ECONOMIC IMPACT ASSESSMENT OF CLIMATE CHANGE IN KEY SECTORS IN NEPAL

Study Supported by

Climate & Development Knowledge Network

Study Implementation Plan

August 2012

Integrated Development Society Nepal
IDS-Nepal

PRACTICAL ACTION Consulting

Global Climate Adaptation Partnership

This project, Economic Impact Assessment of Climate Change in Key Sectors in Nepal, is being undertaken at the request of the Government of Nepal, and is supported by Climate and Development Knowledge Network (CDKN). This project originated to address the target as included in the Climate Change Policy 2011: Assessment of losses and benefits from climate change in various geographical areas and development sectors by 2013.

The work is led by Integrated Development Society (IDS), Nepal, working with Practical Action Consulting Limited (PAC), Nepal and Global Climate Adaptation Partnership (GCAP) in the UK.

For further details, contact the project focal person: Prabha Pokhrel, IDS Nepal, prabha_pokhrel@hotmail.com

Authors: Prabha Pokhrel, Govind Nepal, Dinesh C Devkota, Tara Nidhi Bhattarai, Ram Sharan Kharel (IDS Nepal), Professor Ram Manohar Shrestha, Michelle Slaney, Gehendra Gurung, Apar Paudyal, Moushumi Shrestha (PAC Nepal), Paul Watkiss, Muriel Bonjean, Matthew Savage (GCAP).

Acronyms:

ADB:	Asian Development Bank
AEZ:	Agro-ecological Zone
CANSA:	Climate Action Network South Asia
CBS:	*Central Bureau of Statistics*
CCD:	Climate Compatible Development
CDKN:	Climate and Development Knowledge Network
COP:	Conference of Parties
CSAG:	Climate Systems Analysis Group
DFID:	Department for International Development
DHM:	Department of Hydrology and Meteorology
EACC:	Economics of Adaptation to Climate Change
FAO:	Food and Agriculture Organization
FF:	Financial flow
GCAP:	Global Climate Adaptation Partnership
GDP:	Gross Domestic Product
GFDRR:	Global Facility for Disaster Reduction and Recovery
GLOF:	Glacial Lake Outburst Flood
GoN:	Government of Nepal
ICIMOD:	International Centre for Integrated Mountain Development
IDS:	Integrated Development Society Nepal
IF:	Investment flow
IFF:	Investment and Financial Flow
ISET:	Institute for Social and Environmental Transition
LAPA:	Local Adaptation Plans of Action
MoA	Ministry of Agriculture
MoAC	Ministry of Agriculture and Cooperative
MoAD:	Ministry of Agriculture Development
MoEn:	Ministry of Energy
MoEnv:	Ministry of Environment
MoEST:	Ministry of Environment, Science and Technology
MoHA:	Ministry of Home Affairs
NAPA:	National Adaptation Programme of Action
NARC:	*Nepal Agricultural Research Council*
NCCKMC:	Nepal Climate Change Knowledge Management Centre
NPC:	National Planning Commission
NSDRM:	National Strategy for Disaster Risk Management
O&M:	Operation and Maintenance
OECD:	Organization for Economic Co-operation and Development
PAC:	Practical Action Consulting
PPCR:	Pilot Project for Climate Resilience
RECC:	Regional Economics of Climate Change studies
RRN:	Rural Reconstruction Nepal
SPCR:	Strategic Programme for Climate Resilience

UNDP:	United Nations Development Programme
UNFCCC:	United Nations Framework Convention on Climate Change
WECS:	Water and Energy Commission Secretariat
WFP:	*World Food Programme*
WRS:	Water Resources Strategy
WWF:	World Wide Fund for Nature

Summary

At the request of the Government of Nepal, the Climate and Development Knowledge Network (CDKN) are funding this study on the '*Economic Impact Assessment of Climate Change in Key Sectors in Nepal'*. The work is led by Integrated Development Society (IDS), Nepal, working with Practical Action Consulting Limited, Nepal andGlobal Climate Adaptation Partnership (GCAP) in the UK.

