



# 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).



The NAPA Project was supported by the Embassy of Denmark, UK Department for International Development (DFID), Global Environment Facility (GEF), and United Nations Development Programme (UNDP) Nepal.



**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.

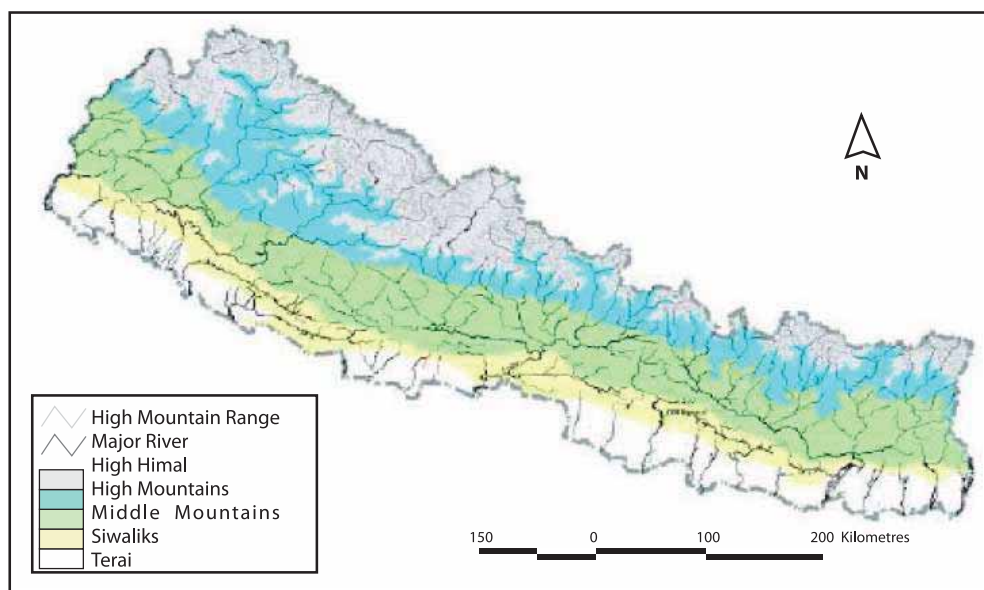
Nepal has more than 6,000 rivers that largely drain north to south. The three main river systems are the Karnali, Narayani (Gandaki), and Saptakosi. Forests occupy 39.6% of the total area (DFRS, 1999). A significant bulk of energy is derived from biomass, mainly fuel wood. Less than a third of the population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

<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.

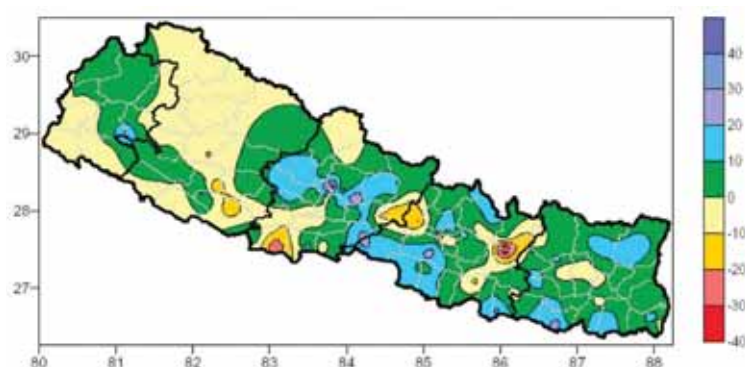
Himalayan glacier melt and retreat have been documented (see for example Seko et al., 1998; Kadota et al. 2000; Naito et al. ,2000; Yamada et al., 1992; Nakawo et al., 1976; Fujita et al. 2001; Asahi et al., 2000). Fifteen Glacial Lake Outburst Floods (GLOF) events have been documented in Nepal (Ives, 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.

