

Part 1

# Synthesis



# Local Responses to Too Much and Too Little Water – Synthesis

## Introduction

The greater Himalayan region spans from the Pamir, Hindu Kush, and Karakoram ranges in the west, along the main Himalayan range in the centre, to the Hengduan Shan and other ranges in the east. The region is a vast area with many different climatic and geographical environments.

The region has always had either too much or too little water. Water availability has always been markedly seasonal, varying greatly over short distances whether located in the south Asian monsoon regime areas in the central and eastern Himalayas or in the climate regimes dominated by winter precipitation from the north-westerlies in the Pamir, Hindu Kush, and Karakoram.

For example, about 80% of the precipitation in Nepal falls within four months of the year; and much of this falls during a few extremely intense rainfall events. The result is too much water during a very short time period, making it very difficult for both humans and plants to benefit from it. Most of it flows quickly through the watersheds and basins of the high mountains and middle hills, causing floods and havoc without much replenishment of groundwater and other natural reservoirs. During the rest of the year, the population struggles to support household needs, agriculture, and industrial demands with too little water.

Since these natural climatic regimes and environments date back to geological time scales, people living in this region have, of necessity, adapted their livelihoods and agricultural and cultural practices to these situations. The seasonal changes in climate and subsequent water availability determine the calendar for sowing and harvesting; other livelihood activities, such as herding, brick making, trade, or house construction; and the cultural calendar for religious and other festivities.

The region and the world at large, however, are currently experiencing a range of changes. Growing

populations are putting ever-increasing constraints on available resources, including water. As livelihood options dwindle, seasonal and permanent migrations are increasing in order to seek new and more prosperous opportunities. The price of food and other commodities at local levels is affected by improved infrastructure, and globalisation and regionalisation of markets. Political turmoil influences all of the above.

The current, and much debated, changes and variability in climate overlay this wide range of drivers. These subsequent changes are exacerbating the already constrained access to water in a sustainable and equitable way. Climate change will have an impact on the hydrological cycle in its entirety, starting with a reduction in snow cover and glaciers and, gradually, availability of water downstream (Eriksson et al. 2009).

The predicted – and to some extent extant – changes in rainfall patterns might be even more important as the frequency and magnitude of high intensity rainfall events increase and dry geographical areas and dry periods become even drier. Monsoon patterns might shift, thereby increasing the uncertainty about when rains will commence and diminish. Climate change will bring increased uncertainty to water availability in time and space. The changes are hardly new, but challenges arise from the rate at which they are occurring, in combination with pressure on land, water, and other resources from a constantly growing population, particularly in the greater Himalayan region. These challenges are pressing the same population to respond and adapt to the changes at a more rapid pace and in more innovative ways than before.

This report presents people's efforts to respond, cope, and adapt to the current rapid changes, focusing in particular on the impact of climate-induced changes on water availability, which overlays other drivers of change.

Over the last couple of years, the global climate change debate has made a noteworthy shift from

focussing on mitigation of greenhouse gas emissions to increasing awareness of the importance of adaptation to unfavourable impacts from changes in climate and its variability (Schipper and Burton 2009). Simultaneously, numerous studies contributed to building awareness that the least developed countries will suffer the most negative impacts from climate change. These countries have contributed the least to global warming and at the same time are most vulnerable because they have not yet benefited from industrialised development.

In the context of impact from ongoing and future climate change, it is increasingly important to understand the broad spectrum of adaptation. Historically, most work on climate adaptation has taken a global, large-scale, or sector-based perspective. There is a gap in research on local adaptation processes, and the factors enabling or constraining them (ISET 2008) and a need for studies based on evidence of local adaptation practices.

The present study was designed to contribute to filling this research gap. The aim was to document and assess the strategies that mountain people use to cope with and adapt to variations in available water resources induced by climate change. The results were based on the findings from five case studies undertaken in four countries in the greater Himalayan region (China, India, Nepal, and Pakistan). The case studies identified and documented local responses to flood hazards and water stress as part of the projects 'Too much water, too little water – adaptation strategies to climate-induced water stress and hazards in the greater Himalayan region' and 'Himalayan climate change impact and adaptation assessment'.

