative. They offer great potential for income generation and equity for households through the widespread participation of members in cooperative activities (Khanal, 2007a). They make effective use of the entrepreneurial skills of members to develop their own livelihood. Members decide democratically the direction their cooperative is going and can modify the rules and conditions of service delivery through discussion. They have written rules that are made by the executive members with the help of the Division Cooperative (Dulikhel). The members vote for the rules to become formal. The different types of cooperatives are discussed, starting with those that are closest to the agricultural cycle.

Dairy, Animal Insurance and Agricultural Cooperatives

A major income boost for farmers is offered by the two dairy cooperatives. Both institutions collect the milk of member households in a chilling centre before selling it to the market. Farmers receive on average NRs. 50 for a litre of milk. Both cooperatives distribute financial resources every fifteen days to their members. In the Kotachaur Dairy Production Society, each member automatically saves an amount of at least NRs. 7,000 a year next to the money received. The cooperatives state that dairy has increased the economic standard of farmers, and that rural households are very enthusiastic to produce milk. However, it is indicated as well that due to milk production the pressure on forest resources has increased, since more fodder is needed to feed the livestock.

“Poor families eagerly wait for the 15th day of the month to come, to pay school fees, buy food, and agricultural materials like pesticides and chemical fertiliser. People even make debt by saying that their money will come on the 15th day. Expenses are made for the household, food, and education. In the past, the villagers did not send their children to school. Not due to a lack of awareness but because there was a lack of money. Now, all the children go to school. Food habits have also changed. Almost all people drink tea and milk now. The people have started to utilise the money for other income source activities, like making a shop. If there would not be dairy it would be hard to sustain life. This is one of the backbones for farmers.” – Kotachaur Dairy Production Society executive member

Insurance services are frequently stated to be an adequate adaptation mechanism to cope with adverse and unexpected shocks and stresses. One Animal Insurance Cooperative exists in the Deupur VDC. The cooperative’s main aim is to prevent a high mortality rate among livestock, and with that an economic crisis for households that are confronted with livestock loss. Each year, members have to pay NRs. 50 to renew their insurance. When they are not able to renew compensation cannot be given when the livestock dies. Main income sources are the amount paid for insurance and renewal of insurance each year. The cooperative collaborates with VDC and DDC offices and receives financial support, which helps to convince farmers to join in. Training programmes about animal farming and health issues are conducted together with the District Livestock Service Centre. During these events and door-to-door visits the benefits of insurance are communicated to the farmers. The cooperative is not allowed to go beyond the VDC boundaries although people from other VDCs have indicated to be interested. There

is much resentment to take insurance as well. Being something new, cooperative employees indicate that it is difficult to convince households of the benefits of being insured.

“Only when the people are severely impacted, they open their eyes and start taking the insurance. Some people think that we may be running away with their money. Another problem is time. When we went to the community, one farmer immediately gave money saying that he had been too busy with the household and livestock work to come and renew the insurance. When we had the annual meeting, we found that sixty livestock insurances had not been renewed. To prevent this situation we have to go from door to door to collect the money so that all are involved.” – Sri Gairibisauna Animal Insurance Cooperative Society executive member

Table 7.4 Dairy, animal insurance and agricultural cooperatives in the six communities

<i>Institution</i>	<i>Foundation</i>	<i>Location</i>	<i>Activities</i>
Kotachaur Dairy Production Society	2054 BS	Acharyatol	<ul style="list-style-type: none"> - 350 litres of milk daily (51 members) - Collection and chilling centre for milk. - Members are obliged to sell their milk to this cooperative. - Management trainings for executive members are provided by the District Agricultural Office. - Emergency fund of NRs. 10,000 to help the needy.
Sipaghat Dairy Cooperative	2048 BS	Thadokol	<ul style="list-style-type: none"> - More than 5000 litres of milk daily - Collection and chilling centre for milk - Members are obliged to sell their milk to this cooperative. - Member trainings about milk quality maintenance. - Management trainings for executive members are provided by the District Agricultural Office. - Provides loans for livestock to stimulate milk production
Sri Gairibisauna Animal Insurance Cooperative Society	2059 BS	Gairibisauna	<ul style="list-style-type: none"> - 672 members in the Deupur VDC. - Provision of animal insurance (10% of the insured animal’s value needs to be paid for insurance and 80% of the value is provided as compensation in case of losses). - Collaboration and support of VDC and DDC offices for awareness campaigns and livestock health trainings.
Pig and Fish Farm Cooperative	2064 BS	Arubote	<ul style="list-style-type: none"> - UNDP support for fishpond and pig farm construction. - Collapsed due to livestock death and lack of motivation and awareness of community members.

Furthermore, one Pig and Fish Farming Cooperative has been established in Arubote with external funding from UNDP, with the aim of improving the income sources of the Majhi. Unfortunately, this initiative has resulted to be a failure as the pigs died due to disease and the fish due to the drying of the water pond. It turns out that in the dry season the streams have insufficient water to provide water to the fishpond since irrigation needs have to be fulfilled first. It is mentioned that the inadequate management and collapse of the cooperative signifies a great loss for the community with a debt of NRs. 90,000 that was taken from the bank and now needs to be paid back. Major factors for the cooperative’s collapse are the lack of strong cohesion among community members and persistent marginalisation of women who formed the project target.

“The women were not able to unite for the work. The project came in the namesake of women, but the men still have the dominant power. The men were not supportive and women did not have one voice to unite for income and women development. Due to a lack of knowledge they are suppressed and do not come out of the house. In many programmes women are marginalised. The programme was meant for women but actually it was led by men.” – villager of Arubote

Saving & Credit Cooperatives

A prevalent institution in the six communities is the Saving & Credit cooperative. With the establishment of these cooperatives, financial service delivery is widened to an audience that would otherwise be unable to access loans for livelihood improvement, mostly due to a lack

of formal documentation that is demanded by banks. The greatest advantage is that people do not depend on local moneylenders anymore, who tend to ask very high interest rates of around 30 percent for a loan. Cooperative interest rates are lower although differences exist, ranging from 12 percent to 18 percent. To take loans, members have to save a certain amount each month (NRs. 50). Most cooperatives have strict rules related to loan use, which is often restricted to income generating activities. When a loan is demanded for goat farming, no other activity may be conducted with it. Monitoring activities are carried out to see whether loans are spent adequately.

Table 7.5 Saving and credit cooperatives in the six communities

<i>Name institution</i>	<i>Foundation</i>	<i>Location</i>	<i>Activities</i>
Sri Indrawati Saving & Credit Cooperative	2048 BS	Thadokol	<ul style="list-style-type: none"> - Saving and credit programme for 450 members - Selling of chemical fertiliser at low price - Income generation training (animal, vegetable farming). - Loan from Nepal Rastriya Bank for a poverty alleviation programme (loans at low interest)
Hinuwapati Saving & Credit Cooperative	2060 BS	Melamchi Bazaar	<ul style="list-style-type: none"> - Saving and credit programme - Provision of agricultural input like chemical fertiliser and pesticides at a reduced price. - Provision of wheat and sugar at a reduced price.
Suvakamana Saving & Credit Cooperative	2065 BS	Melamchi Bazaar	<ul style="list-style-type: none"> - Saving and credit programme for 500+ members - Prioritisation of low income status people - Lacking funds - Training on accounting (members need income generating activities)
Lagarchhe Badudeshya Saving & Credit Cooperative	2066 BS	Tipeni	<ul style="list-style-type: none"> - Saving and credit programme for 90 members - Transforming traditional methods of cultivation into business model with chemical fertiliser at reasonable price and vegetable seeds.
Tipeni Bahudeshya Saving & Credit Cooperative	2063 BS	Lagarchhe	<ul style="list-style-type: none"> - Saving and credit programme - Poverty alleviation fund from the Nepal Rastriya Bank through income generation (vegetable, animal farming) - Agricultural programme (organic fertiliser promotion, pesticide awareness creation, and slope stabilisation with gabion walls) - Collection of milk (100 litres a day)
Balidyashya Saving & Credit Cooperative	2064 BS	Shikhapur	<ul style="list-style-type: none"> - Saving and credit programme for 180 members

Many saving and credit cooperatives have been established in recent years, but that not all are able to provide good services due to a lack of funding. As financial services are delivered by the cooperative without help from outside the demands of members cannot always be fulfilled. In a few cooperatives tensions are observed between members about who can get a loan first. To cope with this, a queue system is applied. The need for loans is prioritised for each member and according to this criteria loans are provided. Loans are first of all given to members who have few other possibilities for income generation. Most cooperatives state that they are able to help their members with a loan in times of emergency. The need for a special emergency fund is frequently expressed but still needs to be established. Most cooperatives indicate that there are not sufficient funds to establish these funds since with the little profit that is made the cooperative expenses can be paid difficultly.

“As the cooperative is made by community members we do not have conflicts in resource sharing. All members understand and there is a strong cohesion. The first priority goes to low income and marginalised people in the community. Those with low income, little land and no alternative income sources are our main focus. There is no difference in the interest rate for different castes, but we think of changing the interest rate according to the economic condition. The poor should be given low interest loans.” – Tipeni Bahudeshya Saving & Credit Cooperative executive member

“The most important change is that the members have a habit of saving and reduce unnecessary expenses. We are able to take loans in times of emergency and saved amounts can be taken whenever it is needed. People do not need to take loans from the moneylender anymore. The income status has changed and the financial crisis has been reduced. There are changes in thinking and behaviour as well. The community was quite disadvantaged but now successful in uplifting income sources. The farmers are able to make more profit.” – Sri Indrawati Saving & Credit Cooperative executive member

Many saving and credit cooperatives also have other activities next to the saving and credit programme. Many assist the agricultural sector by promoting an agricultural business model and selling modern agricultural inputs such as improved seeds (maize, paddy, wheat), chemical fertiliser and pesticides at a reduced price. Facilitating the access to this agricultural input is stated to be a priority need for the farmers to increasing their yields. Activities are mainly focused on income generation, as the objective of these cooperatives is to increase the economic status of rural households. However, some ideological differences are observed between the cooperatives. While some are engaged in the distribution of chemical fertiliser to increase crop yields, others are more influenced by NGOs like CDECF and promote the use of organic fertiliser and new composting techniques to increase the amount of fertiliser. Apart from income generation activities, a few cooperative activities can be observed that fall in the field of natural resource management. These activities are in collaboration with an NGO or district line agencies such as the District Soil Conservation Office (DSCO) and are never carried out autonomously. Various training activities have been conducted to improve slope stability with the plantation of trees and grasses, and the construction of gabion walls.

Women cooperatives and marginalised group associations

Women participation in the previously mentioned cooperatives is increasing considerably (Khanal, 2007b). However, apart from this, special women cooperatives are established as well that exclusively focus on marginalised groups to overcome the traditional social barriers and empower women. The services of these institutions target those that are in need of special attention. By strengthening the income sources of women, opportunities are created to make them financially independent from men. Since women cooperatives also work with a saving and credit programme, the distinction made between different types of cooperatives may seem slightly artificial. Some overlap does exist, even though the objective is slightly different. By making women financially independent of their husbands, social changes take place in the community. It is indicated that women have become increasingly confident over the years. It has become more normal for women to go outdoors and even outside the community for work labour, and it is indicated that women can communicate more confidently than in the past.

“Women worked in the household and were regarded as passive and weak, but as they become financially advanced they are respected more. When we give loans to them they are responsible as they know that they have to pay the money every month. The economic condition has improved compared to the past. This change will lead to other changes such as in education. Social changes come simultaneously. The other change is that they raise their voice. They can share their ideas in the community. In the bazaar area, the women ask loans for business purposes. In the village area they ask for livestock farming and especially dairy purposes.” – Manushi Mahila Cooperative executive member

“As male family members move to other areas they are used to many kinds of activities. Females are working inside the house. Before, when women moved outside the house they were regarded as bad in the community. These times have changed. Now, if the women want to do any kind of income generating activities they can do it independently.” – Mahila Atmanerwata Kendra Nepal executive member

Table 7.6 Women cooperatives in the six communities

<i>Name institution</i>	<i>Foundation</i>	<i>Location</i>	<i>Activities</i>
Mahila Atmanerwata Kendra Nepal	-	Melamchi Bazaar	<ul style="list-style-type: none"> - Saving and credit programme focused on married women in groups of 15 to 25 members for income generation. - Different levels of loans. First loan is only NRs. 5,000 and subsequent loans are up to NRs. 60,000. - Meeting each month to check whether the loans is used adequately in income generating activities. - Emergency fund of maximum NRs. 2,000 for members in need (pregnancy, death, natural disaster).
Micro-Finance Centre for Self-Help Development	2048 BS	Thadokol	<ul style="list-style-type: none"> - Saving and credit programme for groups of poor women for income generation. - Different levels of loans. First loan is only NRs. 5,000 and subsequent loans are up to NRs. 60,000 - Trainings on animal husbandry and health, candle and soap making, focused on income generation. - Emergency fund of maximum NRs. 5,000 for members in need (pregnancy, death, natural disaster).
Utpidit Uthyansan Cooperative Society	2067 BS	Tipeni	<ul style="list-style-type: none"> - Aims to provide income generating training for marginalised, low-caste and indigenous women - Due to a lack of funding no trainings can be given to the women. No bank account can be opened. - Women Rights Awareness Training given by the National Indigenous Women Forum.
Chandevi Mahila Samuha	-	Tipeni	<ul style="list-style-type: none"> - Informal saving and credit programme for 30 women. - Unregistered cooperative, due to a lack of funding and awareness about how to register.
Manushi Mahila Cooperative	2059 BS	Tipeni	<ul style="list-style-type: none"> - Saving and credit programme. - Income generating trainings (livestock farming and candle-making) depending on local needs and available resources. - Emergency fund of maximum NRs. 7,000 for members in need (death of household member, natural disaster).
Namuna Mahila Saving & Credit Cooperative	2058 BS	Shikhapur	<ul style="list-style-type: none"> - Saving and credit programme for 160 women. Most loans are taken for vegetable and animal farming, agricultural input expenses, education and healthcare. - Special focus on poor women who need to survive with daily work labour. - Training on basic accounting skills.
Mahila Matri Sisuu Kalyan Saving & Credit Cooperative	-	Shikhapur	<ul style="list-style-type: none"> - Saving and credit programme for 420 women divided over 18 groups. - Active in health issues (pregnancy and motherhood). Motivates women to do check-up at the health post. Create awareness to make women more confident. - Trainings about basic accounting and income generating activities (poultry, buffalo farming)
Nepalese Majhi Upliftment Association	2052 BS	Arubote	<ul style="list-style-type: none"> - Emphasises on the importance of education with a special programme, including poem and street drama competitions to bring social change and awareness. - Income generating activities (poultry and pig farming) and life skill training (carpentering, tailor work, house construction).

