



# Government of Nepal National Adaptation Programme of Action (NAPA) to Climate Change



## National Adaptation Programme of Action (NAPA)



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### **Cover photos:**

(1) The Shey Phoksundo Lake is one of the major attractions of the Shey Phoksundo National Park, which is located in the trans-Himalayan region of northwest Nepal. The park provides an important habitat for endangered species, including the snow leopard whose survival could be threatened by increased temperature. (2) A farmer ploughing his field in Achham District in the Far Western region of Nepal. Nepal is largely an agrarian economy and therefore highly sensitive to changes in climate and natural resource availability. (3) Biotechnology practiced by residents of Kailali District in Far Western region of Nepal in order to prevent soil erosion in the river bank. (4) Urban settlements in Phikkal, Ilam in the Eastern region of Nepal. The dense and unsafely built urban settlements are one of the major reasons for climate vulnerability. (Photo credits: 1: Gautam Paudyal/World Wildlife Fund Nepal, 2007; 2-4: Gyanendra Karki/NAPA Project, 2009).



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**KATHMANDU  
NEPAL**

*The Prime Minister*

## Message



Climate change has emerged as one of the global agenda of contemporary international relations in recent years. Its impacts have transcended national borders and ramified in several sectors and geographical areas. Increased rate of greenhouse gas emissions in spite of substantial reduction commitment from developed countries has contributed to the average rise in temperature that has impacted the world in various ways. The obvious effects of climate change has directly affected the Himalayas in a highly pronounced manner as manifested in increased rate of snowmelt and threat of glacial lake outburst floods with profound impact on habitation and physical infrastructures. Besides providing drinking water and with huge potential of clean and renewable energy, Himalayas are the lifeline of over a billion people in our region. We take Himalayas as a heavenly abode that provides sanctuary to world-renowned flora and fauna and natural habitat to our people.

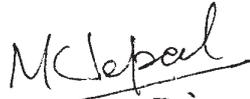
The year 2009 will go down as an important year for us for taking some notable initiatives in the way of combating the threats of climate change. A high-level Climate Change Council under the stewardship of the Prime Minister was constituted and the Ministry of Environment has been instrumental in launching climate change activities in Nepal. The Government of Nepal had its historic cabinet meeting at Kalapatthar (5,542 metres), near the base of Sagarmatha (Mt. Everest) just on the eve of the COP 15 Summit in Copenhagen last December, to highlight the long-term impacts of climate change on the Himalayas and sensitise people both at national and international levels on urgent need to take suitable adaptation and mitigation measures. Besides high-level participation in the Copenhagen Summit, the Government of Nepal took steps to launch a Mountain Initiative to share knowledge and experience on climate-induced particular impacts and forge a common approach to deal with specific concerns relating to mountain ecosystems. As a follow-up, the Ministry of Environment is making preparations for holding a ministerial level meeting of the mountainous countries in Kathmandu in March 2011 to chart a common programme in the interest of countries like ours.

Nepal has negligible contribution on global greenhouse gas emissions but impacts of climate change are tremendous, long-lasting and multi-fold both at uplands and lowlands. Hence, climate change adaptation is our national priority. The National Adaptation Programme of Action (NAPA) has been prepared to address climate vulnerabilities and advance our human development agenda. NAPA is a product of an intensive nationwide consultative process involving all relevant sectors. I had the opportunity to promote discussions on the draft NAPA document in the meeting of the Climate Change Council in August this year. Its next step is to further integrate adaptation aspects into national development processes, and gear NAPA implementation to provide benefits to the climate vulnerable communities and contribute to make our overriding agenda of making the process of socio-economic development climate-friendly.

I would like to take this opportunity to thank the Embassy of Denmark in Kathmandu, United Kingdom's Department for International Development, Global Environment Facility and United Nations Development Programme Nepal Country Office for their support to prepare the NAPA document. I believe that development partners will continue their support with additional resources for the effective implementation of the NAPA and other climate change-related activities.

Finally, I would like to appreciate the contributions made by Mr. Thakur Prasad Sharma, Hon'ble Minister for Environment, Dr. Dinesh C. Devkota, Hon'ble Member National Planning Commission and Dr. Ganesh R. Joshi, Secretary Ministry of Environment for completing the preparation of NAPA document within a comparatively short time period and initiating a number of activities in this regard. I wish the programme all success.

September 30, 2010

  
**Madhav Kumar Nepal**  
Prime Minister and Chairman  
Climate Change Council

# National Adaptation Programme of Action (NAPA)



Minister for Environment

Government of Nepal



Ministry of Environment  
Singhdurbar  
Kathmandu, Nepal

## Foreword

Current trend of greenhouse gas emissions and consequent temperature rise has greatly affected the people, resources and economy of Nepal. High rate of snow and glacier melting, frequent floods and droughts, change in climate-induced vegetation composition and increased health diseases are the prominent impacts Nepal is facing from global phenomenon of climate change. The problems are realized but concerted efforts are required to protect the people, their livelihoods and ecosystems from climate change impacts.

The Ministry of Environment (MoE) - the focal ministry for climate change and environmental matters - has prepared this National Adaptation Programme of Action (NAPA) through wider and extensive consultative processes. The thematic working group approach adopted for NAPA preparation and increased ownership of the government ministries, departments, local governments, academia, non-governmental organizations and civil society provides ample opportunities to implement most urgent and immediate adaptation actions included in this NAPA document.

I consider that NAPA process was also instrumental in enhancing public awareness, institutional development and capacity building, developing implementation framework, and establishing coordination mechanism as well. Establishment of the Climate Change Council under the chairmanship of Right Honorable Prime Minister as a policy guidance and coordinating body, Climate Change Management Division within the Ministry of Environment, and formation of Multi-stakeholder Climate Change Initiative Coordination Committee to ensure functional level coordination are some of the notable activities which coincides with NAPA preparation process.

The NAPA last has been also instrumental in mainstreaming climate change into Nepal's development planning. NAPA process has been internalized and the Government has made commitment to implement adaptation actions to address the needs of the climate vulnerable communities. I consider NAPA preparation a beginning of a long journey to address the adverse impacts of climate change in Nepal. The Government and People of Nepal expect its full implementation. As a Least Developed Country Party to the UN Framework Convention on Climate Change, I consider that NAPA preparation opens multiple avenues for technical and financial resources that should be best utilized to implement the most urgent and immediate adaptation needs as spelt out in this NAPA document.

My special thanks are to my fellow citizens whose interest and participation in the NAPA process provided a basis to faithfully reflect their aspirations. I would like to thank the members of Climate Change Council for their interest and inputs in the process. I would also like to express my appreciation to the development partners namely UK DFID, Royal Danish Embassy in Kathmandu, GEF and UNDP. The Government of Nepal expects for continued support of its partners for the implementation of NAPA and other climate change activities in a manner consistent to the principles set out in the Donor Compact on Climate Change signed in September 2009.

Finally, I would like to appreciate the contribution of Dr. Ganesh R. Joshi, Secretary for completing the NAPA document preparation and the then secretaries Dr. Uday R. Sharma and Mr. Umesh P. Mainali for initiating the NAPA preparation process.

29 September 2010

**Thakur Prasad Sharma**  
Minister  
Kathmandu



Government of Nepal  
**MINISTRY OF ENVIRONMENT**



## Preface

Increased amount of anthropogenic emissions of greenhouse gases has made the climate change a major and costly challenge to climate vulnerable people and communities. The impacts of climate change are more pronounced in landlocked and mountainous country like Nepal. Managing the adverse impacts of climate change on livelihoods, agriculture, water resources, energy, health, biodiversity, and national well-being is a tremendous challenge that requires a comprehensive national adaptation agenda as the starting point.

Nepal prepared the NAPA through thematic working group approach by engaging line ministries and departments, local governments, academe, and non-government organizations, youth, women, indigenous communities, and civil society representatives. Over 2,500 people participated at different stages of NAPA preparation in particular the consultation programmes during the last 15 months. Experiences and lessons of other Least Developed Countries in preparing the NAPA have guided in speeding-up the NAPA preparation process. Nepal is establishing a knowledge management platform and has constituted a multi-stakeholder coordination mechanism named *Multi-Stakeholder Climate Change Initiative Coordination Committee* in April 2010 to serve as a platform for ensuring regular dialogue and consultations and ensure functional level coordination on climate change related policies, plans, financing, programmes, projects, and activities.

Climate change is not just an environmental issue but more importantly a development one. The Ministry of Environment will continue to work closely with the development partners and stakeholders to promote programmatic coherence during NAPA implementation by using an implementation framework, defined in this document, for climate change projects in Nepal. Our engagement in designing and piloting local adaptation plan of action will hopefully provide a viable option for the effective implementation of most urgent and immediate adaptation actions as included in the NAPA document.

I would like to thank all members of the Advisory Board and Project Executive Board for their support and inputs to complete the NAPA document in time. I would like to appreciate the contribution of all participants who were involved in different stages of NAPA activities. Let me appreciate the concerted efforts of the thematic working group (TWG) coordinators and members, TWGs facilitators, consultants and reviewers for sparing their valuable time and inputs to bring the report in the present form. I would like to appreciate the suggestions of the UNFCCC Secretariat on behalf of LEG members and stakeholders who contributed significantly in refining this NAPA document.

Let me take this opportunity to thank our development partners and stakeholders for their support to NAPA preparation. I believe this support will be continued for the implementation of NAPA priorities. I would like to appreciate the efforts and dedication of Mr Purushottam Ghimire, Joint-Secretary and National Project Director, for initiating the NAPA process and finalizing this document and Mr. Batu Krishna Uprety, the then National Project Manager of NAPA Project, and now Joint-Secretary (Technical) and Chief of Climate Change Management Division in this Ministry in initiating the NAPA preparation process and reviewing this document. Similarly, I would like to thank Dr. Devendra P. Chapagain for his valuable contribution in finalizing this document and all officers of this Ministry and NAPA Project staff who were involved in the NAPA process and bring the document in its present form.

29 September 2010

**Ganesh Raj Joshi, Ph.D.**  
Secretary  
Kathmandu

## National Adaptation Programme of Action (NAPA)



Government of Nepal  
Ministry of Environment

### National Adaptation Programme of Action (NAPA) to Climate Change Project



## Acknowledgement

The NAPA Project, signed in November 2008, has produced the NAPA document within about 16 months after the Inception Workshop in May 2009. We are proud to have instigated a country-driven inclusive and consultative process that produced a programmatic approach-based and realistic NAPA document for Nepal.

This document was prepared by the NAPA Project Team with the collective efforts and contributions from six Thematic Working Groups (TWGs) coordinators, facilitators, TWG members, and with contributions from several organizations and individuals. The tireless work of the TWG Coordinators - Messrs Hari Prasad Dahal, Shankar Prasad Koirala, Girija Prasad Gorkhaly, Padam Raj Bhatta, Krishna Prasad Acharya and Pravin Raj Aryal; and respective Facilitators is especially recognized and appreciated. Members of each TWG and its wider reference group are also acknowledged for their inputs. The Least Developed Countries Expert Group (LEG) members of the UNFCCC, civil society and research organizations are acknowledged for their inputs, advice and insights.

I appreciate and acknowledge chairperson and members of the NAPA Advisory Board for their strategic guidance. I would also like to appreciate generous and continuous support of the members of the Project Executive Board Messrs Manahari Khadka, Shiva Sharma Paudyal, Bimal R. Regmi, and Vijaya P. Singh including the invited members Messrs. Simon Lucas, Jorn Sorensen, and Ms. Anupa Lamichhane. I equally appreciate the contributions of development partners, in particular the UNDP, GEF, Danish Embassy and DFID for their generous support to the NAPA Project. I acknowledge the contributions and inputs of people, NGOs and community-based organizations who participated in the NAPA transect appraisal exercises and several consultative meetings all over the country.. Thanks are also due to the members of the media who provided the much needed support of raising awareness on climate change issues including the NAPA process.

I would like to express my sincere gratitude to Hon'ble Thakur P. Sharma, Minister for Environment and Dr. Ganesh R. Joshi, Secretary of the Ministry of Environment for all the necessary coordination and supervision of the NAPA preparation. I would like to appreciate the professional contributions of Hon'ble Dr. Dinesh C. Devkota, Member of the National Planning Commission in the timely preparation of the NAPA document.

I would like to recognize the efforts and dedication of NAPA Project Team members Messrs Babukaji Baniya, Ritu Pantha, Simon Anderson, Sohail Khan and Jessica Ayers. My special thanks are due to Mr. Gyanendra Karki, Mr. Bimal R. Regmi and Ms. Kareff Rafisura for their hard work in the drafting and finalization of this document. I equally recognize the dedication of support staff Messrs. Post Bahadur Thapa and Narayan Dahal. I would like to thank Dr. Devendra P. Chapagain for his valuable contribution in reviewing this document. Finally, I would like to appreciate the contribution of Mr. Batu Krishna Uprety, the then National Project Manager of NAPA Project, and now Joint-Secretary (Technical) and Chief of Climate Change Management Division in this Ministry who played an instrumental role in the initiation of the NAPA preparation process in Nepal and for his contribution in the several stages of NAPA preparation in his capacity as the LEG member to UNFCCC.

September 2010

**Purushottam Ghimire**  
Joint-Secretary and National Project Director



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## Acronyms

ADB	Asian Development Bank
CBO	Community-based Organizations
CBS	Central Bureau of Statistics
CID	Climate-induced Disasters
DADF	District Agriculture Development Fund
DFID	Department for International Development
DHM	Department of Hydrology and Meteorology
DPnet	Disaster Preparedness Network
DWIDP	Department of Water Induced Disasters Prevention
FAO	Food and Agriculture Organization of the United Nations
FECOFUN	Federation of Community Forestry Users Nepal
GCM	Global Circulation Model
GEF	Global Environment Facility
GHG	Greenhouse Gas
IPCC	Intergovernmental Panel on Climate Change
ISET-N	Institute on Social and Economic Transition - Nepal
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LEG	Least Developed Countries Expert Group
LIBIRD	Local Initiatives for Biodiversity, Research and Development
LFP	Livelihoods and Forestry Programme
LRMP	Land Resource Mapping Project
MCCICC	Multi-Stakeholder Climate Change Initiatives Coordination Committee
MDG	Millennium Development Goals
MoAC	Ministry of Agriculture and Cooperatives
MoE	Ministry of Environment
MoFSC	Ministry of Forests and Soil Conservation
MOHA	Ministry of Home Affairs
MPPW	Ministry of Physical Planning and Works
NAPA	National Adaptation Programme of Action
NCVST	Nepal Country Vulnerability Study Team
NDR	National Disasters Report – UNDP
NHRC	National Health Research Council
NEPAP	Nepal Environmental Policy and Action Plan
NLSS	National Living Standards Survey
NTFP	Non-Timber Forest Products
NWP	National Water Plan
MUS	Multi-Use System
OECD	Organization for Economic Cooperation and Development
PEB	Project Executive Board
PRSP	Poverty Reduction Strategy Paper
RCM	Regional Circulation Model
SEBAC	Social Empowerment and Building Accessibility Centre-Nepal
SPOSH	Society for the Preservation of Shelters and Habitation in Nepal
TAC	Technical Advisory Committee
TWG	Thematic Working Group
TYP	Three Year Plan
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee
WECS	Water and Energy Commission Secretariat
WRS	Water Resource Strategy

## Executive Summary

The Government of Nepal has prepared the NAPA through a consultative process. NAPA is a strategic tool to assess climatic vulnerability, and systematically respond to climate change adaptation issues by developing appropriate adaptation measures. The Nepal NAPA report is structured according to decision 29/CP.7 and the guidance and annotated guidelines developed by the Least Developed Countries' Expert Group (LEG). The succeeding sections set out the introduction and national setting, the Nepal adaptation programme framework, NAPA preparation processes and the methods and criteria used in prioritizing the proposed interventions, identification of key adaptation needs, lists of priority adaptation actions, and finally conclusions. Out of about 250 adaptation options proposed by the Thematic Working Groups (TWG), nine integrated projects have been identified as the urgent and immediate national adaptation priority.

This NAPA document is the summary of six TWGs and two cross cutting reports. Details of the process, assessment of climate change vulnerability and impacts and lists of adaptation measures are available in the respective TWG reports.

### Country and population

Nepal is a land-locked country situated in the central part of the Himalayas with a total land area of 147,181 km<sup>2</sup> including High Mountain, Mid-hills, Siwalik (the Churia Range), and the Terai. Each of the physiographic regions has climatic characteristics varying from tropical to alpine conditions within a lateral span of less than 200km.

The population of Nepal is close to 28 million people as of August 2010. The country ranks 193 out of 210 in terms of Gross National Income per capita adjusted for purchasing power. More than 70% of the population lives on less than USD 2 per day.

### Climate

Nepal's climate is influenced by the Himalayan mountain range and the South Asian monsoon. The climate is characterized into four distinct seasons: pre-monsoon (March-May), monsoon (June-September), post-monsoon (October-November) and winter (December-February). Average annual rainfall is approximately 1800 mm. The monsoon rain is most abundant in the east and gradually declines as it moves westwards; while winter rains are higher in the northwest declining as it moves south-eastwards. The highest rainfall occurs in the central and mid hill areas around Pokhara and northeast and east of the Kathmandu Valley. Temperature tends to increase from north to south and decrease with altitude. The winter season is coldest, with the highest temperatures during the pre-monsoon period.

### Observed changes in climate

Observed data indicate consistent warming and rise in the maximum temperatures at an annual rate of 0.04 – 0.06°C. Studies also indicate that the observed warming trend is not uniform across the country. Warming is more pronounced in high altitude regions compared to the Terai and Siwalik regions.

Annual precipitation data show a general decline in pre-monsoon precipitation in far- and mid-western Nepal, with a few pockets of declining rainfall in the western, central and eastern regions. In contrast, there is a general trend of increasing pre-monsoon precipitation in the rest

of the country. Monsoon precipitation shows general declining trends in the mid-western and southern parts of western Nepal, with a few pockets of declining rainfall in the central and eastern regions. In the rest of the country, monsoon precipitation has generally increased. Post-monsoon precipitation shows increasing trends in most of the mid-western and the southern parts of eastern and central/western Nepal. A general declining precipitation trend is observed in most of the far-western and northern parts of the western, central and eastern Nepal. The winter precipitation trends show overall increasing trends except the northern part of mid-western, western and eastern Nepal.

Himalayan glacier melt and retreat have been well documented. Glacial lake outburst floods (GLOF) are being assessed through remote sensing and more recently by ground-truthing of risk assessments.

### Climate change projections

*Temperature:* General Circulation Models run with the SRES B2 scenario show the mean annual temperature to increase by an average of 1.2°C by 2030, 1.7°C by 2050 and 3°C by 2100 compared to a pre-2000 baseline. A recent study that used General and Regional Circulation Models projects the mean annual temperature to increase by 1.4°C by 2030, 2.8°C by 2060 and 4.7°C by 2090. The projections show higher temperature increments during winter as compared to the monsoon seasons. Higher increments in temperature are projected over western and central Nepal as compared to eastern Nepal for the years 2030, 2060, and 2090, with projections for western Nepal being greatest. Similar trends are projected for the frequency of hot days and nights for 2060 and 2090.

*Precipitation:* Precipitation projections show no change in western and up to 5-10% increase in eastern Nepal during winter. During the summer months precipitations are projected to increase for the whole country in the range of 15 to 20%. A regional circulation model projects both rise and fall in the mean annual precipitation with no clear trends. In terms of spatial distribution, this study projects an increase in monsoon rainfall in eastern and central Nepal as compared to western Nepal. Further, the projections indicate an increase in monsoon and post-monsoon rainfall as well as an increase in the intensity of rainfall, and a decrease in winter precipitation.

The large inter-annual variation in rainfall could be attributed to natural cycles. IPCC (2007) projects that there will be a general increase in the intensity of heavy rainfall events in the future and an overall decrease by up to 15 days in the annual number of rainy days over a large part of South Asia. The observations and projections indicate that the key impacts are likely to include: significant warming, particularly at higher elevations, leading to reductions in snow and ice coverage; increased frequency of extreme events, including floods and droughts; and, overall increase in precipitation during the wet season while decrease in the mid-hills.

Nepal is largely an agrarian economy and thereby highly sensitive to changes in climate and natural resource availability. Climate change threatens to reduce the effectiveness of development initiatives across Nepal. For example, drying – added to a trend of warming – will impair food security and affect the availability of water resources. This will increase the vulnerability of marginalized and poor people in both rural and urban areas of western Nepal. Further increases in the intensity of rains in other parts of Nepal – particularly those where the topography is broken and soils eroded – will experience increased flooding and landslide risks threatening human security, water supplies, and urban infrastructure. Hence, effective climate change adaptation is required to counter the negative effects of climate change on development.

### NAPA process

The Ministry of Environment - Nepal Government's climate focal point - has widened the lens of adaptation planning to include programmatic and bottom-up approaches and identification of ways whereby integration of strategies for low carbon development and adaptation can precipitate into a series of co-benefits and economies of scale. It is believed that the NAPA prioritization process serves as a basis for the development of an adaptation strategy that will be able to draw financial resources for implementation from national as well as various global, multi-lateral and bilateral sources. *The Government expects that any and all climate change adaptation support programmes will carefully consider the NAPA outcomes as a first step.*

The MoE established Thematic Working Groups (TWGs) led by line ministries (following the guidance of the Least Developed Countries Expert Group and as suggested at the NAPA inception workshop) to ensure engagement and ownership of a wide range of stakeholders and key government line ministries. Six TWGs were formed, each led by a different line ministry: Agriculture and Food Security; Forests and Biodiversity; Water Resources and Energy; Climate-induced Disasters; Public Health; and Urban Settlements and Infrastructure. The first activity of the TWGs was to stock-take and synthesize key literature and policy documents relevant to climate vulnerability and adaptation under each theme.

Two national and three regional workshops as well as several consultations with the civil society and private sector groups including youth groups, foresters groups, indigenous communities, and disaster risk reduction networks were conducted. In addition, each TWG formed "Reference Groups" for wider consultations on a regular basis.

Micro-level impact assessments were undertaken through three transect appraisal exercises during November 2009 in the western, central and eastern regions of Nepal. Over 60 Government and non-government TWG members participated in these exercises. The individual team analyzed the outputs of the transect exercise both by agro-ecological zone and thematic area. The outputs of these analyses were combined with the stocktaking reports to produce thematic synthesis reports, subsequently summarized into a single "NAPA Summary Report". A number of other consultation activities were conducted during and after the draft NAPA preparation. Several consultations at different levels and in different regions, including a GIS-based vulnerability assessment, have clearly outlined that the mid- and far-western mountains and hills are most vulnerable due to heavy pressure on natural and social capitals and low adaptive capacity together with lack of proper food and nutrition availability.

The vulnerability assessments and the work of the TWGs came up with a "long-list" of adaptation options under each theme. Prioritization of adaptation options was conducted for inclusion in the final NAPA document. These adaptation options were systematized by the NAPA Project Team and an aggregated set of criteria that pooled the common criteria used by the TWGs was derived and then approved by the TWGs. The TWGs then used the aggregated criteria to develop short lists of adaptation options of the highest priority.

The prioritization process to select climate adaptation actions was carefully adopted and was made as consultative as was possible. A multi-criteria analysis was used in a step-wise process that culminated in identifying the most urgent and immediate climate adaptation actions according to national needs and interests.

The criteria to assess the urgent and immediate needs were applied to develop top priority project profiles at the final prioritization workshop. There is strong convergence between several of the most urgent and immediate priority projects identified by individual TWGs.

TWGs agreed to combine priority activities and develop combined project profiles. The NAPA Project Team carried out an integrated ranking of priority activities and clustered these into nine combined project profiles. They are:

- i. Promoting Community-based Adaptation through Integrated Management of Agriculture, Water, Forest and Biodiversity Sector
- ii. Building and Enhancing Adaptive Capacity of Vulnerable Communities Through Improved System and Access to Service Related to Agricultural Development
- iii. Community-based Disaster Management for Facilitating Climate Adaptation
- iv. GLOF Monitoring and Disaster Risk Reduction
- v. Forest and Ecosystem Management for Supporting Climate-Led Adaptation Innovations
- vi. Adapting to Climate Challenges in Public Health
- vii. Ecosystem Management for Climate Adaptation
- viii. Empowering Vulnerable Communities through Sustainable Management of Water Resource and Clean Energy Supply
- ix. Promoting Climate Smart Urban Settlement

The total cost to implement these integrated adaptation measures is about USD 350 million.

The prioritized adaptation options include both urgent/immediate and long term adaptation strategies in key vulnerable sectors under the six TWGs. More focus has been given to providing information, knowledge, skills and technology to the most vulnerable households living in fragile and climate vulnerable districts across Nepal. The strategies and actions have been targeted to increase community's adaptive capacity through livelihoods support, improved governance, collective responses, improved service delivery mechanisms, access to technology, and finance. It has also suggested a watershed and landscape level approach dealing with issues related to food security, biodiversity loss, water scarcity, energy use, settlements, disease outbreak, and governance.