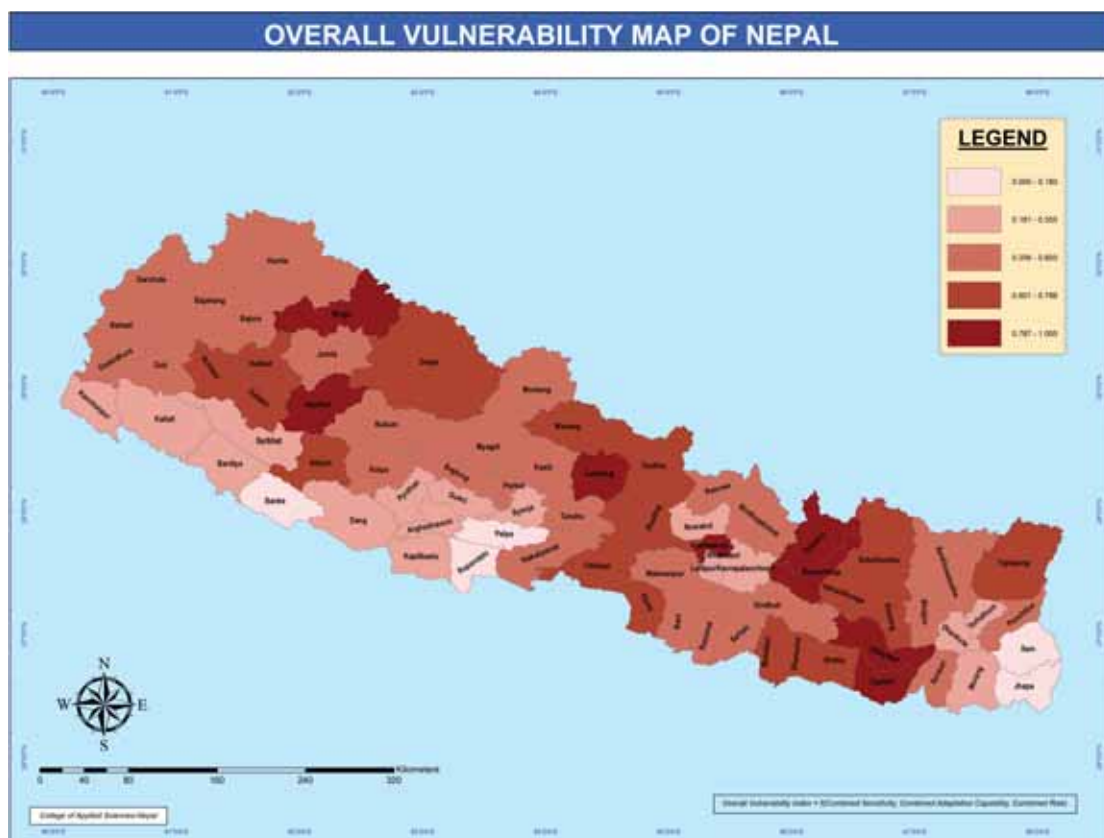
### 2.3 Climate change vulnerability

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, Bajhang, 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).

<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:

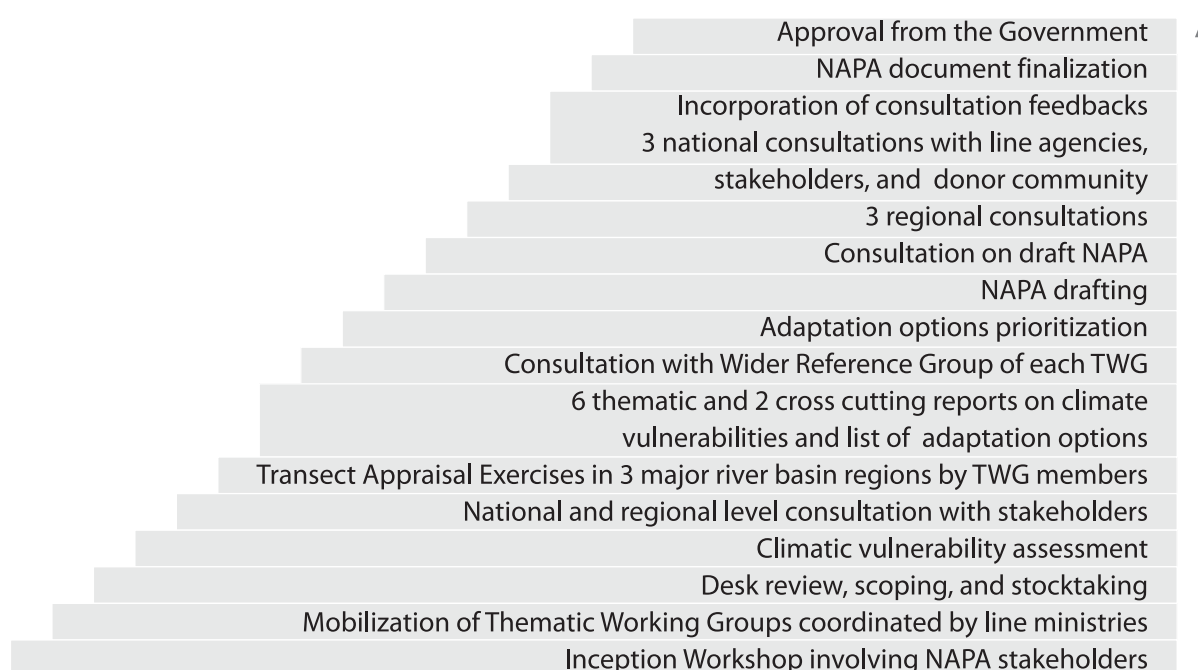
1. Agriculture and Food Security (Coordinator: Ministry of Agriculture and Cooperatives)
2. Forests and Biodiversity (Coordinator: Ministry of Forests and Soil Conservation)
3. Water Resources and Energy (Coordinator: Ministry of Energy)
4. Climate Induced Disasters (Coordinator: Ministry of Home Affairs)
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>