Next to income generating activities, women cooperatives also focus on awareness creation and provide a social safety net. Most organisations have a small fund that can be given to women during an emergency situation. This ranges from the pregnancy period to the burning or collapse of a house due to a landslide. Like in saving and credit organisations, these funds are not formal and big but can still prevent households from suffering economic hardship in

case of an emergency. Women cooperatives and low-caste group associations are greatly involved in awareness creation to improve the living standard of the marginalised segments of society. In these segments that stand at the top of the *vulnerability pyramid*, the people are often unaware of the importance of education as most prefer to stick to ancestral traditions. In Arubote for example, the Majhi prefer to fish in the river rather than diversify their income sources and invest in the education of their children¹². These institutions try to bring about social changes by providing scholarships to children, and giving women a platform to interact with each other and gain confidence. Special attention on caste-hierarchy is very salient since great differences still exist.

“The poor are becoming poorer and the rich community members never help the poor in case of emergency. They are not letting us grow and want to keep the poor people poor. They do not have human feelings. Decisions are taken by the high caste. They want to grow individually to become richer. There is no feeling of helping each other in the community. No social cohesion. The lower caste people are facing hardships to sustain life.” – Utpidit Uthyansan Cooperative Society executive member

“The Majhi are one of the indigenous nations who depend on fishing. In all sectors like education and health we are disadvantaged. Ten years ago, the Majhi had to work for the elite groups like Brahmin and Chhetri as practically slaves. We were compelled to do this to sustain the family. We established the Nepal Majhi Uthaan Sanstha¹³ to raise awareness about our rights. [...] Many programmes have tried to uplift the Majhi community but they were unsuccessful due to lack of hard work and enthusiasm. The Majhi used to be united in all the work but now they are different. Most of them are individualistic for the development of the own family.” – Majhi Association executive member

Different kinds of cooperatives have thus mushroomed in this decade. Households are mostly involved in more than one cooperative, which has created situations in which households are not capable to save a large amount of money in any of them. A result of this is that cooperatives are not always able to function properly due to lacking funds. A number of cooperatives state that they are affected by other cooperatives in their programming since all try to form groups in the community, leading to a confusing intervention landscape. It is also mentioned to be hard to convince poor communities to join the cooperative, since they do not always see the benefit of participating in the cooperatives and cannot give a lot of their time for trainings since they are involved in a daily earning cycle.

While NRUGs mainly had a positive impact in securing the integrity of the natural resource base upon which rural livelihoods primarily depend, access to new livelihood opportunities is provided by cooperatives. It is without doubt that the different types of cooperatives have greatly opened perspectives for rural households to increase their income sources, most importantly by widening access to loans and provide income generation trainings. Two other institutions that determine the possibilities of households to autonomously adapt to social-ecological change are NGOs and government agencies that mostly have a wider reach than the previous two institutions.

Non-governmental organisations

Two NGOs that have projects in the basin are Friends of Sankhu (FoS) and the Community Development and Environmental Conservation Forum (CDECF). They are the primary actors that conduct trainings on new farming and water management techniques. FoS makes efforts for community development through social mobilisation and the formation of a cooperative in each VDC through which activities can be implemented¹⁴. It is indicated that about 60 percent

¹² Interview: Mr. *Bhimsen Majhi* – Teacher in Arubote

¹³ Nepalese Majhi Upliftment Association

¹⁴ Interview: Mr. *Nabin Shakya* - Friends of Sankhu

of the budget is spend in infrastructural development (irrigation canals, drinking water supply and schools) and the rest in institutional development, like the establishment of cooperatives. Of the case-study communities, FoS is particularly active in Thadokol where farmers have experienced a great improvement in their living standard. The CDECF has a different work modality than FoS. It does not conduct interventions autonomously but works as a facilitating institution for external partners who want to implement their projects. A recently conducted project of CDECF is the UNDP Regional Climate Risk Reduction Project in the Himalayas. Another project is the provision of farmer-to-farmer extension services like an agricultural school to promote new and traditional organic farming techniques¹⁵. This project was carried out together with the District Agricultural Office and CDECF, and was funded by Helvetas. The project is carried out in Acharyatol, among other communities.

“We help the women group with income generating activities and distribute improved seeds to them. The first time people cultivated vegetables from our seeds, it was for their own consumption. Then slowly people started to cultivate for commercial purposes. Some farmers have complained about the absence of a collection centre to take the vegetables to the market. Due to commercial farming there is an excessive use of chemical fertiliser and pesticides. To change that mentality we are increasing awareness about organic farming. It is difficult to change mentality since farmers want quick earning and maximum production.” – FoS representative

Table 7.7 Non-governmental organisations that are active in the Indrawati basin

<i>Name institution</i>	<i>Location</i>	<i>Activities</i>
Friends of Sankhu	Thadokol	<ul style="list-style-type: none"> - Education programme (scholarship distribution for marginalised communities, school construction) - Income generating activities (organic vegetable farming, animal and seed distribution, small irrigation canal and water supply construction, and vegetable collection centre establishment). - Free healthcare - Formation of groups to implement activities. When groups perform well, they are formalised into cooperatives with saving and credit programmes for income generation.
Community Development and Environmental Conservation Forum	Melamchi Bazaar	<ul style="list-style-type: none"> - Does not work independently, but with external partners, mostly international donors and district agencies. - Aims to merge traditional and modern farming techniques to increase yields and income. Promotion of high-value crops like tomato and agro-forestry products. - In interventions, focus is on transfer of knowledge about adverse effects of chemical fertiliser and benefits of organic fertiliser.

Government agencies

The VDC and DDC are the main government institutions at the village and district level. Under normal circumstances, they are elected institutions and responsible for the coordination and implementation of all development activities in their territory (Bartlett et al., 2010:12). While the DDC governs the district, consisting of several VDCs, the VDC governs an area that consists of nine Wards. The Village Council represents all Ward Committees within the VDC. The District Council represents all the VDC secretaries and formulates, implements and evaluates development activities. However, due to the politically unstable situation in Nepal there are no democratically elected VDCs or DDCs since 2002, causing the development process to be less transparent. Five years after the end of the armed struggle in 2006, elections have not yet been organised and appointees of the Ministry of Local Development, who are often from outside the community, run the VDC and DDC. Even though the government agencies do not function according to their constitutionally mandated structure, they are still key to support autonomous adaptation through planned interventions.

¹⁵ Interview: Mr. Govinda Sapkota - Community Development and Environmental Conservation Forum

Development plans, including budget distribution, are designed during the annual community assembly where representatives of the nine Wards and political parties participate. The plans are sent to the DDC for approval from where the budget is divided. For many interventions the VDC only provides technical support, while a determining factor on the ground is the community members' willingness to contribute to the project with free work labour¹⁶. Major headings under which projects are conducted are road construction, education, water supply, and the marginalised group fund for low-castes and women. Road construction is indicated multiple times to be the receiver of about half of the funding, as it is the priority necessity of the communities. Roads are now constructed that connect the major settlements in the basin, like Chautara, Nawalpur, Melamchi Bazaar, Sipaghat and Nagarkot.

Figure 7.4 Village Development Committee office in Lagarchhe



“My family has little land. The road has taken about half of it. My request to the VDC was not to take to much land to still sustain my family. They did not listen and constructed the road through my land. They has not paid any compensation so you can imagine what happened to me.” – villager of Tipeni

“The road construction was made by the VDC with free work labour force from the community. To complete the road we had to take a loan. We have brought the jewellery to the bank to get it and the VDC promised to give the money back later, but they never did. Now, the gold is still in the bank. Those who talk and raise their voice get budget but we feel shy to raise our voice, so we receive very little budget.” – villager of Arubote

Much funding is diverted to education in especially low-caste communities. The Shikhapur VDC representative states that one third of the budget focuses on the low-caste and women. Official figures are however absent. In various VDCs a trend can be observed that the women and low-caste budget is diverted to other headings like road construction or education. According to the VDC representatives this is done since both headings are a priority need for the communities while they do not receive enough attention from the DDC. It is also observed that many women were not even aware about the existence of the women's fund at the VDC. For example, in Tipeni the women became aware that the fund existed only after the National Indigenous Women Forum had conducted a training in the community about woman rights.

¹⁶ Interview: Mr. Hom Nath Acharya – Shikhapur VDC

“National policies prescribe how funds need to be distributed, but the people’s needs are different, making it hard to work. We have a fixed heading for the dalit and women, but we are unable to give this. With their permission we use the fund for education and road construction. These are the main sources that absorb funds. People request a road to each village.” – Bhote Namlung VDC representative

“We women have been saying that we need funds for the upliftment of our income sources. They said that they need the funds for road construction. But the situation of the women is very bad. That is why these funds are needed for the women to be independent. The priority should be the poor but they are not doing so.” – villager of Tipeni

One major concern when focusing on water-induced stress and hazards is the absence of an emergency fund to cope with particularly rapid-onset disasters. VDC representatives indicate that no emergency funds are established during the community assembly, although VDCs try to do so. Community members do not consider this fund as a priority, since there is a high demand for other development projects. Communities thus prefer to allocate the money under other headings as resources need to be spend as effectively as possible and preferably with direct results. Apart from rapid-onset hazards, slow-onset hazards are subject of growing concern. Investment in water resources development is insufficient for communities located in certain pocket areas where drought is more severe. VDCs state that they can help with small project, but large projects need to be handed over to other agencies due to a lack of capacity. In that case the VDCs help the communities to obtain support from other district line agencies by writing a recommendation letter.

“If villagers ask for small projects like trainings or creating a small tank, we can help if we have the budget but if they ask for a huge project like an irrigation canal then we will send them to the concerned department and give a recommendation. The VDC makes recommendations to other organisations to prioritise certain projects and working areas.” – Shikhapur VDC representative

“The main natural hazards are landslides and floods. There is no separate fund to reduce them. It depends on whether leaders see these problems as severe or not. In this area we need to stabilise the slopes but community leaders do not see this as a vulnerability. We are not able to spend any money in natural hazard prevention. For the irrigation system there are very few funds. They are not sufficient to develop the system. Small irrigation does not work properly in the community. We are not able to get drinking water facilities.” – Bhote Namlung VDC representative

VDC and DDC offices struggle with a number of challenges that decrease the effectiveness of their work. When financial plans are submitted to the National Planning Commission (NPC) for approval it can take as long as six months before the DDCs get approved and government funds can be allocated to VDCs. Since the funds need to be spent within the same fiscal year, VDC capacity is greatly reduced, while haphazard and messy project implementation is the result. Furthermore, most VDC secretaries stay in the district headquarters, either because they control more than one VDC or because they do not want to live isolated in the rural area. Between offices there is a lack of communication and even trust, being a main cause for the unwillingness to share information. Various offices do not want to share information related to project results since there is a fear that other offices will misuse this information. This issue gives rise to situations of isolated work. People have little idea about the tasks they have to perform. There is a general lack of understanding about the tasks and responsibilities DDC workers need to carry out. Furthermore, a problem exists related to the relation between district-level and central-level offices. Various district officers indicate that district agencies have to make a prioritisation of interventions each year, which have to be approved by the ministry. It however happens frequently that at the central level the prioritisation made in a district plan is altered to include areas that are favoured by political leaders. This is a serious form of corruption that prevents financial resources to reach those localities that most it most, while other localities that are no priority receive funding based on their social network.

“Each year I make a prioritisation of the projects. Then it goes to the ministry and the planning office. When the plan comes back with the budget, I see that the VDCs in the document are not the VDCs that I forwarded. At the central level, they remove and add new VDCs. There are parliament members who intervene. I cannot do anything and I have to carry out the job in the newly selected VDCs, even though these are not the VDCs that need it most. This is not only my problem but also the problem of all the offices.” – [Anonymous]

7.2 Coordination and integration for local adaptation

Institutions in the case study communities are diverse in nature and many in number. They all have a stake in contributing to the adaptive capacity of communities. The VDC and district line-agencies have a strong focus on human development interventions (education) and physical infrastructure development like roads and water supply. Cooperatives particularly increase the accessibility to financial services and agricultural input, and thereby contribute to economic diversification as well as intensification of rural livelihoods. NGOs, in a more isolated way, offer problem-focused interventions by means of institutional strengthening of community organisations. In their own way they shape the manoeuvring space of farmers. The cooperative diversity is often mentioned as beneficial for rural households, as this creates competition among institutions to deliver better services, and also minimises the risk of elite-group capture¹⁷. Households have the freedom to join the cooperatives that best suits their endowment base, and that can most optimally maximise their income sources. Apart from the fact that not all cooperatives have sufficient members to provide good services, diversity in this type of institution is perceived as good. For other types of institutions however, diversity forms a challenge rather than an asset. This particularly counts for the institutions that are active in natural resource management.