The draft NAPA report was reviewed through a public consultation process and was finalized. The Government of Nepal approved the NAPA document on September 28, 2010.

### NAPA PROJECT ADVISORY BOARD

Ganesh Raj Joshi, *Secretary, Ministry of Environment (Chair)*  
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## CHAPTER 1: INTRODUCTION AND SETTING

The Nepal NAPA report is structured according to the guidelines contained in Decision 29/CP.7 and annotated guidance provided by the Least Developed Countries Expert Group. The succeeding sections set out the introduction and national setting, the Nepal adaptation programme framework, NAPA preparation processes and the methods and criteria used in the identification of key adaptation needs, prioritization process, lists of top priority adaptation actions and finally conclusions.

In this introductory section the characteristics of the geography of Nepal, the population and the climate are outlined. In addition, an introduction is made of the national scale climate change adaptation planning in Nepal.

Nepal's Initial National Communication to the UNFCCC (2004) and National Capacity Self-Assessment (2008) pointed out some problems in relation to adaptation activities including inadequate financial, technological and human resources. Barriers were also found in different sectors where incomplete implementation of existing plans and policies are not uncommon, budget allocations have decreased (e.g., agriculture and irrigation), and clear guidelines pertaining to mandates and roles of devolved structures are lacking. Public awareness in relation to climate change with disasters is low; there is only limited reach of early warning systems; and lack of land use planning and limited implementation of building codes are prevalent. These issues will need to be resolved as part of a planned adaptation process.

### 1.1 Geography, population and climate

#### 1.1.1 Geography

Nepal is a land-locked country situated in the central part of the Himalayas stretched between 26°22' and 30°27' N latitudes and 80°40' and 88°12' E longitudes. The total area of the country is 147,181 km<sup>2</sup> that is made up of five physiographic regions (LRMP, 1986): High Himal, High Mountain, Middle Mountain, Siwalik (the Churia Range), and the Terai (Figure 1.1). Each of the physiographic regions has a distinct altitude and climatic characteristics that vary from sub-tropical to alpine conditions within a lateral span of less than 200 km. Table 1.1 shows the characteristics in different ecological belts of Nepal.

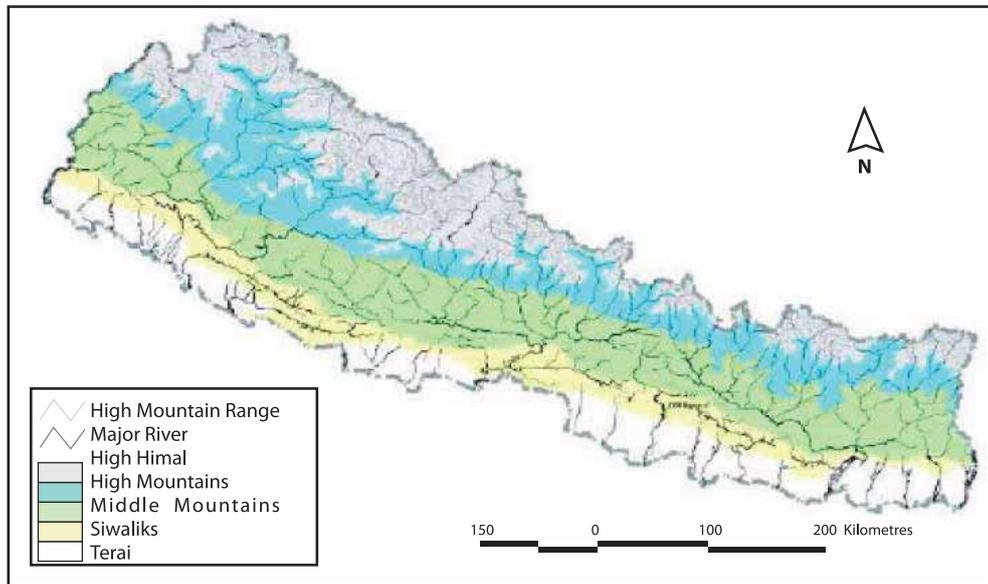
Nepal has more than 6,000 rivers that largely drain north to south. The three main river systems are the Karnali, Narayani (Gandaki), and Saptakosi. Forests occupy 39.6% of the total area (DFRS, 1999). A significant bulk of energy is derived from biomass, mainly fuel wood. Less than a third of the population has access to electricity which comes mainly from hydropower.

**Table 1.1: Climate characteristics in different ecological belts of Nepal**

Physiographic zone	Ecological belt	Climate	Average annual precipitation	Mean annual temperature
High Himal	Mountain	Arctic/alpine	Snow/150mm-200mm	<3°C-10°C
High mountain				
Middle mountain	Hill	Cool/warm	275mm-2300mm	10°C-20°C
Siwalik	Terai	Tropical/sub-tropical	1100mm-3000mm	20°C-25°C
Terai				

Source: WECS, 2005

Figure 1.1: Physiographic characteristics of Nepal



Source: LRMP, 1986

### 1.1.1 Population

The Nepal population is close to 28 million as of August 2010. Nepal ranks 193 out of 210 countries in terms of Gross National Income per capita adjusted for purchasing power and more than 70% of people live on less than USD2 per day (ADB, 2009).

The population is predominantly rural with some urban centers such as the Kathmandu Valley that is gaining importance. Above 85% of the population is engaged in farming, predominantly for subsistence (UNDP, 2009), and the agriculture sector is the second largest contributor (33%) to the gross domestic product (GDP) after services at 39%, whereas industry's contribution to GDP was 23% (ADB, 2009). Tourism contributes significantly to Nepal's income with receipts in 2000 amounting to 15% of exports (Regmi and Adhikari, 2007).

Nepal in essence is a cultural mosaic comprising different castes and ethnic groups belonging to the Tibeto-Burman and Indo-Aryan linguistic families, which is indicative of the waves of migration that have occurred for over 2000 years from the north and south respectively. Although intermingling between the various groups has occurred, they differ widely in the details of cultures and adaptations, combining elements of Buddhism, Hinduism and Islam picked up through cultural contacts over the years. In addition, resettlement of the hill and mountain people into the Terai since the 1960s has added a new dimension to the social landscape resulting in an extremely heterogeneous and complex Terai population (Pradhan and Shrestha, 2005).

### 1.1.2 Climate

Nepal's climate is influenced by the Himalayan mountain range and the South Asian monsoon (NCVST, 2009). The climate, predominantly influenced by the monsoons and westerly disturbance, is characterized by four distinct seasons: pre-monsoon (March-May), monsoon (June-September), post-monsoon (October-November) and winter (December-February).

Average annual rainfall is approximately 1800 mm but there are marked spatial and temporal variations both north-south and east-west. The monsoon rain is most abundant in the east and declines westwards, while

winter rains are higher in the northwest and decline south-eastwards (Practical Action, 2009). Highest rainfall is experienced in the central and mid-hill regions around Pokhara and northeast and east of the Kathmandu Valley.

Temperature varies with altitude and season. It increases from north to south and decreases with altitude. The winter season is coldest, with the highest temperatures during the pre-monsoon period.

### 1.2 National development planning as a framework for climate adaptation

Nepal is undergoing a transition from a monarchy dominated governance system to a federal democratic republic system. In addition, preparations are under way to write a new constitution. At this historic juncture, strenuous efforts have been made to generate a comprehensive National Adaptation Programme of Action (NAPA) through genuinely consultative and inclusive processes.

Nepal's NAPA is set within the country's development objectives. These objectives have been articulated in the national planning strategies and are aimed at addressing the specific economic and socio-political conditions prevailing in the country.

Nepal's development goals, and therefore the NAPA framework, are set under the overriding goal of reducing poverty in the country. Poverty is largely rural in nature with a 14% difference between rural and urban poverty. In 2009, urban and rural poverty levels were 8% and 22%, respectively. Poverty occurrence also varies in spatial terms; in 2009, it was 37.4% in the Mid-Western region while it was 1.9% in Kathmandu.<sup>1</sup>

A series of National Five-Year Plans and Three-Year Interim Plans aimed to achieve poverty reduction by providing a policy framework that encourages investments in primary sectors that form the backbone of rural development and poverty reduction.

Similarly, the overarching aims of the Tenth Plan/Poverty Reduction Strategy Paper (2002-2007) and the Three-Year Plans (2007-2010 and 2010-2012) are to bring about a remarkable and sustained reduction in the poverty level in Nepal.<sup>2</sup> In order to do so the plans identify four broad development priorities: broad-based sustained growth; improvement in access and quality of infrastructure, social and economic services in the rural areas; targeted programmes for social and economic inclusion of the poor and marginalized communities; and good governance to improve service delivery, efficiency, transparency and accountability.

The current Three-Year Plan (2010-2012) also aims at reducing poverty through sustainable economic growth and improving the living standard of the people. Similar to the interventions of the Tenth Plan, it aims at creating employment, reducing economic and regional disparity, and eliminating social exclusion. It accords priority to the agricultural sector and promises policy and budgetary support to ensure implementation of the plan. Previous National Plans addressed different dimensions of sustainable economic growth and concerns regarding the importance of climate change. For instance, the need to internalize environmental impact assessment (EIA) into development planning was articulated in 1980s and in 1993, Nepal Environmental Policy and Action Plan (NEPAP) was prepared to facilitate integration of environmental considerations into the development process. Similarly, the Local Self-Governance Act (1999) provides local governments with a mandate to carry out a number of environment and development related activities.

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<sup>1</sup> <http://www.undp.org.np/mdg/mdg-process.php> for further information.

<sup>2</sup> The National Living Standards Survey (NLSS 2003) shows encouraging results, reporting a decline in poverty incidence from 42 percent in 1995/96 to 31 percent in 2003/04. This has been attributed to an increase in migration and remittances, diversification in agriculture, expansion of rural credit, and impacts of social mobilization campaigns. Figures also show that poverty in Nepal is a rural phenomenon as poverty rates are declining faster in urban areas. However, the starting baseline is very low.

In addition to setting the context within which national adaptation priorities will be identified in the national planning process, modalities should guide the design and implementation of identified adaptation options. For instance, in order to use available resources more efficiently and effectively, the Tenth Plan adopted a number of new modalities for implementation and service delivery. It aimed at redefining the role of the government by creating spaces for the private sector, NGOs, CBOs and local governments.<sup>3</sup> The Plan also placed strong emphasis on prioritizing resource allocations annually through a rolling Medium-Term Expenditure Framework, so that the key poverty reduction priorities can be continued despite shortfalls in resources. In line with this it sought to facilitate budgetary allocation to priority sectors and improve efficiency across different sectors by designing programmes and projects into different phases.

The national development goals mentioned above provide the context within which the NAPA has been framed even though there was no explicit mention of climate change issues until the Tenth Plan. The specific interface between these national development goals and the six thematic areas identified under the NAPA process is highlighted in Table 1.2 taking into consideration the overarching goals of poverty reduction and Millennium Development Goals as reflected in the previous periodic plans.

**Table 1.2: The NAPA framework and Nepal's development goals**

NAPA Thematic Areas	Summary Highlights of Tenth Plan and Three Year Interim Plan Development Goals
<b>Agriculture and food security</b>	<p>Agricultural growth was a major priority in the Tenth Plan and continued in the ensuing Three-Year Interim Plan. The Tenth Plan envisaged agricultural growth to increase by 4.1% and livestock by 4.9% per annum, as well as a reduction in food insecurity and malnutrition. Identified means to enable growth include: diversification and commercialization; enhanced supply and access to irrigation, fertilizers and rural electrification; and improving market linkages.</p> <p>The Agriculture Perspective Plan (1995) emphasized a stronger role for private sector involvement and increased role of communities, farmers groups and cooperatives in the management of infrastructure and assets.</p>
<b>Water resources and energy</b>	<p>The Tenth Plan prioritized the power sector and aimed to expand electricity coverage in a sustainable and environment-friendly manner; accelerated rural electrification; and developed hydro-power as an export item. It aimed also to develop alternative energy, reduce dependency on imported energy and also emphasized to strengthen the role of the private sector in developing and delivering these priorities.</p> <p>Increased irrigation supply via new irrigation facilities and rehabilitation and strengthening of public and community-based irrigation system along with the use of and scaling up of non-conventional schemes using micro-irrigation technologies, which have been used by INGO's in a scattered nature - was also a major priority in the Tenth Plan.</p> <p>The Plan also attached high priority to drinking water and sanitation. Strategies aimed to further strengthen community-based approaches especially in decision-making, benefit sharing and cost recovery.</p> <p>The Three Year Interim Plan envisions that the hydropower sector is to develop based on optimal utilization of water resources to meet the domestic power demand and export the surplus while expanding the development and services in order to contribute to the livelihood improvement of Nepalese people.</p>
<b>Forests and biodiversity</b>	<p>Forest management was prioritized in the Tenth Plan due to its role in promoting rural livelihoods and providing environmental services. The sector was prioritized also to ensuring improved ecosystem services, rural economy and agriculture systems.</p>

<sup>3</sup>. For instance, a District Agricultural Development Fund (DADF) has been set up as a new approach under the Agriculture Perspective Plan Support Programme. Similarly, the Rural Water Supply Sanitation Fund Development Board (Fund Board) was created on March 14, 1996 to promote sustainable and cost effective demand-led rural water supply and sanitation services.

## National Adaptation Programme of Action (NAPA)

NAPA Thematic Areas	Summary Highlights of Tenth Plan and Three Year Interim Plan Development Goals
	<p>The Three Year Interim Plan envisioned that in addition to providing the necessary goods and services to rural communities, the forestry sector has contributed to other sectors significantly. It is essential to make forest products available to general public through protection, conservation and use of forest resources. Similarly, it is necessary to support the livelihood of all Nepalese people, including the poor and deprived groups through the management and sustainable development of forests, watershed area, forest, environment and biodiversity.</p>
<b>Public health</b>	<p>The overarching national objective of the health sector in the Tenth Plan was to reduce the magnitude of poverty substantially and make it sustainable by developing and mobilizing healthy human resources. In order to achieve this objective the Plan aimed to (i) improve the quality of health services, and extend access to these services to poor people living in rural and remote areas; and (ii) manage the rising population, and extend the access of reproductive health and family planning services to rural areas in consideration of maternal health services.</p> <p>Nepal is implementing its Health Sector Strategy as a sector wide approach (SWAP) by linking the annual work plan with the strategy to the medium-term economic expenditure framework (MTEF). The latest strategy includes a chapter on climate change and health. A number of programmes under this strategy are relevant in terms of planning for and adapting to climate change. For instance, policies and programmes like the National Drinking Water Quality Standards (2006); early warning epidemic reporting systems in 28 districts; devolution of health services to local management community in the district and village council to ensure community oversight; community health insurance scheme, are likely to help address the impacts of climate change.</p> <p>The Three Year Interim Plan envisions establishing appropriate conditions of quality health services delivery, accessible to all citizens, with a particular focus on the low-income citizens and contribution to the improvement in the health of all Nepalese citizens.</p> <p>However, information on the interaction between climate change and health impacts is limited.</p>
<b>Urban settlements and infrastructure</b>	<p>The Tenth Plan focused on infrastructure development, especially on road networks, and expansion of electricity and national communication infrastructure. Previous Plans and Acts had also focused on land reform (Five Year Plan, 1965-70); planning codes; controlling urban pollution; water supply and management; addressing rural-urban migration by supporting rural development. These Plans, including the Tenth Plan, however, didn't explicitly address climate induced risks and in their current form will only be able to provide post-disaster emergency relief in the form of emergency shelters and housing for disaster-affected families.</p> <p>The proposed Disaster Risk Reduction Action Plan for Nepal (2010-2013) calls for the preparation of a risk-sensitive land use plan for Kathmandu Valley (i.e. the five municipalities and villages within the Valley) that provide a framework for development, land allocations and related strategies, policies and regulatory tools and procedures for controlling future growth and safeguarding it from natural hazards.</p>
<b>Climate-induced Disaster</b>	<p>Disaster risk management was prioritized in the Tenth Plan. Government has approved the National Strategy for Disaster Risk Management (2009). The long term vision of the strategy is to establish disaster resilient communities. The strategy aims to mainstream disaster risk reduction into development through sector development and poverty alleviation planning and incorporates the principles of the Hyogo Framework of Actions.</p> <p>The Three Year Interim Plan sets its objectives to promote security of life and property from disasters through sustainable, environment-friendly and result oriented development by making disaster management practices efficient, competent, strengthened and effective.</p>

The Government of Nepal (GoN) has recently approved the Three Year Plan (TYP) Approach Paper (2010-2012) which has broad-based objectives of, *inter alia*, promoting green development, making development activities climate-friendly, mitigating the adverse impacts of climate change, and promoting adaptation. The TYP also has objectives of mitigating urban pollution and protecting rural natural beauty.

The key expected outcomes of the TYP are to prepare and implement a national framework on climate change adaptation and mitigation, disaster risk reduction, poverty reduction and poverty environment initiatives.

The TYP has adopted the following strategies: (i) strengthen the institutional capacity related to environmental policies and regulations; (ii) internalize environment management into the development efforts; (iii) prioritize and plan for effective implementation of national and international environmental commitments; (iv) adapt with climate change and manage natural resources sustainably; (v) make meteorological forecast more reliable; and (vi) conduct study and research on environmental promotion and climate change.

In order to implement the strategies, the TYP has adopted an implementation approach that made the MoE responsible for coordinating all activities related to environment conservation and climate change. The TYP focuses on identifying agencies and ensuring their roles and responsibilities for NAPA implementation by utilizing national and international support. The TYP also focuses on the need for developing partnership amongst donor agencies, NGOs, local bodies, CBOs and other agencies, and to take an initiative to establish an international research centre on climate change.

### 1.3 The Nepal NAPA Project

NAPAs are a means of prioritizing urgent and immediate adaptation actions. With support from donors and development partners, the Ministry of Environment - the Government's climate focal point has the opportunity to widen the lens of adaptation planning to include programmatic and bottom-up approaches to adaptation, and to find ways whereby integration of strategies for low carbon emission development and adaptation can precipitate a series of co-benefits and economies of scale.

The Government's intention is that the prioritization process for the NAPA is comprehensive enough to be used as a basis for the development of an adaptation strategy that will be able to draw on financial resources for implementation from various global, multilateral and bilateral sources. The Government expects that while considering what activities to support in Nepal, any and all climate adaptation support programmes will carefully consider the NAPA outcomes as a first step. The NAPA process in Nepal has three components:

- Preparation and dissemination of a NAPA document (this report);
- Development and maintenance of a Climate Change Knowledge Management and Learning Platform; and,
- Development of a multi-stakeholder Framework of Action on Climate Change in Nepal.

The milestones in the preparation of NAPA document are summarized in Annex 1. The NAPA document identifies ways to address the urgent and immediate adaptation needs of Nepal based on a country-driven and consultative process. It assessed the vulnerability and impacts of climate change on socio-economic conditions, built environment, and ecosystems; and identifies and prioritizes priority adaptation options. Project profiles for priority adaptation activities are also developed.

NAPA is expected to provide a basis for the government to guide the future climate change governance and manage financial resources in a coherent and coordinated manner. The Government will also use it to communicate its urgent and immediate adaptation needs.

All NAPAs, including that of Nepal, are developed using the guidance and annotated guidelines developed by the Least Developed Countries Expert Group (LEG). These guidelines are flexible to ensure a country-driven approach to NAPA development. Nepal is in an advantageous position of being able to learn from the NAPA experiences of other Least Developed Countries (LDC). The approach to NAPA in Nepal draws from the best practices and cautionary lessons of other LDCs including:

- Ensure a country-driven approach;
- Strategically align the NAPA with other national climate change and development processes to ensure effective mainstreaming and rapid follow-up to implementation of adaptation projects;
- Ensure effective representation of vulnerable groups who have the most urgent and immediate adaptation needs;
- Comprehensive assessments of vulnerability and adaptation measures that integrate technical data on the impacts of climate variability and climate change with local knowledge related to vulnerability and coping with existing climatic stresses;
- Ensure inclusive participation of all stakeholders through the NAPA process.

Formulation of the NAPA document is a critical point of departure for Nepal to identify urgent and immediate adaptation needs. However, an isolated approach to NAPA formulation without consideration of how the NAPA process could strategically be used to create a sustainable support and knowledge infrastructure for climate change activities in Nepal would not warrant a swift and well-coordinated follow up to the identified priorities.

### 1.4 Objectives of the NAPA document

Nepal's NAPA aims to enable Nepal to respond strategically to the challenges and opportunities posed by climate change. The main objectives are to:

- i. assess and prioritize climate change vulnerabilities and identify adaptation measures;
- ii. develop proposals for priority activities;
- iii. prepare, review and finalize the NAPA document;
- iv. develop and maintain a knowledge management and learning platform; and
- v. develop a multi-stakeholder framework of action on climate change.

It is aimed that the NAPA process will continue even after the completion of the NAPA document preparation and the country will own the process and mainstream the outcomes into the national development agenda. NAPA envisions that mainstreaming climate change into national development agenda will contribute to poverty reduction, livelihood diversification and building community resilience.

## CHAPTER 2 FRAMEWORK FOR ADAPTATION PROGRAMME

This section provides an overview of observed and projected climate variability and climate and associated actual and potential impacts of the same. This overview is based on existing and ongoing studies and research, and on expert and local knowledge collected during the NAPA process.

### 2.1 Observed climate variability and change

#### **Temperature**

Observed changes in temperature trend, recent studies and local perceptions collected during the NAPA process indicate an increase in temperature over the years. For instance, Shrestha et al. (1999) in a study based on an analysis of temperature trends from 49 stations for the period 1977 to 1994 indicate a consistent and continuous warming in the period at an annual rate of  $0.06^{\circ}\text{C}$ . Similarly, a study conducted by Practical Action (2009), using data from 45 weather stations for the period 1996–2005, indicate a consistent and continuous warming in maximum temperatures at an annual rate of  $0.04^{\circ}\text{C}$ . The studies also indicate that the observed warming trend in the country is spatially variable.

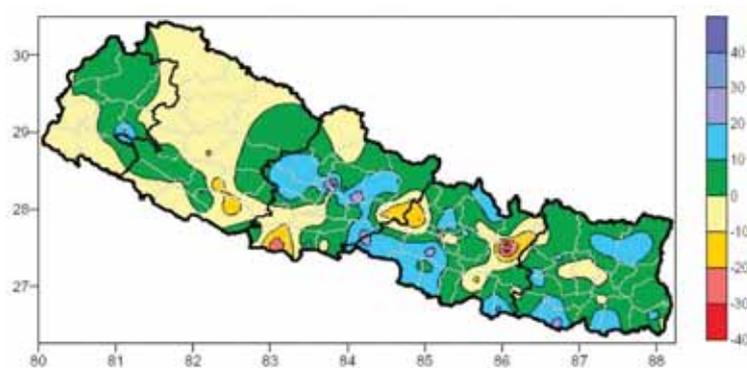
Himalayan glacier melt and retreat have been documented (see for example Seko et al., 1998; Kadota et al. 2000; Naito et al. ,2000; Yamada et al., 1992; Nakawo et al., 1976; Fujita et al. 2001; Asahi et al., 2000). Fifteen Glacial Lake Outburst Floods (GLOF) events have been documented in Nepal (Ives, 1986; Yamada, 1998), the most recent in 1985, when Dig Tsho, a lake in the headwaters of the Koshi River, breached after an avalanche slid into it, overtopping the dam. The event destroyed hydro-electricity projects, bridges, houses and farmlands worth four million US dollars (NCVST ISET, 2009). Reporting of such events resulted in a large scale effort to identify other 'dangerous' lakes and reduce the risk of further GLOF events. Ives (2009) has mentioned that the identification of other 'dangerous' glacial lakes has been based on inadequate scientific data.

#### **Precipitation**

Unlike temperature trends, precipitation data for Nepal does not reveal any significant trends (Shrestha et.al, 2000; Practical Action 2009). The inter-annual variation of rainfall, particularly monsoon precipitation, is so large that observed trends are very uncertain and could be a part of natural cycles (El Niño phenomenon or solar cycles).<sup>4</sup>

The analysis of data from 166 stations across Nepal from 1976 to 2005 revealed an increasing trend in annual rainfall in eastern, central, western and far-western Nepal (Figure 2.1).

Figure 2.1: Annual Precipitation Trends 1976-2005 (mm/yr)



Source: Practical Action (2009)

<sup>4</sup> While the large inter-annual variation in rainfall could be attributed to natural cycles, the IPCC (2007) projects that there will be a general increase in the intensity of heavy rainfall events in the future and an overall decrease by up to 15 days in the annual number of rainy days over a large part of South Asia.