The primary objectives for this study are to (i) provide headline and sectoral estimates of the impacts and economic costs of climate change for key sectors in Nepal (the agriculture and water sectors), and (ii) provide a ranking of climate compatible development options to address the risks identified in these areas.

This report summarizes the implementation plans for the main phase of the study, including the approach and methods proposed.

The approach proposed starts with the current and looks to the future. By considering development and sector plans, it also grounds the study in country and regional policy,assessing the risks of climate change to these plans and the actions needed to mainstream resilience. The method proposed is based on three work-streams.

1) The costs of current climate variability and extremes in Nepal. This will provide the analysis of near-term economic costs, including potential impacts from changes in climate variability. For adaptation, the focus will be on addressing short-term climate variability (now and for the next 5 – 10 years) – focused on current and emerging trends, and identifying short-term, "no and low regrets" actions to deal with these.

2) The risks to current plans over the short-medium term in Nepal. This will provide an initial risk screening of the potential impacts of climate change on current plans, i.e. and the associated economic costs. For adaptation, this will focus on building climate resilience (for the next 5-15 years) – focused pragmatically on incorporating climate change into existing plans, using insights from short-term and long-term climate risks.

3) The longer term impacts and economic costs of climate change to Nepal. This will provide an analysis of the more traditional impacts and economic costs of climate change in key sectors, using information from scenario-based impact assessments and models. For adaptation, the focus will be on planning for medium to long-term climate change (2025 and beyond) –identifying priorities for early action.

These work streams are then drawn together, to provide headline and sectoral estimates of the impacts and economic costs over time (from the current to the future), and allow analysis of an appropriate climate compatible adaptation response. A key benefit of the approach – and one that is different to other (previous and on-going) studies - is that the cost estimates are captured and presented in a way that is of most use for subsequent adaptation assessment.

The methodological steps and practical tasks in each of these activities are outlined in the plan. The proposed sectoral coverage is on **agriculture**, including crops, livestock and arable land, and on **water**, covering irrigation (and the linkage with agriculture), hydropower and water-induced disaster.As the primary aim of the study is to provide a national level analysis, the study will focus at this level. However, as Nepal's agro-ecological / climatic zones are diverse, the analysis proposes to consider risks and adaptation responses in each of the three major agro-ecological/climatic zones (Terai, Hills and Mountains).

Finally the summary presents the proposals for capacity building in country, and stakeholder consultation and communication plans.

TABLE OF CONTENTS

Introduction

At the request of the Government of Nepal, the Climate and Development Knowledge Network (CDKN) are funding a study on the '*Economic Impact Assessment of Climate Change in Key Sectors in Nepal'.* The work is led by Integrated Development Society (IDS), Nepal, working with Practical Action Consulting Limited, Nepal andGlobal Climate Adaptation Partnership (GCAP) in the UK.

The study has two critical objectives:

- First, to provide headline and sectoral estimates of the impacts and economic costs of climate change for the **agricultural and water** sectors, to provide input to the Government's assessment of losses and benefits from climate change in various geographical areas and development sectors by 2013 (noting the report does not cover the economic costs for other important sectors)
- Second, a ranking of climate compatible development options in these sectors to address these risks, , to help the Government strategically start to consider options for climate compatible development pathways.

The project aims to be comprehensive, participatory, and indigenously oriented. A key theme has been to ensure that there is a high level of interaction and co-production between the research team and key Government stakeholders, and to build capacity in Nepal for undertaking such analysis in the future.

Study Outline and Inception Report Structure

The study is broken down into two main phases:

- An inception phase
- An implementation phase

The **inception phase**has undertaken a rapid review of the baseline situation and the available information, drawing from the available literature and stakeholder consultation. It also has established the governance and review structure to take the studyforward. This review has then been used to review findings to propose the work (implementation) plan for the technical work in the study.

