MANAGING CLIMATE RISKS IN THE HIMALAYAS

A Community-centric Approach



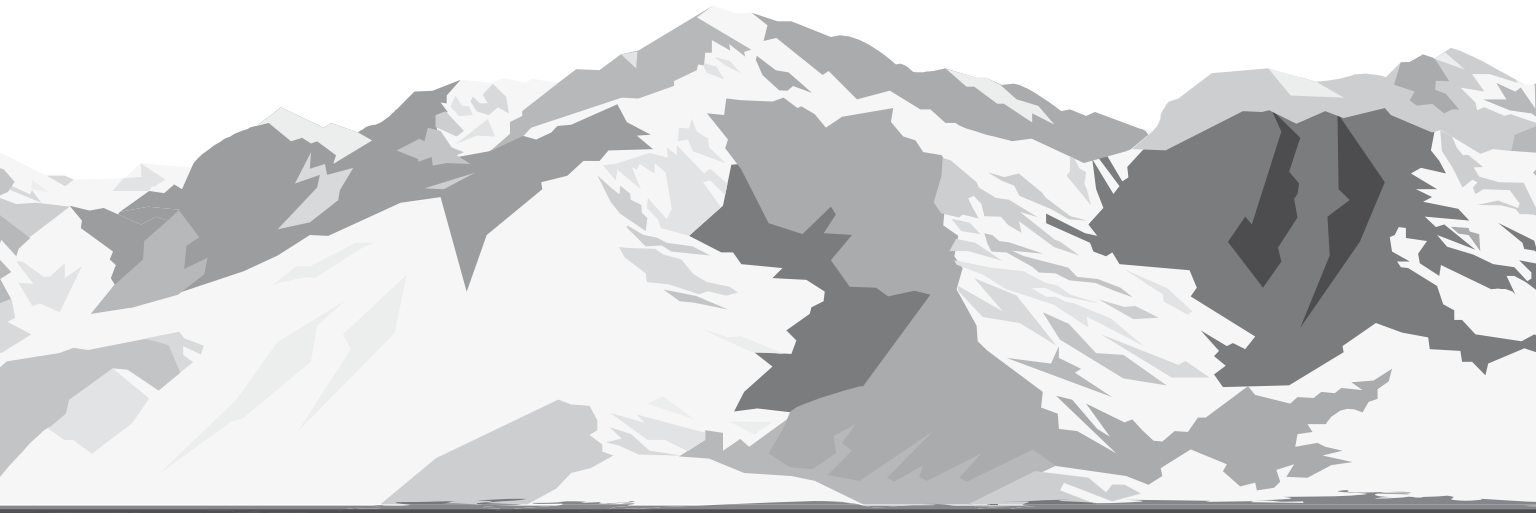

EUROPEAN COMMISSION

Humanitarian Aid

Regional Climate Risk Reduction Project (RCRRP)

a UNDP-ECHO initiative

UNDP



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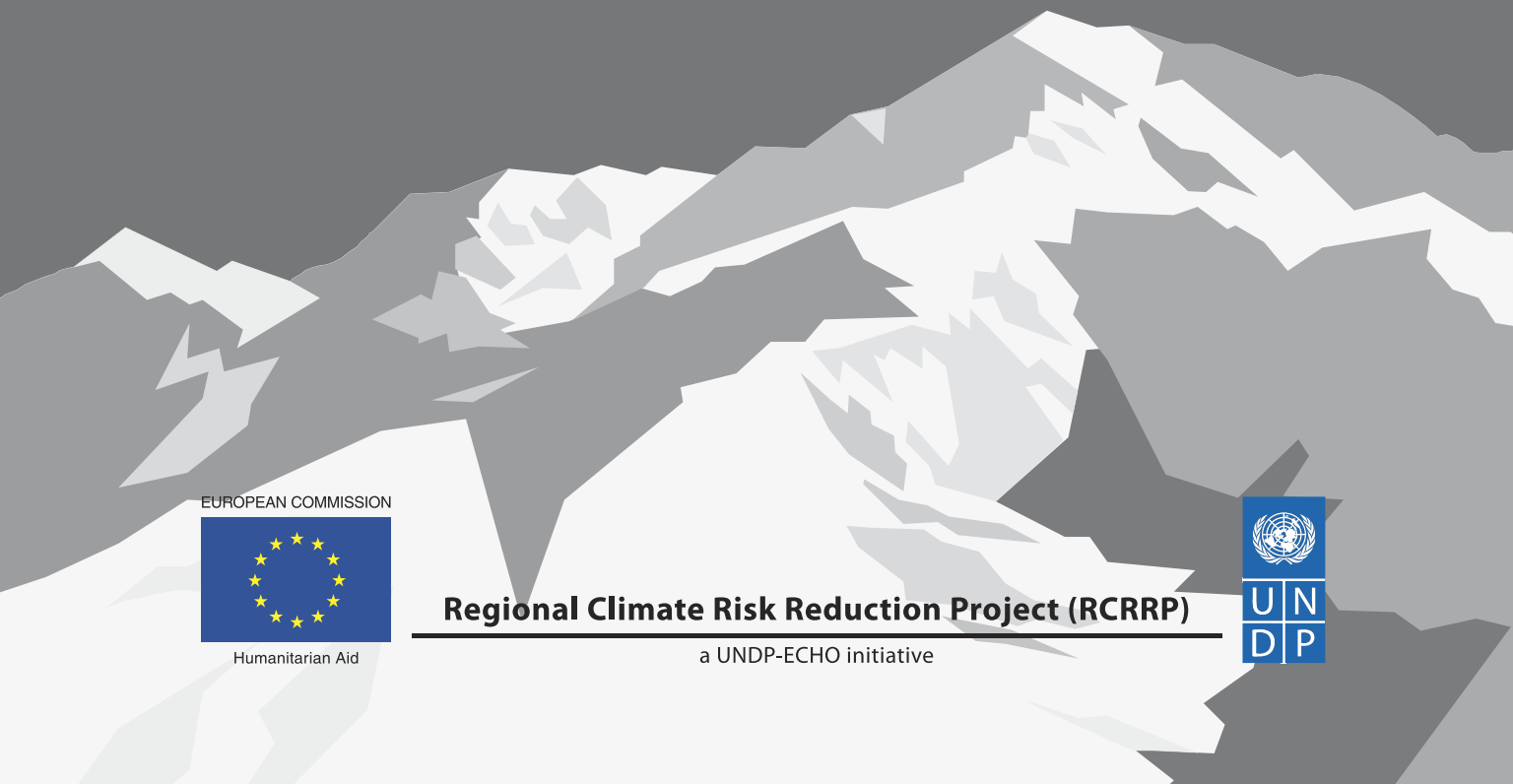

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FOREWORD

The Regional Climate Risk Reduction Project (2009-2010), a UNDP-ECHO pilot initiative, spanned across four countries of the Hindu Kush Himalayan region viz. India, Bhutan, Nepal, and Pakistan. In a limited time span of 15 months, the project worked towards generating awareness on climatic variability, and increasing community preparedness against hydro-meteorological disasters. Partnering with communities, administrative authorities, government bodies, civil society organisations, and the media, various measures were undertaken to strengthen the internal coping capacities of these mountain communities. The project also implemented a gamut of disaster risk reduction initiatives to mitigate the risks emanating from climate change/variability in this region. This publication titled **"Managing Climate Risks in the Himalayas: A Community-centric Approach"** captures the journey, milestones, and achievements of the project. It emphasises the need to focus on locally viable, and easy-to-implement community-centric measures to improve the ability of mountain communities to respond effectively, and recover from the increasing incidences of hydro-meteorological hazards. Community voices find focus in this document as they lend an insight into how the inhabitants perceive the explicit and implicit changes unfolding around them.

Regional Climate Risk Reduction Project Team
Bureau for Crisis Prevention & Recovery, South and Southwest Asia
United Nations Development Programme

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CONTENTS

ABBREVIATIONS AND ACRONYMS

ACORAB	Association of Community Radio Broadcasters
APRC	Asia-Pacific Regional Centre
BCPR	Bureau for Crisis Prevention and Recovery
CBDRM	Community-based Disaster Risk Management
CCA	Climate Change Adaptation
CDRMP	Comprehensive Disaster Risk Management Programme
CDMA	Code Division Multiple Access
CO	Country Office
CPRP	Crisis Prevention and Recovery Practice
CRM	Climate Risk Management
CRM-TASP	Climate Risk Management-Technical Assistance Support Project
CRR	Climate Risk Reduction
DAS	Data Acquisition System
DDM	Department of Disaster Management
DDMP	District Disaster Management Plan
DGPC	Druk Green Power Corporation
DIPECHO	ECHO's Disaster Preparedness Programme
DMIS	Disaster Management Information System
DMP	Disaster Management Plan
DP-Net	Disaster Preparedness Network
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
ECHO	European Commission’s Humanitarian Aid Office
EOC	Emergency Operations Centre
EWS	Early Warning System
GB	Gilgit-Baltistan
GBDMA	Gilgit-Baltistan Disaster Management Authority
GCISC	Global Change Impact Study Centre
GFDRR	Global Facility for Disaster Risk Reduction
GIS	Geographic Information System
GLOF	Glacial Lake Outburst Flood
GoI	Government of India

ABBREVIATIONS AND ACRONYMS

GPS	Global Positioning System
HKH	Hindu Kush Himalayas
HVRA	Hazard, Vulnerability, and Risk Assessment
ICIMOD	International Centre for Integrated Mountain Development
I/NGO	International Non-Governmental Organisation
IEC	Information, Education, and Communication
IT	Information Technology
KPK	Khyber-Pakhtunkhwa
MoHCA	Ministry of Home and Cultural Affairs
NGO	Non-Governmental Organisation
NREGS	National Rural Employment Guarantee Scheme
NRM	Natural Resource Management
NSDRM	National Strategy for Disaster Risk Management
NSET	National Society for Earthquake Technology
PHC	Primary Health Centre
PRA	Participatory Rural Appraisal
PRI	*Panchayati* Raj Institution
RCRRP	Regional Climate Risk Reduction Project
RIMES	Regional Integrated Multi-Hazard Early Warning System
SAR	Search and Rescue
SOP	Standard Operating Procedure
ToT	Training of Trainers
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction
VDC	Village Development Committee
VERT	Village Emergency Response Team
VHF	Very High Frequency
WAPDA	Water and Power Development Authority
WWF	World Wildlife Fund
WWFP	World Wildlife Fund Pakistan

1. Managing Climate Risks

1.1 Climate Change and Variability in the Himalayas

The Hindu Kush Himalayan region is one of the most hazard prone regions of the world. Its fragility stems from its susceptibility to multiple hazards of geological as well as hydro-meteorological origin such as earthquakes, landslides, floods, flash floods, droughts, wildfires, cloudbursts, etc. The physical and socio-economic characteristics of the Himalayan region combined with the changing risk factors such as environmental and climate change, population growth, and economic globalisation have rendered the region highly vulnerable.[1]

Extending over 3500 kilometres, the Hindu Kush Himalayas (HKH) is one of the most glacierised areas in the world outside the polar region with about 15,000 glaciers, which function as nature's renewable storehouse of fresh water in the region. The region is also the cradle of nine major river systems in Asia whose basins are home to billions of people. It is intrinsically linked to global atmospheric circulation, hydrological cycle, biodiversity, and water resources.

Figure 1.1: The Himalayas

With increasing average global temperature, the Himalayan region has witnessed an increase of 0.15°C-0.6°C per decade in the last three decades.[2] Impacts of climate change and climate variability have been well observed in the Himalayas, in particular, with respect to recession of snowline, formation of glacial lakes, and changes in biodiversity in the ecosystems. Several studies indicate that most of the glaciers in the Himalayas have been shrinking at accelerated rates in recent decades. As a result of rapid melting of glaciers, glacial runoff and frequency of Glacial Lake Outburst Floods (GLOF) causing mudflows and avalanches have increased (Bhadra, 2002; WWF, 2005).

Large glacial lakes or ice 'dams' perched precariously on the mountain tops are inherently unstable by nature. Thus, any geological or hydrological incident can trigger a breach, discharging millions of cubic metres of water and debris. The increase in size and volume of glacial lakes and formation of new lakes have made HKH region more prone to GLOFs, particularly in Nepal and Bhutan. In the Himalayan region, it has been observed that the frequency of the occurrence of GLOF events has been increasing in the second half of the twentieth century.[3]

There has also been an increase in the frequency as well as intensity of hydro-meteorological hazards in the region such as higher incidences of riverine floods and droughts, secondary hazards like landslides/slope failures, 'out of season' occurrences of concentrated rainfall, flash foods, and cloudbursts, prolonged drought, torrential

[1] http://www.icimod.org/?page=97
[2] Bajracharya, ICIMOD
[3] http://www.rrcap.unep.org/issues/glof/

rains, etc. Changes in the normal weather patterns, including shifting of seasons, and variations in temperatures, timing and periodicity of sunshine, rainfall, and snowfall, have also been observed. Research by the Pakistan Meteorological Department based on a long-term climate data, reveals that the region which receives almost 65% of total monsoon rains in Pakistan has shifted 80-100 km from the northeast towards northwest regions (consisting of Khyber-Pakhtunkhwa and northwest Punjab).