Seasonal variation in annual precipitation shows a general decline in pre-monsoon precipitation in far-and mid-western Nepal, with a few pockets of decreasing rainfall in western, central and eastern regions. On the other hand, in the rest of the country there is a general trend of increasing pre-monsoon precipitation.

The monsoon precipitation shows general decreasing trends in the mid-western and southern parts of western Nepal, with few declining trend in pockets of the central and eastern Nepal. In the rest of the country, the trend is generally increasing.

Post-monsoon precipitation shows an increasing trend in most of the mid-western and southern parts of eastern and central/western Nepal. A general declining precipitation trend is observed in most of the far-western and northern part of the western, central and eastern Nepal. The winter precipitation shows an overall increasing trends except in the northern parts of mid-western, western and eastern Nepal.

Annex 2 describes local people's perceptions and the location-specific evidence gathered by the NAPA Thematic Working Group members during the NAPA Transect Appraisal Exercise on location-specific perceived changes related to climate change and/or variability. Though perceptions vary across the eco-regions, the exercise reveals that local communities perceived an increase in temperature, an upward shift of agro-ecological zones, changes in precipitation in terms of timing, duration and intensity, and form (less snow and changes in timing). Communities also perceived a shift in wind, frost and dew patterns, as well as increased frequency of extreme events (droughts and floods) and avalanches.

## 2.2 Projected climate change

A couple of studies on climate change projections for Nepal have been published in recent years (OECD, 2003 and NCVST, 2009). The information and data below on projected climate changes are taken from these sources.

### **Temperature**

In the OECD study General Circulation Models (GCM) run with the SRES B2 scenario show mean annual temperature to increase by an average of 1.2°C by 2030, 1.7°C by 2050 and 3°C by 2100 compared to a pre-2000 baseline. The NCVST (2009) study using GCM and Regional Circulation Models (RCM) projects the mean annual temperature to increase by 1.4°C by 2030, 2.8°C by 2060 and 4.7°C by 2090. In general, both studies show higher temperature increment projections for winter compared to the monsoon season. In terms of spatial distribution, the NCVST (2009) study shows a higher increment in temperature over western and central Nepal as compared to eastern Nepal for the year 2030, 2060, and 2090, with projections for western Nepal being the greatest. Similar trends are projected for the frequency of hot days and nights for 2060 and 2090.

### **Precipitation**

The OECD projections on precipitation are similar to those presented by the IPCC (2007). In terms of winter precipitation, the models project almost no change in precipitation in western Nepal and up to 5-10% increase in precipitation in eastern Nepal. During the summer months, however, projections depict an increase in precipitation for the whole country in the range of 15 to 20%. The NCVST (2009) study, projects both increase and decrease in mean annual precipitation with no clear trends (as outlined below table 2.1). In terms of spatial distribution, the study findings project an increase in monsoon rainfall in eastern and central Nepal as compared to western Nepal. Further, the projections indicate an increase in monsoon and post-monsoon rainfall as well as an increase in the intensity of rainfall, and a decrease in winter precipitation.

**Table 2.1: Precipitation projections for Nepal**

Year	Annual mean		Monsoon rainfall	
	Multi-model mean	Range	Multi-model mean	Range
2030s	+0%	-34 - +22%	+2%	-40 - +143%
2060s	+4%	-36 - +67%	+7%	-40 - +143%
2090s	+8%	-43 - +80%	+16%	-52 - +135%

Source: NCVST (2009)

Overall, these climate change projections are in line with observations of climatic change in Nepal. The observations and projections indicate that there is likely to be marked warming that will—at higher elevations result into reduced snow and ice coverage; increased climatic variability, and more frequent extreme events (floods and droughts), and an overall increase in rain in the wet season but decreased rainfall in the mid-hills.

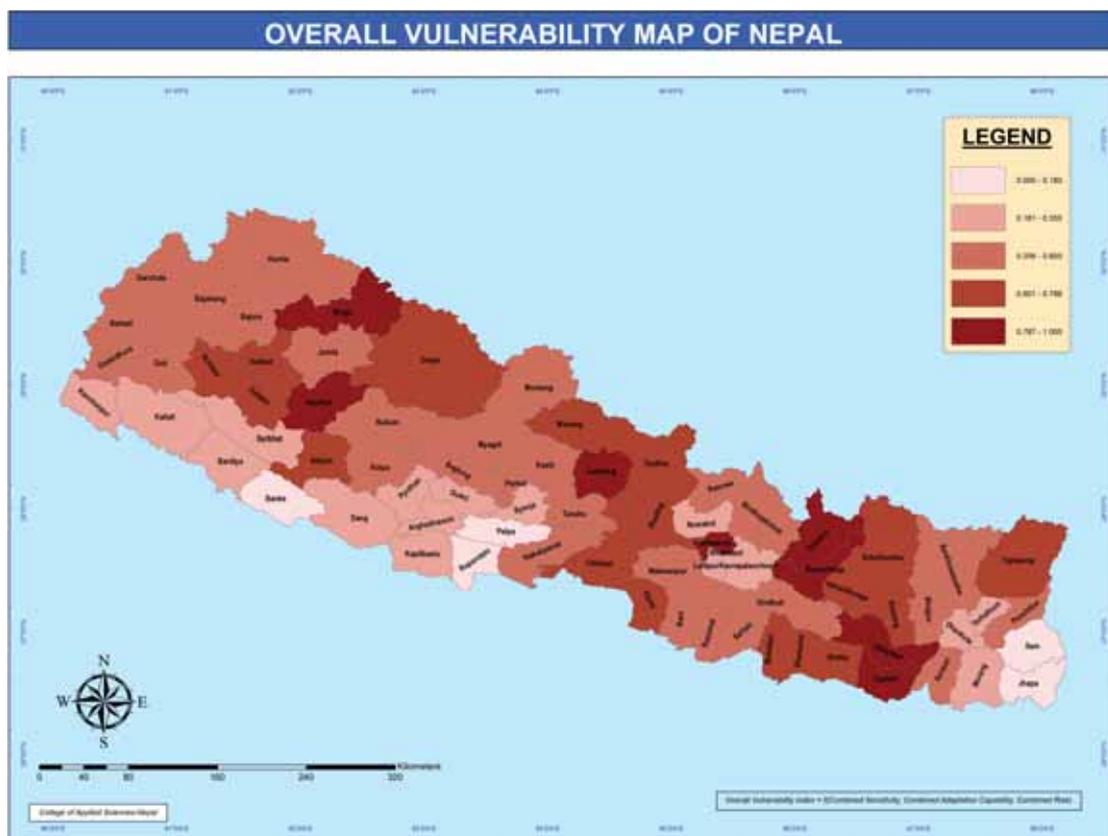
### 2.3 Climate change vulnerability

As part of the NAPA process, a series of climate change vulnerability assessments at the district level was conducted. This work provides information on the areas that are most vulnerable to climate change impacts in Nepal. The assessment was carried out by overlaying climate risk/exposure maps, sensitivity maps, and adaptive capacity maps following the vulnerability assessment framework of the IPCC. The study used data on the spatial distribution of various climate-related risks/exposure in 75 districts. Based on this assessment, the most climate vulnerable districts were identified.

The vulnerability assessment report states that due to data limitations use of expert judgment particularly in assigning weights to the various climate indicators is necessarily subjective. Further work is required on the sensitivity, risk/exposure, and adaptation capability indices and consequently on the maps prepared on the basis of the above indices.

The overall vulnerability map for the districts of Nepal from GIS-based vulnerability map developed by NAPA is shown in Figure 2.2. Table 2.2 lists the districts ranked by the overall climate change vulnerability index. Annex 3 shows more detailed climate change vulnerability maps from the study.

Figure 2.2: Map of Nepal districts showing relative overall climate change vulnerability



**Table 2.2: Nepal districts ranked according to an overall climate change vulnerability index**

Vulnerability Ranking	Districts
Very High (0.787-1.000)	Kathmandu, Ramechhap, Udayapur, Lamjung, Mugu, Bhaktapur, Dolakha, Saptari, Jajarkot
High (0.601-0.786)	Mahottari, Dhading, Taplejung, Siraha, Gorkha, Solukhumbu, Chitwan, Okhaldhunga, Achham, Manang, Dolpa, Kalikot, Khotang, Dhanusha, Dailekh, Parsa, Salyan
Moderate (0.356-0.600)	Sankhuwasabha, Baglung, Sindhuli, Bhojpur, Jumla, Mustang, Rolpa, Bajahang, Rukum, Rautahat, Panchthar, Parbat, Dadeldhura, Sunsari, Doti, Tanahu, Makwanpur, Myagdi, Humla, Bajura, Baitadi, Bara, Rasuwa, Nawalparasi, Sarlahi, Sindhupalchok, Darchula, Kaski
Low (0.181-0.355)	Nuwakot, Dhankuta, Kanchanpur, Bardiya, Kapilbastu, Terhathum, Gulmi, Pyuthan, Surkhet, Arghakhanchi, Morang, Dang, Lalitpur, Kailali, Syanja, Kavrepalanchowk
Very Low (0.000-0.180)	Ilam, Jhapa, Banke, Palpa, Rupandehi

Source: MoE/NAPA Project (2010) *Climate change vulnerability mapping for Nepal*.

Nepal's low level of development and complex topography renders it vulnerable to climate change. The ongoing climate change and changes projected to occur are likely to have impacts on different sectors of Nepal. Impacts on some sectors are likely to be more severe than others. The sensitive sectors are agriculture, forestry, water and energy, health, urban and infrastructure, tourism, industry and overall livelihoods and economy.

The analysis shows that Nepal is highly vulnerable to climate change. It suggests that more than 1.9 million people are highly climate vulnerable and 10 million are increasingly at risk, with climate change likely to increase this number significantly in the future. Vulnerability to climate change is spread across Nepal. However, most of the people living in the mid and far western region are amongst the most vulnerable, a situation closely correlated with the poverty rates in those areas, the heavy reliance on small scale agriculture which is increasingly at risk from more erratic rainfall patterns, and the lack of basic services and alternative livelihood options.

The degree of vulnerability even within the low scored districts may be high due to the prevalence of disparity among the population and lack of access to basic services and social protection mechanisms. For example some of the villages in Banke, which is very low in terms of scored vulnerability index, are worse than some of the villages of high vulnerable districts. This implies that there is a need to carry out vulnerability assessment in all the VDCs and villages of Nepal and identify vulnerable areas and people accordingly.

A number of factors and conditions constitute the vulnerability context. Poor people are vulnerable to loss of physical capital (damage to shelter and infrastructure), human capital (malnutrition and diseases), social capital (displacement of communities), natural capital (loss of productivity in agriculture and fisheries) and financial capital (more disasters and lower income). Degradation of livelihoods by climate change will thus leave poor people with less of the assets they need to withstand shocks and stresses. A study shows that households with low income, small landholding size and lacking access to information and basic services are more vulnerable than with households with relatively richer asset base (Regmi et al., 2009).

## 2.4 Impacts of climate change

The NAPA Inception Workshop identified six major areas that are impacted by climate change. Those six areas are the basic themes for the development of NAPA process, including the formation of thematic working groups. The transect appraisal and other consultations including the climatic information collections have been based on these thematic areas. As presented in Annex 4, local perceptions and expert opinion collected during the NAPA process, highlight that changes in the climate trends listed in the previous section could and are leading to significant impacts on the six thematic areas identified in the NAPA process and could have gender-specific implications.

### 2.4.1 Agriculture and food security

In terms of agriculture and food security, local communities have identified changes in climate as being largely responsible for declining crop and livestock production. Nepal's vulnerable subsistence farming economy is facing risk due to changes in the reliability of stream flow, a more intense and potentially erratic monsoon rainfall, and the impacts of flooding. Decline in rainfall from November to April adversely affects the winter and spring crops. Rice yields are particularly sensitive to climatic conditions and these may fall in the western region where a larger population of the poor live and this could threaten overall food security (DFID, 2009). Assessment also shows that climate change is posing a threat to food security due to loss of some local land races and crops (Regmi and Adhikary, 2007).

### 2.4.2 Water resources and energy

Effects of climate change on water resources could yield manifold implications either due to too much and/or too little water. Climate-induced water stresses directly affects agricultural productivity, malnutrition, human health and sanitation. On the other hand, too much water impacts human settlements, infrastructure and agriculture land. Local communities highlighted that climate induced events have direct impacts on renewable energy sources. For instance, changes in river flow will have direct implications for micro-hydro projects in the hills and mountains; an increase in the number of cloudy days and changes in the form of precipitation (from snowfall to hailstones) adversely affects solar power potential in the mountain; and increased incidence of forest fires threatens the availability of already scarce fuel-wood sources.

Nepal's development is being severely restricted by lack of access to energy. Over 85% of the population relies on traditional biomass for their energy supplies and 18 million people do not have access to electricity.<sup>5</sup> Approximately 90% of Nepal's electricity production is from hydropower. Irregularities in streamflow affect the reliability of hydropower, and siltation from landslides and flood events further reduces power generation efficiency.

### 2.4.3 Climate-induced disasters

The transect appraisal exercise and literature review revealed that Nepal is exposed to various types of hydro-meteorological disasters. Climate change will further exacerbate the existing scenario. More than 4,000 people



A mother and her child are looking for a dry place after the flood of September 2008 in Kanchanpur District in the Far Western region of Nepal (Photo credit: Western Terai Landscape Conservation Project, 2008)

<sup>5</sup>. ADB 2009. Improving Energy Security and Reducing Carbon Intensity in Asia and the Pacific. Mandaluyong City, Philippines. <http://www.adb.org/Documents/Books/Improving-Energy-Security-Reducing-Carbon-Intensity/Improving-Energy-Security-Reducing-Carbon-Intensity.pdf>.

died in the last ten years due to climate-induced disasters causing an economic loss of US\$ 5.34 billion.<sup>6</sup> Data from the Ministry of Home Affairs show that every year more than one million people are susceptible to climate-induced disasters such as floods, landslides, and droughts.

Trends in flooding are also closely related to the effects of higher temperature on glaciers. As a result of increased glacier melt, there are currently 20 glacial lakes at the risk of bursting, six of which have been identified as 'critical'.

### 2.4.4 Forests and biodiversity

Increased temperature and rainfall variability have resulted into shifts in agro-ecological zones, prolonged dry spells, and higher incidences of pests and diseases. Studies show that new alien and invasive species are emerging and their habitat is spreading at a fast rate. Extreme climatic conditions have led to increased incidence of fire in recent years affecting more than 50,000 people<sup>7</sup>. and loss of large areas of productive forest land. These changes (amongst other drivers) lead to species and habitat loss. Communities also observed that they are experiencing seasonal changes observed in terms of early sprouting, flowering and fruiting. In some cases, these changes have benefited communities by increasing the ecological range of cultivation for certain crops. In other cases, climatic changes have negative impacts, for example productivity of some species like panch aule (*Dactylorhiza hatageria*), silajit (*Rock Exedutes*), amala (*Imblica officianalis*), ritha (*Sapindus mukurosii*), timur (*Zanthoxylum armatum*), and bel (*Agle marmelos*) are declining and shifting to higher altitude and green grasses have declined sharply in the Himalayan region (e.g. Mustang). The review conducted by the TWG on forests and biodiversity also suggests that critical ecosystem and resources such as wetlands are depleting due to more frequent disasters and water scarcity.

### 2.4.5 Public health

The current lack of primary healthcare for majority of population also contributes to their vulnerability to future climate change. Because of the poor state of health services in Nepal, public health can indeed be at a higher risk than before from adverse impacts of climate change. Effect on human health is the outcome of several factors, the main factor being the environment. Human health is already at risk from a number of diseases and malnutrition. Human induced climate change may soon become another major contributor to the spread of infectious diseases.

Many vector-borne and water-borne infectious diseases are known to be sensitive to changes in climatic conditions. The present analysis reveals potential impacts of climate change on health especially on growing risk of malaria, kala-azar (visceral leishmaniasis) and Japanese encephalitis outbreaks with mosquitoes being the vector of these diseases. Subtropical and warm temperate regions of Nepal would be particularly more vulnerable to malaria and kala-azar. A rise in temperature would make the subtropical region of Nepal more vulnerable to Japanese encephalitis as well. Many of the common diseases in Nepal are climate related. With changes in the climate, diseases such as malaria, Japanese encephalitis and kala-azar may spread to new regions (Regmi and Adhikari, 2007).

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<sup>6</sup> Ministry of Home Affairs, Disaster Preparedness Network, Documentation Centre, 2010

<sup>7</sup> Centre for Research on the Epidemiology of Disaster (2008). Annual disaster statistical review: The numbers and trends 2007.

## 2.4.6 Urban settlement and infrastructure

In the context of urban settlement and infrastructure, most impacts are cross-thematic in nature and are largely related to climate induced disasters. These disasters have severely affected the infrastructures, such as roads, bridges, community and public buildings, and schools. The impacts are concentrated around urban water and energy resources and adversely affected infrastructure and human health. The urban planning process has increasingly become more challenging due to an influx of climate-induced rural-urban migration. In terms of public health and climate-induced disasters, changes in climate are likely to exacerbate a number of existing health-related problems.

## 2.4.7 Cross-cutting sectors

Implications of the observed climate change impacts were assessed based on gender relations in Nepal. A gender sensitivity analysis was done through a consultative processes, including the transect appraisal exercise. Gender-differentiated climate change effects were also examined. The analysis revealed that men and women differ with respect to climate vulnerability. Since women are largely engaged in climate sensitive sectors, any degree of adverse climate change effect increases their vulnerability. Households dependent on natural resource base become more vulnerable than those whose livelihoods come from sectors that are less climate sensitive. For example, any degree of changes in the availability of water, firewood, and agricultural production directly affects their quality of life.<sup>8</sup> Moreover climatic vulnerability is also aggravated due to socio-cultural and institutional arrangements. Thus gender-related issues need to be taken account while developing adaptation strategies to climate change. Annex 5 presents a summary of gender sensitivity analysis of climate impacts.

Much of Nepal's industrial sector is agriculture-based and supply of raw materials is therefore sensitive to changing climatic conditions. The sector depends on transport networks and power supply, both of which are at risk from extreme climate events. Besides industry, tourism is a key component of Nepal's service sector, and is sensitive to extreme climatic events and seasonal changes. Excessive rainfall, longer drought periods, landslides and floods all affect service industries (DFID, 2009).

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<sup>8</sup>. The impact of climate change on drying of springs and natural wells has increased women's workload by forcing them to travel to distance for water collection.

## CHAPTER 3 THE NAPA PREPARATION PROCESS

### 3.1 Institutional arrangements and consultation

The Ministry of Environment established six TWGs, each led by a different line ministry. Several consultations were undertaken at different levels. The report preparation and finalization was done by incorporating the feedback of stakeholders and related institutions. The process of the Nepal NAPA is summarized in Figure 3.1

#### 3.1.1 Preparation of the NAPA

The NAPA Project organizational structure consists of: (i) Advisory Board (AB); (ii) Project Executive Board (PEB); (iii) Technical Advisory Committee (TAC); and (iv) NAPA Project Team. In order to provide guidance and ensure coordination, the Advisory Board chaired by the Secretary of MoE, has representation from the ministries and other government organizations, the donor community, academia, civil society/ NGO, private sector, and local bodies.

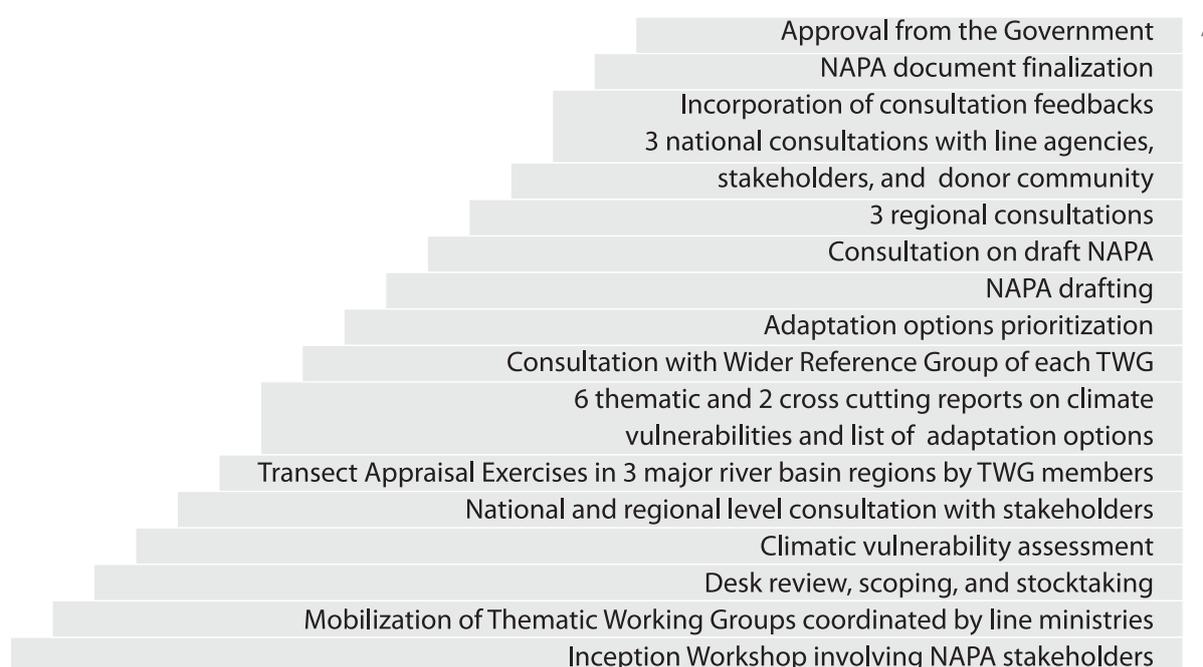
The NAPA Team consisted of Project Executive, Project Manager, Programme Officer, Climate Change Specialist, Climate Change Network Facilitator, and Technical Officer, supported by consultants, administrative and finance staff.

In accordance with the LEG annotated guidelines on NAPA preparation, multi-disciplinary teams were established in coordination with the NAPA Project Team, to undertake many of the tasks required in the development of the NAPA. During the NAPA Induction Workshop in May 2009, it was decided that these requirements could be fulfilled by developing the NAPA through Government led multi-stakeholder Thematic Working Groups (TWGs) to ensure the engagement and ownership of a wide range of stakeholders and concerned key ministries from the very beginning. The topics chosen for the TWGs were based on a consensus of opinions expressed by the key sectors of the economy most prone to climate change impacts and most important in terms of development policy. Due to the importance of hydro-power to Nepal, a single TWG was formed to focus solely on water and energy related themes. Six TWGs were established each led by a different line ministry. They are:

1. Agriculture and Food Security (Coordinator: Ministry of Agriculture and Cooperatives)
2. Forests and Biodiversity (Coordinator: Ministry of Forests and Soil Conservation)
3. Water Resources and Energy (Coordinator: Ministry of Energy)
4. Climate Induced Disasters (Coordinator: Ministry of Home Affairs)
5. Public Health (Coordinator: Ministry of Health and Population)
6. Urban Settlements and Infrastructure (Coordinator: Department of Urban Development and Building Construction)

Each TWG has around 15 members comprising representation from government agencies, NGOs, academic institutions, and relevant UN agencies. Each TWG was facilitated by a thematic facilitator hired by the NAPA project to take primary responsibility for TWG outputs. TWGs became operational in October 2009. They met regularly, and TWG facilitators and coordinators held progress update and planning meetings with the NAPA project team. The first activity of the TWGs was to stock-take and synthesize key literature and policy documents relevant to climate vulnerability and adaptation under each theme. Each TWG produced stocktaking reports.

Figure 3.1 describes the series of steps taken in the NAPA preparation process from the initial desk review, scoping and stocktaking, through vulnerability assessment and transect appraisal exercises, to TWG report preparation, NAPA drafting and finalization

**Figure 3.1: The NAPA process**

### 3.1.2 Consultations and transect appraisals of vulnerability, adaptation needs and options

Assessment of climate vulnerability was done in several stages. First, two national and three regional workshops were organized and several consultations were held with stakeholder groups including youth, foresters, indigenous communities and disaster risk reduction networks. In addition, wider "Reference Groups" of interested stakeholders were formed for each TWG with whom consultations were held on a regular basis. Micro-level impact assessments were undertaken through three transect appraisal exercises in November 2009 in the western, central and eastern regions of Nepal. Over 60 Government and non-government TWG members participated, who then conducted analyses of the outputs of the transect appraisals according to both agro-ecological zones and thematic areas. The outputs of these analyses were combined with draft stocktaking reports to produce thematic synthesis reports, subsequently summarized into a single report as "NAPA Summary Report".



Consultation with people in Karnali Zone in the Mid-Western Region of Nepal by the NAPA Thematic Working Group members during the transect appraisal exercise in November 2009. (Photo credit: NAPA Project, 2009).