The **implementation plan** is summarised in this report. This sets out the proposed conceptual framework, approaches and methodologies. It outlines the activities, level of analysis, geographical disaggregation, methods and models and it sets out a detailed time and work plan for the assessment.

Finally, it sets out the study architecture, reporting lines, consultation proposals, communication plan and capacity building and training activities proposed.

Framing the Study and Outline of Method

This chapter outlines the key questions and issues the study is trying to address. It provides a synthesis of the review and the key lessons from the inception phase, and presents the proposed methodology.

Framing the Issues

A useful way of framing the study is to consider the types of overall questions the study is trying to address. During the inception phase, the team met with stakeholders to outline some of the key issues, set out below.

Sector	Key Questions
Water	
Hydro (electricity) (supply and demand)	What are the risks to current and planned supply capacity –and what adaptation responses are needed?
	How will climate trends (temperature and evaporation, runoff and river flow) and variability affect production (MWh), including by season?
	What are the risks of major high river flow (climate variability and extremes) from higher monsoon and extreme daily precipitation? What are the risks of glacial lake outburst flood (GLOF) to hydro?
	What are the effects of siltation, and impact on lifetime of the hydro project[s]?
	How much will climate change affect future demand for cooling, across different areas?
	How can energy demand for cooling be reduced or what other adaptation measures are needed, e.g. whether for energy efficiency, building design, passive ventilation, etc.?
	How can supply planners adjust the portfolio or introduce risk management measures, or technical adjustments to reduce risks?
Climate (water) Induced disaster	
Flood, droughts	What are the full impacts and economic costs of current climate variability and flood and drought impacts? How are these split between direct (e.g. damage to property) and indirect (production loss, transport disruption), tangible/financial (property damage) and intangible/economic (including loss of life, ecosystems), and direct versus wider economic (macro-economic) categories? How do these vary by location/season?
	How will climate trends (temperature and evaporation, runoff and river flow) and variability affect dry season, low flows, and droughts?
	What are the risks of major high river flow (climate variability and extremes) from higher monsoon precipitation and what are the risks of GLOFs and landslides?
	What are the adaptation responses to address these risks? How do they vary for different risks and different areas of Nepal?
Agriculture	
Productivity and arable land	What are the current effects of climate variability and extremes on productivity and the agricultural sector?
	How will climate change affect crop yields, productivity, value added, prices, imports/exports? How will these effects vary across agro-ecological zones? Will storms and hailstorms be new threats?
	How will climate change affect agro-ecological zones and crop suitability, and thus affect land use patterns? How will pests and disease affect productivity?
	How should farmers and planners adapt to the changes above?
Irrigation	How will irrigation demand change with climate change? How will climate change affect water availability (river and groundwater)? How do these effects vary across agro-ecological zones and seasons?
	How will irrigation investments need to change in the near, medium and long-term and what adaptation options are available?
Livestock	How will climate change affect livestock? What will be the key effects (pests, temperature, disaster, pastoral land and fodder?What adaptation responses are needed?

This is a very comprehensive list, and undertaking detailed (new) quantitative analysis in all these areas is beyond the resources of the study. Nonetheless, as highlighted in the review findings, a lot of relevant evidence exists, and the study can use existing information and complement this with new analysis and modelingto build up the responses to the questions above.

Lessons from the Review

The project has started with a detailed review of existing knowledge and identified gaps. The review found a large body of literature andrelevant studies on climate change in Nepal (though much less on the economics costs). It has also found a large number of recent and ongoing climate initiatives that have relevance for the study. These form a considerable evidence base, which the study will build upon. The findings of the review are presented in the inception report. A summary is presented below.

The study first reviewed the information on the current climate of Nepal and the impacts and economic costs of existing climate variability. The climate of Nepal varies dramatically across the country, across elevation and climatic zones. These differences lead to a range of risks, which necessitate different adaptation responses. The study has also reviewed observational data on recent temperature and rainfall trends: this reveals rising (warmer) temperatures over recent decades, but uncertain precipitation trends at national and even regional level. This means early adaptation actions will have to work within a framework of uncertainty, and that a stronger focus will be needed on monitoring to build the evidence base for future action.