In the recent past, there have been several episodes of cloudbursts affecting villages in the Himalayan region. The 2010 floods in Pakistan that impacted over 10% of Pakistan's total population was the outcome of an unprecedented magnitude of monsoon rains in the north-western province of Khyber-Pakhtunkhwa (KPK).

Climate-induced events have impacted the lives, assets, and livelihoods of the mountain communities of HKH region, especially traditional livelihood options like agriculture and animal husbandry. Decreased productivity of existing crops and the resultant changes in cropping patterns have commonly been observed in the region, such as diminishing quality and productivity of apples in the lower reaches of the valleys of Kullu and Kinnaur districts of Himachal Pradesh, India. Changes in habitat caused by climate change induced disasters such as floods and droughts as well as changes in food supply are leading to decreased production of milk and meat from livestock. Also reported are loss of habitats, species extinction, depletion of pasture lands, diseases in wild animals, pest attacks, high turbidity in water bodies, and waterborne epidemics.

In addition to the direct impact on crops and livestock, events such as landslides and floods result in economic losses due to disruption of transportation linkages with markets, leading to sharp rise in the prices of essential goods and food. Greater intensity and frequency of climate-induced events also discourage tourists, and destroy natural resources and hospitality infrastructure that are crucial to tourism industry.

Mountain communities have been practising risk mitigation and climate change adaptation measures traditionally. Many communities have adopted coping mechanisms such as changes in cropping patterns/agricultural practices, crop diversification, and changes in sowing and harvesting time of crops to less disaster-prone seasons. Communities often depend on social networks than on government assistance to deal with crisis situations. However, rapid urbanisation, population increase, uncontrolled development, sustained poverty, inadequately protected infrastructure, deforestation, and environmental degradation from various anthropogenic activities accentuate the vulnerabilities of mountain communities to the impacts of climate change/variability. Remote terrain and scattered nature of settlements impair communities' access to health and educational facilities, communication infrastructure, response mechanisms, and external assistance in the aftermath of a disaster.

In the changing climatic scenario, communities need information, awareness, and proper training to cope with disasters. The adoption of preparedness and mitigation measures is of utmost importance to minimise the impacts of climate change/variability. This requires

effective strategies at various levels that build on traditional coping mechanisms of mountain communities, and identify culturally acceptable, locally viable, and sustainable measures. Effective disaster response requires decentralised mechanisms to help the communities during emergencies (including community-based Early Warning System).

In response to the need for community-centric measures to mitigate the impacts of climate change/variability, the Regional Climate Risk Reduction Project (RCRRP), funded by the European Commission's Humanitarian Aid Office (ECHO) and the Bureau for Crisis Prevention and Recovery (BCPR), aimed to develop and implement an **integrated climate risk management programme** in the Himalayan region.

1.2 The Regional Climate Risk Reduction Project

The Regional Climate Risk Reduction Project (RCRRP), supported by European Commission's Humanitarian Aid Office (ECHO) and implemented by United Nations Development Programme's (UNDP) Bureau for Crisis Prevention and Recovery (BCPR), through respective UNDP Country Offices in Bhutan, India, Nepal, and Pakistan, aimed to **develop and implement a climate risk management programme to reduce the risks faced by mountain communities from various hydro-meteorological/climatic hazards and to mitigate their impacts.** In partnership with communities and other stakeholders, the project identified preparedness and risk mitigation measures which were subsequently implemented at the community and local administration levels.

The geographical scope of the project extended to communities in 11 districts and 3 cities across the Hindu Kush Himalayan region. The details of the project area are as follows:

Bhutan : Punakha, Wangdue Phodrang, and Bumthang Districts; Thimphu, Phuntseling, and Samdrup-Jongkhar cities;

India : Kullu, Kinnaur, and Kangra Districts in Himachal Pradesh; Chamoli District in Uttarakhand;

Nepal : Dolakha and Sindhupalchok Districts; and

Pakistan : Gilgit and Astore Districts in Gilgit-Baltistan Region.

Figure 1.2: Geographical Scope of RCRRP

The three key project outputs and the activities undertaken for the achievement of these outputs are briefly as follows:

OUTPUT 1: Asses Risks and Impacts of Hydro-Meteorological Hazards in the Himalayan Region

The project assessed the impacts of hydro-meteorological hazards on mountain

communities and the socio-economic infrastructure to develop a better understanding of the nature, occurrence, triggers, impacts, trends, and their interrelationships. This was achieved through the preparation of a database of hydro-meteorological hazards in one pilot district in each country, followed by hazard, vulnerability, and risk assessments. These assessments helped in:

- Establishing a methodology for conducting hazard, vulnerability, and risk assessments for addressing multiple mountain hazards;
- Identifying feasible disaster risk reduction interventions involving adaptation approaches for implementation at community and local administration levels; and
- Promoting disaster risk reduction as a tool for mitigating impacts of climate change and variability processes.

Efforts were also made to compile an inventory of potentially dangerous glacial lakes in the project countries based on secondary data.

OUTPUT 2: Identify and Implement Community-Based Risk Mitigation and Preparedness Measures

Based on the risk assessments, various preparedness and risk mitigation measures were identified and implemented at the community and local administrative levels in all four project countries. These included low-cost and easy-to-implement measures such as contingency planning, identification of evacuation routes and safe shelters as well as preparation of community mitigation plan, Natural Resource Management (NRM), and land use planning. A detailed feasibility study was conducted towards setting up of a community-based Early Warning System (EWS) on the principles of community ownership and 'last mile connectivity'.

Trainings on Search and Rescue, first medical response, NRM, and mitigation measures imparted specific skills to community volunteers regarding emergency response and risk mitigation activities in their communities. In Bhutan, community level capacity building initiatives were supplemented by additional efforts to strengthen disaster risk management system of the country through capacity development of institutional actors, policy advocacy and awareness raising initiatives, establishment of an information management system, strengthening emergency response and preparedness mechanisms, and implementation of school safety initiatives.

OUTPUT 3: Promote Knowledge Networking and Advocate Policy Formulation Process

Efforts were made to share knowledge and information on climate change/variability and related issues at the regional, national, and international levels and to promote greater coordination between research institutions, government agencies, local administrations, and civil society organisations on climate research and practice of Climate Risk Management (CRM). A wide range of activities such as

regional and national level stakeholder consultations, sensitisation workshops, orientation meetings, e-discussions, development and dissemination of IEC materials, use of traditional media, etc. were undertaken to generate as well as enhance understanding of climate change/variability among policy and decision makers, administrators, communities and other stakeholders. These knowledge networking and information sharing initiatives were implemented with the long-term objective of developing risk reduction frameworks at various levels that support locally appropriate solutions for climate risk management.

The project adopted a gender-sensitive approach that not only recognised the vulnerabilities of women, but also worked towards enhancing their resilience and strengthening their ability to respond effectively to disasters through awareness raising and capacity building initiatives. This is of special relevance in mountain communities due to the nature of family and community structures wherein women act as family heads and/or community leaders. In order to ensure greater women's participation, local level women's organisations were actively engaged in the implementation process.

2. Sectoral Impacts of Climate Change/Variability

The Hindu Kush Himalayan region has been witnessing an upward trend in the number, frequency, intensity, geographical spread, and impacts of climate-induced hydro-meteorological hazards. These pose unforeseen challenges to the inhabitants of the region as they impact various sectors such as agriculture, health, environment, and livelihoods. More incidents of floods and GLOFs destroy irrigation, water supply systems, roads, bridges, settlements, and fertile lands. Climate change/variability would add a new stress to ecosystems and socio-economic systems already affected by poverty, natural resources depletion, and unsustainable management practices.[4] This section captures the perceptions and experiences of the communities on how climate change/variability has impacted their lives, assets, and livelihoods. The opinions expressed in this section are not absolute. However, it lends an interesting insight into how communities perceive the changes that are emerging, threatening the semblance of everyday life.

2.1 Agriculture and Cropping Practices

Agriculture is the mainstay of communities in the Hindu Kush Himalayan terrain. For generations, this has been the traditional source of income for majority of households. In recent years, the inhabitants have been experiencing the impacts of climate variability on their main livelihood.

Shifts in Agricultural Patterns

"Due to inconsistency in rainfall we cannot follow or trust the pattern of cultivation we have been practising for ages. Now, we receive rains during our usual harvest period."

Mr. Tauchu, the village head man, Taewong, Punakha, Bhutan

With growing unpredictability in precipitation, the traditional agricultural and cropping patterns are often disturbed. It is a known fact that rural poor and marginalised communities are more vulnerable to risks associated with changes in agriculture and will be the first to suffer the blow.[5] Variability in rain and snowfall patterns has resulted in shifts in agricultural practices across the project villages in all four countries.

In India, less rainfall in 2009 affected apple production, leading to a visible shift towards cultivation of vegetables such as potatoes, and peas. In Saath village of Kullu district, Himachal Pradesh, because of scarcity of water, the preference for cultivation of rice is waning with time.

With changes in precipitation and temperature, there have been shifts in the sowing and harvesting patterns. In Punakha and Wangdue Phodrang districts of Bhutan, inconsistency in rainfall has led to a shift in paddy cultivation. Earlier the seeds were sown during the months of March-April (*Cham-tapni*), and transplanted in the months of June and July, which coincided with the peak of the monsoon season. The crop would then be harvested in the months of September and October. Now, these areas receive rains late, during August-September. As a result, the processes of

[4] http://www.tiempocyberclimate.org/newswatch/feature050910.htm
[5] http://www.dawn.com/wps/wcm/connect/dawn-content-library/dawn/news/pakistan/metropolitan/16-pakistan-may-face-exceptional-climate-change-hs-09

paddy transplantation and harvesting have been delayed.

In the Hindu Kush Himalayan region of Pakistan, around twenty years ago, maize was grown as fodder. However, in the last few years maize is being cultivated as food grains. Since the maize crop has immense vegetative growth leading to lodging and delayed ripening, it delays the sowing time of the winter wheat crop. As a result, the entire cropping pattern of the region has shifted. People living in parts of the Gilgit-Baltistan region have shifted from cultivation of jute, buck wheat, and barley to cash crops as the heavy rainfall of 2010 impacted crops even in the double cropping zones of the region.

Figure 2.1: Farmer in Gligit area of Pakistan

Despite the fact that climate variability has created an increasing number of challenges for most parts of Bhutan, for some there is a silver lining. In Bumthang district of Bhutan, the temperature has become conducive for crops that can be grown at lower and warmer altitudes such as chilly, paddy, and maize. Since the government supported the introduction of these crops in Bumthang, the Bumthaps have started harvesting them now.[6] According to the locals, the cultivation of the new crop is nothing short of a revolution, so much so that 'Buck-wheat', the main cereal in Bumthang, is now on the decline.

Earlier people of the Bagrote valley in Pakistan cultivated a single annual crop as the weather was cold during most parts of the year. However, with increase in the duration of time suitable for crop cultivation, now two crops are being cultivated annually.

Decline in Crop Yield

Variations in rain and snowfall, soil moisture deficits, droughts, and fires have been causing reduction in crop yields.

"We couldn't harvest even the cob of maize that year [2009]. These days the climate is not favouring us. The old irrigation systems are unable to match the current needs. "

Ram Maya Tamang and Sir Bdr. Tamang, Bhorle, Nepal

Earlier in Brahmadiara village of Kangra district, India, the crop yield used to last for seven months of the year. However, with variability in climate, the yield has dropped to 1/8th, and now lasts barely a month. In Thati village of Kangra district, India, many of the traditional crops such as *Dal* (lentils) and *Rongi/Lobia* (beans) have declined in yield, and therefore are no longer produced. Average yield of wheat has decreased to 70%. The above mentioned impacts on agriculture are also being felt in Loharkan village of Kangra district, India.

[6] Bumthaps: people of/from Bumthang

In regions where apple cultivation is a major agricultural activity, changes in the quantum of snow and rainfall have resulted in fluctuations in yield and subsequently the income from it. While snow contributes to a good yield, if it occurs after the flowering period, the plants deteriorate implying losses of great magnitude. Also, if the winter season gets extended, it leads to decrease in crop yield or partial failure of production.

As the prevailing temperatures are close to the tolerance limits for most crops, any further increase will have serious consequences for agricultural production. Various crop simulation models of the Global Change Impact Study Centre (GCISC), Government of Pakistan, indicate that any further increase in temperature will lower yields of wheat and rice in the irrigated areas of the country. In case of inadequate rainfall, the crops are likely to fail as there are no alternative irrigation systems in the mountains.

Frequent floods, flash floods, and heavy downpour wash away precious fertile soil and deposit boulders and sand in irrigated lands, thus rendering them unfit for cultivation. Farmers owning lands along the Punakha - Wangdue Phodrang River (Puna-Tshang Chu) in Bhutan attribute the decrease in yield to siltation and land erosion. Desertification and decrease in soil fertility due to water logging, nutrient loss, and salinity have affected the productivity of crops in the region.