In the present policy structure, the management of natural resources, and water resources in particular, is characterised by a sectoral approach. There are separate government agencies that take care of irrigation, drinking water, sand mining, and watershed management. Both community members and executive members of local institutions alike mention that every organisation establishes a separate group at the local level to implement their interventions, while they all deal with the same resource. They all have their own service delivery rules and implementation methods that are not harmonised with each other. Cases exist of communities that apply for drinking water and irrigation supply schemes in two different offices. While the drinking water scheme cannot be constructed by one office, the other is able to facilitate an irrigation canal. Drinking water is however a resource that requires fulfilment before any other water sector interventions can be undertaken. It is indicated that a lack of coordination increasingly gives rise to controversial situations in which scarce resources are not treated in an integral way. The relation between different water institutions working in the same district is problematic as offices do the same interventions but with inadequate coordination. NGOs do not inform government agencies about their working area and intervention outcomes. The isolated way in which interventions take place causes user groups that are established for the implementation period to collapse when infrastructure is constructed. However, for the maintenance of water schemes and the sustainability of projects, it is better when there is one central organisation at the local level that has a clear view of all water sector interventions and needs. This will also diminish situations in which user groups merely exist temporarily.

“Recently I submitted a drinking water proposal in both the Irrigation Office in Dulikhel and the District Drinking Water Office. The plan was only accepted for irrigation and the drinking water was left out. But in the community our priority need is drinking water. Only after that we need an irrigation system.” – villager of Acharyatol

¹⁷ Interview: Ms. Stephanie Borsboom – World Bank

“We need an umbrella organisation at the VDC level that can govern all the natural resources, including the forest. Why should we have so many groups? Every organisation can give support to the same group. Now, organisations are making user groups independently. We suggest other organisations not to make other user groups since we have a lot. For those who work in resource enhancement, why not work with existing institutional structures? Going into the village, you will encounter five different groups that all are meeting once or twice a month. How much time do farmers have to spend for that?” – Mr. Pokharel – District Forest Officer

Development institutions observe their natural resource interventions increasingly in the context of climate change. This discourse increasingly re-valuates the merits of the Integrated Water Resource Management (IWRM) principle, as a focus on ensuring water availability in actually and potentially water-scarce communities becomes urgent. In this endeavour, it is recognised that a focus on the conservation of water sources through forestation and land use planning is key for successful adaptation¹⁸. Taking into account the need for improved integrated institutions, it is important to analyse what arrangements are present and what initiatives are conducted that can contribute to an IWRM approach.

District Water Resources Committee

The district-level coordination body that is in charge of water resources management is the District Water Resources Committee (DWRC). The 1992 Water Resource Act created the DWRC as the designated body to coordinate water-related activities in the district and manage conflicts. Eight district agencies that touch upon the water sector are represented in this committee (Bhattarai et al., 2002:28). These are the District Development Officer (chair), Local Development Officer (member-secretary), District Forest Officer, District Soil Conservation Officer, District Water Supply & Sanitation Officer, Irrigation Development Officer, District Electricity Officer, and the District Agriculture Officer. However, no water user groups are represented in the DWRC. At present, the main objective of the DWRC is to register water user groups. Community groups who want to conduct initiatives in the water sector have to come with a VDC recommendation to get formalised by the DWRC. This is the only moment that the local group interacts with the DDC. After this, no coordination with the groups or monitoring takes place. Various institutions at the district level have expressed their concern to restructure the DWRC and include more representation from local water users. Pant and Bhattarai (2000:15) already stated that coordination between agencies working in water sector development is lacking, particularly as a result of the marginal coordinating role of the DWRC. However, the fact that most impacts of climate change are water-related makes the DWRC a key committee to spread knowledge and build capacity for planned adaptation through the introduction of the IWRM principle.

“Many offices feel that work should be done in an integrated approach. We always talk about coordination but there is a gap. The DDC should lead the coordination. They make the district profile and all areas of development are incorporated in this. If the DDC really wants it can create an environment of effective coordination.” – Niranjan Shrestha - District Soil Conservation Officer

“Most of the concerned line agencies are a member in the District Council where everything is discussed. It is not that they do not discuss. The thing is that when they go to the field, they do the implementation their own way despite their discussions in the council meeting. Even if you see coordination on paper, during the implementation they have their own plan. The problem is the budget as well. They have to finish the budget no matter what within the fiscal year. If you want to have coordination you need ample of time.” – Deepak KC - UNDP

¹⁸ Interview: Mr. Janak Adhikarki - DWSSO

Indrawati Sub-Basin Project

With the aim to institutionalise the IWRM principle, the GoN Water and Energy Commission Secretariat (WECS) and WWF jointly conduct the Indrawati Sub-Basin Project¹⁹. With this intervention, the institutions aim to address environmental sustainability, economic efficiency and social equity in equal measures, as is envisioned by the IWRM principle in the National Water Plan (2005) (WWF, 2010:5). The project initially centred on the introduction of the IWRM concept, but as prolonged drought and other extreme weather events are emphasised within the climate change discourse, the project is conducted under the label of water-based adaptation, being strongly linked to NRM and livelihoods, without refraining from its initial objectives. The aim is to build ecological resilience and improve people's livelihoods in the face of climate change, which is achieved by establishing Integrated Resource Management Committees (IRMC) at the micro-catchment level. The idea is that these IRMCs unite existing natural resource user groups and interventions within every micro-catchment. IRMC activities encompass income generation and promotion of integrated resource management techniques. A first activity of the committees is to identify all water sources in the catchment²⁰. Then water source conservation measures are taken like conservation pound, micro-irrigation and gabion wall construction, as well as grass and bamboo plantation for slope stabilisation. Most importantly, a continuous access to water resources is aimed to be achieved. The project also has the objective to increase awareness about the IWRM principle and the right of access to water (Himalayan Times, 2010).

“In Nepal, the integrated approach is lacking. There is only a sectoral approach. The irrigation department is not mandated to consider drinking water. There are many offices, but they go on their own without coordination. Irrigation, drinking water and forest have their own user groups. Our efforts are to bring together all those user groups. We establish these integrated resource management committees. We enable them to manage their spring sources, so that they will have ideas and knowledge.” – Haris Rai - WWF

Figure 7.5 The institutional structure of IWRM as envisioned by the National Water Plan.

- 1 - - - - River Basin Organisation
- 2 - - - - - - - - - - District Water Resources Committee
- 3 - - - - - - - - - - - Integrated Resource Management Committee
- 4 - - - - - - - - - - - - - VDC-level Sub-committee
- 5 - - - - - - - - - - - - - - Ward-level Sub-committee

Figure 7.5 shows the institutional structure that WECS aims to implement over time. Most important are the RBO, DWRC and IRMC structures. To facilitate decision-making in the IRMC the sub-committees are also established at two levels. The idea is that in the future an IRMC is established in every micro-catchment (51 in Sindhupalchowk). The current project carries out interventions in five micro-catchments of the Indrawati basin. All IRMCs will be united in the DWRC, where there will be representation of different sectors. The Koshi basin, of which the Indrawati basin is part, encompasses seventeen districts. Therefore 17 DWRCs will be represented in the River Basin Organisation (RBO).

To make the institutional structures of the Indrawati Sub-Basin Project legally mandated, it is required that the GoN backs the National Water Plan with legislation. This plan is however, six years old and little political willingness seems to exist to implement this vision on the short-term. The risk thus exists that this project will be just another one that establishes user groups for project implementation without any further continuation of the structure once the project stops. To better understand the dynamics and impediments of planned adaptation, it is salient to make an analysis of central level policy framework for adaptation that are discussed in the next chapter.

¹⁹ Interview: Mr. Gautam Rajkarnikar - WECS

²⁰ Interview: Mr. Roshan Sherchan - WWF

8. POLICY FRAMEWORKS FOR ADAPTATION

“Climate change is not a priority. It is the Constitution. If there is no climate change policy no one will die and no catastrophe will happen, but if we do not have a Constitution there will be civil war.”

– Santosh Mani Nepal - WWF

Livelihoods are based upon a variety of systems, which when managed properly can unleash a broad potentiality of household strategies, the *manoeuvring space* of rural households. The autonomous adaptation strategies that community members apply are influenced by the planned actions of local, district and central level institutions. Their services and interventions find their origin in policy frameworks, which exert their influence at different levels. In the case that these frameworks have a potential to improve the opportunities received by rural households, a salient question becomes how these policy frameworks can be improved to make it easier for rural households to switch or strengthen livelihood strategies²¹.

The aim of this chapter is to improve understanding of how planned adaptation efforts of the GoN and other development partners can facilitate community resilience. Focus is placed on what institutions are involved in the adaptation process, what the coordination platforms are, and to what extent these processes can be characterised as ‘relevant’. Around the world, discussions on adaptation tend to take place within the climate change discourse. For Nepal, climate change and adaptation research is relatively new and intervention experience limited (De Berdt & Singh, 2009:32). Particularly in the last few years, there has been an increase in the amount of climate change research conducted²². These studies have identified multiple barriers that inhibit the development process and represent a challenge for adaptation efforts in Nepal. Incomplete implementation of plans and policies is not uncommon, budget allocations of agriculture and irrigation are decreasing, and clear guidelines about the mandates and roles of institutional structures are lacking (MoE, 2010:1). Furthermore, public awareness in relation to water-induced disasters is low, early warning systems are limited in reach and land use planning is inadequate. Therefore, a more precise analysis of the landscape of adaptation institutions is required since efforts of planned adaptation will especially have to address the present institutional limitations. This chapter will analyse the institutional process that is unfolding in Nepal to address a new societal problem, which inherently demands for an integrated solution in a context that is characterised by sectoral institutions.

8.1 The first steps of Nepal’s adaptation discourse

The landscape of institutions that are involved in climate change adaptation is quite scattered. Multiple institutions are crucial in providing the basic development structure upon which rural households depend, as well as developing the projects that specifically target situations of increased drought and floods (Bartlett et al., 2010:15). Several government agencies, NGOs, bi- and multi-lateral institutions directly address climate adaptation issues through their work in the field of natural resource management, drinking water and irrigation water supply, capacity building for disaster preparedness and response, and broad economic and political empowerment of communities (Dixit, 2010b:5). Their diversity makes it difficult to assess the role of all institutions related to climate change. Even the list of ministries and government departments relevant to climate adaptation is complex and it is often difficult to determine the exact responsibilities of each institution (Bartlett et al., 2010:8). Therefore, special focus is placed on recent policy processes of both governmental and non-governmental institutions that directly address climate change adaptation.

²¹ Interview: Mr. Ajaya Dixit – ISET-Nepal

²² Interview: Mr. Bijaya Kumar Pokharel - DoHM

Compared to other countries in the global South, Nepal has been slow in developing a national adaptation plan (Bartlett et al., 2010:17). The GoN has given low priority to climate change adaptation since the peace process and preparations of the new Constitution absorb most human and financial resources in the post-conflict situation (De Berdt & Singh, 2009: 25). The following key events are relevant in the light of the adaptation debate in Nepal:

- An early starting point for the integration of adaptation in the national development discourse is the signing of the UN Framework Convention for Climate Change (UNFCCC) in 1992 (Dixit, 2010b:8). This is of particular importance since most climate change adaptation efforts are conducted in close collaboration with the international community. The GoN identified the Ministry of Environment as the Designated National Authority for the design of adaptation and mitigation policies (Regmi & Paudyal, 2009:4).
- The GoN submitted its Initial National Communication to the UNFCCC in 2004 and in 2008 the MoE did a National Capacity Self-Assessment with the support of UNDP, to identify priorities and needs for capacity building to protect the environment (Regmi & Paudyal, 2009:5). The study identified climate change as sustainable development issue and recommended institutional, technical and financial support to analyse the impacts and develop adaptation measures (Gum et al., 2009:23).
- In November 2010, the MoE finished the preparation of the National Adaptation Plan of Action (NAPA) with the support of UNDP, DFID and DANIDA (Dixit, 2010a). It forms a vehicle for the LDC Parties to the UNFCCC to prioritise urgent adaptation measures (MoE, 2011). It is the first initiative to mainstream climate change into the national development process and provides a basis to the GoN to guide adaptation governance and manage financial resources in a coordinated way (Regmi & Paudyal, 2009:2).

Table 8.1 The NAPA thematic groups²³

Thematic Area	Coordinator
Agriculture and Food Security	Min. of Agriculture and Cooperative
Water Resource and Energy	Min. of Energy
Forests and Biodiversity	Min. of Forests and Soil Conservation
Climate-Induced Disaster	Min. of Home Affairs

Integrated Priority Projects
1.) Promoting Community-based Adaptation through Integrated Management of Agriculture, Water, Forest and Biodiversity Sector
2.) Building and Enhancing Adaptive Capacity of Vulnerable Communities through Improved System and Access to Service related to Agriculture Development
3.) Community-based Disaster Management for Facilitating Climate Adaptation
4.) Glacier Lake Outburst Flood Monitoring and Disaster Risk Reduction
5.) Forest and Ecosystem Management for Supporting Climate-led Adaptation Innovations
6.) Ecosystem Management for Climate Adaptation
7.) Empowering Vulnerable Communities through Sustainable Management of Water Resource and Clean Energy Supply

Project Prioritisation Criteria
Potential to reduce adverse impact of climate change
Potential to support local livelihood
Synergy with national priorities
People's participation
Cross-sectoral benefits
Cost-effectiveness
Ease of implementation

Source: adjusted to *MoE, (2010:21)*

²³ Left out for this study are the thematic areas: *Public Health and Urban Settlements and Infrastructure*

Since the adaptation discourse of Nepal is very new, the GoN is just completing the mandatory documents for the UNFCCC with the support of donors²⁴. Nepal is one of the last signatory countries to the UNFCCC to complete the NAPA process. The study has been prepared with a consultative process and thematic working groups involving the ministries that are potentially impacted by climate change. In the case of Nepal, the groups host between eight and sixteen member institutions. Joint secretaries of specific ministries chair the thematic groups that are identified. In *table 8.1*, four groups are depicted that are relevant for rural adaptation. The churning ministry is the one that has more than 50 percent of the stake of the theme²⁵. Groups worked semi-autonomously and were responsible to identify adaptation priorities within their themes that are comprehensive enough to be used as a basis for an adaptation strategy (MoE, 2010:17). A number of integrated projects were prioritised from the group lists, consisting of several components that can be projects of their own. The support of the donor community is considered to be vital for their execution. INGOs can implement their plans and projects in areas the government has not been able to reach for a variety of reasons.