The links between these current and emerging trends were then considered in terms of the impacts and economic costs of current climate variability. This revealed that a large proportion of Nepal's GDP is associated with climate sensitive activities (notably agriculture) and that the country is affected by periodic climate extremes (particularly floods) which lead to high economic costs and impact on millions of livelihoods. These translate into a high current adaptation deficit in the country. However, the review found that the links between climate, agriculture, water and the economy are complex. Importantly, the review found there is a need to recognise spatial disaggregation (sub-national) and the differences in agro-ecological and climatic zones across the country when considering current and future climate risks, and therefore adaptation responses.

The study then reviewed the existing climate information for Nepal, looking at a set of statistically downscaled projections and the available global and regional climate model outputs. The projections show continued (and accelerated) warming in future years, but mixed patterns for future rainfall changes, with large variations in the level of change (and even in the direction of change) between models and locations, especially in relation to future extreme events (intensity and frequency). This reinforces the need to work with multi-model data (rather than central projections) and to recognize this uncertainty rather than ignoring it. It also means iterative strategies will be needed to prepare for uncertain futures, focusing on resilience and robustness, rather than using uncertainty as a reason for inaction.

The review also considered future socio-economic trends, and Government development plans, to investigate future non-climatic drivers, including existing policies and planned activities. Together these form the baseline for current and future analysis, and identify the key plans that require checking for early climate resilience. The analysis of socio-economic trends revealed strong demographic trends – and population increases - that will affect future risks. The review of Government development policies shows that there will be major changes to the sectors, which need to be factored into the analysis when developing a climate compatible pathway. The study will therefore have to align more closely with planned policy than previous and on-going assessments, i.e. it will develop adaptation strategies that are grounded in emerging growth and development.

The study then reviewed the impacts (and economic costs) of future climate change on Nepal. This revealed large differences in the projected impacts, across the range of climate projections and across the different methods used. Much of the focus of the work has been on the longer-term, and there is less coverage on the short-medium period of most relevance for early adaptation planning. Furthermore, there are importantdifferences in results according to whether studies consider trends only, changes in trends and variability, analysis of future extremes, and cross-sectoral interactions (notably the interaction between the agriculture and water sector). This stresses the need for the study to take account of uncertainty in considering these medium and long-term effects. It necessitates the consideration of the range of model uncertainty, interpreting existing information, as well as undertaking new impact assessment model runs to

identify the potential issues of major concern and the associated economic costs.Related to this, there is a need to build linkages with – and complement - other relevant studies, notably the Asian Development Bank (ADB) RECCSA study which is undertaking a regional (six country) study which will include an analysis of impacts and economic costs.

Finally, the review identified many studies on adaptation, which identify hundreds of adaptation options. In the agricultural sector, many of these are based on traditional farm management approaches for agriculture (e.g. changing planting dates, using different crop varieties, increasing fertiliser use and irrigation) though more recent studies emphasize additional techniques focused on sustainable agriculture and climate smart agriculture (e.g. soil and water management, conservation agriculture, agro-forestry, etc.). Similarly, in the water sector, there are many proposed measures for disaster risk reduction / management options (e.g. enhanced meteorological and hydrological capacity, awareness raising, early warning systems, flood management measures, etc.). However, the quantitative (and economic) analysis of all of these options has been much less studied. Related to this, there was found to be little consideration of uncertainty and how options perform across the range of possible futures. Finally, recent studies highlight the issues with barriers to adaptation and the need to take account of climatic and agro-ecological differences, stressing that successful adaptation in Nepal is unlikely to comprise a one-size-fits-all approach across the country. A major gap therefore exists on the quantified analysis of the range of short-medium term measures, their robustness in the face of climate uncertainty, and their regional and sub-national applicability.