"The flooding caused by the cyclone Aila was more severe than the 1994 GLOF. It flooded our agricultural land. The government and the people are still struggling to get rid of sand from the agricultural fields".

Mr. Phuba Namgay, the deputy village head man, Tsheytsho Gewog, Wangdue Phodrang, Bhutan

Occurrences of Plant Diseases

Due to the variation in snowfall and rainfall, there has been an increase in the cases of virus attacks in plants, and new diseases are emerging in crops and trees. In Goshal village of Kullu district, Himachal Pradesh, due to variation in snowfall in the months of January and February, apple trees were attacked by a virus that the inhabitants locally refer to as *kankar*.

Nearly a decade ago, the farmers of Samdingkha in Bhutan could use oranges not only for personal consumption but also for small-scale sales. According to the District Agriculture Office, the emergence of a new disease called 'Citrus Greening' has come into prominence in the last couple of years, especially in the southern belt of Bhutan, adversely affecting the orange trees. In the current scenario, only a few of the trees manage to survive. In Punakha district of Bhutan, the dying orange trees have given way to the cultivation of mangoes.

In Pakistan, around a decade ago there were hardly any crop diseases in the region, except for *lom* (local name for a disease affecting the leaves). Recent years have seen a definite increase in diseases affecting crops, including fruit trees (apple, walnut, pear, apricot). This is attributed to warmer conditions, especially during the winters, and erratic rainfall patterns.

Increased use of fertilisers and pesticides by farmers to save the crops from diseases on one hand and to increase the yield on the other, has further damaged the soil rather than increasing its fertility. In Kinnaur district of Himachal Pradesh, due to increased incidents of pest attacks, communities rely on increased use of chemical sprays to protect their apple orchards. However, the use of sprays on apple trees has rendered the soil unfit for cultivation of any other crop.

2.2 Health

Experiences and observations of communities suggest that climate change/variability and associated changes in the environment have impacted the overall health of the inhabitants of HKH region. Although there is no empirical evidence to directly link the occurrences of health hazards and ailments to climate variability, community perceptions are indicative of the growing number of weather-related health problems.

Health is affected directly by temperature changes, droughts (diseases due to dehydration), floods and flash floods.[7] During disasters such as floods, the rapid spread of vector-borne diseases often poses the threat of an epidemic outbreak. At such times the vulnerability towards diseases is not only observed amongst humans but also amongst the livestock and wildlife.

Health is also affected indirectly from disruption of livelihoods and associated malnutrition caused by climate induced hazards.

"In the last three to four years the number of mosquitoes has gone up at the Singati bazaar which is perhaps an indicator of the rise in temperature."

Ms. Benu Kumari Adhikari & Bhakta Bdr. Siwakoti, Owner of micro hydro management, Nepal

Due to changing environmental conditions, spread of vector borne diseases such as malaria, dengue, and encephalitis, waterborne diseases like diarrhoea, and seasonal incidences of heat stress cause endemic morbidity and mortality in the region. The inhabitants of Punakha and Wangdue Phodrang districts in Bhutan observed an increase in the number of malaria and dengue cases. They also reported emergence of new diseases transmitted by mosquitoes.

Shortage of potable water and subsequent reliance on unsafe water has also led to cases of common waterborne diseases among the inhabitants. In Shanag village of Kullu district, Himachal Pradesh, the inhabitants felt that the cases of fever and dysentery have risen as a result of climate variability.

Community members increasingly prefer modern medicine to traditional remedies prescribed by *Vaids* (traditional medical practitioner). However, home remedies prepared from traditional herbs grown in the backyards are also popular. In many of these villages, Primary Health Centres (PHC) and hospitals are a few kilometres away, thereby limiting the access to qualified medical practitioners.

[7] http://www.who.int/hac/techguidance/ems/flood_cds/en/

2.3 Environment

The mountain regions are speckled with climatically different zones, ecosystems, micro habitats, and biodiversity. Of these, ecosystems that are sensitive to climate change are projected to either shift to higher regions, allowing for more suitable species to flourish or become extinct.

Effects on Flora and Fauna

With changes in climatic conditions, the latitude of forest boundaries is likely to shift to higher elevations.[8] In Bhutan, forest cover and grasslands have receded in almost all the project villages to some extent, despite government's efforts to preserve the forest cover.[9] Communities attribute the recession of the Kamalamai community forest to recurrent forest fires caused by long periods of droughts, among other factors.[10]

In Bagrote valley of Gilgit district, Pakistan, a reduction in natural vegetation on mountain slopes, drying up of pastures, and a decline in tree/forest cover by almost 80%, are largely attributed to warmer climate, less precipitation, overexploitation of resources (mostly for fuel wood use and construction), and deforestation.

Temperature variations have led to declining numbers or in some cases extinction of certain species of flora and fauna. Certain new species of plants, earlier not found in the mountainous region have also appeared. In the Hindu Kush Himalayan region of Pakistan, most locals have observed a decline in plant species like *Daar, Maowa* and *Chilaune*. Juniper, birch, and *kasoonar* (a shrub used for firewood) are all near extinction. Some have noticed the appearance of *Banmara* (Lantana Camara) which was originally found in the Terai region.

Inhabitants of Kheng (Bhutan) observed that *Yeka* (Aesendra Butyracae), a plant used for edible oil, has almost been wiped out. Conifers along the Thimphu-Paro-Wangdue Phodrang highway and small bamboo trees along the Thimphu-Bumthang highway were reported to be dying. According to the District Forest Officer of Bumthang district, Bhutan, the forest is infested with an invasive species called 2-ROSA (2 species of roses) that is fast replacing the natural flora.

"The number of crows and eagles in Samdingkha has decreased drastically. Earlier, this area was full of crows and eagles but now we hardly see any of these birds."

Mr. Tauchu, the village head man, Taewong, Punakha

Decline in the number of crows and eagles in Samdingkha, Bhutan, has led to an increase in the number of frogs and rats, causing greater damage to crops. While the reasons for these changes cannot be ascertained, similar alterations have also been observed in Bumthang, including mass death of wild boars in Tang valley.

[8] http://comstech.org/Portals/0/Docs/TheImpactofClimate.pdf
[9] The Constitution of Bhutan mandates 60% forest cover at all times.
[10] Unplanned construction of roads, schools, and colleges around the forest area has also affected the forest cover.

In certain project villages of Nepal, elders of the village believe that sudden appearances of scorpions in the garden could be a result of changes in the climatic conditions. The appearance of various types of snakes from time to time is attributed to the rising temperature.

With reduced forest cover, incidents of wild animals encroaching agricultural lands, damaging crops, and preying on livestock have been on a rise.

Changing Hydrological Cycle

Climate-related changes have been altering the hydrological cycle leading to fluctuations in precipitation patterns. In most of the project districts unpredictable precipitation is a dominant feature. Climate change could influence monsoon dynamics, cause summer precipitation levels to drop, as well as delay the start of the monsoon season.[11] According to the Water and Power Development Authority (WAPDA) in Pakistan, it is expected that precipitation belts will undergo significant shifts in the coming years, which would have an impact on livelihoods related to agriculture and forestry. In Bhutan, with the shift in rainfall patterns, in the last 5-7 years, the monsoon months that previously lasted from June to August have shifted to April-May or August or even September. The residents of Punakha and Wangdue Phodrang districts of Bhutan received their last winter showers around five years ago. Younger generations are oblivious of "winter rains".

Unexpected heavy precipitation in Bhutan has increased the risks of landslides which in turn disrupt rural water supply schemes and irrigation channels. At the same time, erratic and reduced rainfall has led to drying up or decreased levels of water in many of the perennial sources of water such as streams and rivers. As compared to 5-6 years ago, the stream *Shengana-Rongchu* now carries only one-third the volume of water. The Tshekha stream which irrigated the fields at Samdingkha has dried up. At Yungu and Logodama under Talo *Gewog* and Jimthang, three water sources have dried up. According to Mr. Phuntsho Namgay, the village head man, Dzomi *Gewog*, Punakha, "In the last couple of months, one of the two water sources for Tashi Dingkha School, has dried up. The *Gewog* administration is searching for ways to meet the water demands of the school. The situation is no different in other areas."[12]

In Nepal, mean annual precipitation is increasing, as is the occurrence of intense rainfall, leading to increased erosion of topsoil, riverbeds, and banks as well as sedimentation on fertile lands.

In India, communities and district officials in most of the project districts have reported changes in rain and snowfall patterns. Rainfall in most places has become intermittent, untimely, and also heavy in some instances. In Kinnaur district of Himachal Pradesh the rains in 2009 were restricted to the month of September lasting for two days. In April 2010, showers were more than usual that lasted for a week. Of

[11] http://www.dawn.com/wps/wcm/connect/dawn-content-library/dawn/news/pakistan/metropolitan/16-pakistan-may-face-exceptional-climate-change-hs-09
[12] A *Gewog* refers to a group of villages in Bhutan, an intermediate geographic administrative unit between *dzongkhag* (district) and village.

late, the incidents of floods or heavy snowfall have declined, but there is an increase in the occurrences of flash floods and droughts.

"Around twenty years ago, when I was in school, I used to see snow all around in the winter, now I rarely see snow in the higher valleys. The usual time of frost has shifted from January-March to April-May."

Mr. Choki, Engineer, Punakha Rural Water Supply

Snowfall patterns have undergone considerable alterations in the past couple of years. In India, in many districts where earlier the snow would be nearly six feet deep now has a meagre two feet. The duration of snowfall season has now decreased from 4-6 months (October-April) to barely two months (January-February). Less snow leads to reduced amounts of water at the water sources thereby increasing incidents of drought. Optimum snowfall benefits both agriculture and tourism sectors.

Progress in environmental management has been slow and natural resource degradation remains at the core of many problems. Climate change impacts on land resources will make management even more difficult if appropriate measures are not taken.[13]

2.4 Livelihoods

With changing climate, susceptibility to natural disasters such as droughts, flash floods, floods, storms, and extreme cold spells have further increased the vulnerability of communities in terms of food security and livelihoods. Agriculture and livestock-rearing are the primary livelihoods of mountain communities. With alterations in climatic conditions, traditional means of earning a living through cultivation is under threat as already indicated by the impacts of climate change/variability on agriculture and cropping practices.

Efforts to shift to vegetable cropping have not been very successful. In Kullu valley of Himachal Pradesh, India, the local communities have responded to diminishing apple production by growing other fruits and vegetables. However, the small size of the land holding of most of the farmers and apple growers in the area, and their limited resources are major impediments to diversification.

Moisture deficiencies resulting from reduced snow deposits have led to declining production of grass in the Himalayan grasslands. Most highland communities depend on cattle and sheep rearing for their livelihoods, and therefore, reduced availability of fodder is a matter of grave concern for them. In the Goshal village, Kullu district, Himachal Pradesh, the grasslands around the river banks are turning 'stony' with time, due to siltation and deposition of boulders by frequent flooding. Since the grazing lands are vanishing, the communities find it difficult to rear livestock anymore.

[13] http://www.tiempocyberclimate.org/newswatch/feature050910.htm

Climate variability has spin off effects on other livelihoods as well. Bhakta Bdr. Siwakoti, runs a flour mill for a living. Decrease in rainfall has adversely affected agricultural production, and subsequently the profit figures of his mill.

Shrinking livelihood options and natural resources compel the inhabitants to migrate from the mountains and valleys to neighbouring cities. Migration is on the rise, with male members leaving their homes in search of other alternatives. More often these migrants become wage labourers working long hours, and living away from home for most of the year. This in turn places greater burden on the female members of the family. With increasing migration of farmers, most of the entrepreneurs and farmers with larger land holdings are compelled to leave their land uncultivated as they are unable to find people to tend to these lands.

Community members in the Hindu Kush Himalayan region of India usually migrate between the months of March and November in search of wage labour. Wage labour opportunities have also come up in these villages through the Indian Government's National Rural Employment Guarantee Scheme (NREGS), whereby families Below Poverty Line have managed to avail employment for 100 days. NREGS is also assisting towards improving the local infrastructure and promoting natural resource management.

Apart from agriculture, communities in the region rely on other livelihood options such as dairy farming, carpentry, masonry, and weaving (*yathra*).[14] Many are engaged in service industries such as tourism especially during off-season of agriculture.[15] However, frequent climate-induced disasters discourage tourists, and destroy natural resources and hospitality infrastructure that are crucial to tourism industry.

Figure 2.2: Transportation Links Affected by Hydro-Meteorological Hazards

[14] Yathra is a woollen clothing piece woven by women in Bumthang district of Bhutan.
[15] During the trekking season, men usually accompany tourists as porters with their ponies.

3. Disaster Management Planning & Preparedness

In spite of its high hazard, vulnerability, and risk profile, comprehensive community-based climate risk management initiatives have not been implemented in the Hindu Kush Himalayan region. In most of the project villages, at the community level, there were no existing plans to tackle disasters. Fatalism was evident as many confessed that in the unfortunate event of a disaster, the only thing they could do was to try and escape. High levels of poverty in the mountain areas contribute to increasing vulnerability of communities to cope with the impacts of hydro-meteorological hazards. Inaccessible and dispersed nature of the settlements makes it difficult for response and relief teams to reach them in the aftermath of a disaster, thereby putting communities at greater risk. The capacities of administrative systems in these areas to improve the level of preparedness as well as implement risk mitigation measures are significantly low.