“The Nepali NAPA is currently highlighted internationally as one of the best NAPAs because we have been able to do a lot of consultation. It was one of the last NAPAs so we were able to find out what are the weak points in other NAPAs. We wanted to know from the vulnerable communities what the challenges are. Their voices had never been heard in such a policy document. We were able to go to these places and get those voices into the document.” – Anupa Lamichhane - UNDP

The NAPA has been a donor driven process, as the GoN itself did not allocate financial resources for the process. UNDP had to assure that the process was conducted properly and the NAPA gets the due importance in all ministries. The document is very comprehensive and different compared to other NAPAs²⁶. Every ministry has received a consultant to cut down the issues and identify the actions needed in each sector. However, an issue not fully taken care of in the NAPA is the necessity to include local institutions in adaptation needs. Hence, as a continuation of the NAPA, attention is paid to the formulation of a Local Adaptation Plan of Action (LAPA). The diversity of ecosystems, microclimates, cultures and socio-economic circumstances in Nepal make it salient to downscale any adaptation programme formulated at the national level to reflect location specific needs (MoEST, 2010:18). The LAPA aims to address the DDC and VDC levels by combining climate adaptation, DRR approaches as well as economic and cultural drivers of vulnerability (Jones, 2010:6).

“Even though climate change is not a priority for the government, because of the donors and international seminars the government has started working extensively in it. If the donors do not put the money, the government will not allocate any money for climate change. From that point it is a donor driven process. But the initiations are in international forums. So you cannot really say it is donor driven as climate issues are discussed within the UN and all the parties agree that they have to do this.” – Shiva Sharma Paudyal - DANIDA

In continuation, the MoE has several initiatives related to capacity building for adaptation with the support of different bi- and multilateral donors. The most significant one is the ‘Pilot Project on Climate Resilience’ supported by the WB and ADB. While the NAPA evolves around local adaptation initiatives, the PPCR tries to mainstream climate change in the broader development process. The PPCR is thus broader and focused on the societal structure and institutions and whether they are resilient enough to cope with shocks²⁷. A core component is the identification of capacity and knowledge gaps within the GoN to address adaptation issues. The PPCR’s aims are stated in the Strategic Programme for Climate Resilience. The five components are:

²⁴ Interview: Mr. Batu Krishna Upreti - MoE

²⁵ Interview: Mr. Gyanendra Karki - MoE

²⁶ Interview: Ms. Anupa Lamichhane - UNDP

²⁷ Interview: Ms. Stephanie Borsboom – World Bank

- Floods and early warning systems
- Watersheds (how water sources can best be protected)
- Biodiversity (how loss of natural habitat can decrease)
- The role of the private sector
- The manuals that need to be written to integrate climate change in the various ministries

The components still do not have a lot of detail. It project first needs to be approved by the Climate Investment Fund Committee. Within the PPCR framework, the required trainings and technical assistance are provided to enhance the capacity of the MoE and other ministries (Bartlett et al., 2010:15). The ADB assists in the development of tools like the community-based vulnerability assessment and adaptation planning that help to guide future investment decisions in fields that are likely to feel the impact of climate change. A consortium of five organisations²⁸ works with the ADB to prepare this standard vulnerability assessment tool for local level planning, by incorporating their own fieldwork experiences (Dixit, 2010b:6). This process helps the government to come up with a tool to help understand how vulnerability assessments can be done in different eco-regions of Nepal and how adaptation planning can best be designed. Since there is limited capacity in the government, donors recognise that development partner support is salient²⁹.

The PRSP (2002-2007) and both Interim Plans (2007-2010 and 2011-2013) explicitly address climate risks and adaptation. They identify four development priorities (MoE, 2010:3):

- Improvement in access and quality of infrastructure
- Social and economic services in the rural areas
- Social and economic inclusion of poor and marginalised communities
- Good governance to improve service delivery

The documents mention priorities related to climate change, like the formulation of a Climate Change Policy and integration of environmental aspects in socio-economic development interventions (De Berdt & Singh, 2009:25). The last Interim Plan was adopted with the aim to internalise environment management into development efforts, adapt to climate change and manage natural resources sustainably (MoEST, 2010:6). The GoN has decided that the 2011-2013 Interim Plan needs to be climate resilient. A framework has been constructed with the parameters that are salient to make projects climate resilient. One of the last efforts of the MoE, with the help of WWF, is the formulation of the Climate Change Policy, making Nepal one of the first countries in the world to draft such a policy. It envisions Nepal to be a climate change impact free country where sustainable development and climate justice are achieved³⁰. Particularly the NAPA and CCP are key documents to guide the future of the climate change discourse and to help in realising this ambitious plan.

Government institutions

When diving into the institutional structure of the GoN, various adaptation initiatives can be distinguished. A key institution to cope with the effects of water scarcity is the Department of Irrigation. At present, the institution carries out a first research project related to climate change in the Indrawati basin. Data is collected on agricultural practices and seasonal livelihood systems to learn more about the socio-economic impact of climate change and local adaptation measures of the communities³¹. The Department of Irrigation is mainly concerned with increasing irrigation efficiency. The DWSSO is in charge to protect water sources, but in practice this hardly happens since farmers are mainly interested in catching the

²⁸ Practical Action, IUCN, NAVIN, CECI, WWF

²⁹ Interview: Mr. Anil Pokharel - ADB

³⁰ Interview: Mr. Adarsha Prasad Pokhrel - DWIDP

³¹ Interview: Mr. Uthan Similtina - DoI

water, not in conserving or recharging³². The key institution that is concerned with climate change impacts on the agricultural cycle is the environmental division of the MoAC³³. The MoAC conducted a climate project with the FAO, called ‘Capacities for disaster preparedness and climate risk management in the agricultural sector’. This project aimed to develop a cropping system that is climate resilient, through testing new improved crop varieties in different agro-ecological circumstances. The Nepal Agricultural Research Centre, being part of the MoAC, develops these stress-tolerant crops. Another ministry responsibility is the cooperative, which has become very popular and is identified as one of the pillars of the Nepali economy. As observed in the previous chapter, cooperatives offer a diversity of possibilities to the community to improve livelihoods.

The MoHA is the responsible government agency for disaster risk management. In 2009, it has drafted the Disaster Risk Management Strategy to improve the delivery of disaster relief services during emergency events. It envisions the establishment of a new National Disaster Risk Management Authority. It has to be set up with the Disaster Risk Management Act, which is not yet passed. At present, the DRR division is of secondary importance to the MoHA. The authority needs to be established to increase the weight of DRR and effectiveness of coordination between DRR institutions. The MoHA has also initiated the draft of a District Disaster Plan for all the 75 districts to improve the effectiveness of disaster preparedness. It can thus be said that structural measures are taken by the GoN to make Nepali society more climate resilient. As for now, the DRR division has only eight staff members and few resources. In the meantime, it is responsible to coordinate much larger agencies like the DWIDP. The DRM section of the MoHA has a disaster focal person meeting every month. In each ministry there is a disaster focal person. For a quick response, the MoHA has established the National Emergency Operation Centre for disaster coordination and involves the UN system, the Nepali army and police, and the NRCS.

External development institutions

Nearly 70 percent of the annual government budget comes from bilateral and multilateral donors in the form of loans and grants (Bartlett et al., 2010:10). Donors are powerful in steering development due to their considerable majority contribution to the national budget. Donors consider climate change an important issue in the development discourse and their work in the climate change sector has been significant due to a strong emphasis on adaptation and the mainstreaming of climate change impacts in the portfolio of NGOs, bi- and multi-lateral institutions (Dixit, 2010b:5). This while the GoN clearly mentions that the priority of the government is not climate change, but the peace-process (DANIDA, 2008:21). It can thus be said that the adaptation discourse of the GoN is largely donor-driven.

“Donors are interested in learning, sharing and workshops, but when we ask to do something for the communities there is a lack of fund. The donors focus more on policies and networking at the national level. Funds that can be channelled to the communities are not much available. Perhaps donors are not sure about how climate change will impact.” – Denabad Pandarat - Practical Action

While the GoN hardly undertook any action related to climate change adaptation, civil society carried out a lot of climate change awareness initiatives in the early 2000s. The first efforts from civil society were campaigning activities to increase climate change awareness at national-level institutions³⁴. Awareness activities were organised by involving the youth, establishing ecoclubs, as well as workshops for government institutions. From 2004 onwards, Practical Action implemented a project for rural communities to cope with the impacts of

³² Interview: Mr. Nawalkishor Misra - DWSS

³³ Interview: Dr. Hari Dahal - MoAC

³⁴ Interview: Ms. Moon Shrestha - WWF

climate change. The project focused on improving understanding on community perceptions to changing weather patterns and sharing this knowledge with practitioners. Oxfam started a similar project in 2009 with the project ‘Even the Himalayas have stopped smiling’ as part of a global Oxfam initiative. It tried to have a broad view of how people perceive climate change and what are the impacts that communities are facing. Most NGOs work with a programme-campaign modality, meaning that government agencies are exposed to results from the field with the aim to influence policies and advocate a greater focus on specific sectors.

Many NGO interventions have been conducted in the field of agro-ecological adaptation and community-based disaster risk management. Work is conducted in the field of water source conservation, rainwater harvesting and water-efficient farming technologies. Many NGOs encourage farmers to diversify their crops and use improved (drought- and flood-resistant) crop varieties to increase the resilience of the agricultural system. The plantation of trees and construction of gabion walls is promoted to adapt to the problem of increasingly intense rainfall³⁵. Many are integrated water and agriculture management projects, often focused on districts in Western Nepal. Next to *water scarcity* activities, a large number of institutions are involved in *water hazard* projects. The Nepal Red Cross Society is a predominant institution that deals with the adverse effects of too much water. Particularly community-based disaster risk reduction projects are popular³⁶. Like the NRCS, many other institutions have the work modality to form community groups, bring infrastructure and do rescue management. In the natural resource management sector, conservation committees are often established at the micro-catchment level as well. They are an umbrella organisation that brings together several interest groups for projects like landslide control, river training works and income generating activities, with the goal of poverty reduction and watershed conservation³⁷. Income generation is frequently included in adaptation projects since household vulnerability is often a lack of economic resilience. By offering these trainings livelihood strategies can be diversified.

Many of these projects already existed but institutions realised that these activities are also proper climate change adaptation measures. Since climate change influences the broad scope of livelihood vulnerability, conventional projects that manage the natural resource base and improve the income sources of rural households are adequate. Most institutions still struggle to conceptualise the climate change problem, and come up with relevant response. Agencies need to make use of the perception of local people towards climate change for their adaptation interventions, since a database to observe change processes is absent³⁸. Institutions thus have to rely on secondary information, like focus groups. This makes it hard to say with certainty that adverse trends are a consequence of climate change, while NGOs need to establish clear links with climate change when they claim to be undertaking ‘adaptation’ interventions.

“Communities will say they are affected, but the problem is that they do not know exactly whether it is due to the climate change or not. For us it is difficult to say. It does not really matter what the cause is from their perspective, but when you have a project labelled ‘climate change adaptation’, then you would like to see the linkage as well. Climate change is a multiplier, but to what extent it really intensifies is very challenging.” – Roshan Sherchan - WWF

“The tricky thing is that it is very difficult to separate development activities from adaptation and there is a tendency that in most development projects a little bit is added on climate and then it is a climate change intervention, which is not. That is the dilemma many of the projects face. [...] When there is a big pot of money over there it is really nice and attractive to say a little bit about climate change so that you have more access to funds.” – Sabita Thapa - DFID

³⁵ Interview: Mr. Prabin Man Singh – Oxfam GB-Nepal

³⁶ Interview: Mr. Prajwal Acharya - NRCS

³⁷ Interview: Mr. Narendra Kumar Gurung - JICA

³⁸ Interview: Mr. Prem Paudel - DSCWM

Since the interventions of NGOs are isolated, their value addition for broader adaptation goals and an overall increase of community resilience remains unclear. Donor representatives state it to be more worthwhile to collaborate with the government since this is the actor that is best in place to bring services to the communities in a coordinated way³⁹. The donor community has to help the GoN to fill in the gaps in financing, knowledge, and capacities for adaptation.

8.2 Coordination to achieve adaptation

Particularly the execution of the NAPA has given a great boost to the institutionalisation of climate change adaptation. For its execution, the GoN decided to establish a Climate Change Division, after fifteen years of UNFCCC negotiations. Because of climate change, the MoE has gained a more central role than before. The fact that the MoE is a very nascent and budget-wise very marginal compared to other ministries can be seen as a challenge. The MoE might get around NRs. 100 million, while the MoFSC has a few billion rupees annually⁴⁰. In the meantime it has to coordinate ministries that are much larger and older. The MoE is not an implementing body, but it formulates policies and represents Nepal in the international arena.

“Ten years ago, many organisations were emerging with different plans and objectives. Now, the government is very serious and takes the lead to harmonise DRR and climate change initiatives. The MoHA is trying to come up with a joint effort. [...] I feel that policy changes have happened. You can see the NAPA document. But aggressive and proactive action is needed. Developing policy does not mean that work is done at the community level.” – Prajwal Acharya - NRCS

It does therefore not have ground connections, meaning that it depends on the willingness of other ministries to reach its objectives. From another perspective it can also be said that it is better that the MoE does not have decentralised arms since it is now obliged to coordinate with all other ministries that do have local branches to implement adaptation interventions⁴¹. Other ministries do not like to be coordinated by the MoE since many are already carrying out initial adaptation projects, often together with a donor⁴². Government officials mention that the sectoral mandate of the different ministries, with their own targets and objectives, is a major challenge for coordination. Adaptation coordination between the MoE and other ministries now takes place through the environment divisions of the concerned ministries. The GoN does not plan to make new institutions to implement the NAPA. It needs to be integrated in the existing system. The idea is to establish a unit in the various ministries to ensure that when staff that functioned as a climate change focal point is transferred there will be still the institutional memory. The National Planning Commission needs to make the decision for the establishment of such units by allocating a special budget for it.