Overall, the review confirmed the need to consider climate change within an existing pattern of complex changes from climate and other non-climate drivers, and uncertain future effects, which will change (and evolve) over time. As a result the proposed method adopts a more dynamic view of climate change, bringing together a number of evidence lines across different time periods to form an overall view of the appropriate responses and inter-linkages. The approach starts with the current and looks to the future, and by considering development and sector plans, it grounds the study in national and regional policy.

Analysis of previous studies and frameworks

There are a number of national climate change studies that assess the economics of climate change, and start to move to analysis of the economics of climate compatible development. These include the mini-Stern reviews (the Regional Economics of Climate Change studies, RECCs), as well as initiatives from the World Bank (Economics of Adaptation to Climate Change, EACC[1]), the UNDP (Assessment of Investment and Financial Flows to Address Climate Change, I&FF[2]) and the UNFCCC (National Economic, Environment and Development Study, NEEDS[3]), as well as the immediate priorities captured by the National Adaptation Programmes of Action (NAPA).

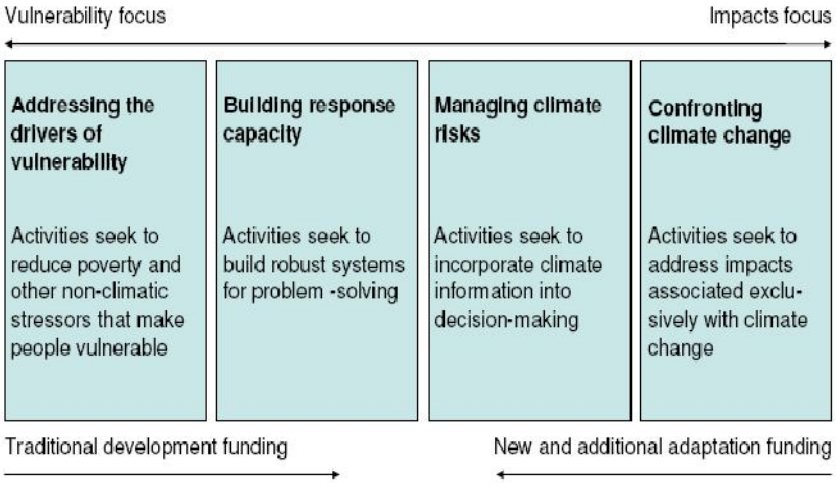
A systematic review of these projects (Watkiss et. al. 2009 for UNFCCC; Pye and Watkiss, 2010, for DFID) have found that these previous economic studies tend to adopt a classic scenario-based assessment, taking climate model outputs, and running sector models to assess the potential longer term impacts of climate change in the future. They then consider a range of technical adaptation options that could reduce these impacts, in some cases assessing the costs and benefits. While these studies provide valuable information, it is clear that on their own, they will not meet the objectives of the current study, particularly in identifying and being able to rank options that are consistent with climate compatible development. This is because (Füssel and Klein, 2006; Burton et. al. 2002) they have insufficient consideration of pressing immediate and short-term policy issues, notably because they focus so much on climate model outputs for the period 2050 – 2100. Moreover, they do not take account of key actors and of existing policy, and they do not consider the full diversity of options,

[1]Economics of Adaptation to Climate Change. 2010. Synthesis Report available at: http://climatechange.worldbank.org/content/economics-adaptation-climate-change-study-homepage

[2]Investment and Financial Flows, as part of UNDP's global Capacity Development for Policy Makers to Address Climate Change project.

[3]The National Economic, Environment and Development Study (NEEDS) for Climate Change Project. More information is available at: http://unfccc.int/cooperation_and_support/financial_mechanism/items/5630.php.

including capacity. As a result, the previous economic of climate change studies do not take account of current vulnerability (including current economic costs), and they do not ground the analysis in the practical implementation of climate compatible development (CDD). A much more relevant framework for considering adaptation in the development context is shown below, which highlights that CCD (adaptation) needs to tackle several different elements. This framework is used as the starting point for the proposed framework here.