Water served as an entry point to assess local adaptation strategies to (climate) change. These are often responses to a combination of stresses or changes – environmental, physical, economic, social, technological, institutional, and political – and rarely made in response to climate stresses alone. However, the economic and social effects or implications of climate stress are often fundamental in triggering adaptive responses. Therefore addressing the impacts of water stress and hazard alone is not enough. Wherever relevant, non-climatic stresses have been considered in order to understand the responses to stresses and hazards related to water.

This report presents the main findings from the case studies in Part 2 in five separate chapters. The full reports of the field teams are provided on a CD in the back of the book.

## Approach and Methodology

Field documentation and assessments were carried out over a period of one year in five case study areas in China, India, Nepal, and Pakistan on how people respond to water stress and hazards in the context of climate variability and change. The five case study sites span the Hindu Kush-Himalayas from west to east, covering a variety of geographical and climatic situations. Two studies in the Koshi basin provided an upstream-downstream context in Nepal and India.

ICIMOD held national consultation meetings and then selected the following partners for the field studies based on criteria such as their previous experience in adaptation research, long-term experience working with communities, and potential as long-term strategic partners:

- the **Aga Khan Rural Support Programme (AKRSP)** worked in Chitral district in the North West Frontier Province in Pakistan;
- the **Institute for Social and Environment Transition in Nepal (ISET-Nepal)** worked in the middle hills of the Koshi basin in Nepal;
- **Winrock International** worked in the Koshi basin and flood plains of Bihar in India;
- the non-government organisation **Aaranyak** worked in the floodplains of the Brahmaputra in the state of Assam in northeast India; and
- **Kunming Institute of Botany (KIB)** collaborated with the **International Agroforestry Centre (ICRAF)** to work in the Salween and Mekong river basins in Yunnan province, China.

The field teams were supported by a resource group which included members from ICIMOD, Stockholm Environment Institute (SEI, Bangkok), IIED (International Institute for Environment and Development, UK), United Nations Environment Programme (UNEP), and the Institute for Social and Environmental Transition (ISET). Two regional workshops were organised for the field teams to discuss and agree on a common research design and to review their progress and outputs. Resource persons provided strategic assistance via critical reviews of draft case studies.

The field teams were asked to focus the discussion on the impacts of past and current water stresses and hazards (versus 'impacts of climate change' *per se*) when in the field. They investigated the following questions at selected sites.

- How are people affected by water stress and hazards?
- What are the local short- and long-term responses?
- To what extent can these strategies reduce vulnerability to water stress and hazards in the context of climate change?

The field-work teams used the same general, common approach for data collection (Figure 1) which included the following key components:

- A literature review on the topic of community adaptation to environmental stress so that teams could build on knowledge already gathered
- Selection of study sites based on selected criteria and covering different types of water stresses and hazards
- Field data collection using participatory and rapid rural appraisal. All teams used semi-structured interviews and focus groups, transect walks, direct

