Farmers' Perceptions of and Responses to Change: The Regional View

The results were analysed for each of the four areas and are summarised in the case studies which form Part 2 of this report. In the following, we present a summary and synthesis of the findings from across the region.

Perceptions of Change and Trend Analysis Across the Study Area

Water is one of the most important factors in subsistence farming. When water supplies become unreliable, this can threaten the whole basis of people's lives. The study focused on poor rural farmers, mostly without irrigated land, for whom precipitation, and especially the monsoon, was fundamental for an optimum harvest. Changes in the amount, timing, and intensity of rainfall were the primary concern of respondents across the study area. The delay in the onset of the monsoon, observed mainly in the western part of the study area – in Uttarakhand in India and Bajhang in Nepal – had significant consequences for the production of the main food crop. It was leading to delays in the sowing of rice and affected the growth of maize, severely affecting food security. There was a perception that annual rainfall was reduced overall, which reduces the recharge of underground aquifers and the amount of drinking water available from springs for communities and livestock. Winter precipitation and snowfall at higher altitudes were seen to be erratic and decreasing dramatically.

Many respondents, and particularly those living at higher altitudes, thought that temperatures were rising. Mosquitoes have appeared in areas previously too cold for the present level of incidence, and fruit and other crops can be grown at altitudes where it was previously not possible, both of which support this perception.

There had been an unprecedented increase in crop disease and pests, again most marked in the western areas of Uttarakhand and Bajhang, areas that also appear to have become drier and that faced prolonged dry seasons with almost drought-like conditions in 2010.

Windstorms appeared to be the greatest hazard in Eastern Bhutan, and change in all parts of the eastern Himalayas (Terhathum in Nepal, Bhutan, and North East India) appeared to be characterised most by a marked increase in the variability of weather events rather than a specific trend in one direction or another.

The perceived changes are summarised in Table 1.

Table 1: **Summary of main changes perceived across the study area (from west to east)**

Uttarakhand, India	Nepal	Eastern Bhutan	North East India
Overall less rainfall, and more erratic	Overall less rainfall, and more erratic	Erratic precipitation patterns (highly variable rainfall patterns within the study area)	Erratic precipitation patterns
Overall decreased water availability	Overall decreased water availability	Overall decreased water availability (with exceptions)	Overall decreased water availability
Less or absent winter rains	Less or absent winter rains		
Increased frequency of intense rainfall events	Increased frequency of intense rainfall events	Increased frequency of windstorms, more severe hailstorms	More severe storms
Increase in pests and disease	Increase in pests and disease	Increase in pests and disease	Increase in pests and disease
Increasing temperatures	Increasing temperatures	Increasing temperatures	Increasing temperatures
Warmer and shorter winters with less snowfall	Warmer and shorter winters with less snowfall		

Assessing Perceived Changes

Notwithstanding the widespread reports of water and other climate-related changes, it is important to remember that climate change may be only one component, and not necessarily the most important, affecting these events. For example, reduction in the perceived availability of water from a well or spring can result from increased demand as well as reduced flows (as shown, for example, in a study by Merz et al. [2002] in central Nepal). Problems of crop productivity and reduced food security can be related to socioeconomic changes such as lack of labour resulting from outmigration, increased demand resulting from increased population, and the cultivation of more marginal lands, as well as from climate change impacts. Similarly, the increase in pests and disease might also be linked to the increasing use of chemical fertilisers, planting of monoculture crops, use of imported seed, and/or more intensive farming methods.

At the same time, human perception is based on memories that change. Comparisons with actual climate measurements indicated that farmers generally had a good memory of the past. However, perceptions were strongly shaped by their experiences in the most recent years. For example, the delayed onset of the monsoon was perceived as a trend, but in 2011, the year after the survey, the rains began early and in some places were much stronger than usual. In Upper Mustang in Nepal, continuous rainfall was experienced over 48 hours in an area where it had barely rained over the past 30 years, damaging infrastructure and vegetation (Shahi 2011).

Notwithstanding the actual causes, farmers across the region clearly felt that the climate was changing, and – most importantly – that it was much less predictable than previously. The erratic nature of the events experienced and lack of predictability posed the greatest problem for the adaptation processes of the rural poor, who were unable to prepare clearly for the annual agricultural processes, and who needed to be prepared for and able to respond to a range of different climatic conditions.

Local Responses to Climate Change

Climate-related changes are already having severe impacts on people's livelihoods, particularly those that are highly dependent on agriculture and animal husbandry related activities. Water scarcity or overabundance, drastic reductions in yields, increases in crop pests and disease, health issues, and increased workloads – especially for women – are some of the challenges that rural mountain communities are facing.

Agrawal and Perrin (2009: 356-357) note that "Adaptation strategies are viewed by some scholars as being prospective in nature in contrast to coping efforts which are seen as being retrospective and in response to specific experiences of variability". The recurrence of hazards leads to some 'coping' strategies becoming prospective in nature. This study uses the term 'coping strategies' to mean 'short-term actions to ward off immediate risk' (ICIMOD 2009) and 'adaptation' to refer to longer term 'adjustments of a system to moderate the impacts of climate change' (Adger et al. 2003). Responses to change can be planned (usually by interventions of public agencies) or autonomous (usually by individuals or communities) (Brooks and Adger 2005). The coping and adaptive strategies used in the study area were grouped according to these definitions and are summarised in Table 2. Coping strategies are generally autonomous and not planned.