Source: Klein and Persson (2008)

Proposed Framework

As the review has shown, there is information on the potential impacts of climate change, and many potential adaptation responses, though much of this is qualitative in nature, and there is a relatively low evidence base on economic costs. Much of the quantitative analysis in Nepal has focused on the medium-long term effects of climate change, considering technical adaptation options. While such studies provide valuable information, it is clear that on their own, they do not meet the objectives of the current study, as they tend to have insufficient consideration of immediate and short term policy issues. Perhaps more importantly, they do not take account of the dynamic nature of the future changes – from short-term trends to future major climate change, and they do not have adequate consideration of the uncertainties in future climate change and model projections.

Furthermore, most of the existing studies in Nepal – especially for future climate change – do not have enough consideration of wider drivers, and they do not take enough account of institutional issues, existing capacity and current policies. The review has shown that the relative importance of climate change must be balanced against other drivers, broader vulnerability, and that adaptation needs to take account of planned development policy. Good development will (mostly) reduce vulnerability to climate change, and adaptation needs to be integrated and mainstreamed within development plans, rather than being presented as a set of stand-alone actions that are implemented anew. Indeed, many existing development actions are forms of early adaptation, and this baseline of existing measures has to be included when assessing the additional actions needed for climate change, and further – in fact it can often be difficult to differentiate what falls under development and what falls under adaptation.

As a result, we propose a different approach for this study, based around the economic costs over time, and viewing the**adaptation** response as a **pathway**. This has a more complex and dynamic view of climate change, bringing together a number of evidence lines over different time periods to form an overall view of the impacts and economic costs, and then looks at appropriate responses. The approach is based on a conceptual framing of adaptation as a combination of strategies and actions that span over time, responding to emerging and changing risks, with high uncertainty. This ranges from good development through to targeted actions to reduce future impacts of climate change.

From Development to Climate Change Adaptation

The baseline for climate adaptation is **Good Development** that contributes to societal goals of economic and social welfare. While this is not part of a climate adaptation regime per se, mainstreaming integrates climate and development so the two cannot be separated. A typical strategy related to agriculture and land use is sustainable land management to improve soil fertility and water holding capacity. Such strategies have been common for many decades and have benefits in terms of reduced water stress in seasons of below-normal rainfall.

Supporting responding to climate change is **Adaptive Capacity and Planning**, enhancing the individual and institutional competence for planning climate resilience. Such capacity is closely embedded in the development baseline of good governance and organizational management of environment, social development and economic growth. However, additional effort to address climate change is required; a typical strategy is support to develop a climate change strategy that coordinates climate resilience planning across stakeholders at the national level.

Reduced current vulnerability, especially to cope with weather-related disasters and extreme events,is an imperative at present. Better coping in the near term can be expected to have significant benefits in reduced impacts in the future. Hence, this mode of adaptation is a mix between the baseline of development and future climate adaptation. A typical strategy is seasonal climate forecasts tailored to food-insecure regions and vulnerable households with support to implement a range of disaster management measures (both on-farm and diversified economic activities).

Climate Resilience is a broad strategy to ensure climate risk does not disrupt development pathways, recognizing that future predictions of climate change impacts are highly uncertain. The focus tends to be on short-term actions, but as part of a robust strategy to achieve resilience in light of a range of potential futures. Although this mode has features of reducing current vulnerability, a typical strategy might be enhancing social protection and poverty reduction through improved micro-finance systems that support smallscale enterprises that deliver improved public services.

The penultimate goal of climate adaptation is **Targeted Climate Change Actions.** This mode has the specific purpose of reducing specific climate change impacts—those effects that are additional to current vulnerability. Since these impacts cannot be accurately predicted or attributed to the additional effects of climate change, this mode is only justified for decisions where there is a high cost of failure if climate change is not considered, for example alteration of major hydrological systems to ensure there is minimal interruption of services given a 'worst case' scenario of water availability.