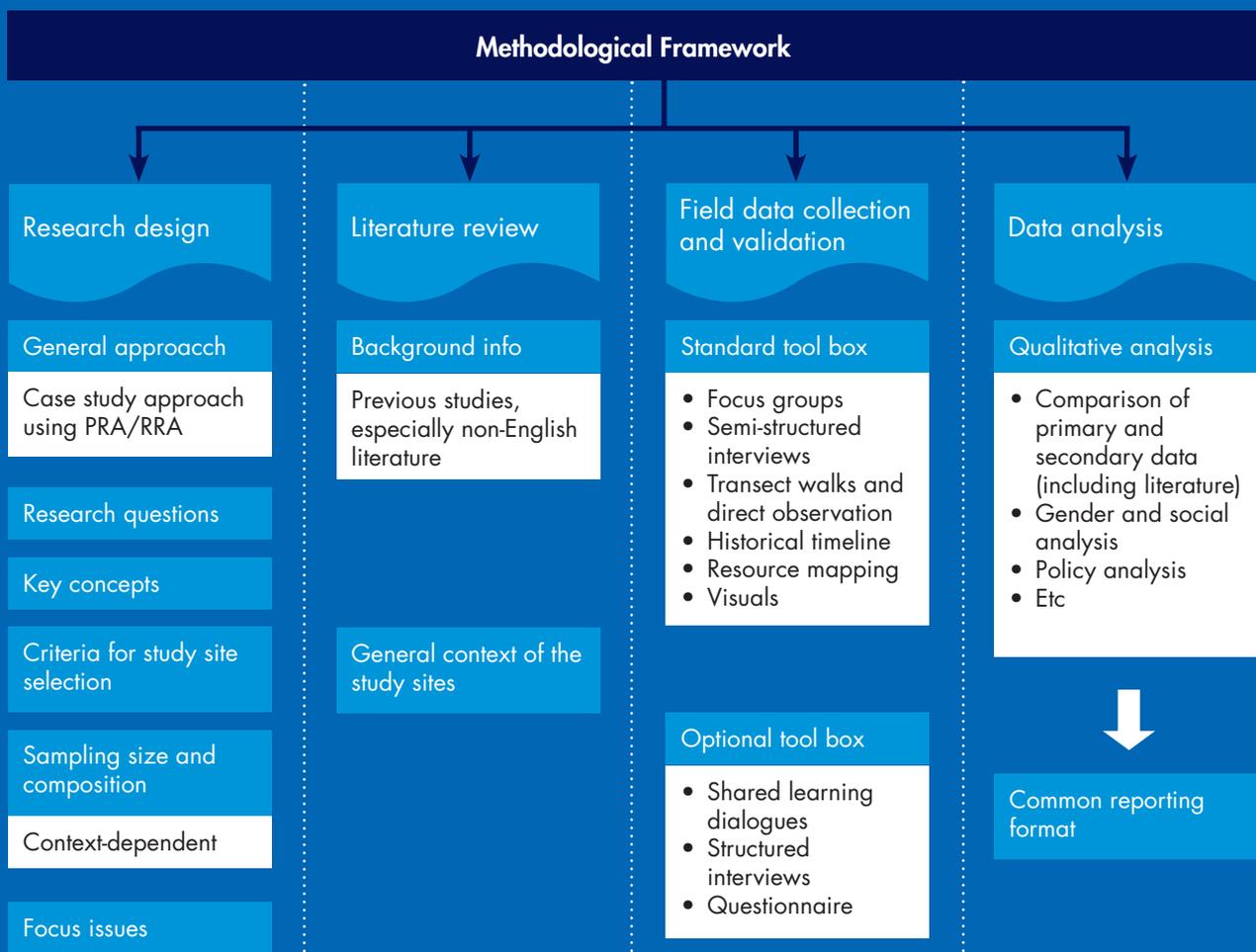
observation, historical timelines, resource mapping, and visuals (photos and videos). Other tools for data collection were used depending on the context and needs.

- A common reporting format focusing on impacts, responses, and factors influencing adaptation strategies served as a guideline for data collection.

The nature of the assessment was mainly qualitative (i.e., people's perceptions and narratives). The qualitative information was complemented by quantitative data whenever possible. People and key stakeholders provided information about the effectiveness and success of the adaptation strategies through focus group discussions.

The assessment also focused on identifying the political, cultural, and socioeconomic factors that hinder or promote the adoption of sustainable and equitable adaptation strategies at the selected sites. Thus, the field teams also considered several salient issues in relation

Figure 1: Methodological framework



to adaptation to water stresses and hazards in order to compare the case studies, including the role of poverty, indigenous knowledge, risk trade-offs, and social networks.

The teams worked with policy consultants who conducted a parallel inventory of existing policies and their impact (or lack of impact) on adaptation strategies in the selected cases. A guideline developed in consultation with the policy study consultants provided a common framework and methodology for all the studies.

The four objectives of the policy studies were to:

- Identify policies relevant to adaptation to water stresses and hazards in the selected sites and for those selected policies;
- Explore the objectives of policy making relevant to adaptation;
- Analyse the factors and processes that affect policy implementation; and
- Assess the extent to which policy implementation affects the ability of different groups of people to adapt effectively to water-related stress and hazards in the context of climate change.

The key preliminary findings on the linkages between planned adaptation (state) and autonomous adaptation (people) are included in this synthesis report.