The TWG coordinators were responsible to finalize their group reports and submit them to the NAPA Project. This NAPA report is based largely on the work of the TWGs. It was circulated to those Government ministries that were involved in the TWGs. The TWGs were charged with the responsibility of developing 'short lists' of adaptation priorities under their specific themes. The prioritization process is described in Section 3.2 below.

The list of all consultations and awareness raising activities prior to the preparation of the NAPA document is listed in Annex 6 together with the key observations made and feedback received at each consultation. A number of consultation activities, including consultations with the Climate Change Council, were also conducted on the draft NAPA document (Annex 6).

### 3.1.3 Local adaptation plans

The participants of the Inception Workshop of NAPA held in May 2009 suggested the preparation of Local Adaptation Programme of Action (LAPA) through country-driven operational process for the effective implementation of the most urgent and immediate adaptation needs that will be prioritized in NAPA. It was further emphasized that Nepal's wide diversity of ecosystems, micro-climates, cultures and socio-economic circumstances, any national scale adaptation programme would have to be complemented by a series of LAPAs (Regmi and Karki, 2010). The LAPAs should reflect the location specific adaptation needs that will facilitate to address the impacts faced by climate vulnerable communities.

Lesson learned from LAPAs implementation would contribute greatly to policy refinement and formulation. In order to make the most urgent and immediate actions pragmatic to suit the local conditions, additional need-based vulnerability assessment will be carried out in the selected localities, including a local-level institutional assessment to examine the effectiveness of existing coping strategies. Nepal considers need-based LAPA as one of the practical approaches to analyze critical and site-specific climate issues and address them accordingly with peoples' participation.

### 3.1.4 Development and maintenance of a climate change knowledge management and learning platform

The key elements of the platform are:

- 1) A web-based portal on climate change and development that provides a centralized platform for climate change practitioners in Nepal to conduct research, network, discuss, and share climate change knowledge
- 2) A public-accessible climate change knowledge management center which will be hosted by the Nepal Academy of Science and Technology
- 3) A moderated mailing list on climate and development topics
- 4) Regular updates on NAPA developments to keep the stakeholders sufficiently informed about the process.



Screenshot of the Nepal Climate Change and Development Portal ([www.climatenepal.org.np](http://www.climatenepal.org.np))—one stop for climate change information, jobs, people, projects and organizations working on climate change in Nepal.

### 3.1.5 Development of a multi-stakeholder framework of action on climate change

The government formed the Multi-Stakeholder Climate Change Initiatives Coordination Committee (MCCICC) in April 2010 under the chairmanship of the Secretary of MoE. The Committee aims to foster a unified and coordinated climate change response in Nepal. It institutionalizes the multi-stakeholder and participatory process of the National Adaptation Programme of Action (NAPA), consolidates the strengths of the six multi-sectoral thematic working groups under the NAPA, facilitates the engagement of the local-level institutions with national institutions as exercised during the vulnerability analysis under the NAPA, and builds on the Donor Compact on Climate Change which was signed between the Government of Nepal and 14 development partners on 2 September 2009.<sup>9</sup>

As a coordination body at the functional level, the Committee reports to the Climate Change Council and contribute to mainstreaming the climate change programmes into development planning and implementation. The recently established Climate Change Management Division at MoE serves as the Secretariat of the Committee, which meets at least once in every quarter. The functions of the Committee are as follows:

- 1) Establish, maintain, and improve communication amongst institutions concerned with and working in the field of climate change;
- 2) Coordinate climate change response in Nepal to foster synergy and avoid duplication of efforts. The areas that have to be coordinated include, but are not limited to, policies, plans, strategies, financing, programmes and projects;
- 3) Provide inputs for developing a national consensus in international climate change negotiations;
- 4) Ensure strategic adaptation and mitigation financing by providing a venue where needs are identified, articulated, and taken into account in the formulation of adaptation financing strategies by development partners and by the Government of Nepal;
- 5) Strengthen multi-stakeholder collaboration in responding to climate change including management of climate risks and opportunities, long-term adaptation to climate change, and building a low carbon and climate-resilient economy, and other areas;



The first Multi-Stakeholder Climate Change Initiatives Coordination Committee meeting in May 2009. (Photo credit: NAPA Project, 2009).

<sup>9</sup> The Compact commits development partners to a set of principles to guide how development partners will support the Government of Nepal in implementing a series of actions that identify and assess climate risks, elaborate, test, and implement adaptive responses, and establish the basis for a climate resilient economy. It ensures that adaptation financing is done in a strategic manner.

- 6) Facilitate to clarify any misunderstanding and/or confusion, if occurred, at any stages of the project cycle; and
- 7) Provide inputs and monitor and evaluate the implementation of priority adaptation actions as identified in the NAPA and other climate change initiatives.

A climate change adaptation projects implementation framework has been included in this document (Section 3.4). The framework provides linkages across planning scales and identifies the key actors from public sector e.g. line ministries, civil society and the private sector to be involved in NAPA implementation. The framework depicts the overall governance structure of climate change adaptation in Nepal.

Components 2 and 3 of NAPA are being used as a platform for information dissemination and sharing with other climate change planning and policy processes currently ongoing in Nepal. For example, Nepal was selected as a country for the Pilot Programme for Climate Resilience (PPCR) as part of the World Bank Strategic Climate Fund with the Climate Investment Funds' programme. The PPCR is intended to enable pilot countries to "transform" their plans and investment programs to address climate risks and vulnerabilities, building upon the NAPAs.

### 3.2 The prioritization process

Reviewing other NAPA processes and taking into account of the experiences, a multi-criteria analysis was found most often been used. In the case of Nepal the prioritization process was carefully undertaken and made as consultative as possible. A multi-criteria analysis was used in a step-wise process producing long and then short lists of priority adaptation actions. This culminated in the TWGs identifying the most urgent and immediate climate adaptation priority actions according to national needs and interests. Project profiles were developed for the identified priority actions.

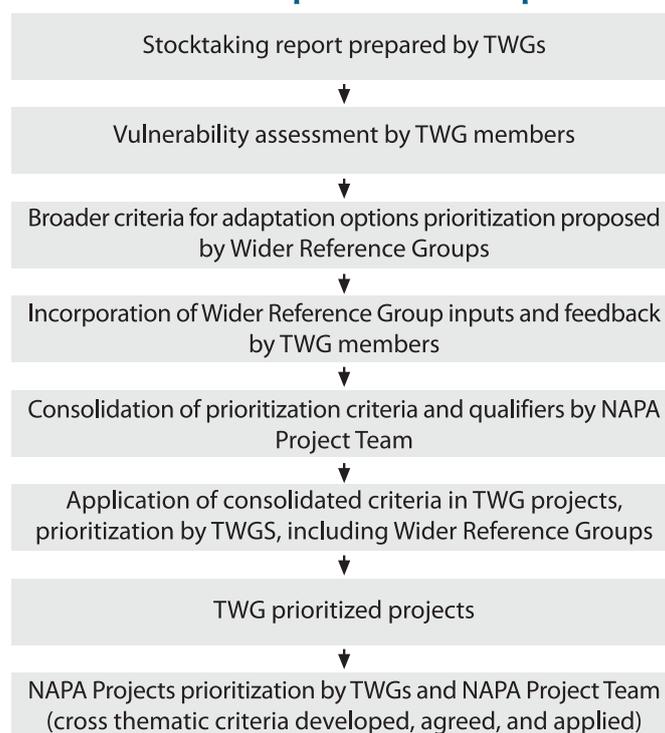
The steps in the prioritization process included:

- 1) Stocktaking, vulnerability assessments and assimilation of information developed by each TWG to identify adaptation needs from the transect appraisal exercises. Each TWG developed a "long-list" of adaptation options. These lists were evaluated by the TWGs for incorporation into the relevant TWG reports, to inform future adaptation planning and implementation under each theme;
- 2) TWG reports were circulated, reviewed and revised incorporating the inputs from all TWG members and wider reference groups in March and April 2009;
- 3) Examination and systematization of the criteria was used by each TWG to identify adaptation options;
- 4) An aggregated set of criteria that pooled the common criteria used by the TWGs was derived and then approved by the TWGs;
- 5) TWGs then used the aggregated criteria to develop short lists of adaptation activities of highest priority;
- 6) Project profiles were developed by the TWGs for a small group of the highest priority options according to the agreed aggregate criteria;
- 7) These profiles were then considered at a workshop and the LDCF prioritization urgent and immediate adaptation criteria<sup>10</sup> were applied to all profiles;
- 8) Each TWG selected its top project profile according to the urgent and immediate adaptation needs
- 9) The NAPA Team generated an integrated ranking of all short-listed priority activities. Priority activities were clustered according to integrated ranking and from these nine combined profiles were developed (see Section 5).

The prioritization process is summarized in Figure 3.2.

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<sup>10</sup>. Prioritized actions that address current highly vulnerable population and/ or where the cost of addressing adaptation will escalate significantly in the near future.

**Figure 3.2: The climate adaptation actions prioritization process**

The outcomes of NAPA prioritization forms a solid base for all current and future climate adaptation support programmes in Nepal.

### 3.3 Themes and criteria used to select priority adaptation activities

The aggregated prioritization criteria and elements (qualifiers) are listed in Table 3.1. All TWGs used these prioritization criteria and qualifiers to identify their top adaptation priorities. The TWGs interpreted the criteria and qualifiers in the way they considered most appropriate for the sectors they were responsible. Details of how the TWGs selected priorities can be found in the TWG reports.

**Table 3.1: Aggregate criteria and qualifiers**

Criteria	Elements				
<b>Potential to reduce adverse impact of climate change</b>	<i>Potential to reduce direct exposure to CC</i>	<i>Potential to help plan for climate change</i>	<i>Potential to secure/enhance ecosystem services</i>	<i>Potential to reduce climate vulnerabilities</i>	<i>Potential to reduce immediate impacts of CC</i>
<b>Potential to support local livelihood</b>	<i>Potential to address urgent adaptation needs</i>	<i>Potential to generate local employment and income generation avenues</i>	<i>Potential to ensure equity in access</i>	<i>Potential to secure livelihood assets</i>	<i>Potential to develop alternative livelihoods</i>
<b>Synergy with national priorities</b>	<i>Synergy with multilateral environmental agreements</i>	<i>Synergy with national development plans</i>	<i>Synergy with sector development plans</i>	<i>In line with institutional capacity to implement priorities</i>	<i>Potential to co-finance</i>
<b>People's participation</b>	<i>Involvement in design and implementation</i>	<i>Local ownership</i>	<i>Social and cultural acceptance</i>	<i>Local capacity building</i>	<i>Inclusiveness (Gender; indigenous &amp; Dalit communities)</i>
<b>Cross-sectoral benefits</b>	<i>Multi-sectoral involvement</i>	<i>Ease of governance</i>	<i>Co-benefits (i.e. mitigation)</i>	<i>Multi-partnership in implementation</i>	<i>Geographical and ecological coverage</i>

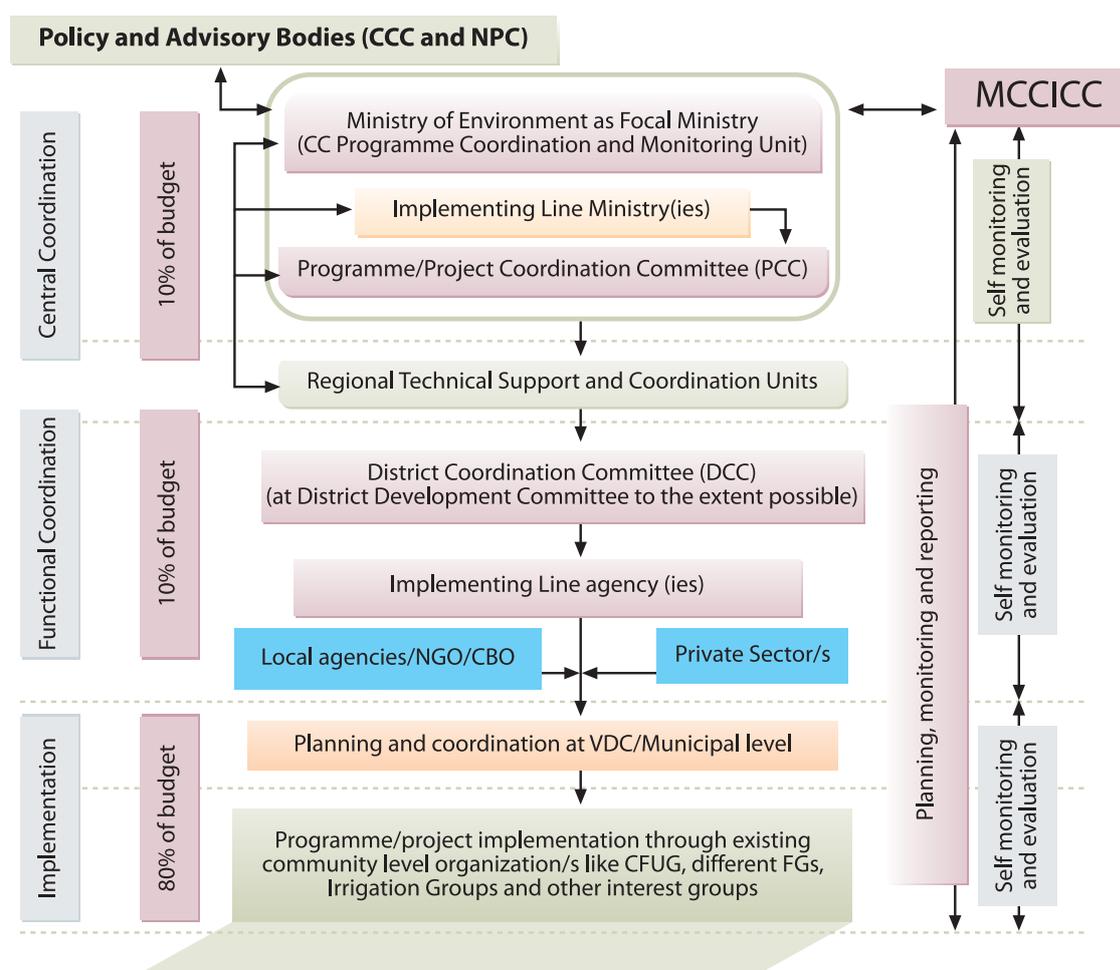
## National Adaptation Programme of Action (NAPA)

Criteria	Elements				
<b>Cost-effectiveness</b>	<i>Input output ratio</i>	<i>Multiplier effects of investment</i>	<i>Potential to mobilize local resources</i>	<i>Sustainability (expansion potential)</i>	<i>Potential to generate additional resources</i>
<b>Ease of implementation</b>	<i>Potential to use of local knowledge and technology</i>	<i>Potential to enhance local/national skills and develop appropriate technology</i>	<i>Local/national ownership (i.e. country driven and community led)</i>	<i>Coherence with local urgent and immediate needs</i>	<i>Address existing or potential resource conflicts</i>

### 3.4 Implementation framework for climate change adaptation projects in Nepal

Figure 3.3 depicts how implementation of NAPA priority projects, and all incoming adaptation projects, should be structured. This implementation framework has been developed with inputs from the PEB, NAPA Advisory Board, members of the Climate Change Council, Multi-Stakeholder Climate Change Initiative Coordination Committee (MCCICC). Various stakeholders were also consulted at different stages and levels during the development of this framework.

**Figure 3.3: A framework for NAPA implementation**



**Acronyms:** CCC: Climate Change Council; NPC: National Planning Commission; MCCICC: Multi-stakeholder Climate Change Initiatives Coordination Committee; CC: Climate change; CFUG: Community Forestry User Group, FG: Farmers' groups

The central idea behind the implementation framework is that NAPA is a process to mainstream climate change adaptation into national development agenda. Hence the NAPA document should be the basis for all support to adaptation activities in Nepal in order to ensure a coherent programmatic approach and systematic reduction of vulnerability and climate change impacts nationwide. While technical responsibilities will be delegated to appropriate ministries and to the appropriate governance level, the implementation of all adaptation projects in the country will be subsumed under a common coordination, management, and monitoring mechanism.

The framework will facilitate the channeling of financial resources and technical expertise for adaptation to the local level as efficiently as possible. Depending on the nature of the project and on the size of the budget, it is envisaged that the operating costs will be kept to a minimum such that at least 80% of the available financial resources reach the local level to fund on-the-ground adaptation activities. All projects will contribute to a common pool of funds to support policy and coordination at the central level and cross-cutting activities that will provide services to all projects, such as research and knowledge management, monitoring and evaluation, and communication through the regional units.

### **Central level**

Being the focal ministry for climate change and environmental issues, the MoE will be responsible for overall coordination between adaptation policy and on-the-ground implementation and amongst stakeholders and partners. On behalf of all projects, it will be responsible for reporting and liaising with the Climate Change Council – the apex body responsible for policy coordination – and the MCCICC.

Within the MoE, a *Climate Change Program Coordination and Monitoring Unit* will be established to ensure synergy amongst various projects. It will also provide an institutional framework to govern the operational coordination of climate change adaptation programmes. It will draw from the appropriate sections within the MoE and relevant organizations in order to facilitate the delivery of basic and cross-cutting services to all projects, such as climate change research and knowledge management, communication, and central-level monitoring and evaluation. It will also support village development committees and municipalities in incorporating adaptation perspectives into local adaptation planning primarily based on lessons learned from on-the-ground project implementation.

Each project will have its own monitoring and evaluation component, which will feed into the central-level monitoring mechanism. The latter will be primarily responsible for tracking how each project is contributing to the overall goals of reducing vulnerability, enhancing adaptive capacity and ultimately to overall national development.

Recognizing that an effective adaptation approach does not necessarily coincide with political boundaries, a *Regional Technical Support and Coordination Unit* will be formed at the development region or watershed level.<sup>11</sup> This unit will consist of experts in relevant fields (e.g. water resources, agriculture, forestry, disaster risk reduction, gender and social inclusion, livelihoods, finance, communication, and monitoring and evaluation) who will provide technical support to local delivery agents in close partnership with the local agencies and local governments. This support unit will ensure an ecosystem-based approach to adaptation across all projects. It will also serve as the monitoring arm of MoE's Climate Change Programme Coordination and Monitoring Unit.

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<sup>11</sup>. As discussed in Chapter 1, there are five development regions in Nepal and three major watersheds. The definition of a "region" in this implementation framework is flexible and cognizant of the evolving nature of the political system in Nepal as the process of Constitution writing is being completed.

### **Project level**

The major responsibility for implementing a project will fall within the ambit of the appropriate line ministry, which in this implementation framework is referred to as the *Implementing Ministry*. If the project is multi-disciplinary and integrated in nature, MoE will coordinate at the centre to designate the Implementing Ministry through consultation amongst the line ministries and with all concerned stakeholders.

The Implementing Ministry will be responsible for constituting a *Project Coordination Committee* with the support of MoE. The specific structure and function of this Committee will be set out in the individual project document and would - to a large extent - depend upon the nature of the project. The general idea is to have a body that will be able to provide strategic guidance for particular project implementation and with whom the project could consult on a regular basis. This committee could consist of representatives from all participating line ministries (in case of multi-disciplinary projects), development partners, experts, and beneficiary groups.

### **Local level**

At the district level, project planning and delivery will be the primary responsibility of the *District Coordination Committee (DCC)* which shall be formed at the District Development Committee (DDC) to the extent possible. The DDCs are already in existence and are a critical part of the current political structure in Nepal. However, due to unforeseen circumstances, if the need of altering the coordination committee raised, that could be formed on a consensus basis.

The concerned DDC will constitute the *District Coordination Committee*. Membership and functions of the committee will be contingent upon the nature and requirement of the individual project but the general idea is to involve the district-level offices of participating line ministries (e.g. Agricultural Development, Forest, and Public Health etc), NGOs, community-based organizations, private enterprises, and local service delivery agents.

The district office of the primary Implementing Ministry (if any) will serve as the Secretariat of the District Coordination Committee. The Secretariat will facilitate the selection of local service delivery agents according to the general guidelines set out in the project document and develop the corresponding terms of reference. It will be responsible for reporting to the DCC, coordinating with the Regional Technical Support and Coordination Unit, and facilitating the mainstreaming of local adaptation plans into development plans.

A diverse set of local service delivery agents will be identified and charged with the task of implementation of project activities. These will be existing community organizations, such as the community forest user groups, farmers' groups, water users groups, mother groups and private enterprises that operate in the project area and have the technical capacity to implement the project activities. They will be accountable to the DDC.

This implementation framework recognizes the current leading role of village development committees and municipalities in local development planning. To reinforce this role, they will be supported to incorporate adaptation perspectives into their local development plans aligning fully with the NAPA.

### **Monitoring and Evaluation**

A central-level monitoring and evaluation system will be developed by MoE in order to track performance on adaptation. The system will also endeavor to identify successes and failures of implementation and key lessons learnt from it. The matrices will be developed based on the stocktaking and vulnerability assessment conducted under the NAPA. It will engage individual projects in an ongoing process of tracking the progress and impacts of their work vis-à-vis the broader goals of reducing vulnerabilities and increasing adaptive capacities.

The monitoring and evaluation system will be administered by the *Climate Change Programme Coordination and Monitoring Unit*. It will be responsible for integrating each project's monitoring and evaluation system with the central monitoring and evaluation system. The Unit will be responsible for feeding the lessons learned from project implementation into the current projects in order to guide adjustments and into the design of new projects.

## CHAPTER 4

# IDENTIFICATION OF KEY ADAPTATION NEEDS, EXISTING ADAPTATION PRACTICES AND OPTIONS

The climate change adaptation priority actions presented for different sectors are provided in Annexes 7 to 14. Priority adaptation options shortlisted by the TWGs and built upon current practices are discussed in this section. This section also outlines the priority adaptation options identified by the TWGs.

Climate adaptation needs have been identified across sectors and also for different groups of people whose livelihood strategies differ in terms of climate sensitivity. The requirements for climate adaptation listed here were identified by the TWGs and considered both productive sectors and different livelihood options.

### 4.1 Agriculture and food security

Rainfall distribution is uneven across the cropping seasons. Summer crops are often over fed, if not flooded. Most winter crops and those planted during spring season are affected by prolonged dry spells. Increased climatic variability and change effects have diverse repercussions on agricultural productivity thereby affecting food security across all agro-ecological zones.

During the transect appraisals the following effects requiring adaptation responses were recorded:

In the mid-hill and high mountain regions increasing temperature has led to the expansion of agro-ecological belts into higher altitudes and increased length of growing period for some crop species. Conversely, high hill animal herders have reported decline in fodder and forage production that has aggravated the prevalence of livestock parasites. In the mid-hills, decreasing soil moisture availability (due to changes in rainfall and temperature) resulted in early maturation of crops, crop failures and reduced agricultural productivity. In addition, decreasing run-off water to feed natural streams (used for irrigation) and re-charging natural ponds, reservoirs and lakes have been reported. In the Terai region similar issues were noted, particularly reduced recharge rate of ground water that has resulted in a reduction of discharge of water in shallow and even deep tube-wells for irrigation for crops.

Data reveal that some 30845 hectares of land owned by 4.7 percent of households became uncultivable in the previous decade due to climate induced disasters (CBS, 2004). Larger impacts were recorded in the Terai region as compared to hills and mountains. The central region of the country was most affected. Recorded impacts were less in the mid- and far-western regions but verification is required considering the probable geographic differences in recording.

Most current agricultural technologies have been developed and adopted under conditions of unevenly distributed rainfall both spatially and temporally. Likely climate change scenarios and increased climatic variability will create new challenges due to inadequacy of technologies according to the need of the diverse agro-ecosystem and climatic conditions.

To a certain extent, the adverse impacts of increasing temperatures and increasingly seasonal and erratic rains on crop productions can be mitigated through improved access to irrigation. However, not all cultivable lands in Nepal are irrigable. Of the total cultivable land, only one third has access to assured irrigation facility. This means that majority of the total cultivable land is rainfed. The feasibility of accessing irrigation varies by agro-ecological zones. The largest area that can be irrigated is in the Terai (98%). A significantly lower proportion of the hill and still less in mountain regions is irrigable.

Current initiatives to address the detrimental impacts of climate change include introduction of better suited crop varieties, adoption of organic farming techniques/practices thus reducing the quantity of chemical fertilizer application, community-based on-farm water management, and establishment of farmer cooperatives to facilitate the implementation of local adaptation programmes. NAPA recognizes that the dire situation facing agriculture and food security is, to a great extent, a result of climate change. Hence, the adaptation priorities in agriculture have been set in the broader perspectives of sustainable agricultural land use system, agrobiodiversity management and favorable and conducive governance mechanism to facilitate local level adaptation responses. Hence the proposed urgent and immediate adaptation options are specifically targeted to improve access to seeds, technology and market, increasing agro-ecosystem resilience and crop productivity enhancement and improving the conventional cropping practices. Annex 7 presents the list of prioritized adaptation options for agriculture and food security. Annex 8 lists down the adaptation options suggested by those consulted during the transect appraisal exercise.