With the objective of addressing these concerns, the Regional Climate Risk Reduction Project devised and implemented a systematic disaster risk management planning process in the project countries. The process began with a Hazard, Vulnerability, and Risk Assessment (HVRA) in the project communities, followed by the preparation of a Contingency/Disaster Management Plan at the village-level which helped identify the at-risk populations and assets in the village. The plan suggested measures to enhance the disaster response capabilities and also recommended easy-to-implement low-cost and community-centric risk mitigation measures. Specific structural and/or non-structural mitigation measures were then implemented in the project villages with community involvement.

In order to enhance disaster response capacities of the local administration and communities, trainings were conducted on first medical response, and search and rescue. Awareness raising initiatives were undertaken to improve the understanding of the impacts of climate change/variability on the mountain communities, and measures that could be adopted to mitigate their impacts. Following sections describe in detail the various steps involved in the disaster management planning process.

3.1 Risk Assessment and Disaster Management Plan Preparation

Hazard, Vulnerability, and Risk Assessment

A Disaster Management Plan is a critical component of any comprehensive disaster risk management initiative. It aims at improving the preparedness and resilience of communities. As the first step towards preparation of a Disaster Management Plan under the RCRRP, assessment of risks posed by hydro-meteorological hazards were carried out in the project districts. Assessments were done in sample villages to get an overall picture of the hazard, vulnerability, and risk profiles of the respective districts. Data was collected from various sources including government records as well as through discussions with the district administrators and other key stakeholders. Historical data on various hazards was collected to identify and analyse their nature, rate of recurrence, and

location of impact. Following this, vulnerability assessment was undertaken to determine the nature and extent of physical, social, and economic vulnerabilities of the inhabitants. Questionnaires were also developed to collect data from the communities on the same. Hazard and vulnerability mapping was done and transect walks undertaken.

The HVRA process also allowed to document community perceptions and experiences with regard to incidences of past hazards and traditional coping mechanisms. In doing so it successfully provided space to both traditional practices and expert inputs to coexist and be integrated in assessment process. Mapping of social, economic, and physical (infrastructure) resources available at both the community and district levels was conducted to determine response capacities. Results of hazard and vulnerability assessments were analysed to arrive at the level of risk the communities were exposed to, with regard to hydro-meteorological hazards.

Figure 3.1: Hazard Mapping Exercise in Kangra District, India

HVRA highlighted the urgent need to build the capacities of these remote and often inaccessible and economically fragile communities in the face of hazards. It also recommended certain measures to be adopted to prepare the communities in the face of future hazards and mitigate their impacts to increase their resilience.

In Kullu district of Himachal Pradesh, India, HVRA went a step further and became the basis for formulating a District Disaster Management Plan (DDMP). In addition to the hazard, vulnerability, and risk profile of the district, the DDMP provides relevant information on all important aspects of disaster management, viz. response, preparedness, mitigation, and risk reduction initiatives pertinent to the district. The response plan component of the DDMP elaborates on the roles and responsibilities of key actors (along with Standard Operating Procedures for the key response agencies and other line departments), institutional arrangements for coordinated response, and necessary hardware and resource inventories. It also draws attention to strengthening preparedness of mountain communities by building local capacities through trainings on First Aid, and Search and Rescue. The plan emphasises measures to mitigate the impacts of recurring hazards such as floods and landslides in the region to reduce vulnerability at the district level while ensuring the socio-economic development of the region. Short-term and long-term risk reduction interventions of both structural and non-structural nature were also outlined in the plan.

Village-level Disaster Management/ Contingency Planning Process

The contingency planning process built upon the data collected and analysed during the

HVRA i.e. physical and socio-economic profile of the villages, history of disasters along with their nature and impact, as well as the response at the community level toward the same. This process also involved the ascertaining of human and other material resources in the village that could be tapped into at the time of a disaster. As part of the process, volunteers, mainly women and youth, were nominated by other community members to constitute DM teams. These 10-15 community volunteers were then grouped according to their skills into different response areas such as first aid and emergency health, search and rescue, information dissemination, relief coordination, etc.

To ensure that all community members have access to these volunteer committees, disaster management information boards were provided in several project villages (e.g. all 10 project villages in India) with their contact details along with those of the village and district level administrators and emergency services (e.g. fire and medical services, police, etc.). In addition to this, an evacuation and emergency shelter plan was also formulated wherein safe routes and areas within or near the village to evacuate people to safety, were identified. The importance of simple measures such as stockpiling of essential commodities was highlighted in the village-level consultations.

Contingency plans are an integral part of community preparedness, but it needs to be revised and updated at regular intervals of time in order to preserve its relevance. Hence the planning process was accompanied by trainings on how to undertake this as an ongoing activity.

In this section, the preparation of Disaster Management/Contingency Plans is discussed separately for each project country because of variations in governance structures and processes adopted.

Bhutan

In Bhutan, seasonal calendars were developed to identify harvest months as well as those months prone to hazards and diseases. During this exercise, attempts were made to link these periods to past occurrences of hazards. Transect walks and village mapping exercises were conducted with the help of the communities. Women and school children identified the vulnerable spots, populations, and community resources. This was followed by the process of hazard ranking. On the basis of the hazard rankings, vulnerabilities and capacities were identified, and an action plan was chalked out. This plan detailed out the roles and responsibilities of various stakeholders with respect to each hazard, before, during, and after the occurrence of a disaster. Through these participatory risk assessments, the communities identified risk reduction measures that were

Figure 3.2: Contingency Planning Process in Bhutan

incorporated in the village-level Disaster Management Plans, prepared at the Community-based Disaster Risk Management workshops. The communities also identified the members who would constitute the Disaster Management teams (DM teams). These members in turn took up the responsibility of informing others of their roles and responsibilities.

Disaster Management Committees were formed at each of the three administrative levels of *Chiwog* (village), *Gewog* (block), and *Dzongkhag* (district). Disaster Management Plans (DMP) developed by the communities were shared with their respective administrative authorities. Updation of these plans at regular intervals would be ensured through participatory monitoring and evaluation. The local disaster management institutions require legal mandate and statutory authority for effective monitoring and evaluation of the DMPs. With the enactment of the Disaster Management Bill, 2011, such initiatives are expected to earn more support in the coming years.

India

In India, contingency planning exercises were conducted in all project villages of Kullu, Kinnaur, Kangra, and Chamoli districts. As part of contingency planning, the baseline information was collected through door to door surveys. This data was used to understand livelihoods and land use patterns to assess the vulnerabilities of the communities. Participatory Rural Appraisal (PRA) tools such as vulnerability and capacity mapping exercises were used in the process. The exercises detailed not only the nature of hazards but also the possible preparedness measures to be undertaken to reduce disaster related risks in future.

Disaster Management Plans were developed through active community participation. Refresher training for the already trained community volunteers on the preparation of Disaster Management/Contingency Plans was held across all the project villages. Hoardings exhibiting basic information and contact details of those responsible for disaster response and management at the community and district levels were also put up in these villages.

Nepal

Preparation of Disaster Management Plans in the villages of Dolakha and Sindhupalchok districts in Nepal began with the Hazard, Vulnerability, and Risk Assessment (HVRA). Available literature on hazards and vulnerabilities were collated and reviewed. Various tools such as household surveys, focus group discussions, in-depth interviews, transect walks, and interactive social vulnerability and risk mappings were also carried out. Following this, a detailed

Figure 3.3: Contingency Plan Preparation in Nepal

HVRA report was developed. Based on these, "Community Contingency Plan for Disaster Response and Preparedness" was developed for seven communities of the two districts.

Pakistan

In Pakistan, orientation sessions were held on village-level disaster risk management planning process in Darley and Bubin in Astore district, and Nomal and Nalter in Gilgit district. The sessions also generated awareness amongst the communities on the existing vulnerabilities and potential hazards threatening the region. Consultations held with the communities and the district government officials helped in the identification and mapping of hazards in the region. The interactions also lent an insight into the existing traditional knowledge on risk reduction. To assess the risk profile of these villages, community consultations, GPS data collection techniques, desk review of past hazards, transect walks, questionnaire survey, focus group discussions, and an assessment of climatic variability and its impacts on various sectors were adopted. On the basis of these activities, village-level Disaster Management Plans were prepared in the project villages. Core emergency response teams for specialised trainings were also identified.

Figure 3.4: Village Disaster Management Plan Preparation in Pakistan

A district-level HVRA was conducted in Gilgit district. The methodology for HVRA was shared with all the stakeholders at the Gilgit Conservation and Information Centre. The field teams accompanied by the stakeholders visited twelve Union Councils as well as the municipal area of the district. These field visits involved identification, ranking, and prioritisation of hazards. The accompanying experts verified the high risk areas for GIS-based mapping. Critical facilities and infrastructure were also mapped. Primary and secondary data on vulnerabilities of the communities were collected and analysed to arrive at the risk profile of Gilgit district.

The village-level Disaster Management Plans as well as the district-level HVRA were shared with the concerned stakeholders including the communities. A stakeholders' consultation workshop was held to stress on the importance of a comprehensive approach for disaster risk reduction. The workshop was attended by key officials, including members of Gilgit-Baltistan Disaster Management Authority, and the communities.

Hydro-meteorological Hazards Database

Under the RCRRP, a database of hydro-meteorological hazards in the Hindu Kush Himalayan region was prepared. The database provides significant information that could be used to determine the hazard profile of the area. It not only indicates past incidents but

also provides relevant information such as the frequency, nature of occurrence, and the impacts of various disasters. An assessment of the past incidents and their impacts in turn act as indicators of the present exposure and emerging risks. It can, therefore, be used to identify the most vulnerable areas in each of the project countries, and adopt appropriate preparedness, mitigation, and risk reduction interventions. The database of hydro-meteorological hazards in the project districts of all four countries were developed in various formats and shared with all key stakeholders.

In Bhutan, the disaster database was developed in the form of a **Disaster Management Information System (DMIS)**. Details of hazard event and damage statistics were tabulated for multiple hazards affecting the country. The interface of the DMIS portal is customised to allow data access to both public users as well as the administrators. The DMIS system was launched by the Department of Disaster Management (DDM) of the Ministry of Home and Cultural Affairs (MoHCA). A Training Module-cum-User Manual was also developed in close consultation with the DDM. Around 40 Information Technology (IT) personnel and DM focal points from all 20 districts were trained in the DMIS in a two-day training programme. The database is available on the website of the DDM at **http://www.ddm.gov.bt/dmis/public/.** The district focal points have basic update rights, while the final review and update rights lie with the Department of Disaster Management officials.

In Pakistan, the disaster database was developed in the Excel sheet template. It was shared with the key stakeholders, and concerned government authorities in the project areas such as the Gilgit-Baltistan Disaster Management Authority (GBDMA) and the District Disaster Management Authority of Gilgit. These agencies are currently developing a web-based inventory and information system (supported by UNDP Pakistan) which will soon be launched on a website. The database will be updated by their offices regularly in the same excel format and will be made available to public through the web. It will also be uploaded on the website of UNDP Pakistan.

In India, the database on hydro-met hazards was compiled for the project districts of Kullu, Kangra, and Kinnaur of Himachal Pradesh in an Excel sheet format. Under UNDP India's ongoing Disaster Risk Reduction Programme, efforts are being undertaken to institutionalise the process of regular updating of the database through the structure established under the Disaster Management Act of India (2005), consisting of State and District Disaster Management Authorities.

In Nepal, the database was developed for Dolakha and Sindhupalchok Districts, also in the Excel format. The database has been shared with the local authorities, civil society organisations as well as committees set up at the community level for disaster preparedness and risk reduction. Climate Risk Management (CRM) component of the newly initiated Comprehensive Disaster Risk Management Programme (CDRMP) of Nepal, implemented by UNDP Nepal, would build upon the excel database towards development of a web-based disaster portal. This would ensure greater reach to all stakeholders and interested persons/agencies and also institutionalise a system through which it would be regularly updated.

The data was made available to the members of the communities at the time of preparing village-level Disaster Management/Contingency Plans thus enabling them to prepare better for similar hazards in future. Since the data on hydro-meteorological hazards is collected at the district level, this can be a valuable source of information for HVRA, Disaster Management Plan preparation or development planning processes in the district. Administrators, researchers, scientists, NGOs, and development practitioners will have access to this data through reports, and the World Wide Web. In addition, the RCRRP website would provide links to the databases allowing for wider dissemination beyond the project period.

Inventory of Potentially Dangerous Glacial Lakes

Hindu Kush Himalayas is one of the most glacierised regions of the world. Regular monitoring of the size of the numerous glacial lakes in the region has revealed that quite a few of them are expanding at an alarming rate due to accelerated glacial retreat and melting associated with climate change.