Analytically, the key concepts behind the proposed approach are:

- To start from the position of the present, and look at the issues of current climate variability and climate extremes, including their economic costs. This is crucial to understanding the current adaptation deficit. It also allows the identification of early quick wins (no regret options).
- To consider other drivers of risks, and how these might change over the coming decades. This allows the study to ground the analysis in current policy, and consider non-climate drivers. It also allows the direct analysis of current Government policies, development and sector plans, assessing whether these are resilient to current and emerging climate change, or whether the plans need amending to enhance climate resilience. This starts the process of embedding (mainstreaming) climate change into current development.
- To consider downscaled projections of future climate change, taking account of the wide range of scenarios and climate models, i.e. considering uncertainty.

- To assess the longer-term effects of future climate change, particularly focusing on areas that might require some early action now, i.e. in relation to infrastructure (long life-times), major impacts and economic costs, etc. This recognises that adaptation actions might be needed in the short-term to allow adaptation to occur effectively in the future.

The advantage of this approach is that it starts with the current and looks to the future, and by considering sector plans, it aligns to the current development plans of the country. These elements can be combined to provide a climate adaptation strategy or pathway (over time) to the risks identified, i.e. a **Climate Compatible Development Pathway**.

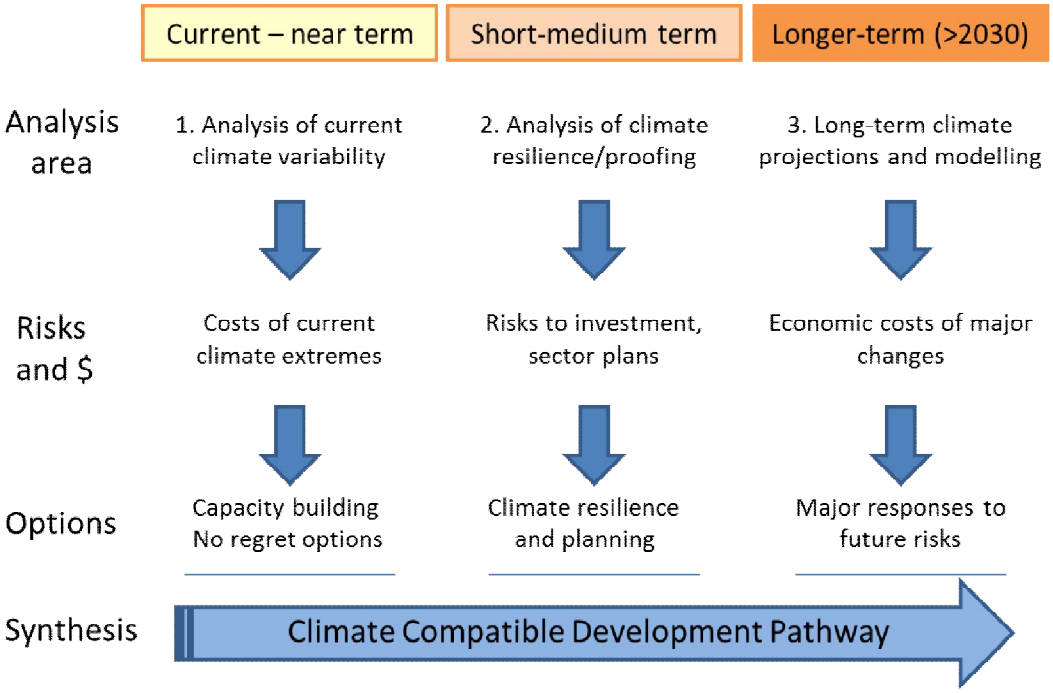
The study is therefore broken into three time periods.