Although more adaptive strategies are listed, these rural communities used coping strategies much more frequently than adaptive strategies. Strategies such as shifting of the agricultural calendar or using stalks of failed crops as fodder are mostly retrospective strategies, employed on a year-by-year basis depending on the actual weather events and requiring few external resources. Such strategies are only effective in the short term; they can buffer the extreme loss of harvests but still result in a decline in yield and cannot prevent damage caused by a consistent lack of rainfall or significant delays in the monsoon. Strategies such as re-sowing after an early season failure, borrowing money, or selling assets may even render people more vulnerable as they are depleting their asset base. In contrast, autonomous adaptation strategies such as non-timber forest product (NTFP) collection or wage labour are a mixture of retrospective and prospective responses. Planned response strategies are mostly prospective and implemented with external assistance, mostly from local institutions, and require resources – financial, human, and technological, including information and knowledge. Except in Bhutan, planned interventions in the study area were mostly single sporadic activities, inaccessible to individual households and too small to reach a critical mass.

Table 2: **Response strategies to climate variability and change in the study area***

Hazard	Coping strategy	Adaptation	
		Autonomous	Planned
Erratic precipitation (too much or too little water)	Adjusting the agricultural calendar (e.g., delayed sowing, early harvesting) [r] Stopping paddy planting [r] Repeat sowing and crop replacement after failure early in the season [r]	Changing to crops that can cope with water and temperature stress (e.g., millet replacing rice, mustard replacing wheat) [r,p] Building canals and ponds for irrigation [p]	Introduction of improved seeds that promise high yields even under dry conditions [p] Starting to cultivate off-season vegetables [p]
Overall reduction in water availability	Using stalks of failed crops as fodder [r] Walking longer distances to collect water, fuelwood, and fodder [r] Performing rituals [r] Changing livestock composition to cope with fodder and water scarcity [r,p]	Mulching to increase soil moisture [r] Moisturising and deep sowing maize seeds to increase chances of germination [r] Rainwater harvesting in tanks to be used for cattle, the household, and vegetable irrigation [p]	Investments in electric water pumps to pull spring water from a nearby stream at a lower elevation [p] Revitalisation of rotational irrigation, a traditional mechanism in northwestern India where water is shared through channels [r,p]
Rising temperatures		Introducing new crops such as ginger and turmeric that fetch higher prices and can better withstand water and temperature stress [p] Growing crops at higher altitudes or cultivating more than one crop per year [r,p]	Polytunnels and polyhouses for higher temperature and humidity for particular vegetables [p]
Increased incidence of pests and diseases	Applying traditional pest management strategies such as scattering ash or cow urine, and setting fires in fields to kill pests [r] Increased use of chemical pesticides [r]	Crop rotation and planting of different crops every season to limit infestations of the same pests as well as provide nutrients to the soil [p]	Kurmula traps to attract and kill white grub (Uttarakhand) [r] Promotion of organic pest control mechanisms (Bhutan) [r,p] Construction of specific storage rooms in households with electrical air circulation systems to reduce post-harvest losses [p]
Physical and socioeconomic stress and shocks (e.g., landslides, heavy precipitation, windstorms, acute food shortages)	Building side drains on sloping fields to divert water when strong rains set in [r] Protecting roofs from windstorms by tying them to the basement of the house or nearby trees [r] Taking loans from stores, moneylenders, or savings groups when cash is short [r] Skipping meals during times of acute food shortage [r] Selling assets such as livestock and jewellery [r]	Mixed cropping of beans with maize to protect the maize plants from strong winds [p] Collection of high value NTFPs such as yarshagumba (*Cordyceps sinensis*) and other medicinal herbs to supplement incomes [r,p] Seeking wage labour in nearby markets or through state/INGO sponsored road-building or construction projects [r,p] Rural-urban migration, both domestic and international [r,p]	Planting oak trees around springs to protect the catchment area [p] Introduction of plants with lower stalks(planned by the Government of Bhutan) [p] Cultivation of *Aloe vera*, which thrives under arid and semi-arid conditions (India)[p]

*p = prospective, r = retrospective

The sustainability of the identified response strategies and their potential to increase mountain communities' resilience are currently unknown, as they will depend on the extent and direction of the changes that will occur. Despite persistent uncertainties, scaling up of successful response strategies and knowledge sharing and transfer will be of the utmost importance. Good practices from the region, effective in limiting damage caused by changing weather patterns, need to be exchanged in order to provide people with as many response options as possible.