Figure 3.5: Area of Thulagi Glacial Lake in Nepal increased by 22% from 1992 to 2007

Studies conducted by the International Centre for Integrated Mountain Development (ICIMOD) have identified 677 glaciers and 2,674 glacial lakes in Bhutan with 24 glacial lakes posing an imminent and potentially high risk.[16] Similarly in Nepal, 3,252 glaciers and 2,323 glacial lakes have been identified of which 20 glacial lakes are considered potentially dangerous. In India, data is available for three states: Himachal Pradesh, Uttarakhand, and Sikkim. In Himachal Pradesh itself, there are 2,554 glaciers, with 156 glacial lakes, 16 of which are deemed potentially dangerous. There are 127 glacial lakes in Uttarakhand. In Pakistan, in one of the sub-basins of the Indus river system (Swat, Chitral, Gilgit, Hunza, Shigar, Shyok, Upper Indus, Shingo, Astor and Jhelum, covering the HKH region of Pakistan) there are 5,218 glaciers with 2,420 glacial lakes that have been identified. Out of the identified glacial lakes, 52 are viewed as potentially dangerous.[17]

Without duplicating the work of agencies such as the ICIMOD engaged in the mapping and monitoring of glaciers and glacial lakes in the region, an inventory of potentially dangerous glacial lakes in the Hindu Kush Himalayan region was developed under the RCRRP, based on secondary data. In addition to details on potentially dangerous lakes, the report provides supporting information on the risks posed by them to downstream communities and also the existing mitigation measures, if any. The report

[16] ICIMOD studies which are updated on a continual basis (2002 inventory being updated in 2011), the Japan International Cooperation Agency (JICA/JST1) has a project (2009-2012) with the Department of Geology and Mines to compile a glacial lake inventory for Bhutan

[17] Formation of Glacial Lakes in the Hindu Kush Himalayas and GLOF Risk Assessment – ICIMOD Publication, May 2010 /

consolidates the available data on glacial lakes in the region, thereby enabling governments, civil society organisations, and communities to take appropriate measures to mitigate the effects of any potential GLOF. It would serve as an important reference document for persons/ agencies, governmental and non-governmental, engaged in climate risk reduction initiatives in the project countries.

3.2 Preparedness and Response

Preparedness ensures a smooth transition from risk exposure to safety by preventing or reducing the impact of a disaster. The greater the exposure to risk, the larger is the need for preparedness.

Events of hydro-meteorological hazards in the upper reaches of the Hindu Kush Himalayas have in the past wiped away entire villages, left communities stranded, livestock astray, and assets ravaged. This journey from possession to abject dispossession could be averted by the timely dissemination of warnings. Early detection, early warning, and early dissemination with the promise of last mile connectivity has been both an integral objective as well as a commitment under the RCRRP. Towards strengthening the preparedness of mountain communities, the following activities were undertaken:

Strengthening Traditional Practices

Despite the political barriers that separate communities of the Hindu Kush Himalayas, they are bound by a shared understanding of the region. They recognise both the language and the fury of nature and collectively brave hazards predominantly of hydro-meteorological origin. Oral and written communication about past floods, and local early warning dissemination practices such as whistling, shouting, running downhill to inform those living downstream, etc. play an important role in averting the worst in case of disasters.[18]

In the mountainous terrains of Pakistan, flood routes and safe locations/shelters (*Biyak* in Shina language) are pre-identified and the information shared with every member of the village. During floods and other emergencies, villagers are intimated by playing animal horns and beating drums in a particular way.[19] In several parts of Gilgit-Baltistan, shepherds' sheds built at higher and visible locations are used to emit/ receive signals in case of emergencies. In case of lightening or cloudbursts, Artemisia bushes are burnt by the shepherds to signal villagers living at lower altitudes of an impending flood. Since Artemisia bushes when burnt produce smoke during the day and flames at night, it allows for the signals to be visible during day as well as night. In other cases, assigned members of the village call out/ shout loudly from a higher place or informers are sent by the village head to knock on every door to warn people of the possibility of a disaster.

In Bhutan, in anticipation of an impending disaster, the local priest/lama in Samdingkha, Punakha used to blow a sea conch popularly known as *Dunkhar*. The local legends are rich with accounts of how this ritual known as the

[18] http://www.unisdr.org/eng/about_isdr/isdr-publications/19-Indigenous_Knowledge-DRR/Indigenous_Knowledge-DRR.pdf
[19] In some areas of Ghizer and Baltistan, communities use a customary set of music or rhythms to communicate warnings. /

'Sidung' had averted several catastrophes, including a heavy hailstorm in Samdingkha. In many communities, worship of the local guardians/deities is considered the only way to protect them from the wrath of nature.[20] There are some who still insist on the efficacy of such practices and in keeping with the traditional culture, perform annual community rituals to promote good will and safety for the year ahead.

In the Goshal village in Kullu district, Himachal Pradesh, in the event of a disaster, whistles or loud noises are typically used to alert the neighbours. Organised shouts through *Mahila Mandal* (Women's Group) or *Panchayati Raj* Institutions or other social groups also help disseminate such warnings.

With the passage of time, many communities have improvised their local early warning systems. In many cases, the animal horns have been replaced with megaphones and more sophisticated devices like walkie talkies and radio sets. In Pakistan, now-a-days, loudspeakers at the mosques are used for announcements. There is also an increased reliance on the media for warnings in the form of special bulletins aired by the radio stations. Satellite monitoring and electronic Early Warning Systems are also being increasingly used.

Despite the existence of traditional early warning systems, the absence of a modern system was expressed as a matter of concern by many community members in the project villages. While many of them are capable of reading signs of nature (such as change in the colour of the water and/or sky, behavioural changes in animals, etc.) to predict an impending disaster, there is a need to augment the existing measures using less technology intensive, community-oriented early warning systems that can reduce human error.

This is particularly significant in the context of the increasing frequency and intensity of hydro-meteorological hazards, the effects of which overwhelm the communities. This along with the slow erosion of traditional wisdom on dealing with such events warranted a new approach to detection, issuance, and dissemination of early warnings in the Hindu Kush Himalayan region.

Enhancing Community Preparedness through Multi-hazard Early Warning System

In an effort to complement the intimate relationship between the mountain communities and nature with scientific observations and empirical evidence, the project worked towards identifying an Early Warning System (EWS) that would alert the communities to the possibility of impending disasters. Such a system would warn communities of multiple hazards emanating from climate change/variability.

As a first step towards the establishment of a multi-hazard EWS in the Project areas, a feasibility assessment was carried out by a team of consultants in three project countries. The hazardous terrains of Bhahang and Shaath

[20] Such community practices are also performed in other parts of Bhutan.

villages of Kullu district in India, Dolakha district in Nepal, and Bumthang district in Bhutan were carefully surveyed. Needs were assessed on the basis of community consultations and meetings held with the nodal government officials. The findings suggested that this region is primarily threatened by floods, flash floods, and landslides. The team also explored if there were any existing provisions for early warnings in the project districts. Based on the study, recommendations were made for Early Warning System that is low cost, community-oriented, less technology intensive, and easy to maintain and operate.

The recommended technology comprises of two key components: (i) a village-level data collection and transmission unit, and (ii) a data processing and warning dissemination unit at the district level. Automatic weather stations installed at key locations of the village would provide real time data on wind velocity, soil moisture, and rate of rainfall. Similarly, an automatic water level monitor would measure the level of water in the rivers. Multiple sensing units in the village would transmit this data to a Data Acquisition System (DAS) at the district control room, which in turn would record the information and generate warnings when certain critical values are exceeded.

On receiving an alert, the village-level Disaster Response Plan (developed under the project) would be activated. The task forces developed through the community-based disaster risk management trainings would play a pivotal role in steering the villagers to respond effectively, thereby minimising the loss of assets and lives.

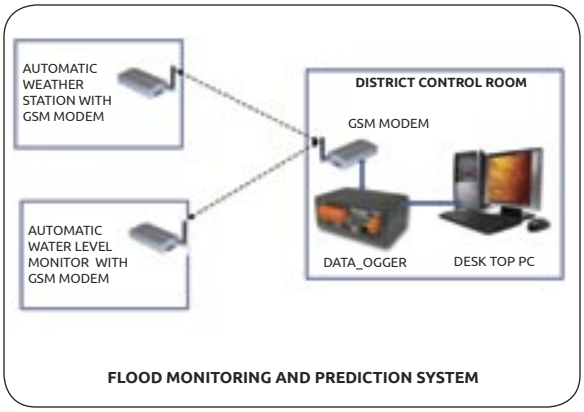

Figure 3.6: Schematic of Flood and Landslide Monitoring and Prediction System

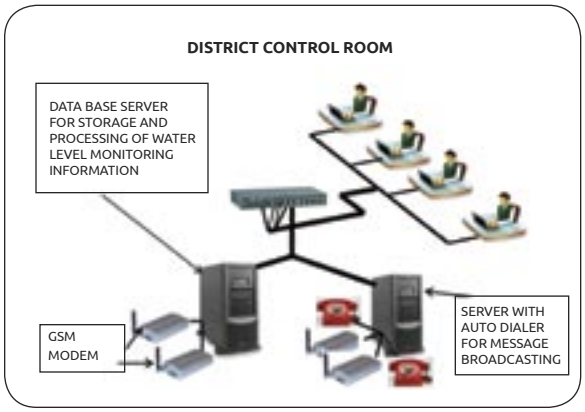

Figure 3.7: Schematic of District Emergency Control Room

The findings of the study along with suggested design specifications for an Early Warning System were compiled in the form of a detailed report. This would serve as the basis for installation of EWS in the project districts by any agency/ government authority in future.

Pilot Early Warning System in Nepal

In order to demonstrate the technology of the proposed Early Warning System, a pilot initiative was launched in the project district of Sindhupalchok, Nepal. The community-

based EWS established in Sindhupalchok consists of two community owned and managed automatic rain gauges with alarm systems, and four flood river gauges at Timbu (Upstream of Melamchi river) and Tipine (Upstream of Indrawati River). Communication between the upstream areas of the two rivers (Indrawati and Melamchi) and the downstream areas where risk prone communities live was enhanced through four Code Division Multiple Access (CDMA) telephone sets, distributed under the RCRRP.

The rain gauges located upstream of these rivers are under the close supervision of community members specially trained to monitor the gauges and inform the rest of the community. In case of rainfall exceeding 150 ml or six consecutive hours, the siren would be activated. Following this, a volunteer would warn the people living downstream through a telephone call. Detailed operating procedures have been developed and designated community members trained in their operationalisation. This system is operational twenty four hours.

Figure 3.8: Rain Gauge at Timbu, Upstream of Melamchi River, Nepal

Figure 3.9: River Water Level Gauge in Dolakha, Nepal

River water level gauges were established in Tipine, Timbu, and Melamchi. If the water level rises above the danger mark, then the informer would alert the downstream communities by means of telephone call. This is operational in the day time. The committees set up at the community and village levels under the RCRRP conduct regular meetings to discuss matters related to disaster preparedness and mitigation, serving as another mechanism to monitor the functioning of the EWS as well as ensure its sustainability.

For an effective Early Warning System, the institutional capacities are as crucial as the technology itself. Efforts were extended to strengthen the government and local capacities to ensure that this multi-hazard early warning system is integrated into development policies and planning processes. An analysis of the information on rainfall, moisture content, wind velocity and direction, etc. gathered over a period of time would inform the decision making pertaining to cropping patterns and agricultural practices. The data gathered through the

EWS would be a rich source of information that would contribute significantly towards larger developmental goals of the village. The communities would no longer be passive recipients, but proactive agents, capable of reducing their risks.

Strengthening Emergency Response and Communication Capacities

Standard Operating Procedures (SOP) for the line departments is one of the key tools which defines the roles and responsibilities of different departments in the event of a disaster. During the September 2009 earthquake that affected Bhutan, the need for such a tool was strongly felt by the Department of Disaster Management. Under the RCRRP, in order to strengthen emergency communication and response capacities of the institutions at the national and district level in Bhutan, a series of consultation meetings pertaining to setting up Emergency Operations Centres (EOC) were held in Punakha, Wangdue Phodrang, and Bumthang. On the basis of discussions in these meetings, Departmental SOPs for EOCs and guidelines for emergencies in the form of an EOC Operational Manual were developed to strengthen disaster response capability in the country. About sixty districts officials were oriented in the operation of EOCs with a hands-on training on radio communications/ VHF sets. Towards setting up an EOC at the district headquarters of Punakha district, basic communication hardware such as radios and VHF sets were also provided.

3.3 Training and Capacity Building

With a view to strengthen response and risk mitigation capacities of communities, various trainings and capacity building initiatives were carried out under the RCRRP. They aimed to develop and enhance skills at the community and district administration levels to deal with the impacts of hydro-meteorological hazards and potential disaster situations in this region. The trainings covered a wide range of topics from emergency response and preparedness to mitigation and risk reduction measures.