A 'writeshop' was organised in 2009 for the country teams, policy teams, and resource group to jointly develop a draft synthesis report which provided the base for the current document.

## Conceptual Framework

### From coping to adapting: Responding to 'too much' and 'too little' water

In order to suggest possibilities for adapting to changes in water availability and hazards, it is important first to understand how people avoid the negative impacts of 'too much' or 'too little' water in present practice. Therefore, the conceptual thinking of this study considered the relationship between development processes, ways to cope with daily risk, and adaptations to climate change. This section describes this conceptual framework and clarifies the main assumptions of the study.

The study drew on several different conceptual frameworks that have been developed to make rural

livelihoods more resilient to change. At its heart, the study assumes that people's livelihood strategies already include intentions and actions to ward off risk wherever possible. These actions, however, are often insufficient to manage the additional difficulties posed by extreme events, major changes, and variability in climate.

People in mountain environments and downstream areas are commonly confronted with too much water (riverine floods, flash floods, waterlogging) or too little water (droughts and water stress). They deal with these hazards through approaches ranging from accepting losses to diversifying their livelihood activities. In other words, for generations people have taken action as part of livelihood strategies to survive in environmentally marginal areas.

People also have a range of coping mechanisms to limit the negative impacts of extremes on their lives and assets, which may have long-term implications for their well-being. The purpose of these mechanisms is to maximise well-being; and this includes dealing with a range of factors besides the risks posed by water stress and hazards.

It is important to remember that not all responses to change, stress, and extremes are a process of adaptation (see Box 1). Some responses are maladaptive as they inadvertently increase sensitivity or exposure to water shortages or floods. Coping mechanisms such as using expensive pumping systems to irrigate agricultural fields or selling off livestock when water is scarce usually provide only short-term relief.

Coping strategies may also hinder options for alternative income sources in times of need, sometimes by damaging vital lifelines found in social networks. When people use these coping mechanisms to respond to new situations, there is no certainty that they will work at all. Indeed, the mechanisms may no longer be sufficient to respond to the changes taking place, and new thinking is required to reduce vulnerability to the new change.

The key to shifting from short-term coping towards adapting lies in reducing people's vulnerability and requires addressing the underlying root causes that make people sensitive and exposed to water-related stress and hazards. Typically, these hazards are not related to the climate alone (Figure 2).

People are affected differently by change due to differential access to and ability to benefit from assets such as natural resources, information, or education. The

## Box 1: Definitions in the field of adaptation

- Responding:** Any action in response to stress. Responses do not have to be adaptive or sustainable. They do not have to be part of a strategy but can be spontaneous. Although responding can be a synonym for adaptation, it does not imply that sensitivity or exposure (vulnerability) is reduced.
- Coping:** Short-term actions to ward off immediate risk, rather than to adjust to continuous or permanent threats or changes – strategies usually rely on selling or using up assets and reserves. Coping strategies are often the same set of measures that have been used before. When using coping strategies as the response to stress, it is possible that vulnerability will increase in the long term.
- Adaptation:** A process of adjusting to changes in variables that influence human well-being and survival. Adaptation takes place with different actors at different levels of consciousness, purpose, and timing. Adaptation goes hand-in-hand with development processes and also needs to reflect other changes, not just climate-induced changes. In general, to be successful, adaptation should be sustainable in the long-term.
- Maladaptation:** Responses to change can result in ‘maladaptation’ when the strategy fails to reduce risk and increases vulnerability in the long term.
- Resilience:** The extent to which a system is able to absorb the adverse effects of a hazard, or the recovery time for returning after a disturbance. Highly resilient systems can endure or bounce back quickly, despite high stress.
- Vulnerability:** How likely an individual or a system is to be harmed by a defined hazard. Vulnerability is a combination of sensitivity, exposure, and capacity to respond to a specific stress. It is relative to the stress and is not the same for everyone.
- Impact:** The way a human or natural system is affected by environmental change, including extreme events.
- Risk:** In the context of environmental change, risk refers to the threat posed by a change, i.e. the probability of an adverse impact. Climate change risk is a function of the magnitude of an individual hazard and/or change and the degree of vulnerability of a system to that hazard and /or change. Unless a system is vulnerable to the hazard, there is no risk.