“Our approach is to integrate the NAPA components into the national system so that climate change activities and low-carbon development are implemented through the existing system. We might need to revise some of the mandates and responsibilities of these government institutions. In the LDCs we cannot develop any institution just for one activity. We have to integrate it in the system.” – Batu Krishna Upreti – Climate Change Division Chief - MoE

“We look at twenty-five ministries to have at least a climate change focal person, a climate change desk, or a climate change cell, whatever is the need of the ministry. We already have a disaster risk focal desk in most of the ministries. We try to push the idea of having a combined climate and disaster focal point. We do not want to come up with two focal points since we cannot create a focal point for every issue.” – Anupa Lamichhane - UNDP

A number of government initiatives have been taken to improve inter-ministerial adaptation coordination. For central policy coordination the Climate Change Council was established,

³⁹ Interview: Mr. Hari Krishna Nepanupadi - ICIMOD

⁴⁰ Interview: Mr. Adarsha Prasad Pokhrel - DWIDP

⁴¹ Interview: Dr. Sabita Thapa - DFID

⁴² Interview: Mr. Shiva Sharma Paudyal - DANIDA

chaired by the prime minister. Seventeen ministers are member, as well as eight independent experts from NGOs, INGOs and academia⁴³. The function of the committee is to develop the national consensus in international climate change negotiations (Dixit, 2010b:8), as well as to formulate strategic adaptation financing strategies (MoE, 2010:18). Next to this, the NAPA facilitated the establishment of the Multi-stakeholder Climate Change Initiatives Coordination Committee (MCCICC) in April 2010 under the chairmanship of the MoE secretary to foster a coordinated response to climate change impacts (MoEST, 2010:19). It offers a platform to enhance communication between institutions to increase synergy and avoid overlap of efforts. It aims to strengthen the impacts of the thematic working groups and mainstream adaptation efforts into development planning.

Chaired by the MoE secretary, the MCCICC represents various development partners from the GoN, civil society and the international community. With the NAPA in place, other institutions outside the government are enabled to follow the prioritisation of projects. It is received very positively that the NAPA is not just nine projects but a list of 120 projects. Civil society organisations can then select projects that reflect their own mission statement and contribute to national adaptation efforts in a coordinated way. Taking into account that the government greatly lacks the resources to implement the whole plan of action itself, it needs to depend on the international community to implement adaptation projects. While the NAPA forms the basis, the MCCICC is its coordination mechanism. Critique exists on the MCCICC as a platform for coordination, since the meetings are characterised by marginal information exchange and hardly any brainstorm or effective output takes place. Furthermore, the committee does not have a secretariat, which makes it difficult to contact or coordinate outside the meetings.

“Climate change adaptation often encompasses conventional development projects. The Ministry of Finance says that there are existing structures. A forest project thus needs to be implemented through the MoFSC. The MoE delivers the technical expertise, coordinates and makes sure that ministries learn from each other and that there is not much overlap. For this they organise the MCCICC, which is their new mechanism. But this is still quite weak. There is some sharing of information but no brainstorm. They keep saying that 80 percent of the money needs to go to the communities, but they also say that the line-ministries need to improve their capacity. Also at the district level many things need to be improved.” – [Anonymous]

Apart from the governmental sphere, a few civil society coordination networks can be identified. Important is the Climate Change Network Nepal, a network that was established by WWF and Winrock International. Initially, 29 member institutions, ministries, departments, NGOs, INGOs, bi- and multilateral organisations came together. The primary aim was to lobby for the Kyoto Protocol ratification by the GoN, to increase awareness about climate change, and improve coordination among development institutions (MoE, 2011). After the ratification, the CCNN continued as an informal network with nine members⁴⁴, to try to influence policies and government plans (DANIDA, 2008:27). The coordination between the CCNN and the GoN is perceived very positively by civil society organisations⁴⁵, as the network’s recommendations are often reflected in plans and policy. Next to platforms, there are examples of international institutions working directly together with the GoN, such as the NRCS that works closely with the DoHM and MoHA. The wide network and strong capacity of civil society organisations (the NCRS has offices in each district and more than 1300 offices at the VDC-level) makes them an interesting partner for the government.

⁴³ Interview: Mr. Gyanendra Karki - MoE

⁴⁴ WWF, Winrock, UNDP, IUCN, NTNC, ICIMOD, Clean Energy Nepal, Practical Action, JICA

⁴⁵ Interview: Mr. Prabin Man Singh – Oxfam-GB Nepal

“WWF was one of the first to start with climate change eight years ago. We established the Climate Change Network Nepal with other organisations, of which WWF was the secretariat till last year. The objective was to come together and get people to start talking about climate change. Very few people took it as an issue. Later it became a meeting for a wider audience and a place to start campaigns, especially involving youth.” – Moon Shrestha - WWF

“Most recommendations we have send are reflected in the NAPA document. In the formulation of the Climate Change Policy we are also involved through the network. The discussion and policy process is quite open and inclusive towards civil society. We are happy that the government at least wants to talk. Whenever civil society give suggestions, the government tries to reflect them.”
– Prabin Man Singh - Oxfam GB-Nepal

8.3 Institutional challenges

Nepal’s national adaptation process needs to occur in an instable post-conflict context where weak government institutions have hindered even the basic development process considerably (Dixit, 2010a). Interviewees mention three problems in particular as factors that inhibit the development process, and forthcoming adaptation efforts, from being effective.

Firstly, a salient problem is the widespread unclarity about the responsibilities and mandates of government institutions. There is very limited official knowledge about the amount of money being spent in interventions and the number of projects that are being focused on by the various ministries. This has lead to significant overlap in the activities of different agencies and inefficient resource allocation (Bartlett et al., 2010:20). For example, the MoHA, DWIDP, DSCWM and DoHM all are mandated to assist in flood- related issues (Dulal et al., 2010:631). This limits the ability to efficiently provide essential services like the expansion of physical infrastructure, the streamlining of resource distribution systems and implementation of poverty reduction programmes (MoEST, 2010:34). Between the Local Self-Governance Act, Irrigation Rules and Water Supply Rules, contradictions are observed whose harmonisation is fundamental for local institutions to function effectively (WECS, 2005:16). Even though it forms an impediment to effective development, the number of contradictions is indicated to decrease slowly⁴⁶. Five years ago, there were more than seventy contradictions between the LSGA and other policy frameworks, while now there are forty.

“The major challenge is that different ministries have different priorities and their rules are often in contradiction with each other. This ministry is responsible for local development, but now it is difficult to determine what is local. A few years ago a project of NRs. 10 million was huge. But not now even NRs. 10 million seems very small because the resources are coming in a huge amount. When you talk about river training works and small irrigation, those things fall under this ministry. But the MoI and the DSCWM also have these small projects. They are not willing to give those things to the local authorities.” – Binod Prakash Singh - MoLD

“Coordination, alignment and harmonisation are the biggest challenges for the coming years. All the ministries think they know it better. It is an institutional problem. There is no coordination and a lot of overlap. The mandate of the ministries should be clear. People talk about harmonisation but it does not happen because if they keep their mandate they can get more money of the Ministry of Finance to do activities.” – Shiva Sharma Paudyal – DANIDA

Secondly, instability of the institutional landscape is a clear problem for effective adaptation coordination. The restructuring of ministries and departments has according to Bartlett and colleagues (2010:19) resulted in confusion and disillusionment among officials. The division of the Ministry of Water Resources into the new ministries of Irrigation and Energy is a good example of how institutions are continuously changed in Nepal. In the same way, the Ministry of Environment, Science and Technology was split in the Ministry of Environment and the Ministry of Science and Technology. The MoAC has been restructured nine times since 1967. Furthermore, within government agencies a high staff turnover can be observed. The

⁴⁶ Interview: Mr. Binod Prakash Singh - MoLD

movement of civil servants between ministries causes a lot of institutional memory to be lost and gives few incentives to servants to ‘do a good job’. Few constructive policy process and interventions seem to take place in this unstable context. The absence of institutional continuity has adverse consequences for government effectiveness, just as high staff turnover results in substandard coordination between government agencies.

“We have a shortage of skilled manpower. Most people have gone abroad for their higher study and did not return, and others have left this organisation. In the government agencies there are a few persons who receive all the training and the rest does not receive anything. If you have good links, you have opportunities to do many interesting things.” – Bijaya Kumar Pokharel - DoHM

“Every year the staff of the DRM division changes. A person is appointed for one year and after that he leaves and all the institutional memory will be lost. We are not technical persons so we will be transferred to any ministry. Staff from the department of postal services can also come here to the disaster risk division.” – Sagar Mishra - MoHA

Thirdly, the development process is seriously hampered by a lack of human resources, little awareness and low priority given to climate change at various government levels. According to Gum and colleagues (2009:23) many key ministries like the MoAC and the MoI are largely unaware about climate change implications, despite their involvement in a few even though nascent activities. Officials have a hard time to conceptualise climate change impacts on the interventions of their own institution. A clear problem in most ministries, including the MoE, is that awareness and capacity is concentrated with a few persons who have received all the trainings and are thus more capable to manage the adaptation process.

8.4 Relevance of climate change adaptation

With the aim to observe the *relevance* of climate change adaptation initiatives and to see what is new and what old about the current discourse, special focus is placed on policy framework. A variety of climate change adaptation initiatives are undertaken in Nepal. The NAPA, Climate Change Policy and PPCR form the core of adaptation efforts. Despite this fact, questions are unavoidably raised when a problem of a clear lack of coherence between older and newer policy frameworks is observed. It is noteworthy that the donor community and GoN eagerly embark on a variety of adaptation initiatives, while other policy frameworks like the National Water Plan (NWP) have not yet received the due attention they need. At the same time the Integrated Water Resource Management principle forms the focus on the NWP, which is seen as an adequate adaptation measure.

The NAPA thematic group on Water Resources and Energy took the National Water Plan (2005) as the foundation for the development of a list of adaptation priorities. Despite this fact, the thematic group failed to establish a clear link with the IWRM approach as an adequate adaptation tool in situations of rising pressure on water resources. No reference is made to the vision of the National Water Plan to establish integrated resource management committees at the micro-catchment level, while the WECS and WWF are jointly conducting fieldwork to test the establishment of integrated resource management committees. More than fieldwork experience, the IWRM concept needs legislative support from central level institutions. This is urgently required, before the new governance structure can become mandatory. However, there is considerable resistance of established government agencies that do not want to change their mandate.

Within government agencies there is a widespread ‘*why bother if things can also go easily*’-mentality⁴⁷, which illustrates the government officials’ unwillingness to experiment with new policy approaches and institutional structures. It is mentioned that the Climate Change Policy

⁴⁷ Interview: Prof. Dr. Khem Raj Sharma - NEC

could be established so quickly since it does not aim to alter present institutional structures. A Water Resources Act however, requires a fundamental change of existing structures and therefore triggers resistance from ministries who do not want to change the *status quo*. Donor representatives state that it is difficult to work with the government mentality in which few officials want to take risk and just work according to their job description. Most civil servants and politicians are not striving towards the most optimal institutional structure. At present, there is no central institution that can address water resources in an integrated way. Even the Ministry of Water Resources recently splitted into the Ministry of Irrigation and the Ministry of Energy. This illustrates a trend of increased sectorialism instead of a path towards integration. Despite the good intentions of the NAPA process, a divide-and-rule mentality is still ingrained in the Nepalese political landscape.

“The attitude is the major challenge to effectively implement policies. Technically, all engineers are trained. Most of them are highly educated, but they lack the attitude and proper mindset. It is the way of thinking.” – [Anonymous]

“Some ministries are very well established and have their mandates for many years. They want to maintain their status quo. There is a lack of flexibility and willingness to experiment. They are just following the conventional practices, whereas this is a paradigm shift. While a climate change policy is established, which almost no country has, there is no good institutionalisation of water resources management. [...] Until now, the support is given for sectoral development. Ministries are hardly familiar with what integration really means.” – [Anonymous]

At the national level, challenges can be identified related to general development constraints as well as problems that particularly relate to increasing the adaptive capacity of Nepalese society. Since adaptation depends for a large part on the success of basic development efforts, adaptation interventions can only do well when the wider institutional challenges listed above are also addressed. The adaptation process in Nepal has initiatives like the NAPA that address local adaptation concerns of rural communities, as well as efforts like the PPCR that focus more on the resilience of societal systems and institutional structures. Taking into account the difficult post-conflict context, the adaptation process in Nepal does seem relevant in the sense that development institutions aim to make the development process more integrated and resilient. The issue is that the way in which natural resources are used and perceived needs to change drastically.

The adaptation efforts that are currently undertaken in Nepal are not sustainable as long as government agencies do not show the urgently required leadership to fundamentally change the institutional structure of natural resource management. The climate change adaptation debate has amplified the realisation that pressure on natural resources is increasing and thereby momentum is created to place the vulnerability of existing societal and livelihood structures at the centre of attention. To facilitate this momentum, the GoN needs to re-value existing strategies and plans of integrated resource management. While the NAPA and PPCR significantly contribute to better coordination between development institutions, adaptation efforts at the central level can only be considered truly relevant when they are willing to alter the institutional structure and place IWRM at the centre of local decision-making.

9. DISCUSSION

The current global climate change discourse increasingly emphasises on the risk of water-induced stress and hazards in particularly the global South. In a development context, little adaptive capacity exists and communities stand close to the natural resource base, since livelihood strategies greatly depend on ecosystem services, particularly land, forest and water resources. The social-ecological system perspective taken in this research reflects the idea that social structures are an integral part of nature. Ecosystem integrity is thus of vital importance for the resilience of the social system. Even minor changes in the natural environment can cause a sudden loss of ecosystem services and reduce the capacity to support subsistence livelihoods. As a result of the many interviews and observations described in this study, a number of factors are of particular importance for community resilience. How communities react to ecological disturbance depends on their current state, particular context, connections across scales, and persistence of relationships with external institutions.