### 4.2 Water resources and energy

Climate warming is often accompanied by changes in the hydrological cycle e.g. changes in rainfall patterns, snow and glacier melting, more atmospheric water vapor and evaporation, and changes in soil moisture and runoff. These changes impact the water sector and other sectors such as agriculture, energy, human health, water-induced disasters and urban settlements.

Water and the hydrological cycle are both the root cause of climate change related problems as well as the mainspring of solutions. The adaptation need is to achieve and maintain water security and thereby energy security. Adaptation measures need to ensure availability of acceptable quantity and quality of water for health, livelihoods and production of agricultural enterprises. In the energy sector, adaptation should ensure reliable and sustainable supply of water.

The Water Resources Strategy (WRS), adopted in 2002, laid the foundation for the formulation of the National Water Plan (NWP) for Nepal. The Plan was approved by the Government of Nepal in 2005. Outcomes of the WRS are short, medium and long-term guidance for water resources development measures including hydropower. The ten strategic outputs of the WRS can be categorized under three broad headings: (i) security (e.g., manage water induced disasters), (ii) use (e.g., adequate and sustainable supply) and (iii) mechanisms (e.g., information systems, legislative frameworks, etc).

The NAPA Water Resources and Energy TWG used the National Water Plan (NWP) as the basis for the development of a list of adaptation programmes and projects. Climate screening has been done within the NWP framework and a list of climate adaptation options has been developed. The programmes need to target the most climate vulnerable communities. The adaptation priorities in the water resources and energy sector focus on better and more accessible information and technology, stronger and more adaptable institutions, and natural and human-made infrastructure to store, transport and treat water, and to maintain energy production base, and expand and integrate transmission and distribution networks. The urgent and immediate adaptation priorities focus on efficient and multipurpose use of water resources, conservation of watershed areas, and upgrading and expanding of hydrological-meteorological stations. Annexes 9 and 10 present the list of prioritized adaptation options for the water and energy sectors respectively.

### 4.3 Climate-induced disasters

The NCVST (2009) study projects that the current frequency of hydro-meteorological extreme events such as droughts, storms, floods, inundation, landslides, debris flow, soil erosion and avalanches will increase due to projected climate change.

Factors that exacerbate vulnerability to climate-related disasters, which are identified by the TWGs through discussions with communities include: inadequate institutional guidance and land-use regulation, failure to implement building construction codes, inadequate public awareness on climate related disasters and ways to reduce community exposure, and limited reach of early warning systems.

Disaster risk reduction measures being undertaken in Nepal include: construction of embankments, check dams and spurs to limit the negative impacts of flooding and river bank cutting (Moench et al, 2009; DWIDP, 2006/2007); awareness raising programmes, and the development of early warning system (DWIDP, 2006/2007; NDR, 2009); emergency protection, rehabilitation works, geological information system (GIS) development, training, seminar, institutional building, research and provision of insurance; provision of irrigation system to cope with changes in rainfall patterns; piloting of community based flood warning system (NDR, 2009); and mapping of flood hazards.

In recognition of the increasing significance of climate change effects in disaster risk in agriculture sector, adaptation practices are being piloted in some districts of Nepal (FAO, 2009). These include rainwater harvesting and soil moisture retention through conservation farming (water harvesting ponds, soil mulching, planting forage/fodder grasses and legume plant/tree species and agroforestry systems); flood mitigation by creating river embankments, planting bamboo and fodder/forage grass, and slope stabilization and management by planting fodder trees, coffee on terraces and hedge row planting. Disaster risk reduction (DRR) practices that have relevance for adaptation include strengthening resilience, diversifying livelihood, planning, providing insurance and developing an early warning system. The urgent and immediate adaptation priority is focused on DRR specifically through community led programmes and initiatives. Annex 11 presents the list of prioritized adaptation options for climate-induced disasters.

### 4.4 Forests and biodiversity

Field observations show that forest ecosystems are deteriorating and biodiversity is suffering from climate change. This is probably related to higher temperatures in lower altitudes, upward shifting of vegetation, encroachment of invasive species and thereby colonization, and increased prevalence of disease and pests. The prolonged winter dry spells has increased the incidence of forest fires that have destroyed large forest areas and forest biomass, and hastening the emission of carbon dioxide into the atmosphere.

Upward shifting of ecological belts is expected with the rise in temperatures. However, upward movement of species will be limited due to adverse environment for their growth (e.g soil and moisture conditions). Tree line shifting is expected to be slow because of the limited natural dispersal of seeds. Therefore, high altitude species, such as birch, *Jatamansi*, *Kutki*, etc. are likely to become more vulnerable with increase in climatic and human induced stresses. Habitats for mountain fauna such as snow leopard are increasingly threatened due to increased temperature. Reduced snowfall, untimely rains, and increased dryness have altered the flowering and fruiting behavior of plants, which is closely related to the survival of wildlife. When seasons of food availability change, it changes the periodicity of life cycles of animals and insects such as reproduction, migrations, and hibernation. This results into serious vulnerability for wildlife and is a threat to the people who depend on biodiversity for their livelihoods.

Adaptation in ecosystems, and particularly forests, requires the managers (very often the communities) of these natural resources to be aware of climate change effects and an understanding of the long term nature of degradation. Degradation of the ecosystem means loss of the services the society derives from the system. Management programmes need to be planned and implemented as a matter of urgency to safeguard resources that if lost are difficult if not impossible to restore.

Almost one-third of the forest area in Nepal is under community-based forest management systems including community forest, collaborative forest, leasehold forest, buffer zone community forests and conservation areas. These systems have evolved through local knowledge based initiatives. The Livelihoods and Forestry Programme has initiated work with forest user groups for implementing local climate adaptation actions plans. This work is being implemented with 2500 forest user groups in some 300 VDCs in 15 districts. Community adaptation funds are being established. The main stakeholders are forest user groups, VDCs and local NGOs. The identification of adaptation programmes has been initiated in some communities. They have identified watershed management, farm land conservation, forest management, awareness raising, and capacity building through income generation activities.

Nepal has enormous forest resources, which can help in reducing the adverse impacts of climate change, reducing poverty, and supporting economic development. Experiences from community forest management have provided enough evidence that Nepal's forest management have the potential to sequester huge amounts of carbon, which can enter into both voluntary and international carbon marketing thus generating financial resources. Nepal is keen to integrate and mainstream climate change in the development process. Existing forestry governance and institutional structure could facilitate in identifying the potential trade-offs and in properly assessing the costs and benefits.

To deal with impacts as well as opportunities in the forest and biodiversity sector, adaptation should focus on sustainable forest management, improved governance and capacity at the local level, and supporting the adaptation priorities of the most vulnerable through improved access and equitable benefit sharing. Many communities in the Terai region have started discussion on ways to initiate schemes that pay for environmental services as incentives for adaptive management. Due to several pressures including climate, the country's forests and biodiversity are facing multiple threats. Hence the proposed programmes are targeted at restoring the ecosystem as well as building communities' adaptation capacity.

The adaptation needs identified in forest and biodiversity include ways of ensuring ecosystem health and services through watershed and landscape level planning and management. It also includes empowering local communities and service providers with the capacity to address key challenges posed by climate change while harnessing the potentials and economic benefits of forest management. Annex 12 presents the list of prioritized adaptation options for forests and biodiversity.

### 4.5 Public health

Climate change impacts on public health are a global concern. The review conducted by the NAPA TWG on Public Health suggests that Nepal like other countries has been experiencing an increasing impact on human health. There are increasing trends in the prevalence of vector and water-borne diseases in the country. Disasters, particularly floods, have been found to have a direct impact on public health. *Malaria, kala-azar, dengue, Japanese encephalitis, filariasis* and water borne diseases such as *diarrhea, cholera and typhoid* are commonly found in many parts of the country. Increased climatic variability has worsened the health situation of the vulnerable population in general and the poor and the disadvantaged groups in particular.

It is difficult to relate the existing and changing prevalence of disease patterns noted in the transect appraisals and from other scattered epidemiological data specifically to climate change without a root-cause analysis. However, many of the health-related concerns raised by the communities relate with water, food, disasters and settlements issues already raised under other thematic working groups. For example, malnutrition is likely to impact via declining agricultural yields. Declining domestic water supplies will have a direct impact on hydration as well as an indirect impact on health through declining sanitation. Sanitation and prevalence of diseases are likely to increase with changing settlement patterns. Climate induced disasters may have a direct impact on injuries, as well as indirect impacts on human health through damage to infrastructure, degradation of water quality, and poor sanitation.

The adaptation strategies identified have focused largely on awareness raising and public health initiatives at the community level. The urgent and immediate need is to carry out research and studies to understand the scale and epidemiology of health problems caused by climate change and formulation of evidenced-based adaptation strategies. Adaptation priorities on the health sector also include increasing access to information and knowledge on impacts of climate change on human health particularly with regard to emergence and outbreak of diseases including piloting and implementation support.

Most adaptation options identified by rest of the NAPA thematic areas are relevant to the health sector. For example, rainwater harvesting identified by the water and energy group as a community-based adaptation option also increases domestic water supply and improve sanitation; early warning systems identified by the climate induced disasters reduce human injury and deaths; agricultural diversification that increases food availability as well as livelihood options, all contribute to ensuring nutrition and well-being. Annex 13 presents the list of prioritized adaptation options for public health.

### 4.6 Urban settlements and infrastructure

Climate change impacts urban settlements both directly and indirectly. Direct impacts, such as disastrous floods, reduce freshwater supplies. Indirect impacts of climate change could be experienced due to extreme events that increase food prices and/or damage livelihood assets of the vulnerable communities.

Climate change is likely to result in increased damage to buildings, energy services, telecommunications, transport structures and water services (IPCC, 2007). All of these impacts are likely to affect the quality of lives and safety of the local communities. Climate vulnerability of settlements and the need to adapt will vary depending on their form and size, location, geography, and economy.

The dense and unsafely built urban settlements are one of the major reasons for climate vulnerability. The ongoing physical changes in the urban settlements are land use, new built form, land transaction, and land fragmentation. Open spaces as place of escape during major disasters are becoming scarce adding to the vulnerability of the urban communities. In the past, most construction works had been carried out without proper planning, monitoring and supervision.

The urban settlements and infrastructure adaptation measures followed are at three levels: government, community, and individual. The likelihood of urban (metropolitan, municipality) entities having the capacity to formulate and implement sound climate change adaptation measures depends heavily on the enabling provisions provided by the government through legislative, financial and institutional arrangements. It also depends on these entities assuming appropriate responsibility at the optimal scale.

Climate resilient urban settlements and infrastructure require improved effective and pro-poor structures of governance. Building adaptive capacity of individuals and communities are essential to redress these new challenges. To materialize this, two policy gaps identified are: (a) reducing the threat through prevention and (b) improving the coping capacity of the vulnerable communities thereby enabling them to deal with stresses. The strategic adaptation program in urban settlements and infrastructure were proposed in order to address key gaps identified in policy, capacity and governance. The adaptation programs were selected considering its relationship with climate change. The other factors for selecting the programs include: high probability of risk that pose a significant threat (high impact), risks that are already perceived, risk that will increase most rapidly, and risks to areas that are very sensitive to climate changes in relation to urban settlements and infrastructures in Nepal. The urgent and immediate adaptation priority will focus on improving urban settlement and infrastructures and making it more resilient to climate change impacts. Annex 14 presents the list of prioritized adaptation options for urban settlements and infrastructure.

## CHAPTER 5

### PRIORITIZED ACTIVITIES FOR CLIMATE CHANGE ADAPTATION

#### 5.1 Priority climate change adaptation activities selected

It was noted at the prioritization workshop - where the urgent and immediate criteria were applied to the top priority project profiles for climate adaptation actions - that there is a strong convergence between and among several of the most urgent and immediate priority activities. The TWG representatives agreed to combine common priority activities into combined profiles. The prioritization process has been described in Section 3.2. Table 5.1 presents an outline of the combined profiles of national adaptation priorities drawn from TWG priorities and shows how priority activities have been clustered. The combined profiles are presented in Section 5.3.

**Table 5.1: Clustering of priority activities into combined profiles**

<b>Combined Profile 1</b>
<b>Title:</b> Promoting Community-based Adaptation through Integrated Management of Agriculture, Water, Forest and Biodiversity Sector
<b>Activity Components</b>
<ul style="list-style-type: none"> <li>· Ensuring ecosystem and community adaptation to climate change through integrated watershed management in Churia</li> <li>· Initiating on-farm soil and water conservation activities to support hill and mountain communities vulnerable to climate change</li> <li>· Promoting water management in river basin areas at municipal level.</li> <li>· Reducing the vulnerability of communities and increasing their adaptive capacity through flood management</li> <li>· Promoting and upscaling Multi Use System (MUS) for the benefit of poor and vulnerable communities in mid-hills and Churia range</li> <li>· Scaling-up and implementing non-conventional irrigation systems in water stressed areas</li> </ul>
Estimated total cost: USD 50 million
<b>Combined Profile 2</b>
<b>Title:</b> Building and Enhancing Adaptive Capacity of Vulnerable Communities Through Improved System and Access to Service Related to Agricultural Development
<b>Activity components:</b>
<ul style="list-style-type: none"> <li>· Enabling climate vulnerable communities to sustain livelihoods by improving access to agricultural services</li> <li>· Increasing community climate adaptive capacity through improved production and marketing systems</li> <li>· Strengthening highland-lowland linkages to improve community access to goods and services</li> <li>· Promoting sustainable underground water management for irrigation</li> <li>· Promoting improved animal breeds adaptable to climatic uncertainty</li> </ul>
Estimated total cost: USD 44 million
<b>Combined Profile 3</b>
<b>Title:</b> Community-based Disaster Management for Facilitating Climate Adaptation
<b>Activity Components:</b>
<ul style="list-style-type: none"> <li>· Building capacity to enhance community adaptation to climatic hazards</li> <li>· Developing water retaining structures as sustainable adaptation measures to address the effect of climate change</li> <li>· Establishing, rehabilitating, and conserving small scale drinking water supply schemes and traditional water sources</li> <li>· Reducing the disaster risks at community-level with climate change dimension</li> </ul>
Estimated total cost: USD 60 million

### Combined Profile 4

Title: GLOF Monitoring and Disaster Risk Reduction

**Activity Components:**

- Monitoring of GLOF and reducing climate-related disaster risks
- Developing early warning systems in disaster prone areas
- Linking climate change with disaster risk reduction and enhancing institutional capacity at different levels
- Mapping of hazards, assessing disaster impacts, and developing contingency plans
- Managing existing hydrological and meteorological network at the Department of Hydrology and Meteorology (DHM) and scaling-up its services
- Initiating GLOF and disaster-related research and development activities

Estimated total cost: USD 55 million

### Combined Profile 5

Title: Forest and Ecosystem Management for Supporting Climate Led Adaptation Innovations

**Activity Components:**

- Managing trees outside the forests in public and private land (agro-forestry practice)
- Maintaining the balance between fuel wood demand and supply for rural household energy through plantation
- Scaling- up of biomass energy technologies (quantity, quality, and coverage) for less fuel wood consumption
- Managing community-based forest fire in mid-hills and Terai

Estimated total cost: USD25 million

### Combined Profile 6

Title: Adapting to Climate Challenges in Public Health

**Activity Components:**

- Reducing public health impacts of climate change through evidence based research and piloting
- Empowering communities through public education for responding adverse effects of climate change in public health
- Investigating disease outbreak and emergency response
- Scaling up programmes on vector borne, water and food borne diseases and disasters
- Strengthening forecasting / early warning and surveillance system on climate change and health

Estimated total cost: USD 15 million

### Combined Profile 7

Title: Ecosystem Management for Climate Adaptation

**Activity Components:**

- Promoting improved pasture and range land management techniques to rehabilitate degraded mountain ecological zones
- Conserving and promoting medicinal plants and NTFPs in all potential ecological zones
- Initiating integrated wetland management in Terai
- Managing biological corridor in the Terai and mountains

Estimated total Cost: USD 31 million

### Combined Profile 8

**Title:** Empowering Vulnerable Communities through Sustainable Management of Water Resource and Clean Energy Supply

**Activity Components:**

- Conserving lakes supplying water and ecological services to urban areas
- Promoting rain water harvesting structures and technologies
- Conserving water supply source (quality as well as quantity) and strengthening programs of existing projects affected by source reduction
- Developing nationwide urban groundwater monitoring system and enhancement of regulatory measures
- Establishing and improving micro-hydropower projects being affected by the acute water shortages
- Improving water mills for multi use

Estimated total cost: USD 40 million

### Combined Profile 9

**Title:** Promoting Climate Smart Urban Settlement

**Activity Components:**

- Enforcing building codes in municipal areas incorporating climate change dimensions
- Rehabilitating the vulnerable communities
- Increasing the efficiency of the use of underground water resources for urban population
- Establishing municipal compost plants and developing strategy to link with Clean Development Mechanism (CDM) to generate additional revenue
- Building the capacity of local level institutions for efficient water and energy planning and project implementation

Estimated total cost: USD 30 million

## 5.2 Challenges and barriers to implementing adaptation measures

Weak governance due mainly to an extended political transition and various other factors has hindered the country's normal development. This has limited the State's ability to concentrate on essential development functions such as expansion of physical infrastructures, streamlining the resource distribution system, and implementation of poverty reduction programmes. The current economic situation suggests that there is a need to allocate more resources to develop physical infrastructure and increase people's access to basic services.

Nepal has the lowest coverage of infrastructure facilities among the South Asian countries. As indicated by the Global Competitiveness Report 2008/09, of the 134 countries, Nepal ranked at 130 compared with Pakistan (62), India (90), Sri Lanka (101) and Bangladesh (121). This has major implications in terms of economic growth and social prosperity.

Being one of the poorest and most vulnerable countries, Nepal will suffer the most from climate change. The imperative therefore is intensive effort to include climate change adaptation at the heart of national planning which is now reflected in the TYP Approach Paper of the Government. Nepal will have to bear huge burden of accumulated and additional costs in adapting to climate change if actions are not taken immediately.

There is a greater understanding that LDCs with fragile economy and ecosystem needs additional funding to tackle adverse impacts of climate change. Nepal's understanding is that this funding is in addition to existing international aid commitment because the cost of climate change was not factored in when aid commitments were made to help developing countries in meeting the Millennium Development Goals (MDGs). It is equally important not to divert money from away pledges already made to Nepal, such as for education, health, water and infrastructure.

As Nepal's adaptation framework is set largely within the country's national development framework, there are a number of lessons emerging from experiences in implementing development objectives that will be relevant for implementing adaptation. The issues and challenges lies in integrating and mainstreaming climate change in the development process and its harmonization within the national policy and operational framework.

Major barriers to achieving sustained poverty reduction pertain to factors related largely to nonexistence of elected local bodies; performance not achieved as desired from bilateral and regional trade agreements and donor assistance; slow growth of revenue streams and high recurrent expenditure; and limited delivery of development related services.

In addition to these macro-level barriers, the Stocktaking and Stakeholders Consultation carried out for the preparation of Nepal's Second National Communication to the UNFCCC identified critical problems in relation to adaptation activities. These include inadequate financial, technological and human resources.

Specific to the thematic areas, barriers in the forestry sector (and potentially applicable to other sectors), include inadequate implementation of existing plans and policies (MoEST, 2008). Similarly, although agriculture has been given highest priority in the poverty reduction strategy, budget allocations to this sector and irrigation have decreased. In the context of irrigation, the large irrigation schemes have not been effective enough to provide irrigation facility as intended due to technical and other management related problems. In the health sector, barriers to achieving identified results have been attributed to the lack of clear guidelines pertaining to mandates and roles of devolved structures. In the context of urban settlements and climate induced disasters a number of factors that undermine effective adaptation were identified during the NAPA process. These include lack of public awareness on climate-related disasters and limited reach of early warning systems, lack of land use planning and limited implementation of building codes.

### 5.3 Priority project profiles

The nine combined profiles are presented below.

#### Combined profile 1

**Title: Promoting Community-based Adaptation through Integrated Management of Agriculture, Water, Forest and Biodiversity Sector**

#### Project Rationale

Climate change is a cross-cutting issue by virtue of its nature and impacts. In Nepal, the major impact of climate change on the vulnerable communities is the deterioration of livelihoods options and natural safety net. The potential impact of climate change can have adverse, detrimental and multiplier effects to ecosystem conservation, natural resource management, and food and water security. At the same time, due to the country's rugged terrain and scattered settlements at different elevations from north to south, upstream-downstream linkage is very crucial as far as climate adaptation is concerned. This also demands an integrated approach to ecosystem management and adaptation. Therefore Nepal's NAPA envisions establishing a set of adaptation measures at watershed and landscape levels and enhancing capacity of the vulnerable community through better access to technology, innovative knowledge and practices. The rationale for the proposed project is outlined below:

- i. Climate change impacts are cross-cutting in nature and sectoral impacts are interlinked.
- ii. Climate change impacts are more severe to the poor and marginal communities residing in vulnerable and critical watershed areas
- iii. Nepal's rural livelihoods are based on the socio-natural interface and strengthening this interrelationship is necessary
- iv. Community's resilience is low because of reduced livelihoods options and collective threat to their natural capital
- v. Integrated approach to build community resilience can develop collective effort to minimize adverse impacts of climate change
- vi. In Nepal, due to its geography, people's upward- downward movement (north to south) and strengthening the upstream-downstream linkage is indispensable

### Description

As the proposed project is integrated and cross-cutting in nature, it has some vital components that have direct impacts on rural livelihoods and natural and social capital. The project components are:

- i. Watershed management in Churia to ensure ecosystem and community resilience to climate change and promotion and scaling-up of Multi Use System (MUS) for the benefit of poor and vulnerable households
- ii. On-farm soil and water conservation initiatives to support hill and mountain communities vulnerable to climate change and increase income from off-farm livelihoods
- iii. Flood management to increase the resilience of communities
- iv. Conservation of natural and social heritage in the high mountains

### Goal

The overall goal of the proposed project is to increase community's resilience in order to enable them to better adapt to climate change by creating livelihoods opportunities through integrated resource management at watershed level.

### Objectives

- 1) To produce and provide technology, skills and services for increased production and productivity of natural and human capital;
- 2) To promote sustainable farming practices including on-farm soil and water conservation initiatives for increased productivity and off-farm livelihood support;
- 3) To promote community based disaster risk reduction schemes for managing natural floods in the low land and landslides in the hills; and
- 4) To diversify livelihood options and income through better management of water, energy, forest and biodiversity.

### Activities

- i. Adaptation needs assessment at the basin region and local level (village development committee and district development committee level adaptation plans)
- ii. Capacity building of stakeholders and communities within and around project area (including institutional strengthening and coordination)
- iii. Sectoral plan development for each component with the involvement of local stakeholders
- iv. Mobilization of community-based organizations and local communities for implementation of local adaptation plans
- v. Installation of required structures for disaster risk reduction (e.g. early warning system, community-based disaster risk reduction plan preparation and implementation)
- vi. Sustainable soil and water management (organic farming, community biodiversity management, integrated pest management, irrigation facility)
- vii. Efficient water management (water harvesting schemes, multi use water system and technologies e.g. drip irrigation)
- viii. Sustainable forest and resource management (community fire control, non-timber forest products management)
- ix. Natural and social heritage conservation through community mobilization
- x. Food security programmes implementation (promoting local technology and innovations)

### Short term outputs

- i. Food security of vulnerable people and communities enhanced by using climate resilient options
- ii. Resource-use efficient options widely adopted for on-farm and off-farm income generation
- iii. Community sensitized about climate change adaptation through public awareness raising
- iv. Community adaptive capacity and decision making power enhanced

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- v. Resource management on a sustainable manner with focus on watershed and water conservation
- vi. Community led disaster management initiated
- vii. Climate resilient soil and water conservation measures availed for wider adoption
- viii. Integrated short term and long term adaptation plans and vision prepared
- ix. National and local capacity strengthened to develop climate resilient community
- x. Climate friendly infrastructures developed
- xi. Community-driven climate change adaptation projects implemented in demonstration sites

### **Potential long term outcomes**

- i. Food sufficiency for poor, marginalized, and disadvantaged farmers in water stressed areas attained
- ii. Climate-induced disaster resilient communities developed within the project area and demonstration effects to other areas observed.
- iii. Climate adaptation modality involving public and private sector developed
- iv. Livelihoods of the climate vulnerable including local poor and indigenous communities improved by increasing income from natural resource-based employments (green jobs)
- v. Water conservation for dry season to be used for different purposes availed
- vi. Climate adaptation in development plans and programmes integrated and mainstreamed
- vii. Government led and donor, civil society, private sector and local communities supported adaptation actions more harmonized and coordinated

### **Implementation**

The Ministry of Environment will coordinate the overall delivery of the project but the sectoral agencies i.e. appropriate levels of the Ministry of Agriculture and Cooperatives, Ministry of Local Development, Ministry of Forests and Soil Conservation, Ministry of Home Affairs, and Ministry of Energy will be taking the lead in the implementation of the project in specific sites consistent with the Implementation Framework described in Section 3.4.