The trainings were attended by community members (mainly volunteers), carefully identified from the communities, with adequate representation of women, youth, specially-abled members, socio-economically vulnerable groups, and representatives of local government institutions. Core teams with adequate capacity and skills to initiate/ support search and rescue efforts and provide immediate medical assistance to affected people were constituted and also equipped with basic equipments. For example, in Bhutan, disaster management committees and disaster management teams (four in each *chiwog*) were constituted.[21] These teams assumed the responsibility of emergency search and rescue, first aid, early warning and communication, evacuation and temporary shelter, and water and sanitation. Women were particularly encouraged to form first aid and shelter teams.

[21] Administrative unit comprising of a cluster of villages with around 40 households

The participants of these trainings were oriented in concepts of disaster management and equipped with simple preparedness measures that could be adopted on an everyday basis. As a result of these trainings, the participants were able to understand the linkages between changing climate and hydro-meteorological hazards, and its impacts on various aspects of their lives. Short films depicting various mountain hazards and the preparedness measures that need to be adopted to mitigate their impacts were also screened. At the end of these trainings, disaster management kits were distributed.

Figure 3.10: Life Saving and Rescue Items Distributed to Communities, Nepal

River water level gauges were established in Tipine, Timbu, and Melamchi. If the water level rises above the danger mark, then the informer would alert the downstream communities by means of telephone call. This is operational in the day time. The committees set up at the community and village levels under the RCRRP conduct regular meetings to discuss matters related to disaster preparedness and mitigation, serving as another mechanism to monitor the functioning of the EWS as well as ensure its sustainability.

In Bhutan, a series of district level Community-based Disaster Risk Management Training of Trainers (CBDRM ToT) were conducted for district and block level officials.

Trainings were conducted by experts from various government and non-governmental organisations/institutes. Details of some of the trainings conducted are as follows:

Search and Rescue (SAR) and First Medical Response

With the objective of building community response capabilities in the event of a disaster, and to minimise their reliance on external assistance, community level trainings were conducted on practical search and rescue techniques and first medical response. The training module adopted a multi-hazard approach consistent with the hazard profile of the area and imparted both theoretical concepts and practical skills related to SAR and first medical response.

Participants, primarily volunteers from project communities/villages, were trained in key Search and Rescue activities including rope management, rock climbing, river crossing, and evacuation techniques. Basics of knots, harness, rope coiling techniques, setting up of improvised belay stations in the urban context, urban stone wall climbing, and belaying and rappelling techniques were taught and practised in groups.

Figure 3.11: Search and Rescue Training in India

A refresher orientation on SAR for the already trained community volunteers was also held in the project villages.

In the water search and rescue session, making and use of bamboo raft, bamboo ladder and bamboo stretcher, casualty evacuation, and administration of cardio pulmonary resuscitation (CPR) were some of the basic skills taught to the trainees. Advanced SAR techniques such as Throw bag technique, Zebra technique for river crossing, rescue team management, rescue team organisation, rescue operation team programming, planning of the rescue operation, and casualty stretcher evacuation along a steep cliff and underground were rigorously practised by the trainees.

Figure 3.12: Water Search and Rescue Training

Mock fire rescue and evacuation drill in multi-storied hospital building, simulation of casualty evacuation from cliffs, and simulation of night time rescue missions were also conducted. Basic SAR training kit was provided to individual participants along with a first aid box to be used at the community level.

In Bhutan, the first ever national level comprehensive Search and Rescue Training of Trainers was conducted for members of key institutional responders at the national level such as the Royal Bhutan Police, Royal Bhutan Army, Royal Body Guard, and Druk Green Power Corporation (DGPC). The training aimed at raising a cadre of Search and Rescue personnel to respond in case of emergencies. The participants would be responsible for imparting these skills to others to enhance the response capacities of the communities. For institutionalising the Search and Rescue training, the Royal Bhutan Police and Royal Bhutan Army made a commitment to include the Search and Rescue training module in the regular in-service training programme. It was suggested that selected candidates be sent for advanced specialised rescue training. This would serve as a refresher course as well as help upgrade their existing skills.

Community members were also trained in practical techniques for providing first medical care, including the treatment of various types of injuries, burns, electric shocks, and

Figure 3.13: Search and Rescue Training of Trainers in Bhutan

Figure 3.14: First Aid Training

poisoning. A refresher orientation course for the already trained community volunteers in first aid was held across all the project villages. Along with the trainings, first aid kits were distributed to representatives of the local government bodies or community volunteers in the villages to ensure their proper usage during times of need.

In the immediate aftermath of natural disasters in the region, communities were able to demonstrate some of the visible impacts of search and rescue trainings.

Immediately after the Attabad landslide event in early January, 2010, in Gilgit-Baltistan region of Pakistan, the community volunteers including women trained under the RCRRP were able to evacuate and assist affected people. Similarly, the specialised task forces constituted in Pakistan rose to the occasion during the devastating floods of 2010. The newly trained community emergency response teams assisted the government in conducting search and rescue operations.

Figure 3.15: Distribution of First Aid Kits to Community Volunteers, Kullu District, India

Figure 3.16: The RCRRP Trained Volunteers in Action in Gilgit District, Pakistan, During 2010 Floods

Natural Resource Management and Land Use Planning

There is a growing need to recognise the relationships between population growth, the physical demands of human settlement, economic planning and the most appropriate use of available land. The landscape itself must be treated as a valued resource in managing risk.[22] One of the most important adaptation strategies towards flash floods based on local knowledge is the ability to "read" the landscape and thereby to make interpretations on where to build houses and homesteads. Some communities have opted to construct elevated food stores.

Community-based Natural Resource Management is considered to be one of the most effective ways to manage natural resources as people use their local knowledge to conserve these resources. It also helps inculcate a sense of ownership amongst the communities. Strengthening community- based natural resource management can go a long way in mitigating the risks of disasters.

The Natural Resource Management (NRM) training in India highlighted the significance of effective management of natural resources for socially beneficial and ecologically sustainable development of mountain communities. As part of the training, the relevance of NRM was explained in the context of reducing vulnerability communities to hydro-meteorological hazards such as flash floods and droughts. Along with imparting conceptual and practical knowledge on NRM, the trainings were contextualised to the specific needs of the communities. Through interactive sessions participants were informed of NRM practices such as alternative cropping patterns with minimum water consumption, and the use of locally available seeds and organic manure.

In Bhutan, similar NRM workshops were organised in Punakha and Bumthang districts, where communities were oriented in various aspects of environmental management such as afforestation, mountain ecosystems, and land use management strategies for climate change adaptation and disaster risk reduction. Following this, bamboo plantations, and stone lining along the banks of river/water channels in flood prone areas were undertaken. Furthermore a manual – 'Natural Resource Management Practices – A Tool for Community-based Disaster Risk Reduction and Climate Change Adaptation' was also developed.

Community members participated in a natural resource mapping and contingency planning workshop in Singati in Dolakha district of Nepal.

In Dolakha district of Nepal, land use mapping and planning exercises were carried out in Suridobhan in Bhorle Bazaar and Singati Bazaar respectively. A two-day land use planning workshop was held at Bansbari Village Development Committee (VDC), Sindhupalchok, Nepal. The participants included forty farmers, with a significant representation of women.

[22] http://www.unisdr.org/eng/about_isdr/basic_docs/LwR2004/ch5_ Section2.pdf

Figure 3.17: Land Use Planning Workshop, Sindhupalchok, Nepal

School Safety

School safety is an important aspect of reducing vulnerability of children. Therefore, substantive measures were adopted under the RCRRP to identify and mitigate various risks within the confines of schools. Recognising the pivotal role played by teachers in promoting a culture of safety, trainings were organised to enhance their understanding of simple preparedness and mitigation measures.

In Bhutan, a four day workshop on non-structural school safety was held at Trashigang Middle Secondary School. A total of forty teachers, principals, and education officials from the Department of Education, Royal Government of Bhutan, attended the workshop. The main objective of the training was to develop a team of trainers within the school to implement various aspects of school safety. A separate session on sustaining this capacity building initiative was held to ensure that this particular school emerged as an exemplary model that other schools, particularly in Trashigang district, would aspire to imitate. Subsequent trainings were conducted by these trainers in other schools of the district.

The four day training module was integrated into the existing training module of the Department of Education's Safe School Programme. The module detailed the multi-hazard profile of Bhutan, discussed the need for school safety, explored aspects of emergency management, and exhibited the dos and don'ts through practical demonstrations. The content also included mock drills, the development of School Disaster Management Plan, an evacuation plan as well as a family disaster preparedness plan. Following the successful completion of the training, a school safety manual was published and shared with all the stakeholders.

In Pakistan, awareness raising programme was undertaken in six schools of the Gilgit-Baltistan region. Through this initiative school children and teachers were introduced to basic concepts of disaster risk management. They were also

Figure 3.18: School Safety Training in Pakistan

made aware of structural and non-structural measures to be adopted to combat the impacts of hydro-meteorological hazards. With the objective of sensitising school children towards disaster related risks, painting competitions were held in Naltar and Hopper.

Similarly, a school awareness programme was successfully concluded for the schools of Suri Dobhan, Bhorle Bazar and Singati Bazar in Nepal. Interschool art and quiz competitions were held in Sindhupalchok to generate awareness on disaster risk reduction amongst school children. In India, a painting competition was held in a government school in the Kullu district of Himachal Pradesh. Meetings were held with teachers on ways to sustain such awareness initiatives.

In the long run these initiatives hope to foster a generation of youngsters who are capable of responding to disasters effectively.

4. Mitigation Measures for Climate Risk Management

4. Mitigation Measures for Climate Risk Management

Disaster mitigation is an ongoing effort to lessen the impact disasters on people and their assets.[23] Historically, communities of the Hindu Kush Himalayan region have applied their traditional wisdom to mitigate the risks of natural calamities. In a telling example of local ingenuity and adaptive capacity, mountain communities in Pakistan, used to build houses in clusters called *"Giram"* (in Brushaski language) or *"Goot"* (in Shina language) at a certain height in order to protect themselves from floods and external aggressions. While constructing these houses with stone masonry, wooden beams were extensively used for reinforcement. Such structural measures were often complemented by management arrangements at the village-level. In the traditional system of village management called *"Zaito"*, all village activities were scheduled (in the form of an activity calendar) and supervised by the village leader or the *Numberdar*. The activity calendar would stipulate the specific time for sowing, harvesting, herding, etc. in specific pastures. These regulations were strictly enforced and violators had to face penalties.

In view of the impacts of climate change/variability, complementing traditional knowledge with contemporary interventions is an ideal way to strengthen the existing capacities within a community. In keeping with the findings of the HVRA and contingency planning processes, and based on community priorities, several structural and non-structural measures for mitigation were undertaken across the project countries. These focused on natural resource management, water conservation, and land use planning.

4.1 Structural Measures for Mitigation

Structural mitigation refers to any physical construction to reduce or avoid possible impacts of hazards, which include engineering measures and construction of hazard-resistant and protective structures and infrastructure.[24] Under the RCRRP, structural interventions such as construction of retaining walls, water diversions for floods/flash floods, flood protection walls, and water harvesting structures were undertaken with community participation. In some of these project areas, watershed management and check dam constructions are already been carried out by the Government authorities.

Flood Protection Measures

Rivers that sustain communities wreak havoc when there is a spate. Therefore, various flood protection measures were carried out in the project countries.

In Bhutan, gabion walls were constructed along the river banks to avoid flooding in Bajo-Thango, Wangdue Phodrang. Along the river banks of Samdingkha, Bhutan, boulder lining in lieu of gabion wall (concrete flood protection wall), was constructed at the breach points. This was an example of a quick, easy, and cost effective risk mitigation measure. The first layer constituted of stone linings, followed by bamboos planted along the Samdingkha stretch. Bamboos have high carbon intake and are therefore stronger than most other trees, reducing the impact of floods. In case the stone linings are washed away, they could be gathered to reconstruct the lining. Once the

[23] http://www.csa.com/discoveryguides/archives/ndht.php
[24] http://www.crid.or.cr/digitalizacion/pdf/eng/doc16966/doc16966-i6.pdf

bamboos grow, people can harness economic benefits from the same.

In India, structural interventions included the construction of twenty seven boulder walls with the help of crate wires to check the overflow of water in the Kullu district of Himachal Pradesh. Similarly, a flood protection wall with a drainage channel was constructed in the Bhahang village of Kullu district, to protect the downstream communities.

Figure 4.1: Structural Mitigation Measures in India

Loose boulder boundary walls of dimensions 500 m (L) x 1m (H) x ½ m (W) were built at plantation sites in two villages in Chamoli, Uttarakhand, India. This would prevent cattle from grazing in the plantation sites, prevent soil erosion, help retain soil moisture, and reduce the risk of landslides.

Traditional water Harvesting Structures

Greater occurrences of droughts in the Hindu Kush Himalayas bring to attention the growing need for water conservation measures. Communities have historically employed traditional methods of water harvesting.

Figure 4.2: *Khatri* in Kangra District, Himachal Pradesh, India

In Kangra district of Himachal Pradesh, the main hydro-meteorological hazard stems from acute shortage of water. This has resulted in large-scale migration of men for better

part of the year. With a view to overcome this challenge, the traditional practice of storing and conserving water in '*Khatris*' was supported under the RCRRP. *Khatri* is a small reservoir built at the foot of the mountains, to capture drops of moisture inherent in the mountain rocks. These structures ensure that water is stored for use all year round and meets the drinking and household requirements of the communities.