The current state: sensitivity of mountain livelihoods

In the Indrawati river basin, large differences can be observed between communities that are located within short distances. Not all communities have the same *vulnerability spectrum*. The vulnerability notion can be used to describe the marginality of rural households, and can guide analysis of the actions needed to improve wellbeing. In the case study, marginality tends to occur along caste and gender lines. These divides are still deeply rooted in society and economy and greatly determines the options people have. Agricultural land is highly fragmented with a reduced potential for expansion due to relief, climatic conditions and soil fertility conditions. The vast majority of households in the case study has less than 0.5 hectare, while the poorest households are endowed with less than 0.25 hectare. The differences within communities related to land endowment tend to be as large as the differences between them. The food situation also varies greatly between and within communities, depending on family and land size, and access to irrigation.

Sensitivity is used to describe the degree to which a community has access to system that help to cope with social-ecological change. Due to its mountainous context, poverty rates, population pressure, small-scale agriculture reliance, weak economy, poor infrastructure, and low social sector levels, Nepal is a disaster hotspot. Disasters are deeply embedded in a given social context, being a symptom of the marginality of groups, and exposure of systems. This vulnerable environment causes disturbance to be too overwhelming to cope with quite soon.

The context: perceived exposure

Global Climate Model studies suggest that the impacts of climate change will be considerable, with warming being pronounced at higher altitudes of the Himalaya. At present, around 80 percent of the precipitation falls within four months of the year, and the prediction is that this hydrological pattern will become increasingly skewed. In the communities, drought clearly impacts the agricultural cycle and drinking water supply. At the same time there are also cases of water abundance such as flooding, riverbank erosion and landslides that are triggered by intense rainfall. This rainfall has grown more erratic, intense and unpredictable and especially the people that already had restricted access to water resources notice the changes better.

A number of water scarcity hotspots can be identified in the Indrawati river basin. Even in the valley, water scarcity is increasing as a synergy of both ecological and human factors. The river level has lowered about 1.5 meters in recent years due to excavation works of the sand mining industry. This has started to have serious consequences for the possibilities to irrigate the fields located near the river. The construction of new irrigation canals seems very difficult without external assistance, and even though external institutions have developed some

irrigation canals and drinking water facilities, the amount of water flowing through them has decreased and is insufficient for all households.

Increasing rainfall variability has put an additional pressure on the farming system. A general trend can be observed of farmers having to take greater risk in agricultural practices. Rainfed agriculture is increasingly unable to meet the growing demand for food and in a context that was already characterised by marginality this represents a problem of increasing concern. To improve the yields many farmers apply chemical fertiliser and pesticides. This trend however created a situation in which the input costs increase, while yields often remain the same due to restricted access to water. Exacerbating climate variability results in the trend that many agricultural practices of collective action become less reliable as more households try to diversify their income sources. There is less willingness to contribute free work labour to a natural resource base that is increasingly characterised by uncertain gains.

The severity of ecological change depends on the capacity and speed of rural communities to adjust their livelihood strategies. It is just one of the many challenges rural communities face, and it is often not perceived as the most pressing one to address. Climate variability can continue to exacerbate to levels in which they become more harmful to rural livelihoods and trigger serious imbalances in the social-ecological system. Changing weather patterns can however also be reversed and return to the 'normal' situation. While the conviction of the latter scenario triggers a business-as-usual mentality, the first scenario can at least create a sense of urgency to study the resilience of the most vulnerable communities. In case that observed climatic changes continue, how well are rural communities then prepared to cope and adapt to them?

Connections across scales: opening up the adaptation potential

Development contexts are often characterised by numerous social, economic and ecological challenges and a lack of financial resources to solve them. An understanding of how scarce resources can best be allocated to increase the adaptive capacity of rural communities is thus urgently required. Livelihood resilience depends on the interaction of assets, exposure and the institutions with which communities are linked. Institutions shape the *manoeuvring space* of rural households through their services and interventions and have a great potential to enable communities to adapt to the adversities of water-induced stress and hazards. Most adaptation research has focused on isolated adaptation efforts, rather than on the role of institutions as facilitators of climate resilient development. This study has embraced the latter and in this perspective, a distinction needs to be made between autonomous and planned adaptation.

Autonomous adaptation includes all the actions and strategies that rural households apply independently as a reaction to social-ecological change. *Planned adaptation* encompasses a wide range of services and interventions of very diverse institutions, with the common aim to widen the *manoeuvring space* of these rural households. There are many different types of interventions that can contribute to the widening of livelihood options, and one way to conceptualise this diversity is as a development-adaptation continuum. Activities that focus on development issues address situations of marginality that make people vulnerable to harm, regardless of the causing factors. On the other hand, adaptation issues focus on building resilient problem-solving mechanisms that provide the foundation for more targeted actions at the local level. In this way, the UNDP Regional Climate Risk Prevention Project and WECS/WWF Indrawati Sub-basin Project stand close to the adaptation side of the continuum, while the service delivery of VDCs and cooperatives stands at the development side of it. They all have an impact on the *manoeuvring space* of rural household and contribute, when conducted properly, to reduce community vulnerability.

When capacity levels and certainty about future climate impacts are low, greater investment in addressing the underlying causes of vulnerability is required, since it is then essential that measures revolve around no-regret strategies that are proper regardless of the direction and magnitude of change. Efforts that result to be very adequate are an investment to improve natural resource management, as the main livelihood strategy remains to be agriculture, and an investment in the provision of so-called *gateway systems*. These are entitlements that, once rural households have access to them, add new dimensions to their manoeuvring space and make them capable to benefit from alternative income sources. As can be observed these systems are very diverse and include:

- *Communication* devices like telephones that enable people to develop and maintain social networks, make business transaction and build productive livelihoods, while televisions and radios enlarge the flow of potentially useful information into the community.
- *Roads* that greatly facilitate the emergence of a business sector. Infrastructure is seen as fundamental for further development as it opens possibilities to connect and trade with particularly Kathmandu valley. While the valley road is in place for several years, hill roads are constructed at present and give way to small businesses uphill as well.
- *Credit* allows households to be more resilient by engaging in new income generating activities both inside and outside the agricultural sector. While credit is mainly used for improved agricultural input in hill communities, in valley settlements it is also used for business purposes. While numerous households use credit services, few of them have taken insurance. Being something new, it is difficult to convince households of its benefits.
- Money earned with new income sources, is frequently invested in *education*, which can be seen as one of the new needs that farmers regard fundamental to have success. The number of household members that has obtained a School Leaving Certificate is indicated to have grown in many communities. The education status of particularly the traditionally marginalised and isolated communities is however worrisome.

Gateway systems greatly contribute to livelihood diversification and transform geographically limited communities into settlements where livelihoods are translocal and no longer strongly interdependent. Migration has become one of the most effective livelihood diversification mechanisms to cope with the adverse effects of population growth and water-induced stress and hazards. Translocal livelihoods have reduced household vulnerability by bridging the dry season gap and cope with increasingly uncertain yields. The fact that remittances are mainly used for food expenses means that they fulfil a basic necessity in most communities.

The role of institutions

A research gap exists on how institutions influence autonomous and planned adaption and the factors that foster and inhibit the autonomous adaptation of rural communities and what are the main challenges or gaps that prevent institutions from delivering more resilience. Salient features are the types of institutions present in the communities, the services and interventions they provide, and whether these activities find resonance with community needs. It is also important to observe whether these interventions are in harmony with each other.

It is crucial that institutions function as a platform for communities to alter their livelihood strategies autonomously. Most fundamental for traditional livelihood strategies are natural resource user groups that manage forest and water resources. However, a widespread lack of capacity and knowledge is observed in these groups. CFUGs are observed to fall short on measures that can prevent forest encroachment but at least they are formal. Most water user groups have collapsed, with the exception of the irrigation user group in Thadokol. Many water tanks and supply systems have been constructed that divert water from relatively far-away sources. This has prevented that in most communities situations of water shortage have

emerged in the face of changing rainfall patterns. Nevertheless, the water supply schemes are not necessarily sustainable when other techniques, like water source conservation measures and rainwater harvesting is not applied simultaneously. However, due to their presence many community members do not perceive that sources are drying in alarming rates, and indicate to be only willing to invest and manage their natural resource base when there is a direct threat of deterioration. Hence, due to a lacking feeling of urgency, user groups soon disintegrate after external actors hand over maintenance responsibility. Natural resource management institutions of any importance are district line agencies, central government institutions and the donor community, that mostly have very isolated interventions in disaster risk reduction or watershed management with the same work modality of establishing user groups, bringing infrastructure or 'awareness', and then handing over the project to the community.

Next to institutions that focus on improving the balance of the social-ecological system, either by managing natural resources or reducing the adverse effects of water-induced hazards, many other institutions exist that contribute to a wider *manoeuvring space* of rural households and that address the vulnerability of specific groups. Most importantly, these institutions are cooperatives that were established particularly in the last decade. They offer a great potential for income diversification and equity. Their programmes are diverse and encompass dairy production, saving and credit, insurance, agricultural input provision, and income generation trainings. Special cooperatives have been established that exclusively focus on women and marginalised groups with the aim to overcome traditional social barriers with economic empowerment and awareness creation. Their success however depends greatly on the social cohesion in a community and the ability of households to see the benefits of the cooperative.

NGOs are the primary actors that conduct trainings on new farming and water management techniques and that focus on institutional development, mostly of cooperatives. NGOs can be seen as the innovators that have most linkages across scales. In the governmental sphere, the VDC mainly focuses on the provision of roads and education, while water supply and marginalised group support are lagging behind. Road construction is indicated multiple times to be the primary fund receiver, since it is a priority demand of the communities.

Various governance challenges can be observed that prevent public financial resources to reach the communities or sectors that need it most, while others that are no priority receive funding based on their social network. Incomplete plan and policy implementation is not uncommon at the central level, budget allocation for agriculture and irrigation is decreasing and clear guidelines about the mandate of institutions is lacking. These governance challenges form possibly the greatest obstacle for effective local adaptation.

Resilience gaps: persistence of relationships with institutions

This study has shown that the institutions that operate in the Indrawati river basin are many in number and diversity. This institutional diversity can be beneficial but represents a challenge as well. Cooperative diversity is often mentioned to be beneficial for rural households, since it creates incentives for cooperatives to deliver better services and minimises the risk of elite-capture. For natural resource management institutions however, diversity is a challenge. At present, there are separate agencies that take care of irrigation, drinking water, sand mining, and watershed management. Lacking coordination is giving rise to controversial situations in which scarce resources are not treated as such. While great institutional progress has been made in the last decade to widen the economic *manoeuvring space* of rural communities, particular resilience gaps can be identified in the natural resource management sector. The absence of land use planning and integrated management practices as well as the emphasis on resource extraction rather than conservation increases pressure on the natural resource base.

Little resource management capacity and memory exists at the local level, since the isolated nature of resource management causes user groups to collapse once projects are conducted. There is a worrisome absence of institutional stability and continuity. Natural disturbances like drought, flooding, landslides and the subsequent degradation of ecosystem services can however create momentum to revise the nature of institutional structures through *adaptive cycles*. Opportunities for innovation, new ideas and different ways of doing and thinking can emerge after severe disturbance since a system, in order to be resilient, is then forced to encompass the willingness to learn, experiment and embrace locally develop rules.

NAPAs form the primary instrument to mainstream adaptation into the national development agenda in the global South and contribute to poverty reduction and community resilience. With the Nepalese NAPA in place, both government and non-governmental institutions are enabled to work jointly in a set of clearly defined priorities. Nevertheless, the NAPA misses the opportunity to highlight the value of local institutions for water sector adaptation and continues a tradition of isolated interventions with a short-term working modality of forming user groups, constructing infrastructure and conducting awareness activities that is followed by government agencies and NGOs. The fact that the GoN engages in many new adaptation initiatives, like the NAPA, PPCR and Climate Change Policy, without touching on the nature of less-than-optimal institutional structures raises questions.

In the global climate change discourse, the Integrated Water Resource Management (IWRM) approach is increasingly recognised as a very adequate water sector adaptation measure. The fact that climate impacts are mostly water-induced makes the creation of integrated water sector institutions key to build local capacity. The vision of Integrated Resource Management Committees (IRMC) at the micro-catchment level has yet been established in the GoN's 2005 National Water Plan. This vision mandates that all natural resource management institutions have to implement their interventions through the IRMC, in which all NRUGs of the same micro-catchment are united. At present, natural resource management institutions operate in isolation from each other and the local reality, with little attention for the continuity of service delivery after implementation has occurred. The IRMC needs to provide the institutional memory and capacity to integrate different natural resource-related sectors at the local level to further the need of land use planning and zoning for natural resource conservation.

To enforce this institutional structure, the NWP needs to be backed by legislation. Little political willingness seems to exist to do so on the short-term, since a Water Resources Act requires a fundamental change in the mandate of numerous central government institutions that now treat water resources with a sectoral perspective. This unwillingness to change the *status quo* at the central level stands in sharp contrast with the idea that policy-planning needs to be seen as a set of experiments, designed to build and sustain resilience. Planned adaptation efforts especially need to address the barriers that inhibit institutions from incorporating new ways of doing and thinking when situations of increasing pressure on social systems demand for institutional innovation. Nevertheless, the improvement of *institutional structures* for integrated resource management will result in better adaptation measures in comparison with the implementation of any other climate change adaptation *project*.

Efforts have been made to analyse the role of institutions, their services and interventions in facilitating local adaptation. It has been observed that the study of the institutional aspects of adaptation is messy by times since numerous types of institutions contribute to shape the *manoeuvring space* of rural communities. Since the chance that rural communities have to deal with higher levels of social-ecological imbalance is likely to increase, an institutional analysis is essential to measure the adaptive capacity with which society is endowed.

Remark added in print: variability within communities

The main focus of this research has been to identify factors that determine the resilience of *entire* communities to situations of too little and too much water, and particularly on the institutions that offer a platform for communities to autonomously adapt. However, it has been observed that not only between but also within communities, capacity differences exist, which are largely determined by the capital assets to which households have access and the traditional barriers they have to cope with. A few underlying factors are caste, land size, and social capital. However, to analyse the relevance and extent of intra-community differences has gone beyond the scope of this research.