Figure 2: **The shift from coping to adapting**



Livelihoods already have strategies to reduce risk posed by climate variability and coping mechanisms to deal with water-related hazards (floods, drought). This mode of response may not be sufficient when climate change enhances stresses and extremes. The shift to sustainable livelihoods therefore requires improved actions but must be couched in an appropriate policy context that goes beyond the local level.

factors that influence people's access include gender, caste, ethnicity, entitlements, social networks, wealth, and policy contexts. Although people are not passive victims without the impetus to improve their lives, moving from coping to adapting requires the right enabling conditions to allow responses to take root and develop sustainably.

Factors beyond the local level influence people's vulnerability because some actions taken at community or household level to adjust to new situations may not work in existing policy and market contexts. For example, climate factors such as precipitation and temperature determine crop choice, but the market also influences cash crops. The ability to transport crops to the market may be essential to access cash incomes, but may depend on the existence of a road.

## Key Findings and Lessons Learned

This discussion draws on the findings from all five case studies. The studies looked at situations where people are responding to too much water (floods, waterlogging) or too little water (drought, water stress) in regions spread across the greater Himalayas: in the dry mountain valleys of Chitral in Pakistan, the middle hills in Nepal and flood plains of Bihar, India in the Koshi basin, the flood plains of Brahmaputra in Assam in India, and the hill areas of Yunnan, China. The main findings from each study site are summarised in separate chapters in the next section.

Many of the areas are chronically water scarce and in others people have lived with recurrent floods and droughts for centuries. However, the nature of the risks is changing, as the dynamics of the hazards are changing along with changes in people's vulnerability to them. With this, people's perspectives on the hazards and their attitudes towards their livelihoods are shifting.

Gentle, expected floods can bring beneficial deposits of fine nutrient-rich silt that increases soil productivity. However, as climate change and variability bring extreme events more frequently, floods increasingly become more intense, frequent and destructive, often depositing large quantities of coarse sediments on inundated areas, which render the land unusable.

The overall impact of floods on the landscape, lives, and livelihoods has brought about significant changes in the socioeconomic conditions and cultural milieu of villages and society. Water stress is also likely to be more severe in the future. With increased demand for water, more competition, and more variability in water

availability, people are struggling to manage with former arrangements, even if they have always lived with water scarcity.

Nevertheless, people in these communities have developed their own ways of responding to drought or flood situations, although the strategies may not always have been optimal. Historically, people have always adjusted to changes, whether these are climatic, political, economic, or social. The responses that we documented are mostly focused on reducing exposure and sensitivity to variability in water availability through effective and efficient utilisation of resources. In general, the responses have been oriented more towards short-term actions than towards long-term planning.

The different responses and the experiences with them in this time of change were looked at in terms of common factors and common messages for those who are supporting the development of new adaptation approaches to meet the challenges of climate change.

### Message 1 – Livelihood diversification emerges as a central adaptation strategy but support through institutions and policy is needed for long-term sustainability

People in mountain environments who are confronted with too much or too little water already have approaches for dealing with climatic uncertainty, variability, and extremes, ranging from accepting losses to diversifying their livelihoods through both on- and off-farm activities.

People with diverse income sources appear more resilient to water variability than those with fewer income sources. With significant changes in climate, government, or society, these strategies may no longer be sufficient on their own. When strategies no longer work due to the magnitude of change taking place, new thinking is required to reduce vulnerability to this change. Livelihood diversification emerges as a central strategy that can help people overcome periods of insecurity resulting from climate-related water stress, but the availability of many of these activities is conditional on enabling policies and institutions. People are never entirely isolated from larger institutions, policies and market trends, which influence everything from crop choice to entitlements. A good understanding of this broader policy and institutional context will be crucial in order to identify and support adaptation practices with a potential to be sustainable over time.