**Time Frame:** Five years

The Project is divided into two phases.

Phase I: Project set up and strengthening capacity of project partners and stakeholders (1.5 year)

Phase II: Project implementation (3.5 years)

**Estimated total cost:** USD 50.0 Million

### **Risk and Barriers**

- i. Political instability and weak coordination mechanism at local level
- ii. Access to technology and financial resources to deliver the urgent and immediate priorities
- iii. Delay in implementation will increase the project cost due to increased vulnerabilities

### **Monitoring and Evaluation**

Monitoring and evaluation will be done in line with the Implementation Framework (see Section 3.4)

### Combined profile 2

#### **Title: Building and Enhancing Adaptive Capacity of Vulnerable Communities Through Improved System and Access to Services Related to Agricultural Development**

##### **Project Rationale**

Most of the rural communities are dependent upon agricultural production for food security and livelihoods. Agriculture in both irrigated and rainfed areas are dependent upon favorable climatic conditions. The changes in temperatures and rainfall are leading to increased crop failure, pasture shortages and possibly increased incidence of pests, diseases and parasites. The agricultural development strategies and policies need to address current impacts and future climatic risk to make the governance and delivery mechanism more robust and climate smart.

##### **Description**

The nature of the project is to enhance the adaptive capacity of the vulnerable communities by improving access to inputs and services that are required for agricultural development. The project components are:

- i. Capacity development of extension and advisory services
- ii. Technology provision that enables adaptation to increased droughts and erratic rains
- iii. Provision of finance and communications, transport and trading arrangements
- iv. Identification and provision of plant and animal genetic resources that have highly climate adaptive characteristics – drought tolerance, resistance to flooding, shorter growing seasons, heat tolerance, etc.
- v. Enabling policy and legal provisions to support community-based adaptation initiatives and implementation of local adaptation plans.

##### **Goal**

The overall goal of this integrated project is to develop the climate change adaptation capacity of vulnerable farmer communities by developing climate resilient agricultural practices.

##### **Objectives**

- 1) To promote the technologies on crops and livestock that can address climatic risks and uncertainty.
- 2) To improve the of vulnerable communities to modern agricultural technologies and services
- 3) To enhance the adaptive capacity of poor communities

##### **Activities**

Adaptation in agriculture can be supported through provision of robust and efficient extension services and appropriate technologies, market incentives, linkages between agro-ecosystems that allow specialization and buffering, and the provision of quality production inputs.

The activities proposed to support adaptation in agriculture are:

- i. Enabling climate vulnerable communities to sustain their livelihoods by improving access to basic agricultural services, technology and practices (on-farm agro-biodiversity management, integrated pest management, home garden promotion, farmers field school)
- ii. Enhancing community climate adaptive capacity through improved production and marketing systems (collective marketing)
- iii. Strengthening of highland-lowland linkages to improve community access to goods and services
- iv. Promoting crop varieties and animal breeds adaptable to climatic risk and uncertainty
- v. Strengthening the governance mechanism from local to national level through robust legal policies, strategies, institutional mechanism and financial resources.
- vi. Strengthening mechanism to increase access of most vulnerable communities to agriculture system (strengthening poor farmers institutions, saving and credit schemes, farmers decision making through farmers' groups, etc)

### Short-term outputs

- i. Climate smart agricultural extension and advisory related services strengthened
- ii. The need for climate adaptive technologies addressed by public and private sector supply chain actors
- iii. Knowledge and information, resources and products exchanges and trading between highland and lowland areas enhanced
- iv. Support to implement local adaptation plan of action increased
- v. Use of climate adaptive crop varieties and livestock breeds increased

### Potential long-term outcomes

- i. Wide-scale changes in agricultural production and marketing practices that enable adaptation to climate change effects observed
- ii. Agriculture-based rural livelihoods based in climate change vulnerable areas sustained

### Implementation

The Ministry of Agriculture and Cooperatives (MoAC) will lead the project. Agricultural research and development organizations will be involved in assessing adaptation needs and developing the technological packages for adaptation. MoAC and MoE/Department of Hydrology and Meteorology, and other knowledge-based organizations will be involved in the delivery of an integrated package of agricultural extension, climate information, and technology management District Development Committees and Village Development Committees will facilitate the inclusion of project plans into their annual plan. Private sector and civil society will be involved in extension, technical inputs and service delivery. Farmers' cooperatives and agricultural producer groups are main stakeholders at local level.

**Timeframe:** Five years

**Estimated total cost:** USD 44 million

### Risks and barriers

- i. Low resolution climate change projections upon which to base assessment of adaptation needs and adaptive technology selection
- ii. Mainstreaming climate change into organizational operations may be difficult to achieve
- iii. Costs of adaptive technologies may prohibit adoption
- iv. Farmers lack investment resources to enable adaptation

### Monitoring and Evaluation

- Baseline information and data generation in terms of agricultural technologies and practices
- Monitoring through assessment of adoption rates of adaptive technologies and business development of private sector providers
- Evaluation by independent team of experts

### Combined profile 3

#### Title: Community-based Disaster Management for Facilitating Climate Adaptation

##### Project Rationale

Observations of the effects of increased climatic variability in some parts of Nepal show increasing erratic and intense rains. This climatic trend combined with fragile landscape, deforestation and eroded soils are leading to landslides and flash flooding hazards. It is projected that rainfall intensity will increase across many areas of Nepal with climate change. Vulnerable communities will have to increase adaptive capacity to cope with climatic hazards.

These hazards also affect the availability of water resources particularly for household use. Water supplies need to be managed so they are climate proofed. Studies show that communities recover most quickly from climate-induced disasters such as flash flooding if drinking water supplies are reliable and accessible before and after disasters.

##### Description

The nature of this project is to managing disasters at the community levels in order to facilitate the climate adaptation. The project components are:

- i. Capacity development for adapting climatic hazards and reducing disaster-related risks
- ii. Development of infrastructures to minimize the hazards and risks
- iii. Development of safety-nets and basic services

##### Goal

The overall goal of this project is to manage climatic hazards at the community level through enhancing their adaptive capacity.

##### Objectives

1. To build the capacity of communities to adapt to a changing climate
2. To conserve domestic water sources and management of climate-induced disasters.
3. To protect the communities from climate-induced disasters

##### Activities

The project activities will focus on facilitating climate risk management to ensure that basic water sources are protected in order to facilitate community based adaptation. The adaptation activities identified as most important are:

- i. Building capacity to enhance community adaptation to climatic hazards (e.g. drying of natural water sources)
- ii. Construction of water retaining structures to address the effect of climate change
- iii. Establish, rehabilitate, and conserve small scale drinking water supply schemes and traditional water sources
- iv. Community-based climate-induced disaster risk reduction mechanism developed to protect safety nets and basic services

##### Short-term outputs

- i. Vulnerable communities better aware of climate induced disaster risks
- ii. Communities trained in disaster risk reduction practices and well equipped with local adaptation plans
- iii. Communities better protected from climate-induced disasters
- iv. Climate proofed water supplies developed

### **Potential long-term outcomes**

- i. Losses of property and life due to climate induced disasters reduced
- ii. Community action of sustainable climate induced- disaster risk reduction achieved

### **Implementation**

The Ministry of Home Affairs will lead the project in collaboration with Ministry of Irrigation and Ministry of Physical Planning and Works. Construction companies will also participate to elaborate water retention structures. Disaster risk reduction professionals from private sector and civil society organizations will be also mobilized.

**Timeframe:** Six years

**Estimated total cost:** USD 60 million

### **Risks and barriers:**

- Low resolution climate change projections upon which to base assessment of climate risks
- Mainstreaming climate change into key mandates and operations of organizations may be difficult to achieve
- The cost of water retention structures and climate proofing water supplies may prohibit wide-scale construction
- Communities unable to mobilize to implement disaster risk reduction procedures

### **Monitoring and evaluation**

- Baseline information generation in terms of disaster hazard exposure and occurrence
- Monitoring through assessment of the effectiveness of water retention structures and sustainability of water supplies during climate hazard-related events
- Evaluation by independent team of experts commissioned by lead ministries

### Combined profile 4

#### Title: GLOF Monitoring and Disaster Risk Reduction

##### Project Rationale:

In Nepal according to available data resources, temperature increase is higher in Himalayan regions compared to other regions. The increase of temperature will increase the rate of snow melting. Due to the weak natural dams there is a risk that can lead to GLOF events. Nepal has already experienced a number of GLOF events. If mitigation and disaster risk reduction activities are not in place, the country will suffer more from these events.

##### Description

The project is focused on the monitoring of GLOF events so as to reduce the possible disaster risks. The project components are:

- i. Glacial lakes monitoring to reduce potential hazards
- ii. Development of appropriate structure and early warning systems to support the livelihoods of downstream communities

##### Goal

The overall goal of this project is to contribute to the reduction of GLOF risk and enhance the sustainability of environmental services from the Himalayas.

##### Objectives

1. To monitor critical glacial lakes and identify GLOF-vulnerable communities and work with them to reduce risk
2. To provide alternative livelihoods to GLOF-vulnerable communities
3. To develop climate proof infrastructure and support services in GLOF sensitive areas.
4. To reduce the chances of loss of lives and properties due to GLOF

##### Activities

- i. Monitoring of the potential glacial lakes (emphasis on the six major GLOF potential lakes)
- ii. Implementation of structural measures for the GLOF reduction
- iii. Implementation of disaster risk reduction activities (establishment of early warning systems, forecasting and preparedness in downstream communities)
- iv. Support to GLOF-vulnerable communities through creating alternative livelihoods opportunities (agriculture and forest based livelihood, alternative energy)

##### Short-term outputs

- i. Hazard/risk mapping of the GLOF potential areas achieved
- ii. Information about the conditions of the GLOF potential lakes generated
- iii. Downstream communities in disaster preparedness and risk reduction activities involved

##### Long-term outcome

Downstream communities realize less adverse impacts from the GLOFs due to rising temperature

##### Implementation

The Ministry of Environment will lead the project with the involvement of other relevant line ministries and implementing partners

**Timeframe:** Five years

**Estimated total cost:** USD 55 million

##### Risk and Barrier:

Delay in implementation due to the existing situation and inadequate funding

##### Monitoring and Evaluation:

The monitoring of the activities will be carried out by the lead ministry in collaboration with the implementing partners. The evaluation will be done by a team of experts commissioned by MoE.

### Combined profile 5

#### Title: Forest and Ecosystem Management for Supporting Climate-led Adaptation Innovations

##### Project Rationale

Increased climatic variability is resulting in reduced precipitation during the winter and dry seasons. Rising temperature, glacial retreat and changes in water availability will also lead to changes in biodiversity. The influence can be seen in the timing of seasonal events (e.g. flowering, migration) in rates of growth and reproduction and in the distribution of species.

Forest fire intensity and occurrence has increased in recent years. Forest fire not only burns the fuel in forest floor and forest biomass, but also destroys habitat for many wild species such as insects, birds and wild animals. Another cause of loss of forest ecosystem is massive deforestation. Deforestation and indiscriminate use of trees for fuelwood are reducing the energy security of the rural poor. Better management of trees whether within forests, plantations or on agricultural lands is required to improve biomass energy availability. It is also important to harness economic benefits of sustainable forest management (linking to market and attracting carbon financing) for supporting the livelihood of millions of communities dependent on these natural resources.

##### Description

The project is concerned with managing the forest and the ecosystem in order to promote innovations for climate-led adaptations. The project components are:

- i. Capacity development of forest dependent communities, farmers and rural population
- ii. Assessment of potential sites for tree plantations and investments in community managed plantation
- iii. Generation of biomass energy and related technologies
- iv. Research and extension of adaptation priorities

##### Goal

The overall goal of this project is to develop community-based innovations to adapt with changing climate and conserve ecosystem services.

##### Objectives

1. To develop community capacity to mitigate forest fire occurrences and self sustained forest produces
2. To support in implementing adaptation priorities in the local level
3. To scale-up technologies and strengthening the local institutions

##### Activities

- i. Community-based forest fire management implementation in the mid hills and Terai
- ii. Management of trees outside the forests in public and private land (agro-forestry practices)
- iii. Plantations to maintain the balance between fuel wood demand and supply for rural household energy
- iv. Scale-up of biomass energy technologies (quantity, quality, and coverage) for less fuel wood consumption
- v. Strengthening local level forest institutions and their governance
- vi. Supporting the implementation of adaptation priorities of community forestry user groups
- vii. Facilitating market linkages and voluntary carbon financing

##### Short-term outputs

- i. Vulnerable communities become more aware of fire hazard and better able to manage forest fire events
- ii. Vulnerable communities have access to adaptation technologies and practices
- iii. Farmers trained in agro-forestry practices
- iv. Community forestry user groups sensitized on economic and carbon financing potentials
- v. Rural population become more aware of sustainable biomass energy technologies
- vi. User groups' capacity enhanced for forest fire management.

### Potential long-term outcomes

- i. Natural forest better managed by communities and protected from forest fires
- ii. Loss of natural resource base due to forest fires reduced
- iii. Peoples' access to biomass energy in rural areas improved
- iv. Use of sustainable biomass energy technologies increased
- v. Additional employment created from management of forest goods and services

### Implementation

The Ministry of Forests and Soil Conservation (MoFSC) will lead the project in partnership with other relevant organizations.

**Timeframe:** Three years

**Estimated total cost:** USD 25 million

### Risks and barriers

- i. Inadequate fire risk assessments
- ii. Mainstreaming climate change into organizational mandates and operations may be difficult to achieve
- iii. Cost of agro-forestry and sustainable biomass energy technologies may prohibit wide-scale use

### Monitoring and evaluation:

- Baseline information generation in terms of fire events occurrence
- Monitoring through assessment of the effectiveness of fire risk management
- Extent of adoption and use of biomass energy
- Evaluation by independent team of experts commissioned by the MoFSC

### Combined profile 6

#### Title: Adapting to Climate Challenges in Public Health

##### Project Rationale

Extreme events are expected to become more frequent as a result of climate change. Climate extremes can have devastating effects on human health and society. In Nepal, historical information reveals that disasters, famines, and disease outbreaks have been triggered by droughts and floods. From 1954 to 2002, floods have affected over a million people in Nepal. The indirect impacts of climate change and variability include increases in vector-borne diseases (malaria, kala-azar, dengue, viral encephalitis, flariasis) and water and food-borne diseases (diarrhea, dysentery, typhoid).

Despite the fact that projected changes in temperature and rainfall will almost certainly alter relative magnitudes of hydrological cycle, the country lacks a reliable climate early warning system and basic infrastructure to reduce the impacts of extreme weather events. The health sector should have sufficient database, a strategically focused programme and policy to combat with adverse impact of climate change on public health. An integrated approach must be adopted for health planning and research in different climatic regions of the country

##### Description

The project focuses on the climate change adaptation in the public health sector of Nepal. The major components are:

- i. Mapping of major communicable diseases and water and food-borne diseases
- ii. Exploring indigenous knowledge and community practices for health adaptation appropriate for different ecological regions
- iii. Strengthening Hospital Management Information System (HMIS) and early warning system
- iv. Capacity building in public health for climate adaptation

##### Goal

The overall goal of this project is to support adaptation planning in the health sector by generating evidence of the linkages between climate change and public health

##### Objectives

1. To reduce the impacts of climate change on public health through research and development programmes
2. To strengthen institutions through provisions of logistics and related support services
3. To enhance the capacity of service providers and communities

##### Activities

- i. Reduce public health impacts of climate change in Nepal through evidence-based research and piloting
- ii. Community empowerment and public education for responding adverse effects of climate change in public health
- iii. Disease outbreak investigation and emergency response
- iv. Programme to scale up control of vector, water and food-borne diseases
- v. Strengthening forecasting/early warning systems on climate change and health
- vi. Integrated surveillance of vector and vector-borne diseases
- vii. Logistics support to Rapid Response Team (RRT) such as provision of essential drugs, medical supplies and equipments
- viii. Expansion of vector-borne control programme from 26 districts to all districts.
- ix. Formation of 300 Rapid Response Teams at sub district level and mobilization of teams to the field

### Short-term outputs

- i. Staff trained to operate and maintain advanced public health and early warning system
- ii. A functional early warning system in place
- iii. Greater awareness of the end users created regarding relevance and importance of weather information
- iv. Two way communication system between local health facilities and surveillance system established
- v. Hospital Management information System (HMIS) system in central, zonal and district hospitals strengthened
- vi. Vector-borne disease programme expanded

### Potential long-term outcomes

- i. Operational data collection networks strengthened and made responsive to user's needs
- ii. Climate information in the national public health planning process integrated
- iii. Quality dataset for climate change developed
- iv. Population protected from adverse impacts of climate change on public health.

### Implementation

The Ministry of Health and Population will lead the project in collaboration with the Ministry of Environment, Ministry of Energy, Ministry of Agriculture and Cooperatives and Ministry of Local Development. The relevant NGOs, CBOs, and local communities will also be involved.

**Timeframe:** Three years

**Estimated total cost:** USD 15 million

### Risks and barriers

- i. Inadequate technical skills, human resources and financial capacity
- ii. Unavailability of quality data on climate and health impacts, few meteorological station coverage, poor health surveillance system
- iii. Inter-departmental coordination weak both among and within governmental ministries
- iv. Inadequate fund allocated to research
- v. Concrete methodology lacking for assessing the impacts of climate change on vulnerable populations

### Monitoring and evaluation

District Health Office/District Public Health Office will be responsible for quarterly monitoring. Ministry of Health and Population will be responsible for mid-term and end of the project evaluation.

### Combined profile 7

#### Title: Ecosystem Management for Climate Adaptation

#### Project Rationale

Climate variability is causing deleterious changes in key ecosystems such as the high mountain rangelands and wetlands. These areas have high ecological value and also support livelihoods of poor people. The conservation of ecosystems is necessary in order to sustain the livelihoods of those dependent on the ecosystem. Adaptation of the ecosystem is hampered by inappropriate management and over exploitation of natural resources.

#### Description

The project focuses on the ecosystem conservation in order to support the livelihoods of the communities who are dependent on it. The project components are:

- i. Promotion of improved pasture and range-land management techniques to rehabilitate degraded mountain ecological regions
- ii. Conservation of medicinal plants and non-timber forest products (NTFP) in potential areas
- iii. Integrated wetland management in Terai through innovative mechanisms like facilitating the governance of ecosystem services
- iv. Landscape level corridor management in the Terai

#### Goal

The overall goal of this project is to conserve the ecosystem and promote the ecosystem-based livelihoods of the people living in the Western Nepal.

#### Objectives

- i. To rehabilitate the degraded areas through promotion of improved pasture and range-land management techniques
- ii. To conserve and utilize local ecological resources for livelihood support
- iii. To enhance the capacity of local communities for sustainable management of resources

#### Activities

- i. Develop and support implementation of Local Adaptation Plans (focused on conservation and management) for high mountain and wetland through user groups
- ii. Study the impacts of changes in precipitation and temperature on pastures, herbs and NTFP management
- iii. Train local communities in management of the selected climate sensitive natural resources
- iv. Implementation of management plan for forest and habitat management, including control of invasive species, promoting indigenous species, income generating activities to local communities from wetland resources.
- v. Monitoring the impact of climate change in indicator species.
- vi. Prepare and implement eco-tourism promotion plan.
- vii. Study and documentation of indigenous wetland conservation knowledge, skills and practices.
- viii. Promotion of livelihood opportunities from high mountain and wetland resources
- ix. Identify and implement legal measures to enable management of high mountains and wetlands and maintain upstream and downstream linkages.

#### Short-term outputs

- i. Local communities better able to manage high mountain and wetlands for biodiversity conservation
- ii. Improved management of important ecosystems
- iii. Local communities able to conserve medicinal plants and NTFPs from adverse impacts of climate change
- iv. Sustainable management of forest resources thereby contributing to additional biomass generation or climate change mitigation.
- v. Improved communication and coordination between upstream and downstream communities including service providers

### **Potential long-term outcomes**

- i. High mountain and wetland ecosystems conserved and better able to adapt to climate change
- ii. Livelihoods of those dependent upon the ecosystems sustained

### **Implementation**

The Ministry of Forests and Soil Conservation (MoFSC) will lead the project and will work in collaboration with the Ministry of Environment, Ministry of Agriculture and Cooperatives, and Ministry of Local Development. In the districts, there will be project team attached to concerned district office under MoFSC. Local communities will also be involved in the project implementation.

**Timeframe:** Three years

**Estimated total cost:** USD 31 million

### **Risk and barrier**

- i. Insufficient and weak coordination among local communities, and related line agencies at different levels may affect in attaining the project's output and outcome.

### **Monitoring and evaluation**

The central level project coordination committee will guide the implementation mechanism of the project. A mechanism for smooth implementation of the project in districts will be established through activity implementation committee, which will take place once in every month. The committee will be represented by appropriate organizations working in districts under MoFSC, local government and appropriate community-based organizations.

## Combined profile 8

### **Title: Empowering Vulnerable Communities through Sustainable Management of Water Resource and Clean Energy Supply**

#### **Project Rationale**

Climate change effects will be mediated through the introduction of appropriate adaptation measures. Hence water resources and energy supply systems need to be adapted to cope with both too much and too little water in all seasons.

Nepal has been already facing water scarcity due to changes in climatic trends. Adaptation activities designed early will not only be cost effective but also provide opportunity to increase adaptive capacity of the local communities through efficient water and energy supply. This includes investment in efficient water resource management and clean and low carbon energy technologies.

#### **Description**

The project is the nature of sustainable management of water resources and supply of clean energy to empower vulnerable people. The project components are:

- i. Conservation of water sources and their sustainable management
- ii. Development of institutional and physical infrastructures for the efficient utilization of water (including rain water)
- iii. Promotion of sustainable clean energy supply

#### **Goal**

The overall goal of this project is sustainable management of water resources and supply of clean energy.

#### **Objectives**

- i. To manage water resources and supplies using a combination of climate proofing, climate risk management, and water use technologies.
- ii. To ensure the sustainable supply of clean energy through developing related technologies and schemes
- iii. To develop/enforce regulatory mechanism for sustainable harvesting of water resources
- iv. To enhance the capacity of the institutions and related stakeholders

#### **Activities**

- i. Conservation of lakes supplying water and ecological services to urban areas
- ii. Water supply source conservation and strengthening programmes of existing projects affected by source reduction
- iii. Piloting rain water harvesting structures
- iv. Promoting clean and low carbon energy technologies (small micro hydro, solar, biogas, solar power)
- v. Financial analysis and economic appraisal of existing innovative water and energy schemes and practices
- vi. Development of nationwide urban groundwater monitoring system and enactment of regulatory measures
- vii. Establishment and improvement of micro-hydropower projects being affected by the acute water shortages
- viii. Improve water mills for multi-use
- ix. Facilitate the implementation of local adaptation plans for efficient water and energy management

### Short-term outputs

- i. Urban water sources adaptive management plans including lake conservation developed and implemented
- ii. Appropriate water harvesting techniques promoted
- iii. Pilot urban groundwater monitoring systems in place for key urban centers
- iv. Regulatory framework to improve management of water resources and supply systems amended/developed
- v. Access to clean and low carbon energy for vulnerable households improved
- vi. Methods for climate proofing micro-hydro plants and water mills developed, tested and used

### Potential long-term outcomes

- i. Urban water sources managed to overcome climate change challenges
- ii. Key lakes conserved
- iii. Widespread adoption of water harvesting techniques
- iv. Urban groundwater monitored and information used for improved adaptive management
- v. Regulatory framework for management of water resources and supply systems amended
- vi. Climate proofed micro-hydro plants and water mills promoted
- vii. Sustainable clean energy and low carbon investments at national level achieved

### Implementation

The Ministry of Environment will lead the project in collaboration with Ministry of Energy. Water professionals and the private sector companies that offer climate proofed water harvesting, micro-hydro and water mills technologies will also be involved. Water user groups will also be involved in promoting technology adoption

**Timeframe:** Three years

**Estimated total cost:** USD 40 million

### Risks and barriers

- i. Inadequate climate change projection information upon which to base assessment of climate effects on water sources
- ii. Mainstreaming climate change adaptation into key organizations may be difficult to achieve
- ii. Costs of climate proofing micro-hydro and water mills may prohibit its wide-scale adoption
- iii. Reluctance to adopt water harvesting technologies

### Monitoring and evaluation

- Baseline information generation in terms of water source status, functionality of micro-hydro plants and water mills, and water harvesting technology use
- Monitoring through assessment of the effectiveness of adaptive management of water sources and functionality of micro-hydro plants and water mills, and water harvesting technology use
- Evaluation by independent team of experts commissioned by Ministry of Environment and Ministry of Energy

## Combined profile 9

### Title: Promoting Climate Smart Urban Settlement

#### Project Rationale

Climate change impact on urban areas are likely to be severe particularly in terms of increased exposure to flooding, disturbance to water sources, and need for increased energy consumption for cooling.