Nevertheless, a general trend is suggested that particularly agricultural practices of collective action are losing importance, as community members are becoming less willing to contribute their free work labour for management of productive infrastructure. It has been emphasised by various community members that households are more individualistic. Since these households increasingly apply livelihood strategies that primarily benefit themselves, rather than the community as a whole, resilience differences between households become more pronounced. Future research therefore needs to focus on whether these increasing differences influence the resilience of *entire* communities in a positive or negative way. In this respect it can be speculated that households that build the strongest livelihoods may either function as a informal social safety net for less fortunate households, or they may leave the community for further improvement of their income opportunities, in a context of increasingly translocal livelihoods. To allow a reliable answer to this question, a larger sample size is required.

10. CONCLUSION

Exacerbating climate variability, land use change and population growth are among the major challenges of the twenty-first century that will make the fulfilment of basic human needs increasingly problematic. The distribution of water, being a source of basic services but also of hazards, is likely to become increasingly skewed in the forthcoming years, resulting in situations of a too much and too little of water. In mountain communities, livelihoods are characterised by a strong link with the natural resource base. It can be concluded from this present study that exacerbating climate variability has made livelihoods that are based on the agricultural cycle already increasingly uncertain. Growing impacts of water-induced stress and hazards on mountain communities in the global South make the design of an analytical framework for community resilience urgently required.

The main question of this study is: **What are the factors that determine the resilience of rural communities to water-induced stress and hazards?** Community resilience essentially depends on the management of ecosystem services and access to gateway systems like infrastructure, finance, and knowledge generation, which largely shape the alternative income options apart from the subsistence livelihood. Access to these services and systems is fundamental to sustain or widen the *manoeuvring space* of households. Various institutions, such as NRUGs, NGOs, cooperatives and government agencies facilitate access to one or more of these systems through their services and interventions. While one single institution is limited in its activities, it is the diversity of institutions and interventions that shape the institutional kaleidoscope that facilitates autonomous livelihood strategies.

From an inventory of interviews with institutions and community members it became clear that the most important natural resource management interventions found to contribute to community resilience are the provision of physical infrastructure like drinking water supply schemes and irrigation canals to adapt to drought, and gabion walls and reforestation to deal with landslides and flooding. District line agencies, central government institutions and the donor community have a central role in delivering these interventions. Outside the natural resource management sector, cooperatives greatly facilitate access to financial services, improved agricultural input provision, income generation trainings and empowerment projects for marginalised groups, while VDCs and DDCs are instrumental in providing roads and education facilities. These institutions, in combination with economic development in nearby Kathmandu valley have widened the possibilities of households to diversify their income sources. Household-based livelihood strategies as seasonal migration have become prominent to bridge the driest months of the year and cope in years of dwindling yields. The remittances that are earned during this period are mainly used for food purchase, thereby fulfilling a key household necessity. Nevertheless, agriculture still is the main livelihood component in all communities and it is thus vital to ensure the integrity of ecosystem services on the long-term.

A question of relevance is which type of institutions are most salient to facilitate resilience of communities. From this research it can be concluded that the answer to this question is different for each community, depending on various factors such as the local institutional constellation, the predominance of affiliated households and the nature of the various livelihood strategies in the community. A few examples can be named. With regard to natural resource management institutions, it can be argued that the communities that are endowed with most land and water resources are likely to benefit most from irrigation and gabion wall construction investments, as is the case in Thadokol, while communities with little access to water resources will not benefit from these investments made, as can be seen in Devasthan. This creates situations in which previously better positioned communities receive institutional support in a disproportional way in comparison with communities where the investment of

financial resources seems to have less potential to widen the *manoeuvring space*. However, a number of institutions are observed that make special efforts to include marginalised groups in their service delivery. Being part of the poorest segments of society can therefore mean particular attention of institutions, as is the case for women in low-caste Arubote. Although for specific communities only some institutions may seem relevant, it can be concluded that with the entire river basin as a unit of analysis, it is the diversity of institutions that is of importance to facilitate community resilience.

Various institutional challenges inhibit expanding the *manoeuvring space* of rural livelihoods to water-induced stress and hazards. A fundamental problem deals with the sectoral approach and short-term implementation modality of natural resource management institutions. While pressure on water resources increases, a severe coordination gap exists between natural resource institutions. This resilience gap finds its origin in the current setup of central and district institutions. The adaptation discourse in Nepal urgently needs to foster a paradigm shift from a sectoral to an integrated IWRM approach. Attention needs to be paid to the development of IWRM legislation that supports the NWP, instead of focusing on new adaptation initiatives that leave the problem of current institutional structures untouched. The establishment of IRMCs at the micro-catchment level can ensure institutional stability and continuity and foster land use planning. A strategy to change the mandate of government agencies and the work modality with which institutions conduct their interventions is advised.

11. PERSPECTIVE

“This autonomous and planned adaptation is all academic. You have to be practical! It is all market, transportation, energy. For overall economic development, it all might come. But if there is water scarcity you have to directly hit that. If you have a specific problem, you need to target with specific interventions.”

Batu Krishna Upreti - Climate Change Division Chief, MoE

In continuation, a number of recommendations are summarised that aim to further the efforts in the field of climate change adaptation. Being a relatively new field of academic enquiry, much unclarity is still observed about how development institutions can best progress in making mountain communities resilient in the face of water-induced stress and hazards. This study has suggested that an adequate adaptation measure is not to focus on new adaptation *projects*, but to pay attention to the way in which society is organised as a major determinant of adaptive capacity. Hence, the nature of *institutional structures* requires special attention.

Possibly most pressing is the need to study what the *adaptation* concept really means on the ground and for policy frameworks. The statement by the Climate Change Division Chief of the Nepalese Ministry of Environment clearly shows the gap that exists between academia and practitioners. While the first tend to think in ways that are all encompassing, the latter try to boil the problem down to the most basic components. This field of tension is particularly problematic since Development Studies have the moral duty to be practical and action-based. Ways have thus to be found so that research supports policy formulation. While the majority of Development Studies scholars work in the field of socio-economic change, exacerbating climate variability demands a focus on the growing imbalances that exist in the social-ecological system.

It is urgently required to provide a critical analysis of the adaptation efforts made by governments in the global South that aim to ensure a continuous flow of ecosystem services for the wellbeing of rural communities. In the global climate change debate, much attention is placed on water conservation and land use planning for better management of the natural resource base. In this perspective, there is a need to focus on the role of institutions as facilitators of social-ecological resilience. A major finding in the Nepalese case study is that mainly institutional challenges prevent adaptation from being truly relevant. Institutional innovation for integrated resource management is greatly lagging behind while the pressure on natural resources is mounting. More emphasis is thus needed to solve the challenges that prevent institutions from realising resilience.

This research has focused on identifying the factors that determine community resilience. Upon identification of all relevant factors, additional questions can then be asked. A number of these are: whether it is possible to determine when communities reach a ‘sufficient’ degree of resilience, how institutional structures need to look like to achieve maximal resilience in a context of constraint financial inputs, and identification of the social-ecological limits within which interventions can still have a positive impact. Furthermore, it is increasingly important to focus on the extent to which adaptation measures and new economic activities contribute to increased pressure on ecosystems. In the case study it was observed that the application of chemical fertiliser has greatly acidified the soil and dairy production has increased the need for forest products. Adaptation measures that stand loose from ensuring ecosystem service integrity and focus on extraction rather than conservation are not likely to be sustainable in the long run. These are just a few of the relevant questions that need to be addressed in future research efforts.

Lastly, since the underlying factors of resilience to water-induced stress and hazards are manifold, a system approach is the most adequate perspective to understand the complexity of a river basin. In this project, an attempt has been made to make the research question feasible by placing special focus on the role of institutions. Nevertheless, more efforts are also needed to fully grasp the way in which households create resilient livelihoods. Points of attention are a focus on the *thresholds* that need to be passed before a household changes livelihood practices, and which prerequisites the communities perceive to be needed to engage in new form of doing. A better understanding of the thresholds for livelihood transformation has the potential to improve institutional response.

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APPENDIX 1. LIST OF INTERVIEWED PERSONS

National level institutions

Organisation	Name	Function
Asian Development Bank	Pokharel, A.	Climate Change Consultant
DANIDA	Paudyal, S.S.	Climate Change Coordinator
DFID	Thapa, S.	Climate Change and Natural Resources Adviser
GoN – DoI	Timilsina, U.	Depute Director General
GoN – DoMH	Pokharel, B.K.	Hydrologist Engineer
GoN – DSCWM	Khanal, K.P.	REDD Forestry and Climate Change Cell
GoN – DSCWM	Paudel, P.P.	Soil Conservation Officer
GoN – DWIDP	Gajurel, A.K.	River Training Project Coordinator
GoN – DWIDP	Pokhrel, A.P.	Independent Consultant
GoN – MoAC	Dahal, H.	Joint Secretary
GoN – MoE	Karki, G.	NAPA Technical Officer
GoN – MoE	Uprety, B.K.	Depute Director Climate Change Division
GoN – MoHA	Mishra, S.	Disaster Risk Reduction Coordinator
GoN – MoLD	Singh, B.P.	Under-Secretary Environment Unit
ICIMOD	Nepanupudi, H.K.	Disaster Risk Reduction Coordinator
ISET–Nepal	Dixit, A.	Director
IWMI	Shrestha, A.	Director
Nepal Engineering College	Sharma, K.R.	Director
Nepal Red Cross Society	Acharya, P.	Community-based Disaster Risk Prevention
Oxfam–GB Nepal	Singh, P.M.	Climate Change Coordinator
Practical Action Nepal	Bhandari, D.	Climate Change Coordinator
UNDP	Khasi, D.	RCRRP Coordinator
UNDP	Lamichhane, A.	NAPA Responsible
WECS	Rajkarnikar, G.	Senior Division Engineer
World Wildlife Fund	Dongol, Bhawani	Fresh Water Programme Coordinator
World Wildlife Fund	Shrestha, M.	Climate Change Coordinator
World Wildlife Fund	Sherchan, R.	Sacred Himalayan Landscape Coordinator

Sindhupalchowk district level institutions

Organisation	Name	Function
GoN – CIDDO 7	Aryal, R.B.	CIDDO Chief
GoN – DDC	Karki, V.	District Development Officer
GoN – DFO	Pokharel,	District Forest Officer
GoN – DSCO	Shrestha, N.	District Soil Conservation Officer
GoN – DWSSO	Adhikarki, J.	District Water Supply & Sanitation Officer
GoN – DWRC	Sapkota, G.	Assistant District Administrator
GoN – DWRC	Upreti, P.P.	Local Development Officer
GoN – WECS	Saha, P.	Manager Indrawati Sub-basin Project
NRCS Sindhupalchowk chapter	Kamal,	Manager
World Wildlife Fund	Rai, H.C.	Co-manager Indrawati Sub-basin Project

Indrawati river basin institutions

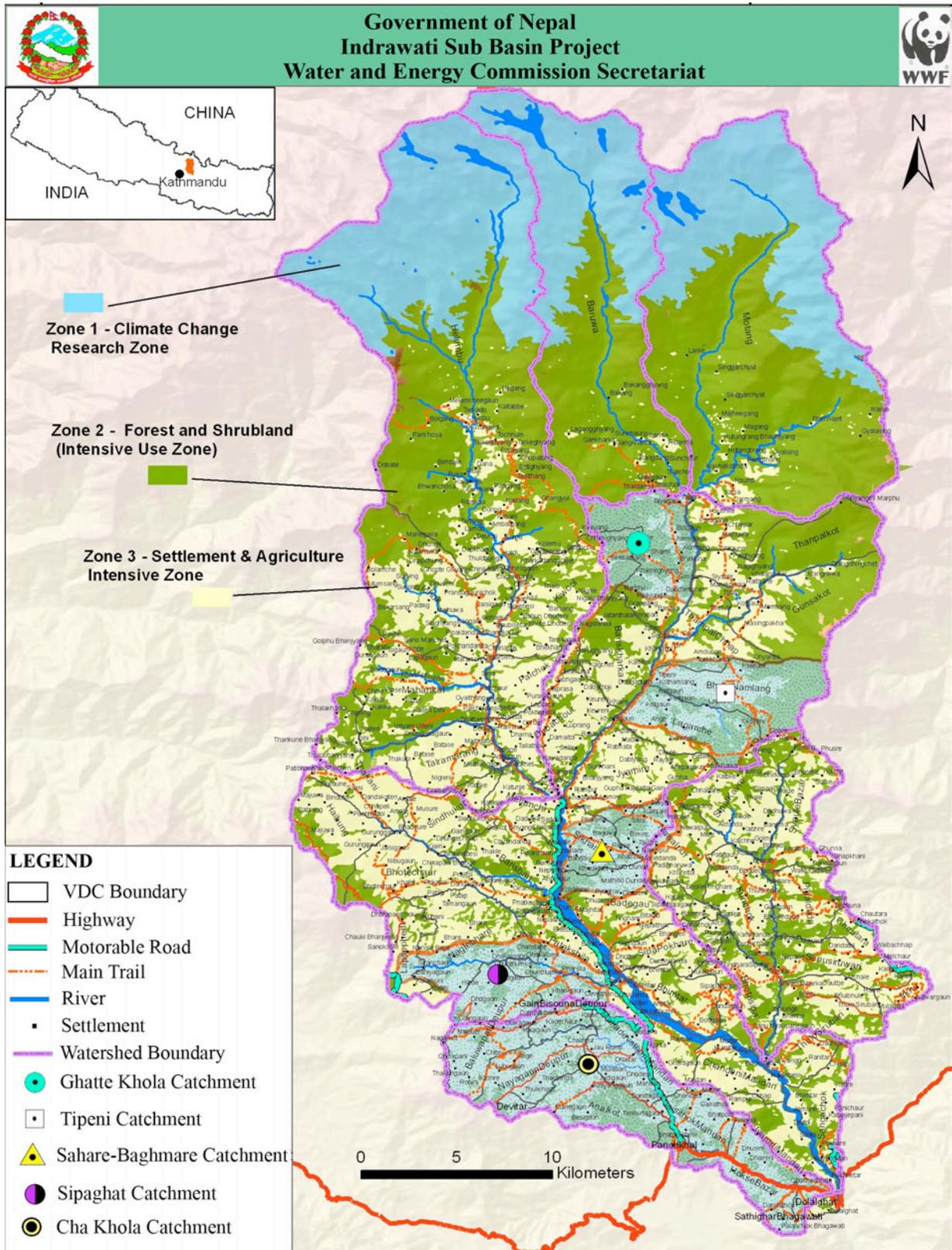
Organisation	Name	Locality
Acharyatol (ex) Water User Group	Acharya, B.K.	Acharyatol
Bagmara Chapleti CFUG	Baln, S.	Shikhapur
Bothe Namlang VDC	Jyoti, B.L.	Tipeni
Chandevi Mahila Samuha	Danuwar, S.	Tipeni
CDECF	Acharya, K.	Thadokol
Deupur VDC	Magar, G.	Gairibisauna
Friends of Sankhu	Shakya, N.	Thadokol