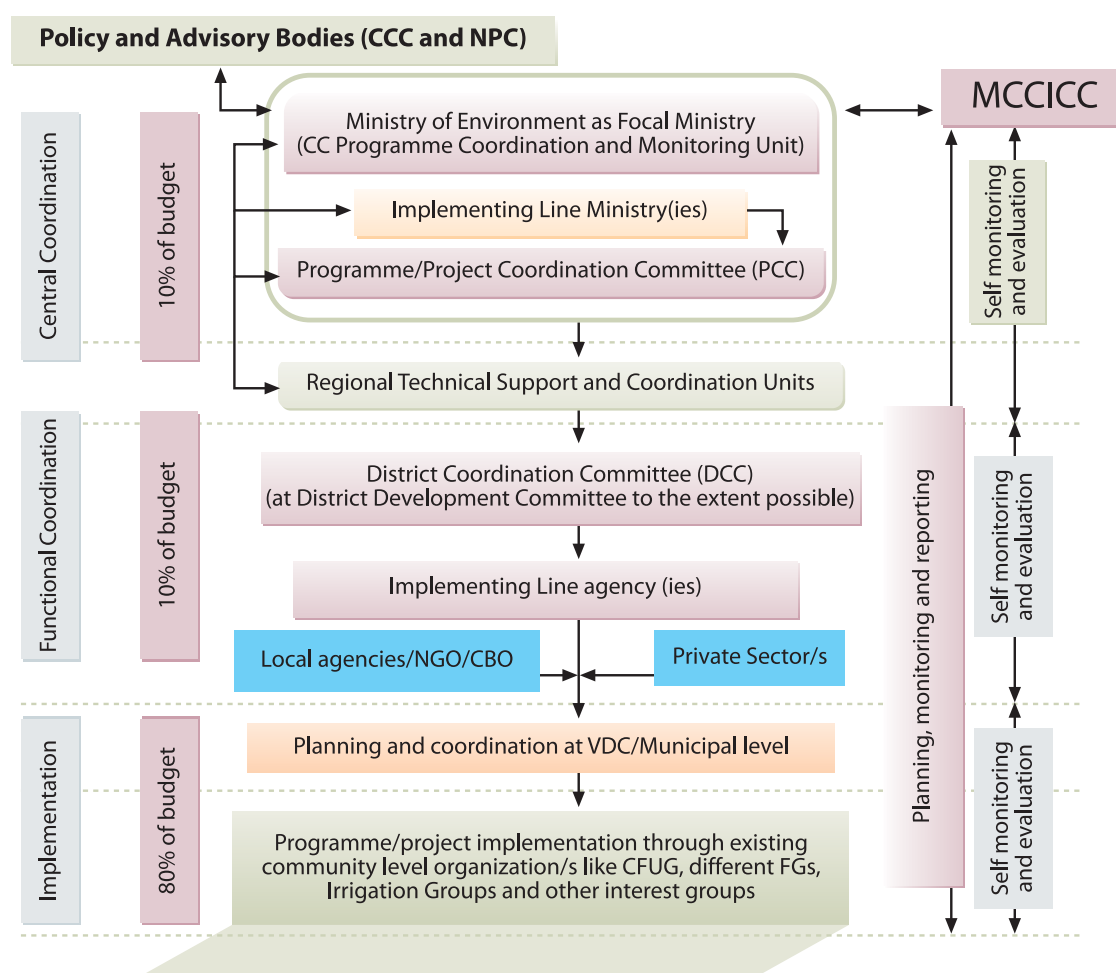
## National Adaptation Programme of Action (NAPA)

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>
Title: 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>
Title: 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>
Title: 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