The unsafe built form in urban settlements in Nepal is one of the major reasons for vulnerability. Physical changes within municipalities in Nepal can be observed as land use changes, new built forms, and land fragmentations. In some areas, the new structures are built by untrained local contractors without adjusting designs and construction for impacts of climate changes. Most construction works are carried out with minimal considerations of building codes and monitoring.

#### Description

The project is focused on the development and promotion of climate smart urban settlement in Nepal. The project components are:

- i. Enforcement of building codes in municipal areas
- ii. Management of municipal waste
- iii. Capacity building of institutions and communities in planning and management

#### Goal

The overall goal of this project is to promote climate smart urbanization process in Nepal through national and local capacity building.

#### Objectives

1. To develop mechanism for incorporating climate change dimensions in the building codes
2. To manage and utilize the municipal waste and link it with clean development mechanism
3. To enhance the capacity of the related stakeholders and institutions

#### Activities

- i. Incorporate climate change considerations in building codes in municipal areas
- ii. Enforce building codes
- iii. Identification of vulnerable communities that require rehabilitation and rehabilitate them
- iv. Establish municipal compost plants and develop strategy to link with Clean Development Mechanism (CDM) in order to generate additional revenue and as co-benefits to adaptation
- v. Strengthen capacity of local level institutions for efficient water and energy planning and project implementation
- vi. Facilitating in developing and implementing low carbon development strategies (piloting in urban areas and scaling in country side)
- vii. Awareness raising and information dissemination through print and electronic media
- viii. Training to municipal engineers, and contractors

#### Short-term outputs

- i. Better awareness about building codes in municipal areas
- ii. Building codes revised to incorporate climate change dimensions
- iii. Most climate vulnerable communities identified and plans for rehabilitation developed
- iv. Municipal compost plants developed and operated
- v. Local organizations aware of and able to carry out more efficient water and energy planning and project implementation
- vi. Low carbon development and clean energy promotion strategies adopted

### Potential long-term outcomes

- i. Building codes adjusted for climate change effects
- ii. Most climate vulnerable communities rehabilitated
- iii. Municipal compost plants well-functioning and CDM related revenue generated
- iv. Local organizations implementing efficient water and energy activities
- v. Improved access to financial resources to support low carbon energy and water use management schemes

### Implementation

The Ministry of Physical Planning and Works will lead the project. The municipal authorities, private sector construction companies and local urban peoples' organizations managing projects will also be involved.

**Timeframe:** Three years

**Estimated total cost:** USD 30 million

### Risks and barriers

- i. Costs of rehabilitation of communities may be high
- ii. Construction business intransigence to accept and follow building codes

### Monitoring and evaluation

- Baseline information generation based on current adherence to building codes and incidence of urban communities affected by climate induced hazards
- Monitoring of adherence to building codes by new builds and plans
- Monitoring of climate-induced damage and loss of homes
- Evaluation by independent team of experts commissioned by the lead ministry.

## CHAPTER 6 CONCLUSIONS AND THE WAY FORWARD

The Nepal NAPA is a process beyond just report preparation. This process now moves to the implementation of the identified priorities. The NAPA document has clearly set out the Government of Nepal's priorities for adaptation action. All support to adaptation activities in Nepal now has a coherent basis of prioritization as set in this report.

The Nepal NAPA process benefited NAPA experiences elsewhere and having available greater support from development partners, in addition to the Least Developed Countries Fund (LDCF).

The process has also had the advantage of being able to convene wide involvement – both from the government and non-governmental stakeholders. The Ministry of Environment hosted the NAPA team and provided necessary coordination and guidance to prepare NAPA document. The wider ranges of consultations with the stakeholders and potential beneficiaries throughout the country have enriched the NAPA process that contributed the process to be more inclusive and country-driven.

During the preparation of NAPA, the Government of Nepal has adopted a Three-Year Plan (2010-2012). The Plan has broad-based objectives of making development activities climate-friendly, mitigating the adverse impacts of climate change, and promoting adaptation. It has contributed to adopt strategies, *inter alia*, for adapting with and conducting studies on climate change; and making meteorological forecast more reliable. In order to implement the strategies, the Plan has made the MoE responsible for coordinating all activities related to environment conservation and climate change, and NAPA implementation through national and international support.

Intensive work carried out at different levels has provided a basis for prioritizing adaptation actions across various sectors. These priorities would provide a basis and platform for the development of a national climate change adaptation response strategy and it is anticipated that funding will be available from diverse sources to implement these priorities.

Nepal considers NAPA as a solid foundation for the implementation of most urgent and immediate adaptation options. The Government of Nepal will make every effort to implement the NAPA prioritized adaptation actions effectively with enhanced participation of stakeholders and climate vulnerable people. It is envisioned that experience from NAPA implementation will further streamline adaptation actions including other climate change activities in Nepal.

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## Annexes

### Annex 1. Milestones in the preparation of the Nepal NAPA

Project Signed:	November 2008
Inception workshop:	May 2009
TWG formation:	September 2009
Induction workshop:	October 2009
Transect appraisal exercise for detailed vulnerability assessment:	November 2009
Writeshop:	December 2009
Synthesis workshop:	February 2010
Reference group consultation workshops	5-10 March 2010
Project prioritization criteria development (with MCA tool)	by 15 <sup>th</sup> April 2010
Project prioritization and first draft of NAPA	End of May 2010
National and regional consultation on draft NAPA	June-July 2010
Final NAPA	September 2010
Follow up proposals development and submission	September 2010

## Annex 2. Perceptions of climatic hazards and climatic changes identified during the Transect Appraisal Exercises

West	Central	East
<b>High Himalaya</b>		
<p><b>Changes in temperature</b> Days are getting warmer and nights are less cold</p> <p><b>Changes in precipitation</b> Rainfall: becoming erratic, delayed onset; reduced rainfall in the dry months; intense rainfall episodes in the monsoon; Snow: Decrease in snowfall; snowline has changed; Untimely and unusual snowfall; Increase trends of snowmelt</p> <p>Increase in extreme weather conditions Increased incidence of avalanche Changes in frost/hail patterns; Untimely tuwalo (heavy morning fog)</p>	<p><b>Changes in temperature</b> Days are becoming hotter; maximum temperature last year was 24°C to 25°C now it is 27°C</p> <p><b>Changes in precipitation</b> Rainfall: Increased variability in rainfall pattern; Delayed rainfall; Increase in high intensity episodes while total amount remaining the same; In recent years, more rainfall is experienced during the later stage of the monsoon Snowfall: Decreased amount; Shift in the timing of occurrence (e.g. in Mustang, snowfall occurs in late April); duration increased up to <i>Baishakh</i> (mid-April to mid-May)-; Changing to rainfall/hail stone with an increase in hailstorm events. <b>Changes in wind pattern</b> North wind used to blow only on specific periods, now it occurs throughout the year (from seasonal to annual changes)</p>	<p><b>Changes in temperature</b> Increase in surface temperature; Days becoming hotter</p> <p><b>Changes in precipitation</b> Rainfall: Increased variability: Rain is irregular and unpredictable; Shorter rainfall duration with intense rain spells; Shorter winter rainy season; Rainfall timing - Delay in the occurrence of monsoon rain (it used to start from <i>Baishakh</i> or <i>Jestha</i> (May-June), now it starts from <i>Sharaban</i> (July to August); shorter west-to-east rainfall season; Decrease in cloudy days Snowfall: Shortened snowfall period</p> <p><b>Change in wind Pattern</b> Stronger wind and erratic storm; western wind blows more than eastern wind Intensity of frost and dew shortened Lightning frequency increased</p>
<b>Mid Hills</b>		
<p><b>Changes in temperature</b> Days are getting warmer; nights are less colder; rural areas (e.g. Dadeldhura) are getting warmer</p> <p><b>Change in Precipitation</b> Rainfall: rainfall becoming erratic and unusual timing of rainfall is becoming common; delayed onset; reduced rainfall in the dry months; intense rainfall episodes in the monsoon Snowfall: Decrease in amount and duration of snowfall for the past 5 years</p> <p><b>River Flow</b> Dry season water flow in west Rapati river has decreased last year from minimum record flow of 35 cubic m/sec to 31 cubic m/sec (Gopghat stream and gauging station) Increase in extreme weather conditions</p>	<p><b>Changes in temperature</b> Increase in temperature; cold wave in the winter has increased</p> <p><b>Change in Precipitation</b> Increase in erratic and high intensity rainfall episodes;</p> <p><b>Change in wind and other weather patterns</b> Increase in wind intensity increased and timing changed Fog &amp; <i>tuwalo</i> – duration of fog decreased (previously, fog is until 12 PM but now visibility starts by 10 AM); <i>tuwalo</i> pattern changed Hailstorm: changes in the period of hailstorm (previously hailstorms occur in March-April, now it has been delayed); changes in size and shape of hailstorms (previously their shapes are rounded, now their shapes are pointed)</p>	<p><b>Changes in temperature</b> Increase in surface temperature; Number of hot days increasing</p> <p><b>Changes in precipitation</b> Changing rainfall pattern: short intense spells of rainfall; delay in the onset of rainfall by as much as 2-3 months; rainfall season duration decreased Incidences of prolonged droughts</p> <p><b>Change in wind and other weather patterns</b> Cloudy days decreased Stronger wind becoming more prevalent, very erratic Intensity and duration of frost and dew decreased Increased incidence of windstorm and hailstorm; hailstorm season has shifted Lightning episodes increased</p>

## National Adaptation Programme of Action (NAPA)

West	Central	East
<b>Terai</b>		
<p><b>Changes in Temperature</b> Increase in temperature; extreme temperature events with extreme cold days and extreme hot days; increase in cold waves during winter; village is becoming warm (Sukhad)</p> <p><b>Changes in precipitation</b> Shifts in rainy season: delayed onset - rainfall of Chaitra to Ashad (April to June) has now shifted to Bhadra/Ashoj (July/September); Decrease in rainfall amount with short intense rain spells (leading to occasional floods); Increased rainfall variability with unpredictable rainfall &amp; reports of both increased and decreased duration</p> <p><b>Change in Wind Pattern</b> Altered wind patterns – duration of western winds is longer</p>	<p><b>Change in Temperature</b> Increase in temperature - days becoming increasingly hotter, while mornings are cooler; <i>Sitlahar</i> (coldwaves) duration has become longer - starts earlier and lasts for a longer time compared to the last 5-10 years</p> <p><b>Changes in Precipitation</b> Rainfall pattern has become more erratic; high intensity but short duration</p> <p><b>Change in wind pattern</b> Early occurrence of westerly winds. It used to blow only after January 15<sup>th</sup>, now it blows as early as October/November</p>	<p><b>Change in Temperature:</b> Increase in temperature.</p> <p><b>Changes in Precipitation</b> High intensity of rainfall in shorter period of time; decreased number of rainy days, however an increase in intense rainfall (year round rainfall remaining the same) Both foggy days and frost days disappeared</p> <p><b>Change in wind Pattern</b> Hot winds have increased.</p>

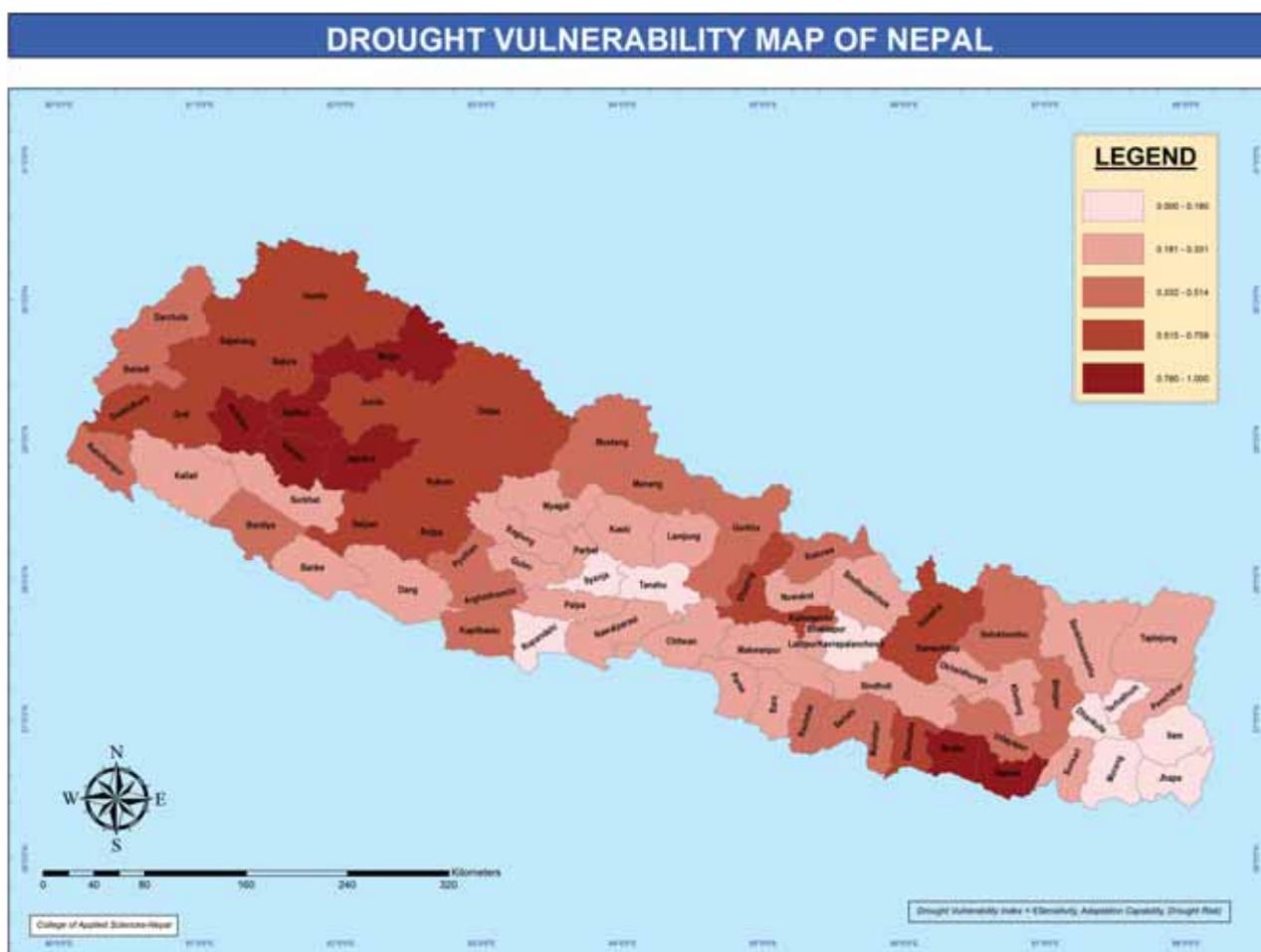
### Annex 3. Key results of district-level climate change vulnerability assessment in Nepal

This annex draws information from the MoE/NAPA Project (2010) study “Climate change vulnerability mapping for Nepal.” Maps and tables showing relative climate vulnerability related to GLOF, droughts, flooding and landslides for the 75 districts of Nepal are presented below. The map and table of overall district level relative climate vulnerability are presented in Section 2.1.



#### District ranking-GLOF Vulnerability Index

GLOF Vulnerability	Districts
Very High (0.911-1.000)	Dolakha, Solukhumbu, Manang, Mustang, Taplejung, Gorkha
High (0.767-0.910)	Khotang, Sankhuwasabha, Lamjung, Okhaldhunga, Ramechhap, Dhading
Moderate (0.598-0.766)	Bhojpur, Panchthar, Udayapur, Tanahu, Terhathum, Sindhuli, Dhankuta
Low (0.001-0.597)	Baglung, Chitwan, Parbat, Myagdi, Nawalparasi, Sunsari, Gulmi, Syangja
Very Low (0.000)	Jajarkot, Mugu, Kalikot, Dailekh, Saptari, Achham, Siraha, Dolpa, Humla, Kathmandu, Jumla, Dadeldhura, Bajura, Bajhang, Rukum, Salyan, Rolpa, Doti, Dhanusha, Baitadi, Sarlahi, Bardiya, Pyuthan, Rasuwa, Kanchanpur, Bhaktapur, Mahottari, Kapilbastu, Darchula, Rautahat, Arghakhanchi, Parsa, Dang, Banke, Kailali, Sindhupalchok, Lalitpur, Makwanpur, Nuwakot, Surkhet, Kaski, Palpa, Bara, Rupandehi, Kavrepalanchowk, Ilam, Morang, Jhapa



### District ranking-Drought Vulnerability Index

Flood Vulnerability	Districts
Very High (0.760-1.000)	Jajarkot, Mugu, Kalikot, Dailekh, Saptari, Achham, Siraha
High (0.515-0.759)	Dolpa, Humla, Kathmandu, Jumla, Dadeldhura, Bajura, Bajhang, Rukum, Salyan, Dolakha, Rolpa, Ramechhap, Doti, Dhanusha, Dhading
Moderate (0.332-0.514)	Baitadi, Sarlahi, Bardiya, Pyuthan, Rasuwa, Manang, Kanchanpur, Mustang, Bhaktapur, Gorkha, Mahottari, Udayapur, Kapilbastu, Darchula, Rautahat, Bhojpur, Solukhumbu, Arghakhanchi
Low (0.181-0.331)	Sindhuli, Parsa, Dang, Banke, Kailali, Gulmi, Taplejung, Sindhupalchok, Lalitpur, Makwanpur, Panchthar, Nuwakot, Chitwan, Baglung, Surkhet, Sankhuwasabha, Kaski, Palpa, Khotang, Nawalparasi, Bara, Myagdi, Parbat, Okhaldhunga
Very Low (0.000-0.180)	Lamjung, Sunsari, Rupandehi, Tanahu, Kavrepalanchowk, Ilam, Terhathum, Morang, Syangja, Dhankuta, Jhapa

## FLOOD VULNERABILITY MAP OF NEPAL - Terai Ecological Zone



### District ranking-Flood Vulnerability Index

Flood Vulnerability	Districts
Very High (0.788-1.000)	Mahottari
High (0.534-0.787)	Rautahat, Chitwan, Parsa, Saptari, Siraha, Sunsari, Dhanusha, Bara
Moderate (0.337-0.533)	Sarlahi, Nawalparasi, Kailali, Jhapa, Morang, Kanchanpur, Bardiya
Low (0.001-0.336)	Banke, Kapilbastu, Rupandehi
Very Low (0.000)	Achham, Arghakhanchi, Baglung, Baitadi, Bajahang, Bajura, Bhaktapur, Bhojpur, Dadeldhura, Dailekh, Dang, Darchula, Dhading, Dhankuta, Dolakha, Dolpa, Doti, Gorkha, Gulmi, Humla, Ilam, Jajarkot, Jumla, Kalikot, Kaski, Kathmandu, Kavrepalanchowk, Khotang, Lalitpur, Lamjung, Makwanpur, Manang, Mugu, Mustang, Myagdi, Nuwakot, Okhaldhunga, Palpa, Panchthar, Parbat, Pyuthan, Ramechhap, Rasuwa, Rolpa, Rukum, Salyan, Sankhuwasabha, Sindhuli, Sindhupalchok, Solukhumbu, Surkhet, Syangja, Tanahu, Taplejung, Terathum, Udayapur

**LANDSLIDE VULNERABILITY MAP OF NEPAL - Hill and Mountain Ecological Zone**



**District ranking-Landslide Vulnerability Index**

Landslide Vulnerability	Districts
Very High (0.787-1.000)	Udayapur, Kathmandu, Mugu, Lamjung
High (0.630-0.786)	Darchula, Baglung, Rolpa, Achham, Makwanpur, Dolpa, Parbat, Taplejung, Ramechhap, Gorkha, Salyan, Doti, Bajhang, Sindhuli, Bhaktapur, Solukhumbu, Baitadi, Kaski, Rasuwa, Sindhupalchok, Jajarkot, Rukum, Nuwakot, Dhading, Myagdi
Moderate (0.47-0.629)	Bajura, Bhojpur, Okhaldhunga, Sankhuwasabha, Syangja, Dailekh, Arghakhanchi, Tanahu, Kalikot, Kavrepalanchowk, Dolakha, Khotang, Dang, Surkhet, Humla, Gulmi, Jumla, Panchthar, Pyuthan
Low (0.001-0.476)	Ilam, Manang, Dadeldhura, Mustang, Palpa, Terhathum, Lalitpur, Dhankuta
Very Low (0.000)	Saptari, Siraha, Chitwan, Mahottari, Sunsari, Dhanusha, Nawalparasi, Rautahat, Sarlahi, Bara, Kanchanpur, Parsa, Morang, Kailali, Jhapa, Banke, Kapilbastu, Rupandehi, Bardiya

## Annex 4. Local perceptions of climate change impacts

Water & Energy	Agriculture & Food Security	Forestry & Biodiversity	Urban Settlements & Infrastructure	Public Health	Climate Induced Disasters
Decreased access to water supplies; Increase in surface run-off leading to erosion & difficulty in capture and storage of water; Increased frequency of floods & drought leading to adverse impact on infrastructure	Changes in crop productivity due to delays in cropping cycle; up-ward shift in agro-ecological zone; increase in crop diseases and pests ; reduced water availability; Decline in livestock productivity due to increase in incidences of disease including sterility & decrease in fodder species; Loss of crop & forest diversity, e.g., Jaluka “wild saag”, local rice varieties, wild mint, local cucumber and bitter gourd have disappeared;	Biodiversity loss, including a reduction of wild animals and local & migratory bird species & loss of high altitude herbs & NTFP; Changes to wildlife habitat. Example, upward shifting of tree line; Change in precipitation (snow to rainfall) is exacerbating causes of fuelwood scarcity Increase in disease and insect attacks, including increase of invasive alien species; Early flowering and fruiting Increased dryness in forest Increase in forest fire incidences	Increase in extreme weather events could impact urban infrastructure as well as energy infrastructure like micro-hydro plants; Impact of disasters leading to greater migration to urban areas; Increase disruption to socio-economic infrastructure and human well-being Decrease in supply & quality of water Increase the cost of maintenance of public green spaces, parks and playing fields in settlements	Cold and heat related injuries and illness ( heat stress, heat waves) and exposure Deterioration of water & air quality Increased risk of water & vector borne disease Social, Physical and mental stress and workload Damaged public health infrastructure & lack of access to health services during severe weather conditions Health related migration and displacement during epidemic and outbreak of disease	Increase in Flood/Landslides Increase in Drought and dryness Thunderbolt/hail storm/windstorm Increase in Forest fire Outbreak of certain diseases Conflict over natural resources Displacement and migration

**Annex 5: Gender sensitivity analysis of climate change impacts**

Water & Energy	Agriculture & Food Security	Forestry & Biodiversity	Urban Settlements	Public Health	Climate Induced Disasters
<p>Decreased women's access to water resources increases work load, impacting on reproductive health (e.g. prolapsed uterus) and personal hygiene.</p> <p>Climate induced resource conflicts increases social violence, anxiety and depression in women.</p> <p>Women are often the household members who look after water firewood and energy management. Any risk involving them should be addressed in climate adaptation strategies.</p>	<p>Male out-migration imposes additional work load on women.</p> <p>Women consume less food during shortages causing under-nourishment and weakness - especially during pregnancy and lactation.</p> <p>Women are custodians of local knowledge, agricultural skills and practices (e.g. seed preservation) and other livelihood related activities. Loss of these resources due to climate change would Make women more vulnerable. Adaptation strategies need to improve women's access to these resources.</p> <p>Due to limited access to credit, market, land, and agricultural extension services, women are more vulnerable to adverse climate change impacts.</p>	<p>Reduced availability of income generating forest products affects women and marginal communities directly because of their high level of reliance on such products for revenue generation and as safety nets.</p> <p>Women and marginalized groups have limited access to new information and communications to support adaptation.</p> <p>Climate induced resource use conflict amplifies existing gender inequalities. Women become more vulnerable when conflict leads to social violence, anxiety and depression</p>	<p>Water scarcity would mean that women have to spend more time collecting water.</p> <p>Migration and frequent movements due to temporary displacement related to flash floods pose risks of insecurity and sexual violence against women.</p> <p>Inadequate incorporation of gender concerns in urban planning and policies undermines adaptation.</p> <p>Under representation of women and marginal communities in urban projects and infrastructure development. Women are to be important actors in the development of urban adaptation.</p>	<p>Due to socially constructed multiple roles, more women than men die or get injured from climate change related health hazards</p> <p>Climate change exacerbates gender differentiation and poor health of women.</p> <p>Women bear the brunt of providing increased care of vulnerable children, sick, disabled, and old age people.</p> <p>Climate change-induced diseases, such as respiratory disorders, allergy, asthma and other respiratory diseases appear more among women, marginal people including children. This leads to women's illness, physical and mental stress.</p>	<p>Women have less access to early warning and climate information and generally, lack the skills to survive extreme events.</p> <p>Women face the risk of increased sexual violence in temporary shelters.</p> <p>Cultural and social restrictions curtail mobility of women and their ability to avoid disasters.</p> <p>Women and marginalized people are poorly represented in formulating disaster related policies and programme.</p> <p>In case of food scarcity, women often eat less and also become less careful about their health which also makes them to become more prone to malnutrition and diseases.</p>