## Message 2 – Social networks and local institutions play a vital role in enhancing adaptive capacity

Social networks and institutions contribute significantly when facing challenges related to uncertainty and scarcity in water resources. Social networks facilitate collective water management, equitable distribution of irrigation water, livestock management, communal grazing, and securing external assistance to supplement traditional adaptation strategies. Traditional institutions like the gram in Chitral district, Pakistan, and the designation of women as water guards in Yunnan Province, China, help to manage water conflicts.

Networks play a vital role in making migration an option, for example by ensuring that migrants go to the same location and support each other once there, for example for migrants in Chitral. In communities where cultural ties are strong, kinship and willingness to cooperate and help their fellow villagers has helped deal with some tenure issues, landlessness, and homelessness created by the continuous loss and gain of land.

Access to new land for settlement and farming in a dynamic riparian environment is assured when land rights are recognised by community and social institutions. However, in the light of increasing population pressures villagers could be facing a changed situation. When different cultural/ethnic groups are found in the same location and must suddenly deal with sharing dwindling or eroding resources, tension or conflicts can arise because relationships have not been established to deal with these issues. Strong networks within different groups can similarly create conflict if they prevent outsiders from aligning themselves with the customs and norms.

## Message 3 – Cultural norms affect people's adaptive behaviour; despite being deeply rooted, they can shift over time in response to the needs

Responses to water stress and hazards are often influenced heavily by cultural norms and traditions. Consequently, different groups in the same community respond differently. This includes behaviour and attitudes related to cultural taboos and superstitions that are associated with ethnic identity, as well as gender differences.

In the state of Assam in India, for example, non-Mishing people are unwilling to use the flood-tolerant housing

design used by the Mishings communities, even though the construction has proven to help avoid flood impacts, simply because they do not want to be associated with the lower-caste Mishings.

At the same time, many people acknowledge the need to make exceptions. A shift in attitude may be the result of fewer options, as well as generational differences. In order to deal with climate-related changes and stress, people in Assam have had to take on new occupations and livelihood options previously considered socially unacceptable, such as trading, selling fish, and liquor production.

## Message 4 – With good governance and planning that takes into account climate risk, infrastructure development can contribute to enhancing water security and flood management

Reducing the risk posed by floods and droughts is often associated with infrastructure construction. In the case studies, infrastructure development has been mainly for irrigation and flood control.

Water-related infrastructure such as dams, pumping stations, water tanks and drainage systems (serving irrigation and flood control needs), mostly managed on a communal basis, have strengthened coping capacities of local communities. The irrigation infrastructure built in past decades in Yunnan has provided the basis for current local water security.

In Assam and Bihar, poor governance of embankments has led to the acknowledgement that embankments are not a panacea for flood protection as they have both contributed to waterlogging and been a causal factor for catastrophic floods resulting from sudden breaching.

In Nepal, people have responded to water stress by digging trenches in riverbeds to access groundwater. These trenches allow for access to limited amounts of water for irrigation, but may give rise to conflicts between those who have resources to hire machinery, labour, and pumps to transfer the groundwater to the fields, and those who do not. As a result, trenches and wells must be guarded from theft. Most of the larger infrastructures in the study areas lack a governance system allowing for the participation of local, affected, or benefiting populations. Facilitating the inclusion of the local level would contribute towards good governance, and a more sustainable maintenance of the structures.

### Message 5 – Factors enabling adaptation may also be constraining factors

Enabling factors for adaptation include policies, institutions, relationships, networks, or infrastructures that play a role in reducing the risk posed by water stress and hazards. These are always specific to the local situation and condition. However, what serves as an enabling factor one day can be a constraining factor the next. Further, enabling factors can come at a high cost, and may benefit one person but not another. Enabling factors might simultaneously be constraining, forcing people to make choices leading to tradeoffs that can have consequences for their overall well-being.

While infrastructure development such as embankments have provided protection most of the time in Assam and Bihar, people have also been falsely lured to feeling safe settling near them. This false sense of security has increased vulnerability to floods, because traditional strategies to reduce flood risk have not been implemented. In both Assam and Bihar, infrastructure has also adversely affected people's traditional mobility and natural river flows, further increasing their vulnerability to floods. In Nepal, the development of roads to provide vital access to markets has damaged numerous natural springs, leading to greater water scarcity.