Under the RCRRP, as a pilot initiative, a *Khatri* was constructed in Kangra district of Himachal Pradesh with active community participation. Simultaneous plantation in the *Khatri* catchment area demonstrated a comprehensive approach to risk mitigation. The plants would reduce runoff and increase the moisture content in the soil, thereby recharging the *Khatri*. They would also act as soil binders and therefore minimise the occurrences of landslides/mudslides.

Trenches of dimensions 7' (L) x 2' (W) x 2' (D) were dug for rain water harvesting at the plantation sites in India. Trenches typically capture some amount of runoff water. This process would not only aid in water conservation but also help minimise loss of top soil and conserve moisture.

Figure 4.3: Trenches for Water Conservation

4.2 Non-structural Measures

Non-structural interventions implemented under the RCRRP included Natural Resource Management (NRM) initiatives such as plantations in India and Bhutan, and land use planning in Nepal.

Plantations

Plantations have multiple benefits in the context of climate related uncertainties and disasters. Plantations not only protect the forest cover but also work as a tangible flood mitigation measure. In flood and landslide prone areas they help stabilise the soil, while in drought prone areas they help in retaining the much needed soil moisture. Furthermore, they also support the community by providing livelihood options, fodder, and fuel wood.

Perennial glaciers that feed rivers such as Pho chu in Bhutan bring huge boulders, moraines, sand and stones ashore every year. The force of floods during monsoon, drastically changes the course of the river resulting in erosion of the banks. It also floods agricultural land with water, and deposit sand and boulders. To mitigate the impacts of these events, bamboo saplings were planted along river banks and sites of landslides with the help of local communities. Bamboo was chosen because of its soil retention, faster growth, and better carbon sequestering capacity. Bamboo plantations would not only protect the communities from the impact of GLOFs and flash floods, but also supplement as a source of income.

In Punakha district of Bhutan, about 250 bamboo saplings were planted by the villagers. Enthusiastic school children of Samdingkha planted 1500 bamboo and champ saplings along the flash flood prone river bank. With the objective of increasing community awareness, saplings were also planted on the eve of National Social Forestry Day, 2 June 2010.

In India about 9000 saplings were planted in 5 villages across the project districts in Himachal Pradesh and Uttarakhand. These consisted of various plant varieties such as *Akhrot* (Walnut), Oak, Bamboo, *Buransh* (Rhododendron), *Vimal* (local fodder plant), and *Devdar* (Himalayan Cedar). The selected plants would yield multiple benefits as the varieties could be used for generating income, medicinal purposes, fuel wood, and fodder for the cattle.

The process was carried out with the active participation of community members, local administrators and women's groups. Village leaders, Panchayat representatives, and members from the local women's groups participated in discussions to decide on the location of the sites and selection of plant varieties. Plants were purchased from the nursery of the forest department and technical guidance on the same was also sought from them. Community members participated in the plantation process by digging pits, sowing seeds, planting the saplings, and filling pits. At every stage of the process technical inputs were sought from agencies like *Krishi Vigyan Kendras* (KVK) of the Agriculture Department and natural resource management specialists.

Figure 4.4: Plantation Process in a Project Village, India

In order to ensure that this initiative sustains in the long run, care and maintenance of the plants would be undertaken by the community members themselves, especially those from the women's groups.

Loose boulder walls were constructed around the plantation sites in several villages to protect the saplings and young plants from wild animals and grazing livestock.

Land Use Planning

In addition to plantations, land use planning was undertaken as a crucial risk mitigation measure.

In Nepal, in addition to natural resource mapping, land use mapping and planning exercises were undertaken in Dolakha district. Along with the mapping of existing land use patterns, needs assessment and planning of plantation areas were carried out by over 70 community members. As a result of this initiative, an agroforestry nursery was established in Singati. Based on the specific needs of the communities, seedlings of plants that provide food and fodder would be made available to the people through the nursery. Appropriate land use planning and its proper implementation were seen to reduce the risk of land degradation and promote income generation for vulnerable communities.

5. Knowledge sharing, Advocacy & Awareness raising

To minimise the risks associated with climate change/variability, effective communication is as critical as scientific, engineering, and organisational solutions. Communities must be motivated and empowered to adopt the needed changes. In order for climate-related information to be fully absorbed by audiences, it must be actively communicated with appropriate language, metaphor, and analogy. It should be combined with narrative storytelling, made vivid through visual imagery and experiential scenarios, balanced with scientific information, and delivered by trusted messengers in group settings.[25]

Under the RCRRP, a multi-pronged approach was used to generate awareness on the impacts of climate change/variability, and strengthen the response and risk mitigation capacities of mountain communities. Every attempt was made to ensure that the activities were engaging and participatory in nature. In order to sensitise key stakeholders, advocacy initiatives were undertaken and relevant information disseminated to bring about policy changes. Knowledge networking initiatives were also undertaken with a view of focusing on the integration of knowledge from different sources and domains across space and time. The following sections describe the various activities in detail.

5.1 Knowledge Sharing and Networking

E-discussions

Online discussions offer virtual forums allowing people to offer their opinions/expertise on substantive issues. It encourages exchange of experiences and lessons learnt, and feed into similar initiatives.

An e-discussion on **"Developing a Training Module for Disaster Risk Reduction and Climate Change –Advice and Experiences"** was initiated by Solution Exchange, Bhutan, in the month of April, 2010.[26] In the discussion that lasted a month, respondents emphasised the need for the training module to include components such as sustainable land management, methods of seed selection in accordance with the soil type and conditions, basic first aid, disaster response mechanisms, and watershed restoration measures. This knowledge sharing forum not only informed the existing training modules but also promoted awareness on the subject. The query generated informative responses from Bhutan and other places.

With a view to understand and assess the gamut of issues related to climate-induced risks and its associated impacts in the Hindu Kush Himalayas, a regional e-discussion was hosted by Disaster Management and Climate Change Communities of Solution Exchange India, Solution Exchange Bhutan, and DRM Asia Network. Two sets of queries were floated in November 2010, and the discussion lasted over a month. The respondents included disaster management practitioners, members of the e-communities as well as the RCRRP team members from India, Bhutan, Pakistan, and Nepal.

The first query titled **"Climate risk management strategies in the Himalayan Region: Sharing Experiences and Learning"** explored the following questions:

[25] The Psychology of Climate Change Communication, Source: http://www.cred.columbia.edu/guide/pdfs/CREDguide_full-res.pdf

[26] Solution Exchange is a knowledge-sharing initiative of all the United Nations agencies in India, to help improve development effectiveness in the country. The initiative brings together development practitioners from the government, NGOs, multi-laterals and bi-laterals, private sector, academia, activists, etc to share knowledge and facilitate collaboration amongst them.

- How has climate change/climate variability led to increase in frequency and intensity of disasters in the Hindu Kush Himalayas and how it has affected livelihoods?

- What has been the response from the communities and government institutions to reduce the risks of such variability/disasters? Have these strategies changed over time?

- To what extent communities depend upon government assistance and social networks to deal with crisis situations?

The second set of questions titled "Climate change in the Hindu Kush Himalayas - Experiences, Examples" discussed the following:

- Existing early warning systems used for tackling climate change/climate variability

- The level of understanding of climate change adaptation among the communities, policy makers, and representatives of local governance institutions, and ways to enhance them

- Adaptation and risk reduction measures being taken at the local level to combat climate change

These questions led to an engaging discussion which elicited around 30 responses from practitioners in the fields of disaster management, climate change, environment management, development planning, NGOs, community-based organisations, local representative institutions, technical agencies, and research/academic institutions. The following key points emerged from the e-discussion:

- There has been an increase in the frequency and intensity of hydro-meteorological hazards in the Hindu Kush Himalayan region characterised by higher instances of riverine floods, droughts, and Glacial Lake Outburst Floods (GLOF), 'out of season' occurrences of concentrated rainfall, flash foods, and cloudbursts, and greater number of secondary hazards.

- Climate-induced events have impacted the lives, assets, and livelihoods (traditional livelihoods like agriculture and animal husbandry) of the mountain communities leading to decreased productivity of existing crops, loss of agricultural land and grazing pastures, decreased production of milk and meat of livestock, species extinction, diseases in wild animals, pest attack, waterborne epidemics, severe threat to food security of communities, economic losses due to disruption of transportation linkages with markets, and impacts on tourism industry.

- Many communities have adopted coping mechanisms to deal with these changes including shift in farming patterns and techniques, soil management techniques, and introduction of native/new species of crops to improve crop productivity and food security. Communities also depend on social networks, primarily friends and

relatives in the village and the neighbouring villages, than on government assistance to deal with crisis situations. Despite these measures, vulnerabilities of communities are further aggravated by poverty and extreme pressure on resources.

- There is a growing need to enhance the knowledge, information, and skills of local communities, and to sensitise local governance institutions on all aspects of climate risk management. There is also a need to undertake systematic research/ studies that establish direct linkages between climate change/variability and increasing number of hydro-meteorological hazards in the region.

- A strong policy framework based on sustained cooperation between the Himalayan countries is essential to mitigate the short-term as well as long-term impacts of climate-induced hazards. Such a policy should involve the people living in the region, as they are most affected by these emerging risks.

- Decentralised and community-centric disaster response systems are required to help the communities during emergencies. Such a system would involve the use of simple Early Warning Systems (EWS) and cost-effective and reliable means of communication. A certain level of community preparedness can also be supported to help them respond more effectively to disasters.

Web-based Resources

In view of the wider reach of the internet, a dedicated web link,

http://www.managingclimaterisk.org/rcrrp.htm was set up which hosted project related information and documents. The link hosts relevant information pertaining to the project such as training manuals, training/workshop reports, other project publications, monthly updates, IEC materials including posters and project brochures, media clippings, photographs, and videos of project activities. The web link is updated at regular intervals.

Figure 5.1: The RCRRP Website

YouTube, a Google subsidiary, hosts videos on a variety of subjects. To take advantage of its growing global viewership, videos pertaining to the RCRRP activities were uploaded on www.youtube.com for a wider reach.

Publications

By documenting its interventions, the RCRRP aimed to advance the information

Figure 5.2: Some of the Knowledge Products Developed Under the RCRRP

and knowledge available on climate risk management. A variety of manuals and publications were developed and disseminated. These included: Training Manuals for First Aid, Search and Rescue, and Community-based Disaster Risk Reduction, Operational Manual for Community-centric Early Warning System, Feasibility Study on a Community-based EWS for Hydro-met Hazards in the Himalayan Region, Disaster Management/Contingency Plans for project villages, HVRA Reports, and an Inventory of Potentially Dangerous Glacial Lakes in the region.

Reaching out to DRM and Climate Change Communities of Practice

With the objective of sharing the learning from the RCRRP, updates of project activities across the four countries were shared at regular intervals with project communities, disaster management practitioners, nodal government bodies, and technical/research/academic institutions. Articles on project activities were shared with Crisis Prevention and Recovery Practice (CPRP) Net, UNDP-GoI Disaster Risk Reduction Programme (2009-2012) Monthly Update, and DIP Action India.[27] These initiatives also offered greater visibility to the project in the DRM and Climate Change Communities of Practice.

Regional Workshop on Climate Risk Management

Knowledge exchange and sharing of experience has been an important means to develop the DRR practice and to build a community of practice. A regional workshop on Climate Risk Management was organised on 15-17 September 2010 in Bangkok. Over 30 DRR practitioners from UNDP Country Offices (CO), Asia-Pacific Regional Centre (APRC), and the Bureau for Crisis Prevention and Recovery (BCPR) participated in the workshop. In recognition of the increasing need to address Climate Risk Management (CRM) in a coherent and effective way, the workshop aimed at focusing attention to particular issues related to CRM programming including: the elements of CRM programmes (EWS, CBDRM, risk assessment, etc.); cross-practice understanding (DRR-CCA); Joint UN Programming approaches; cross-sectoral implementation (agriculture, water, health, livelihoods, and environment); and specific capacity building requirements. The workshop offered the unique potential to foster knowledge exchange, and share good practice approaches among regional practitioners, and create through collective efforts high quality programming and a rich body of expertise in climate risk management.

27) DIP Action India is the e-newsletter of DIPECHO partners

Regional Coordination Network

A regional coordination network was set up through meetings and a workshop with the Regional Integrated Multi-Hazard Early Warning System (RIMES), Bangkok. A lot of work related to local level vulnerability assessment would be carried out through the Climate Risk Management—Technical Assistance Support Project (CRM-TASP), implemented by RIMES and financially supported by UNDP. CRM-TASP is being implemented in India, Nepal, Bhutan, and Pakistan, all four countries included in the RCRRP. Efforts are underway to continue the work under the RCRRP through a partnership with the United Nations International Strategy for Disaster Reduction (UNISDR). A proposal for setting up early warning system for GLOFs and other mountain hazards in Nepal is being developed by UNISDR in collaboration with the BCPR, UNDP.