## Annex 6: Consultations and awareness raising activities

Date	Thematic area	Organizing partner	No. of participants	Focus of discussion	Key observations /feedback
26 June 2009	General, consultation with Youth and media	Direct	45	Introduction to NAPA, CC regime and Nepal, COP 15, role of media in CC	Youth are enthusiastic to contribute to climate change action; youth are interested for volunteer contribution, media is searching for its role
6 July 2009	Local stakeholder consultation in Dolakha	MoE and local partners in Dolakha	37	Climate change introduction, NAPA project and process, observed climatic vulnerability	People's understanding on climate change is clear. Local observations need to be linked with climate science
13 July 2009	Local stakeholder consultation in Nuwakot	MoE and local partners	48	Climate change introduction, NAPA project and process, observed climatic vulnerability	People's understanding on climate change is clear. Local observations need to be linked with climate science
23 July 2009	Agriculture and food security	Ministry of Agriculture and Cooperatives	40	TWGs operations, TWG member selection, facilitation and remuneration	Agriculture sector is more vulnerable to climate change; livestock should not be overlooked, key areas of adaptation need to be identified
2 August 2009	Forest and biodiversity	Nepal Foresters' Association	52	Mitigation vs adaptation, conceptual framework and ownership of TWGs, CC impact analysis and relevancy to forestry and biodiversity	International and local concept of adaptation and mitigation need to be understood, TWG framework and ultimate responsibility and authority boundary should be clarified.
11 August 2009	General, indigenous Women and Climate Change	National Indigenous Womens' Federation	36	Role, right and responsibility of indigenous community, Traditional and indigenous knowledge to cope with climate change	Indigenous communities are more sensitive to climate change, they need support and indigenous knowledge should be identified and recognized

## National Adaptation Programme of Action (NAPA)

Date	Thematic area	Organizing partner	No. of participants	Focus of discussion	Key observations /feedback
17 August 2009	Climate and disaster	DPNet-Nepal	41	Mainstreaming disaster into climate change regime and link with poverty issues, identification of climate induced disaster	Many work have been done but information is scattered, coordination is vital, research and science back up highlighted
7 September 2009	Indigenous community, rural landscape and climate change	Representing Organizations of Indigenous Communities	55	Evidence of climate change in countryside, local coping mechanisms, indigenous knowledge on climate change adaptation	The experiences shared by the indigenous peoples can be viewed as evidence of climate change, such as locally changed pattern of agriculture and housing, changing biodiversity pattern. local knowledge is useful for coping with climate change
5 November 2009	Regional consultation in Lahan	Lok Kalyan Nepal (Participated districts-Sarlahi, Mahottari, Dhanusha, Sindhuli, Udaypur, Siraha, Saptari)	90	Climate change impacts, upland-lowland relationship, Siwalik situation, livelihoods impacts	Siwalik is in critical situation, Rapid urbanization and population growth has put more pressure on livelihoods, disasters have become more frequent, people's coping capacity is decreasing
10-20 November 2009	Transect appraisal Exercise (details below)	ISET-N, LIBIRD, Practical Solution, NEWAH, FECOFUN, Practical Action, SEBAC	above 1000	Climatic vulnerability observation, people's perception collection and set adaptation mechanism	Increased temperature, decreased water resources, flora and fauna composition changed, introduction of new diseases, decreased agro-productivity, seasonal cycle changed
22 November 2009	Regional consultation in Pokhara	LIBIRD	80	Regional impacts of climate change and adaptation practices	People and local organizations are trying to adapt, state intervention is necessary

## National Adaptation Programme of Action (NAPA)

Date	Thematic area	Organizing partner	No. of participants	Focus of discussion	Key observations /feedback
12 March 2010	Regional consultation in Dang	Livelihood Forestry Programme (LFP) (Participated districts-Rukum, Rolpa, Pyuthan, Salyan, Dang)	85	Regional impacts of climate change, Adaptation approaches, biodiversity and climate change	LFP piloted community adaptation fund, forests are threatened by climate change so forest based livelihoods are in crisis. Adaptation programme should be implemented through community organizations and their capacity need to be strengthened
15-18 March 2010	National Climate Training for Media	Direct	32	Role of media in climate change and adaptation	National media are not much aware of climate change impacts. Local climate news are not reflected in national media. Greater sensitization is needed
4 April 2010	Local consultation in Syangja	ASK Nepal	110	Climate change impacts in mid hills and adaptation options	Rivulets and springs vanished, decreasing ground cover, temperature increased, agro-productivity decreased, long draught, frequent floods and landslides
20-22 May 2010	Regional Climate Training for Media in Far western Region)	SEBAC-Nepal	40	Regional climate change impacts from media point of view, media coverage and sensitization on climate reporting	Local changes in ecology and climate are obvious but due to lack of knowledge, it is difficult to relate with science. Local journalists could document climate change evidence

## National Adaptation Programme of Action (NAPA)

### Consultations on NAPA draft

Date	Venue	Organizing partner	No. of participants	Nature of Participants	Focus of discussions
17 June 2010	Kathmandu, Hotel Annapurna		50	MCCICC Members, donors, development partners	Vulnerability mapping, adaptation prioritization process, prioritized projects, implementation framework
20-21 June 2010	Nepalgunj (regional)	PSPL	60	GOs, NGOs, civil society, media from mid and far western region	Vulnerability assessment, prioritized project implementation framework, feedback to the proposed projects and implementation plan
25-26 June 2010	Pokhara (regional)	LI-BIRD	40	GOs, NGOs, CBOs (LI-BIRD Partners)	Climate change issues, local adaptation practices, adaptation additionality challenges
11-12 July 2010	Ilam (regional)	NCDC	50	GOs, NGOs, civil society, media from eastern region	Local and regional climate change issues and ways to address those issues through the NAPA
19-22 July 2010	Nagarkot (national)		35	Govt. officials, media, UNFCCC negotiators	NAPA concept and development, key features of Nepal's NAPA and expected outcomes, implementation Plan
29 July 2010	Kathmandu	Practical Action	15	I/NGOs, civil society	NAPA process, vulnerability assessment, prioritized projects, role of NGOs/civil society in NAPA implementation
11 August 2010	NPC		10	National Planning Commission's Vice Chair and officials	NAPA process and outcomes, coordination and implementation plan
13 August 2010	MoE		18	NAPA Advisory Board	NAPA and expanded NAPA, coordination and implementation framework, NAPA follow up, LEG comments
29 August 2010	Office of the Prime Minister	Climate Change Council	35	Climate Change Council members, and MoE and Prime Minister's Office's officials	NAPA prioritized projects, implementation mechanism, funding sources etc.
23 September 2010	MoE		40	Climate Change Council Expert members and MCCICC members	Final NAPA outcomes

## Transect Appraisal Exercise

Transect	Coverage districts	Partner Organization	Direct Participation	Key outputs
Eastern (Koshi Basin Region)	Sankhuwasabha, Terathum, Dhankuta, Morang, Sunsari	Practical Solution, NEWAH, FECOFUN, East Foundation	above 1000	Peoples' perception on climate change, mass sensitization, vulnerability observation, triangulation with stocktaking, active involvement of TWGs, vital information for NAPA
Western (Gandaki Basin Region)	Mustang, Myagdi, Parwat, Baglung, Kaski, Syangja, Palpa, Rupandehi, Kapilwastu	LIBIRD	above 1200	Peoples' perception on climate change, mass sensitization, vulnerability observation, triangulation with stock taking, active involvement of TWGs, vital information for NAPA
Far Western (Karnali Basin Region)	Darchula, Dadeldhura, Doti, Achham, Kailali, Kanchanpur, Baitadi, Banke, Bardiya)	Practical Action, SEBAC Nepal	Above 1000	Peoples' perception on climate change, mass sensitization, vulnerability observation, triangulation with stocktaking, active involvement of TWGs, vital information for NAPA

## Annex 7. List of priority adaptation options for agriculture and food security

Climate change effect/ Impacts	Adaptation options
<b>Increases in intense rainfall/ Epidemics</b>	Awareness raising
	Provision of the food/clean drinking water
	Promotion of Community level waste management
	Provision of emergency health care
<b>Reduced rainfall &amp; increased of temperature/ Drought</b>	Identification of Potential drought prone area
	Forecasting
	Livelihood diversification
	Distribution of drought resistant crops species
	Provision of food aid
<b>Reduced rainfall &amp; increased of temperature/ Forest fire</b>	Awareness raising
	Conservation/promotion of afforestation reforestation programme
	Forest fire control
<b>Increased temperatures/ GLOF and avalanche</b>	GLOF/Avalanche mitigation
	Awareness Raising
	Early warning system and forecasting
<b>Increased temperatures/ Heatwave</b>	Awareness raising
	Reforestation/Afforestation
<b>Other/ Coldwave</b>	Awareness raising
	Provision of the warm clothes
<b>Other/ Hailstorm/Windstorm and Thunderbolt</b>	Provision of Insurance
	Community based fund
	Livelihood diversification
	Weather forecasting

## Annex 8. Adaptation options for agriculture and food security identified during the transect appraisal exercises

Agriculture and food security climate adaptation options	
<b>Terai</b>	<ul style="list-style-type: none"> <li>Replace shallow with deep tube wells</li> <li>Introduce toria, niger, arahar, maize in place of potatoes and jute</li> <li>Better rain water collection</li> <li>Introduce short maturing and hardy crops</li> <li>Use of anti-helminthics</li> <li>Use of local pesticides and insecticides</li> <li>Use of high potential drugs to control aphids</li> <li>Reduction of synthetic fertilizers and increased use of organic manures</li> <li>Minimum or zero tillage</li> <li>Address market and production issues through farmers' cooperatives</li> <li>New varieties of crops adopted due to higher temperatures</li> <li>Fruits and vegetables in reduced water availability and unpredictable rainfall areas</li> <li>Micro-irrigation</li> <li>Use of alternative energy options</li> <li>Plantations to restore natural water supplies</li> <li>Water harvesting</li> <li>Flood control</li> <li>Breeding more adaptable varieties and breeds</li> <li>Insurance Schemes for crops and livestock</li> <li>Small-scale irrigation</li> <li>Local capacity building</li> <li>Public awareness</li> <li>Early warning system</li> <li>Trainings on new technologies</li> <li>River-training programmes</li> </ul>
<b>Mid hill</b>	<ul style="list-style-type: none"> <li>Grow vegetable crops, toria, niger in place of potatoes</li> <li>Selection of short duration crop varieties</li> <li>Rain water collection</li> <li>Drip irrigation</li> <li>Increased use of anti-helminthics, pesticides, insecticides,</li> <li>Use of high potential drugs to control aphids</li> <li>Use improved varieties and fertilizers,</li> <li>Pump water from downstream</li> <li>Rain water harvesting at local level</li> <li>Water conservation ponds</li> <li>Use of ground water</li> <li>Increase community awareness on climate change adaptation</li> <li>Studies on climate change in relation to disease, pests, parasite incidence,</li> <li>Epidemiological study of prevalence of plant, animal diseases, and parasites in different climatic zones</li> <li>Increase community awareness on crop and livestock insurance, market outlets, seed bank, decentralized buffer stock, cold storage etc</li> <li>Plantations to maintain micro-climate</li> <li>Promote agro-forestry,</li> <li>Promote water harvesting</li> <li>Improve water sources,</li> <li>Breeding adaptable variety and breeds, Community awareness, crop, livestock insurance, market outlets,</li> <li>Promote seed bank, Establish decentralized buffer stock, cold storage</li> </ul>

**Agriculture and food security climate adaptation options**

<b>Mountain</b>	<ul style="list-style-type: none"> <li>Tree planting around farm lands and water sources</li> <li>Replace present crops with hardier varieties</li> <li>Rain water collection</li> <li>Restricted grazing</li> <li>Change in tree crop type e.g. from apple to orange</li> <li>Tapping snow water sources</li> <li>Small scale irrigation</li> <li>Alternative energy sources e.g. improved cooking stove; solar panel; back boiler; smoke water heater; micro hydro power</li> <li>Forest plantation</li> <li>Government introduced micro-irrigation technology</li> <li>Soil conservation works</li> <li>Provision of training</li> <li>Establishment agro-industries</li> </ul>
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**Annex 9. List of priority adaptation options for the water sector**

Themes within the water sector	Climate adaptation relevant programmes
Water Induced Disasters	Water-related Disaster Management Policy and Program
	Risk/Vulnerability Mapping and Zoning Program
	Disaster Networking and Information System Improvement Program
	Community-level disaster preparedness program
	Relief and Rehabilitation Measures
	Activation of Inundation Committee
	Flood, Drought, Landslides/Debris Flow, GLOF and Avalanche Adaptation Program
Environmental Action Plan on Management of Watersheds and Aquatic Ecosystems	Improve Environmental Database System
	Map Climatically Sensitive Watersheds and Aquatic Ecosystems
	Develop Water and Wastewater Quality Standards and Regulations
	Implement Climate Change Adaptation/ Water Conservation/ Education/Awareness Program
	Implement climatically sensitive Watersheds and Aquatic Ecosystems Protection, Rehabilitation and Management Programs
	Promote Community Participation in the Management of Watersheds and Aquatic Ecosystems to enhance climate change adaptation
	Enhance Institutional Capacity and Coordination
	Develop Watershed Management Policy
Water Supply, Sanitation and Hygiene	Accelerated Stand-Alone Sanitation Improvement Program (ASASIP)
	Rural Water Supply and Sanitation Program (RWSSP)
	Small Towns Water Supply and Sanitation Program (STWSSP)
	Kathmandu Valley Water Supply and Sanitation Program (KVVWSSP)
	Major Towns Water Supply and Sanitation Program (MTWSSP)
	Water Supply and Sanitation Institutional Strengthening Program (WSSISP)
Irrigation for Agriculture	Integrated Program for Irrigated Agriculture
	Improved Management of Existing Irrigation Schemes
	Improved Planning and Implementation of New Irrigation Systems
	Strengthening of Capacity Building of Local Level Institutions in Planning and Project Implementation

## National Adaptation Programme of Action (NAPA)

Themes within the water sector	Climate adaptation relevant programmes
Hydropower Development	Program to develop cost-effective micro, small, and medium hydropower
	Program to enhance rural electrification
	Program to Improve Power System Planning
	Program for Power and Energy Sector Reform and Development
Water-related Information Systems (Decision Support	Management of existing hydrological and meteorological network at DHM
System for River Basin Planning	Extension of hydrological and meteorological networks of DHM
and Management)	Funding and management of hydrological and meteorological networks of DHM
Regional Cooperation Frameworks	Program to appraise and understand the water-related needs of neighboring countries
	Program to pursue confidence-building measures with neighbors
	Programs to implement mutually beneficial development activities
Policy and Legal Frameworks	Policy and Legislation related to water resources management reviewed, amended and harmonized in the context of climate change
Institutional Mechanisms	Restructure and activate central planning organization
	Institutional Capacity Building of Government Agencies at Central and Local Level
	Central Level Institutional Setup for Study, Research & Development on Climate Change Prediction, Policy Mainstreaming, and Adaptation
	Set up institutional framework for coordinated and integrated development at the basin level

### Annex 10. List of priority adaptation options for the energy sector

Themes within the water sector	Climate adaptation relevant programmes
Formulate National Energy Strategy (NES) and National Energy Plan (NEP)	Formulate National Energy Strategy and National Energy Plan taking into consideration of climate change based on the doctrines of integration, coordination, decentralization, popular participation and implementation of energy programs within the framework of good governance, equitable distribution and sustainable development
	Afforestation Programs to maintain the balance between Annual Fuel Wood demand and Supply for Rural Household Energy
Promote Alternative Energy Technologies	Scaling up of biomass energy technologies (quantity, quality, and coverage) for less fuel wood consumption
	Develop and promote solar energy technologies
	Develop wind energy
	Up scaling the Development of improved water mills
	Research and Development Bio-fuels
Utilization of Gravity Energy Energy Switch Over	Promotion for utilization of gravitational energy
	Promote electrical Vehicles
	Promote energy efficiency
	Promote use of electrical appliance at the households
	Promotion of Solar energy in public lighting
	Promote blended fuels
	Promote the use of natural gas source available within the country
Monitoring and Evaluation of Alternative Energy Technologies	Monitoring the performance of alternative energy technologies
	Monitoring and evaluation of the social, socio-economic and health indicators of the users of alternative energy
	Policy and Legislation related to energy management reviewed, amended and harmonized
Institutional Mechanisms	Restructure and activate central planning organization
	Restructure and strengthen government ministries and departments
	Maintain clear separation of roles between policy, operation and regulation/monitoring
	Strengthening institutions involved in alternative energy equipment manufacturing and supply
	Supporting the NGOs, CBOs and Private sectors for promotion of bi-fuels use in the communities
	Support to Academic and Research institutions
	Set up institutional framework for coordinated and integrated development at the VDC, District and central level

**Annex 11. List of priority adaptation options to address climate-induced disasters**

Climate change effect/ Impacts	Adaptation options
Increases in intense rainfall/ Floods	Enhance the capacity of all the water-induced disaster related institutions
	Strengthen early warning system and forecasting
	Promotion of reforestation/afforestation programme
	Implementation of structural measures
	Conservation of Churia/Siwalik regions
	Strengthen the capacity and coordination of GO, CBOs, NGOs, INGOs, local authorities, professional societies for disaster management networking
	Hazard/vulnerability mapping and zoning
	Discouraging and restricting settlements in high risks-areas
	Establishment and management of emergency supply ware house
	Making preparations for emergency response, relief and rehabilitation measures
	Activation of inundation committee
	Clearing water logging
	Resettlement of vulnerable community
	Provision of transport and access to market
	Designs of the islands for the villagers to be used during the flood
Implementation of the building codes	
Increases in intense rainfall/ Landslides	Hazard mapping and Risk zoning
	Awareness raising
	Discouraging and restricting people living in high risk areas
	Resettlement of the vulnerable community
	Promotion of afforestation /reforestation programme and bioengineering technique
	Implementation of structural measures
	Inventory on landslides
	Implementation and promotion of water harvesting system and conservation ponds
	Improvement of the degraded land
Promotion of proper agriculture practice	

## Annex 12. List of priority adaptation options for forests and biodiversity

Areas for climate change effect/ impacts	Adaptation responses
Community based forest fire control	Capacity building programme for forest managers, awareness building programme for communities, fire prevention programme for forest managers, as well as policy reform for effective and easy implementation.
Programmes of forest pathogen control	Identification of pathogens, study of life cycle of pathogens, developing appropriate mechanism, training to the forest managers.
Control of invasive species	Research to control invasive species (Michenia), control mechanism dissemination.
Integrated forest management for water	Management of vegetation which results increase in infiltration and decrease in evapo-transpiration
	Management of vegetations which result less evapo-transpiration.
	Increase ground water recharge through conservation pond (reservoirs) and contour ditches
	Protection of water source from landslides, erosion and other disturbances.
	Protection of forest water canals from excessive loss
Integrated Watershed Management in context of climate change	Vegetation management, conservation farming, improving recharge through conservation ponds and other mechanisms.
Watershed conservation in Mustang	Identification and implementation of wind erosion control activities such as shelterbelts, buffer strips, control of water erosion activities, promotion of water conservation measures through vegetation and land management.
Wildlife management in relation to climate stress	Identification of wildlife impacted by high temperature and drought, habitat improvement, development and implementation of conservation plans.
Vulnerable species conservation	Identification of species, preparing and implementing management plan
High altitude rangeland conservation	Identification of the management area, preparing rangeland management plan, training to local communities.
Management in Landscape level	Identification of threatened flora and fauna, establishment of corridors and connectivity, identification of activities for their movement and dispersal, preparing and implementation of landscape level conservation plan.
Management of Wetlands	Preparation and implementation of wetland conservation plans with involvement of local communities.
Management of Herbs for Poverty Reduction	Identification of risk region, species at risk, preparing and implementing management plan with involvement of local and indigenous communities.
Conservation of riverine forest	Identification of appropriate forest types, preparing and implementing management plans with participation of local communities.

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Areas for climate change effect/ impacts	Adaptation responses
Trees outside the forests or Agro-forestry in communal and private land	Identification of empty land owned by household and communities, promoting appropriate species according to need of local communities, awareness building for promotion of trees in private and community owned land.
Private Land Conservation Forestry	Identification of proper area for promoting private forestry, training land owners in tree plantation and management, providing subsidy for private forest promotion.
Collection and Maintenance of Biodiversity Database	Selection of pilot area, preparation of biodiversity database in the region.
Payment of Environmental Services	Establishment of forum for upstream and downstream communities interaction, conservation of resources in upstream, implementation of upstream conservation measures. Initiation of discussion among upstream and downstream communities for payment of environmental services.
Awareness and Capacity Building of Stakeholders	Awareness building to local communities and other local stakeholder in the potential climate hazards in the area, training local communities to combat potential hazards.
Policy Reform	Incorporation of climate friendly policies in forest sector policy for climate adaptation and mitigation, joining sector adaptation activities also for mitigation.
Research and Development for adaptation	Identification of research issues, conducting research with involvement of vulnerable local communities.

**Annex 13. List of priority adaptation options for public health**

Need for climate adaptation	Adaptation responses
Reduce the impacts of climate change on human health	Strengthening health system.
	Awareness raising and capacity building,
	Promotion of appropriate local adaptive knowledge,
	Coordination among concerned stakeholders,
	Integration of health impacts of climate change into broader development plans and related activities.
	Research on climate change and health for evidence based planning.

## Annex 14: List of priority adaptation actions for urban settlements and infrastructure

The following adaptation options were identified by the TWG for urban settlements and infrastructures. The risk factors taken into account in selecting the adaptation options include: those that pose a significant threat; risks that are already perceived; risks that will increase most rapidly; and, risks to urban areas and infrastructure that are highly sensitive to climate changes.

1. Downscaling climate change scenarios at meso-level
2. The use of downscale climate change findings to train/raise capacity building and educating policy makers, planners, officials of GON, engineers from the respective metropolitan/municipalities
3. Enforcement of planning regulations, building codes in urban areas incorporating climate change dimensions.
4. Replicate eco cities, healthy cities projects of DUDBC in other municipalities
5. Demarcation of territories, water ways and buffer zones by constructing paths etc.
6. Piloting rain water harvesting structures such as ponds for ground water recharge, dampening peak flows (in and upstream of ) urban areas. Encourage the practice of "Harvest Where It Drops". For this promote programs of rainwater harvesting at community level.
7. Development of nationwide urban groundwater monitoring system and enhancement of regulatory measures
8. Water management of River basin management at municipal level.
9. Establish, rehabilitate, and conserve small scale drinking water supply schemes and traditional water sources
10. Rehabilitation of traditional ponds
11. Exploration and assessing the possibilities of increasing water discharge in the polluted rivers like Bagmati
12. On site sanitation at community where city level system doesn't exist.
13. Establishment of household and community level waste management, replicate community managed wastewater treatment system where city level system doesn't exist or works.
14. Establishment of sanitary landfill sites for waste disposal
15. Establishment of municipal compost plant and explore and develop strategy to link with CDM to generate additional revenue
16. Establishment of biogas systems in hotels, colleges, army barracks, police posts and households
17. Conservation of water and reuse of waste water
18. Establishment of early warning systems for flood
19. Use of energy efficient system and appliances, energy efficiency through loss reduction in transmission and distribution.
20. Development of mass transport







The Government of Nepal holding a historic cabinet meeting in Kalapatthar (5,542 meters), near the base of Mt. Everest on the eve of the Fifteenth Session of the Conference of Parties (COP15) to the United Nations Convention on Climate Change in December 2009. The cabinet meeting aimed to call the attention of the international community to the long-term impacts of climate change on the Himalayas and to urge countries to take urgent adaptation and mitigation measures. (Photo credit: Government of Nepal, Department of Communication, 2009)

## Government of Nepal National Adaptation Programme of Action (NAPA) to Climate Change

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