### Message 6 – Adaptation requires striking a balance between short-term priorities and long-term gains

The purpose of diversified livelihoods is to maximise well-being, and this includes dealing with a range of factors apart from the risk posed by water stress and hazards. Some of the approaches adopted to support well-being now may compete with approaches aimed at resilience later. Immediate concerns for financial gain, for example, may outweigh long-term financial stability, resulting in actions that pay off now but at a high cost to later benefits.

Adaptation is a process of moving towards resilience, and requires long-term thinking. Poor people in marginal environments plan in a different time frame. To them, there is no practical reason to question whether responses to water stress and hazards will be sustainable in fifteen years time if they do not ensure survival today or tomorrow.

Some choices made to meet immediate short-term goals may have adverse consequences in the long term, such as selling off land and livestock during periods of crop failure due to floods or droughts in order to be able to pay off short-term debts.

### Message 7 – National institutions and policies strongly affect people's ability to adapt at the local level, but the national level is rarely informed by adaptation concerns and priorities

Policy landscapes dealing with water resources, disaster risk reduction, agriculture, and other issues related to local adaptation tend to be filled with overlaps and contradictions. In the countries studied, they also largely fail to take climate change and the adaptation needs of local people into account, or even to prioritise the well-being of poor rural people.

For example, investment in irrigation in Yunnan in China has provided the physical basis for strengthening communities' coping capacity. When drought occurs, irrigation system management is adjusted to reflect water supply limits and to minimise losses in agriculture. However, the agenda is driven by the government's economic interests in the cash crops rather than ensuring that people are able to cope with dry periods or inadequate rainfall. This is demonstrated by the fact that upland communities continue to face water constraints because they have not been the focus of infrastructure investments.

The weak links between local adaptation and enabling policy appear to stem from both the generally low priority given to climate change adaptation by most governments (even in China, which is putting considerable resources into greenhouse gas mitigation policies), and poor feedback loops for bringing local priorities to the attention of policy-makers. Where local level officials can sometimes mediate policy measures, as in the case of Yunnan, national policies and institutions can be more supportive.

## Conclusions

Local adaptation is an area of growing interest, nationally as well as in the international environment and development policy communities, in part because it is on the local level that the benefits of adaptation will be the most obvious. Furthermore, adaptation at the local level has clear links with development, as many of the actions that are considered necessary for households and individuals to adapt to climate change are also high on the sustainable development agenda.

The case studies presented in this report document many creative responses to water stress and hazards, but show that these need to be aligned with other processes if they are to be successful, even over a short period. The

effectiveness of these responses is often influenced by the development context in which people live. National policies and institutions may have an important impact on local level livelihood choices, depending on how these get translated down to the local level. At the same time, if local needs and concerns are communicated upwards in the policy hierarchy, they can inform higher levels of agenda setting, which can in turn ensure that local priorities are reflected in broader decision-making. If local concerns are ignored, or if no channel is available to enable dissemination to different levels, the higher levels can be inconsistent with local needs, and at times be major drivers of vulnerability to climate variability.

National policies often do not take into account or build on existing capacity to respond. Thus, even if responses are taken at a local level, they may not be able to influence the real cause of vulnerability, consequently leaving people in a vicious cycle of coping without moving them onto the pathway towards resilience.

Unfortunately, there are inadequate methodological tools for assessing whether responses are moving towards increased resilience over the long term, have only short-

term benefits, or inadvertently move towards increased exposure and/or sensitivity to stress, hazards and change. An analytical framework to help make these distinctions would provide a useful contribution to the field of knowledge on adaptation to climate change.

The results from the case studies show that effective use of existing capabilities and enabling conditions coupled with access to livelihood options and opportunities can enhance the capacity to respond successfully to water stress and hazards; however, this does not guarantee that vulnerability will be reduced. Besides the importance of the larger enabling environment, responses to water stress and hazards can be considered adaptive only if they build resilience to change and variability over the long term.

Enhanced resilience means that people have the ability to increase their well-being even if water stress and hazards worsen. Learning to manage uncertainty means learning to live with change, variability, and extreme events.

The main findings of the case studies are presented in the next section (see map below for location of the sites).

### Location of the sites of the case studies