Hariyali CFUG	Satyal, H.R.	Tipeni
Hinuwapati Saving & Credit Cooperative	Sapkota, M.	Thadokol
Kotachhaur Dairy Production Saving Society Ltd.	Acharya, D.P.	Acharyatol
Lagarchhe Bahudeshya Saving & Credit Cooperative	Dhital, P.R.	Tipeni
Mahila Atmanerwata Kendra Nepal	Shrestha, S.	Melamchi
Mahila Matri Sisuu Kalyan Saving & Credit Cooperative	Sapkota, S.	Shikhapur
Manushi Mahila Cooperative	Neupane, N.	Tipeni
Namuna Mahila Saving & Credit Cooperative	Rijal, S.	Shikhapur
Rakse Chapleti CFUG	Lama, T.	Nawalpur
School-based Disaster Risk Prevention Programme	Bhattari, J.	Tipeni
Shikhapur VDC	Acharya, H.N.	Shikhapur
Shikhapur Balidyashya Saving & Credit Cooperative	Sapkota, B.S.	Shikhapur
Shree Gairibisauna Deupur Animal Insurance Cooperative	Acharya, D.	Gairibisauna
Shree Indrawati Saving & Credit Cooperative	-	Thadokol
Suvakamana Saving & Credit Cooperative	Shrestha, M.	Melamchi
Tipeni Bahudeshya Saving & Credit Cooperative	Dhital, R.M.	Lagarchhe
Utpidit Uthansan Cooperative Society	Gurung, B.	Tipeni

Communities (questionnaire)

Name	Community	Name	Community
Shankar Baniya	Devisthan	Ganesh Baniya	Devisthan
Shankar Damai	Devisthan	Shiva Damai	Devisthan
Shyam Bahadur Damai	Devisthan	Tilak Man Bajracharya	Devisthan
Raj Kumar Shrestha	Devisthan	Jeevan Lal	Devisthan
Shambu Baniya	Devisthan	Rada Shrestha	Devisthan
Salik Ram Shrestha	Devisthan	Gokul Damai	Devisthan
Narayan Shrestha	Devisthan	Bhudev Kalwar	Devisthan
Prem Kazi Poti	Thadokol	Mina Tamang	Thadokol
Maila Danuwar	Thadokol	Rabindra Bhattarai	Thadokol
Sita Ram Shrestha	Thadokol	Kailash Sunuwar	Thadokol
Dhana Bahadur	Thadokol	Ananda Vaidhya	Thadokol
Bhaktu Ram Shrestha	Thadokol	Dalak Bahadur Bhandari	Thadokol
Murari Prasad Sapkota	Thadokol	Ram Prasad Nepal	Thadokol
Narayan Prasad Bhattarai	Thadokol	Sano Kancha Danuwar	Thadokol
Gibrath Tiwari	Thadokol	Purna Prasad Bhattarai	Thadokol
Devi Prasad Acharya	Acharyatol	Ambika Prasad Acharya	Acharyatol
Daya Nath Acharya	Acharyatol	Chet Nath Acharya	Acharyatol
Om Prasad Acharya	Acharyatol	Bishnu Nepali	Acharyatol
Delli Prasad Acharya	Acharyatol	Sher Bahadur Nepali	Acharyatol
Keshav Acharya	Acharyatol	Binod Nepali	Acharyatol
Bishnu Acharya	Acharyatol	Krishna Bahadur Nepali	Acharyatol
Kedar Nath Acharya	Acharyatol	Jagat Bahadur Tamang	Acharyatol
Gopal Majhi	Arubote	Pukar Majhi	Arubote
Surya Bahadur Majhi	Arubote	Dhurba Majhi	Arubote
Som Bahadur Majhi	Arubote	Krishna Bahadur Majhi	Arubote
Jatan Bahadur Majhi	Arubote	Kanchi Majhi	Arubote
Thulo Babu Majhi	Arubote	Bhayen Bahadur Majhi	Arubote
Bhimsen Majhi	Arubote	Ratna Bahadur Majhi	Arubote
Kancha Majhi	Arubote	Subash Majhi	Arubote
Phurgerbu Sherpa	Okrani	Lagba Sherpa	Okrani
Phurbuti Sherpa	Okrani	Phurba Sherpa	Okrani
Mingbuti Sherpa	Okrani	Lamo Yangze Sherpa	Okrani
Padam Bahadur Lama	Okrani	Yangze Sherpa	Okrani
Dawa Sherpa	Okrani	Nimadiki Sherpa	Okrani
Kame Sherpa	Okrani	Pasang Lama Sherpa	Okrani
Sonam Lama	Okrani	Mingmar Sherpa	Okrani
Trilochan Bhattarai	Tipeni	Rajesh Himalaya	Tipeni
Tilak Bahadur Adhikarya	Tipeni	Bhramha Lal Shrestha	Tipeni
Mina Tamang	Tipeni	Tek Bahadur Karki	Tipeni
Ram Bahadur Danuwar	Tipeni	Bel Bahadur Shrestha	Tipeni
Mawaraj Shrestha	Tipeni	Bhakta Bharati	Tipeni
Purna Shrestha	Tipeni	Alok Kumar Sungtro	Tipeni
Bhaleta Bahadur Khatri	Tipeni	Tej Bahadur Kekshapati	Tipeni

APPENDIX 2. INDRAWATI SUB-BASIN PROJECT MAP



Source: WECS/WWF, 2011

APPENDIX 3. NEPAL'S POLITICAL SITUATION

Nepal's state of development is shaped by its rich and turbulent history. This section is an attempt to briefly summarise this history, to provide better understanding of the research context. Nepal has been an independent kingdom since 1768, being virtually isolated from outside influence throughout the 18th and 19th century (Riaz & Basu, 2007:125). However, the country was a *de facto* British protectorate between 1816 and 1923. Nepal's development history starts in 1950, when the country opens up to the world. By then, the literacy rate was 2 percent, infant mortality reached a staggering 300 per 1000 live births, and life expectancy was 35 years (Kernot, 2006:297). Nepalese rural communities lived in great isolation with only 400 kilometres of road in the whole kingdom, of which 5 kilometres were paved.

With the dawn of democracy, two major political parties emerged, the Nepali Congress Party, followed by the Communist Party of Nepal. The first economic development plan was issued in 1956 and focused on import substitution. The goal was to create employment and improve living standards, but this failed to benefit the rural population that constituted 86 per cent of the population (Sharma, 2006:554). The industrial sector based in the Kathmandu Valley could not provide enough jobs to meet the needs of the rural population. IS policy favoured urban-based, non-agricultural activities while the majority of the country's citizens had rural-based, agricultural livelihoods. In 1960, King Mahendra dissolved parliament and dismissed the cabinet with the argument that a multiparty system could not solve Nepal's political and socio-economic problems (Sharma, 2006:560). From that moment, the country was ruled by the single-party *Panchayat System* in which the King kept all executive power. This arrangement functioned with the help of local councils and representatives who ruled the various districts under the supervision of the palace (Kernot, 2006:297).

By the mid-1970s, Nepal had developed a considerable IS industry behind a tariff wall, while there were only few export-oriented industries (Sharma, 2006:554). Primary products dominated exports and were heavily taxed by the public-owned Nepal Food Corporation to raise revenue and provide the urban population with food. The extraction of rural resources led a considerable decline in agricultural productivity and capital input, increasing the rural-urban inequality considerably. The government first placed high priority on poverty reduction and the rural-urban bias in its Fifth Development Plan (1975-1980). However, with half-hearted measures that failed to address the urban-rural bias, and in combination with a lack of political accountability this plan failed to make any impact (Sharma, 2006:559).

To improve governance Nepal passed the Decentralisation Act in 1982, but in practice most development programmes remained decentrally managed (Baral & Heinen, 2007:521). In 1986 the State again tried to address the rural-urban bias by means of implementing Structural Adjustment Programmes (SAP) under IMF and World Bank pressure. The SAP included measures to address the deteriorating fiscal operation of the government and a wide range of reforms in trade, investment, agriculture, and the finance sector. Unequal growth patterns contributed to high poverty and inequality in the country. Between 1985/1986 and 1995/1996, the non-agricultural sector grew about 7 percent a year, while the agricultural sector only increased by 3 per cent a year as against a population growth of 2.2 percent a year (Sharma, 2006:558). The real income of two-third of the population that depended on agriculture thus did not grow and the percentage of the population below the poverty line rose from 33 percent in 1976/1977 to 42 percent by 1995/1996 with poverty being much severe in the rural areas. During times that more investment in agriculture was needed, this actually stagnated due to the SAP pressures to cut the budget deficit.

In 1990, the *Panchayat System* was abolished after a series of challenges the monarchy had to cope with throughout the 1970s and 1980s (Riaz & Basu, 2007:136). With the new 1991 Constitution multi-party democracy was reinstalled and Nepal became a constitutional monarchy (Lawoti, 2008:366). This democratisation also resulted in the institutionalization of corruption, with political leaders cultivating a culture of impunity and lack of accountability. Even though the Constitution acknowledged Nepal is multi-ethnic and multi-lingual, it created a highly centralised government, and maintained earlier policies that had declared Hinduism the official religion, integrated Hindu

values into governance structures and that had made Nepali the sole official language. The Hinduisation of culture had happened to the great disadvantage for those that fell outside the caste system or born in lower castes and CHHE dominance remained after the abolishment of the *Panchayat System*. Although not in practice, the Constitution envisaged the people of Nepal as a collectivity and identity on the basis of religion, caste or language was banned.

The time period of 1990-2002 is described as 'exclusionary democratisation'. The nature of the post-1990 state was not different from the state under tight control of the Monarchy. Nepal remained a patrimonial State that represented only a small segment of society, being disembedded from the majority of society (Riaz & Basu, 2007:124). However, during this time an explosion in identity and women's rights activism took place as well. Excluded groups mobilised, the media witnessed a boom and civil society broadened. Nepalese society experienced a surge in awareness about inequality and discrimination. In 2000, demands to the State and dominant society were made by the more than fifty native language groups to address the linguistic discrimination (Lawoti, 2008:367). While the new democratic era brought limited changes to economic and social systems, it added new claimants to the limited resources of the state, contributing to the further deprivation of the already marginalised (Riaz & Basu, 2007:137). Political representation did not increase and demands for social justice only received minimal recognition. This political exclusion contributed considerably to the erosion of representative democracy and resulted in a governance crisis and fertile ground for social unrest.

Twelve governments were formed in twelve years, and social groups and political parties organised frequent strikes that were often implemented with coercion. In this chaotic political landscape the Maoist movement emerged with the intention to put an end to injustice, social inequity and foreign domination (Kernot, 2006:299). The Maoist forty-point manifesto included the end of corruption, as well as racial, gender and caste discrimination, and demanded land reform, drinking water, roads and electricity for all villages (Sharma, 2006:565). It also includes the right to self-determination, cultural autonomy, federalism and a secular state (Lawoti, 2008:372). Participation of indigenous nationalities, 'untouchables' and women in Maoist forces has been significant since its start in 1996. The ten years of armed conflict produced a culture of violence that was characterised by massacres, disappearances, displacements, school closures, forced conscription of children, extortion, bombings and other acts of extreme violence. The Maoists' reign of terror, in the end, did little to support their stated goals (Kernot, 2006:299). More than 13,300 people had been killed by 2006 and more than 50,000 people were displaced (UNDP, 2009:22).

The royal palace killings, with the double murder of the then King and crown prince in 2001 made the crisis complete (Raiz & Basu, 2007:124), leaving the way open for the unpopular Prince Gyanendra, who is widely believed to be responsible for the death of his brother and nephew (Kernot, 2006:297). By 2005, law and order severely deteriorated and frequent strikes called by Maoist disrupted public life throughout the country. The already fragile social services and infrastructure further deteriorated with the eruption of violence. Against this background, the King assumed absolute power and put several political leaders under house arrest, declaring the state of emergency (Sharma, 2006:561). Subsequently, a high number of marginalised group members found space in the royal cabinets, including several leaders of ethnic parties. The King's absolute rule lasted for a year after which parliament was reinstated following severe protests. In November 2005, the Maoist rebels and seven political parties agreed on a programme aimed at restoring democracy. One year later, the government and Maoists signed the Comprehensive Peace Accord, declaring a formal end to ten years of rebel insurgency (UNDP, 2009:14). At the start of 2007, Maoist leaders were elected to parliament and joined the interim government, thereby moving into the political mainstream. In April 2008, a Constituent Assembly election was held which met one month later, formally abolishing the monarchy and proclaiming Nepal a republic. In the same year, a government under Maoist leadership was formed and the process to form a new Constitution started by the end of 2008. Till today, this process has not been concluded, placing severe constraints on government effectiveness.