Differences in Adaptive Capacity

Essentially, having adaptive capacity means having the assets (including knowledge) needed to implement adaptation strategies. Adaptive capacity is determined by various factors including recognition of the need to adapt, willingness to undertake adaptation, and the availability of, and ability to deploy, resources (Brown 2010). Following this definition, the poorest, with the least ownership and access to financial, technological, and human assets, generally have the lowest adaptive capacity. In the Himalayas, this situation is further aggravated by the fact that the rural poor are mostly involved in subsistence agriculture, and thus directly affected by changing weather patterns. Adaptation in agriculture is very challenging, and even more so for the poor. Essentially, climate change has the capacity to make an already poor household or community poorer.

Poverty itself is strongly influenced by social factors such as gender, caste, and pre-existing human capital. Women in much of India and Nepal have low access to resources and decision-making rights. When harvests fail and alternative incomes are needed, they have few skills and little education and can often only work as wage labourers, usually for lower wages than their male counterparts. Most women must also depend on men for the financial and physical capital needed to develop alternative sources of income. The situation is slightly better for women in Bhutan and parts of North East India, where women have more control over assets. The caste system in much of India and Nepal is also an important element to consider when determining adaptive capacity. Members of Dalit castes (the lowest caste, previously deemed 'untouchable') in Nepal and India have historically been marginalised and are generally poor. Other ethnic and indigenous groups in Nepal and India have also suffered discrimination. These societal beliefs translate into poverty-perpetuating habits. For example, in Bajhang in Nepal, Dalit people were previously prevented from entering the areas where yarshagumba (*Cordyceps sinensis*) is collected as there is a holy temple there; they have only recently been able to participate in this high-income-generating activity. In Terhathum in eastern Nepal, Dalit people reported that untouchability was no longer a problem; however, indigenous groups such as the Tamang and Limbu report discrimination by higher-caste neighbours. The wealthier, high caste farmers are also the local moneylenders, and thus an integral part of the system that traps people in poverty. The problems are compounded by poor people's lack of access to education; indigenous farmers often couldn't read and write, making them even more vulnerable.

Human capital, specifically literacy and higher education, becomes crucial in the search for employment. Older people and women in the study area had lower levels of literacy. Literacy was also one of the most significant factors triggering poverty in Eastern Bhutan. In Nepal, the low caste Dalit groups have comparatively less education (WB and DFID 2006). In one village in Bajhang where almost all the inhabitants were Dalits, only one villager had completed 10th grade (school leaving certificate year). In the words of a woman from the village "I never went to school and now it's like being blind". In contrast, a higher caste (Chettri) woman from Terhathum said, "We don't have to hide from the people. We can speak up in front of them and we know how to read and write a letter and calculate. Without education I could not run this little shop besides working in the fields." These two quotations illustrate the importance of human capital for diversifying livelihoods away from climate sensitive subsistence farming, thus increasing resilience.

In summary, although influenced by social factors, adaptive capacity in the study area was broadly determined by poverty and the reliance on income sources that depend on timely weather patterns. As agricultural yields for subsistence become increasingly at risk, other income sources will become increasingly important. Those who currently depend on off-farm activities or on a variety of livelihood strategies both on and off-farm, and who have comparatively higher educational attainments, are perhaps the ones who will be most able to adapt, as their livelihoods do not entirely focus on professions that are dependent on predictable weather events. It is the poorer farmers in the region, with small marginal landholdings at a distance from markets, who depend solely on agriculture and have few income-generating options, who will find it hardest to adapt.

Institutional Opportunities and Constraints

Institutions can be crucial in determining and influencing the adaptive capacity of any group, particularly by structuring impacts and vulnerability, mediating between individual and collective responses to climate impacts and thereby shaping outcomes of adaptation, and delivering external resources to communities in order to facilitate adaptation (Agrawal and Perrin 2009). Local institutions – the primary bodies in contact with farmers – can play a significant role in limiting vulnerability in mountain areas, where farmers suffer from poor accessibility. However, in most parts of the study area, the outreach services provided by local institutions were insufficient. They did not meet the needs of the people, and did not reach the people in most need. Furthermore, most institutions were unaware of climate-related risks, and thus had no advice or support to offer in coping or adaptation. Bhutan was an exception; in Bhutan local government authorities were highly responsive to problems related to agriculture or animal husbandry and to farmers' needs for information and support.

Across the region, local institutions need to be strengthened in terms of technological, financial, and human resources to enable them to deliver demand driven services where they are most needed. Climate change mainstreaming among these institutions will be vital in order to enable them to disseminate the latest information in a timely manner to help avoid climate-related risks such as crop losses and subsequent food insecurity.

Policy

At the policy level, considerable efforts have been made by all three countries in this study to develop policies and adaptation programmes at the national level to address climate change. These include the development of National Adaptation Programmes of Action (NAPAs) in Nepal and Bhutan and the National Action Plan on Climate Change in India. However, such national policies are still insufficient for the people in mountain areas, as it is crucial to take the local context and the specificities of mountain areas into consideration. Nepal has also formulated Local Adaptation Plans of Action (LAPAs). It remains to be seen whether these will be beneficial for mountain people. However, if they are shown to deliver tangible benefits, other countries with mountainous areas should consider formulating similar plans in a participatory manner.