5.2 Sensitising Key Stakeholders

Sensitising key stakeholders towards the emerging risks associated with climate change/variability is necessary for developing policies and programmes that mitigate these risks. With this objective, a number of workshops were conducted for various stakeholders such as members of parliaments, administrative officials, and the representatives of the media in all the project countries.

In Nepal, a Disaster Risk Reduction Toolkit was launched for the Constituent Assembly members. Ms. Purna Kumari Subedi, Vice Chairperson of Constituent Assembly, inaugurated the event. It was attended by 120 participants including the Constituent Assembly members, government officials, UN Agencies, I/NGO representatives, and other key stakeholders. The toolkit consisted of several documents on disaster risk management, maps, fact sheets, and a proposed early warning strategy for floods in Nepal.

Figure 5.3: Launch of the Disaster Risk Reduction Toolkit for Constituent Assembly Members, Kathmandu, Nepal

Similarly, a stakeholders' consultative session on climate risk management was held at the World Wildlife Fund (WWF) regional office in Gilgit, Pakistan.

In Bhutan, a one day workshop was held to orient the parliamentarians on disaster risk reduction. More than 70 participants, including 35 Parliamentarians from both the Houses (National Council and National Assembly) of the National Parliament attended the event. The workshop was jointly organised by the Department of Disaster Management (DDM), MoHCA and the Project team. The information shared with the members of Parliament helped

secure their support for the formulation of a policy and legislative framework on disaster management in the country.

Figure 5.4: Participants of the Parliamentarians' Orientation Workshop on Disaster Risk Reduction, Thimphu, Bhutan

Recognising the indispensable role of media in reaching out to stakeholders across sectors, media sensitisation initiatives were held in all four countries. In India, community volunteers, who had received specialised trainings in first aid, search and rescue, and contingency planning under the RCRRP were invited to share their experiences and how the project intervention had brought about a change, both at individual and community levels. The media interaction

Figure 5.5: Media Sensitisation Workshop, Shimla, India

brought together key stakeholders including the administrators, international development agencies, international humanitarian agencies, civil society organisations, training/academic institutions, and the media to a common forum. It provided them an opportunity to express their commitment toward the cause.

Similarly, a two day orientation workshop for journalists was held in Pakistan. The participants visited the project sites where they got an opportunity to interact with the communities. The Village Emergency Response Team (VERT) members organised a simulation exercise on search and rescue as well as first aid.

Journalists from project districts, along with the national media were invited to attend a media sensitisation workshop in Nepal. Following the launch of DMIS, a similar media sensitisation workshop was held in Bhutan.

5.3 Awareness Raising through Diverse Media

Audiovisual Media

Animation film is an effective tool to trigger the viewers to understand existing problems and suggest possible solutions to overcome the challenges. It allows the audience to be informed of hydro-meteorological hazards in more creative and engaging way. Recognising the complex nature of issues associated with climate change and variability processes, an animation film "*Asha Chure*" (on flood safety and preparedness measures) was developed in

Bhutan explaining the key concepts, triggers, and impacts in an easy-to-understand format. The primary target audience was the communities. The film was aired nationwide everyday from October 2010 to November 2010 on Bhutan Broadcast Service, the national television. The repeat shows ensured reinforcement of the message and its reach to maximum number of viewers.

A potent and effective medium of communication in the rural interiors especially where access to technology and modern mediums of communication is restricted, community radio is unique and attains the character of that particular community. Participatory in nature, it avoids the biases of a top down approach. A joint radio initiative for policy advocacy and awareness on DRR was conceptualised and implemented by DIPECHO (ECHO's Disaster Preparedness Programme) partners, the Association of Community Radio Broadcasters (ACORAB), Nepal, and the Project team. It produced and broadcasted radio programmes consisting of biweekly short news as well radio magazine(s) on DRR related issues including simple preparedness measures against hydro-meteorological disasters.

Traditional Media

Folk media is an effective way to reach out to the communities in a form that is familiar to them. It breaks the formal barriers of communication to interact with the communities directly. A *Nukkad Natak* (street theatre) was performed by the community members at the *Dussehra Mela* (fair) in the Kullu district of India. This was aimed at raising community awareness on hydro-meteorological disasters and the corresponding mitigation/ preparedness measures that could be adopted by the "at-risk" communities. The performances were repeated at the project villages in the district and were well received by the communities. A CD capturing the essence of this street play was also developed.

Figure 5.6: Street Theatre on Hydro-Meteorological Hazards and Mitigation Measures Performed at the Kullu *Dussehra Mela* in Himachal Pradesh, India

A similar street play was organised in the Sindhupalchok district of Nepal, which discussed wider issues of disaster management and risk reduction in the context of hydro-meteorological hazards in the region.

Information, Education, and Communication (IEC) Materials

Posters were developed and disseminated under the RCRRP as an effective way to generate awareness on climatic risks, sectoral impacts, and risk mitigation measures. These were exhibited at various events and distributed to the stakeholders. In Pakistan, Bhutan, and Nepal

posters were developed in their respective national languages for wider dissemination. In Bhutan, the posters were distributed as inserts with the national newspaper, *Kuensel*.

Figure 5.7: Posters on Climatic Risks, Sectoral Impacts, and Risk Mitigation Measures Developed under the RCRRP

Posters encouraging community participation and suggesting community-oriented solutions were developed as part of disaster risk management activities in Bhutan. The posters suggested various preparedness and safety measures such as stock piling of essential non-perishable food items, avoiding constructions in hazard prone areas, etc.

Figure 5.8: Posters Developed in Dzongkha used for Community Trainings in Bhutan

Information boards and banners were put up at strategic locations in the project areas. These displayed information on local level disaster committees and their contact details along with those district level administrators and emergency services (e.g. fire and medical services, police, etc.). They also exhibited messages to enhance awareness of hazards in the area as well as preparedness and risk mitigation measures.

Figure 5.9: Information Boards in Project Villages

Project brochures were also developed in English, Hindi, and Nepali languages.

To reinforce the visibility of the RCRRP, bags, notebooks, folders, pen drives, pens, mugs, and T-shirts were developed and distributed to the communities and other stakeholders from time to time at various consultations and meetings. The utility value of the products ensures visibility of the project as well as the message it carries, within and beyond the project communities/ stakeholders.

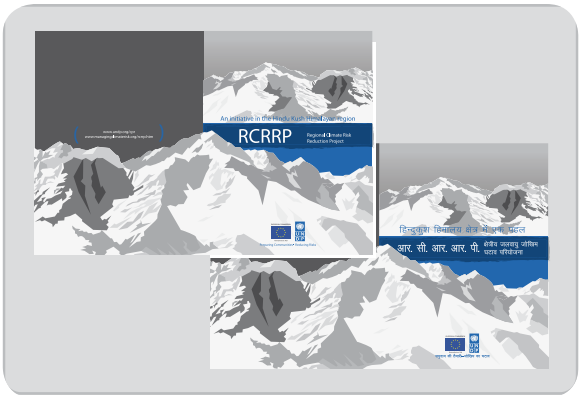

Figure 5.10: The RCRRP Project Brochures

Awareness Campaigns

Awareness campaigns were held in all four countries during local and international events/ days dedicated to disaster risk reduction, to improve the understanding of hydro-meteorological hazards, and ways to enhance the resilience of communities through climate risk management interventions.

A series of awareness initiatives were undertaken in Bhutan on the International Day for Natural Disaster Reduction. An awareness campaign on natural hazards was also launched on the eve of International Food Festival in Thimphu, in remembrance of the devastating earthquake of 21 September 2009. Banners on different hazards and safety measures were displayed. Around 20,000 people visited the fair.

Similarly, around 150 people participated in an awareness rally at Singati Bazaar in Nepal, to mark the International Day for Disaster Reduction.

In addition, training modules and manuals addressing climate risk management were developed in consultation with training institutions at the district/province/state and national levels and circulated to a wider group of DRR practitioners and communities.

Summary of the e-discussions along with individual responses and useful references can be downloaded from:
Query 1 ftp://ftp.solutionexchange.net.in/public/drm/cr/cr-se-drm-clmt-16111001.pdf **Query 2** ftp://ftp.solutionexchange.net.in/public/clmt/cr/cr-se-clmt-drm-14121001.pdf

6. Community-centric Disaster Risk Reduction:

A Tool for Integrated Climate Risk Management

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The Regional Climate Risk Reduction Project represents a meaningful intervention in community preparedness and disaster risk reduction in the mountainous regions of Bhutan, India, Nepal, and Pakistan. It was implemented in remote and inaccessible areas of the Hindu Kush Himalayan region, and the activities were often the first of its kind in the communities inhabiting these areas. In its outreach and targeting, the project represented a significant intervention in climate risk management.

Under the RCRRP, a wide range of activities including emergency response and preparedness, risk assessment, capacity building, mitigation, and knowledge management were implemented. In its breadth of activities, the project made a significant contribution to the concept of an **integrated climate risk management project** as it included and reinforced typical DRR components, and anticipated the elements of climate change adaptation and risk management in its scope.

Communities adopt different coping mechanisms to deal with the impacts of climate change/variability. Some of the climate risk management strategies include soil, land, and water management, adapting to changing cropping patterns, afforestation, etc. For effective implementation of these measures, communities need access to information and skills.

The project, therefore, emphasised enhancing the capacities of mountain communities through the adoption of preparedness and mitigation measures. Strategies were crafted at all levels, building on traditional coping mechanisms of these communities, and identifying and implementing culturally acceptable, locally viable and sustainable alternatives. Effective disaster response requires decentralised mechanisms to help the communities during emergencies (including community-based Early Warning System).

Response and risk reduction capacities of communities and local administrations were strengthened by:

- generating awareness among communities and local administrations about hydro-meteorological hazards and building a mindset of risk reduction;
- training and capacity building for first medical response, search and rescue, contingency and response planning, etc.;
- promoting community-oriented early warning systems;
- introducing concepts and practices related to natural resource management and land use planning and management;
- implementing feasible, community-led, low-cost risk mitigation measures such as construction of embankments and water harvesting structures, afforestation with plantations, etc. and
- networking knowledge on climate risk reduction issues by facilitating interactions and sharing of information/data from various stakeholders, especially scientific and technical/research institutions.

The experience and knowledge generated through the implementation of pilot initiatives under the RCRRP reaffirms the need to establish a sustainable model linking climate change adaptation and DRR measures at the community level. A community-centric approach holds the key to reducing disaster related risks at the grassroots level and ensuring sustainability in the long run.

Under the RCRRP, communities participated in the project activities in a very proactive and responsive way. They contributed their time and effort to the project, provided many constructive suggestions for implementation, and emerged more informed and knowledgeable about their risks and vulnerabilities. The activities evoked a positive response from the communities as it touched their lives and improved their physical security. A sense of trust and confidence was developed with the community in course of the project.

The RCRRP drew upon women's participation and their resilience, to implement the project activities. Women played a lead role in contingency planning processes; attended training sessions in first aid and Search and Rescue that built their capacities to respond to emergencies; and actively participated in development and implementation of natural resource management and other risk reduction initiatives such as plantations in the project areas. Their knowledge of local conditions complemented by inputs from experts enhanced the efficacy of the process. They were also sensitised towards hazards emanating from climate variability, and advised on approaches to mitigate associated risks.

Within a short time frame of 15 months, the RCRRP implemented wide-ranging activities in four countries of the HKH region. However, the project activities need to be continued further in order to have long-term impact. The project tried to make a strong case for continuation of these activities through UNDP Country Offices and national governments. UNDP and other international agencies too have recognised the importance of these interventions in reducing risks and vulnerabilities at the community level. In most of the countries new interventions have been planned to continue the project activities. A number of new initiatives are being planned with the support of United Nations International Strategy for Disaster Reduction (UNISDR), Global Facility for Disaster Risk Reduction (GFDRR), World Wildlife Fund (WWF), and other agencies. It needs to be said that a project of this nature needs more time in implementing its activities.

The RCRRP provides valuable insights on the impacts of climate change/variability on various sectors including agriculture, health, environment, and livelihoods. Therefore, a holistic approach to managing the emerging climatic risks in the region need to be multi-sectoral in nature, aimed at minimising risks as well as securing livelihoods. Land use planning and natural resource management should be integral components of climate risk reduction initiatives. The project demonstrated how simple measures such as plantations and stone lining




Figure 6.1: Participation of Women in Project Activities

of streams and rivers when adopted together would not only reduce the risks of floods and flash floods, but also help generate livelihood options for the communities.

Community-centric interventions need to be complemented by supporting national and regional efforts at policy formulation, coordination, and exchange of improved scientific knowledge related to climate change/variability and adaptation measures. A multi-stakeholder approach would encourage government authorities, technical and research institutions, civil society organisations, and communities to work collectively towards integrating disaster risk reduction and climate change adaptation.

Local governments entrusted with the responsibility of disaster management have a significant role to play in climate risk management by undertaking systematic risk assessments, and the preparation and implementation of comprehensive disaster risk management plans in consultation with key stakeholders. Strengthening capacities of NGOs to address climate risks and forming extensive networks of practitioners in the area will strengthen the CRM approach.