1) The costs of current climate variability and extremes in Nepal. This will provide the analysis of near-term economic costs, including potential impacts from changes in climate variability. For adaptation, the focus will be on addressing short-term climate variability (now and for the next 5 – 10 years) – focused on current and emerging trends, and identifying short-term, "no and low regrets" actions to deal with these.

2) The risks to current plans over the short-medium term in Nepal. This will provide an initial risk screening of the potential impacts of climate change on current plans, i.e. and the associated economic costs. For adaptation, this will focus on building climate resilience (for the next 5-15 years) – focused pragmatically on incorporating climate change into existing plans, using insights from short-term and long-term climate risks.

3) The longer term impacts and economic costs of climate change to Nepal. This will provide an analysis of the more traditional impacts and economic costs of climate change in key sectors, using information from scenario-based impact assessments. For adaptation, the focus will be on planning for medium to long-term climate change (2025 and beyond) –identifying priorities for early action.

Thethree work streams are outlined below:



Source GCAP

Overview of project methodology

These work streams are then drawn together, to form an analysis of the economic to provide headline and sectoral estimates of the impacts and economic costs over time (from the current to the future). These will provide an input to the Government's assessment of losses and benefits from climate change in various geographical areas and development sectors by 2013.

The information will allow analysis of an appropriate climate compatible adaptation responses to these risks. A key benefit of the approach – and one that is different to other (previous and on-going) studies - is that the cost estimates are captured and presented in a way that is of most use for subsequent adaptation assessment. Importantly the adaptation responses look to form a set of complementary activities, together forming an '**adaptation pathway**'that considers current and emerging risks, takes account of uncertainties, and ensures synergies and inter-linkages are accounted for. This will provide useful inputs to the Government in advancing national adaptation planning and in helping to build the justification for projects and programmes.

As the primary aim of the study is to provide a national level analysis, the study will focus at this aggregation level. However, the review shows that Nepal's agro-ecological / climatic zones are diverse, and a national adaptation pathway will need to take this heterogeneity into account This poses a key challenge, i.e. whether the analysis should be national level and top-down, versus sub-national level and bottom-up, and the degree of disaggregation used. Our proposed approach is therefore to work at a national level, but todifferentiate between the three major agro-ecological/climatic zones, i.e. between the Terai, Hill and Mountains, to consider what impacts and economic costs arise in each of these zones, and to design appropriate options for different areas of the country. It is highlighted that there are regional (political) disaggregation issues, alongside the agro-ecological classification. It is not possible to undertake a detailed region by region analysis, and build this bottom-up assessment into an aggregated national plan, but it is recognized that many of the issues with adaptation are institutional, and that therefore it is useful to take account of the regions in considering the move towards practical implementation.

The proposed sectoral coverage is on the **agricultural sector**, including crops, livestock and arable land, and on the **water sector**, covering irrigation (and the linkage with agriculture), hydropower and water-induced disaster. The three specific work streams, and the synthesis step, are described in detail below. The section also outlines the stakeholder consultation and capacity building activities.

Work Stream 1) Addressing the Cost of Current Climate Variability and Emerging Trends

Summary of Work Stream

This workstream focuses on the costs of current climate variability and extremes in Nepal. It will provide the analysis of near-term economic costs, including potential impacts from changes in climate variability. It will then identify immediate short-term actions, focusing on 'no regret' options, associated with addressing short-term climate variability (now and for the next 5 – 10 years) to address current and emerging trends.

The key objectives, methods and outputs are summarized below.

Objectives	Data, Methods and Models	Outputs
Assess current and near-term economic costs from climate variability. Identify and assess immediate short-term actions.	Climate data and trends (by 3 zones) Economic analysis of databases of current extremes. Analysis of agricultural statistics. Stocktake of existing adaptation options using review and consultation.	Headline impacts and economic costs of current variability. Identified list and initial analysis of options, for different risks and zones.

The first workstream aims to assess the current and near-term economic costs of climate variability, including emerging trends, and identify immediate short-term adaptation actions, collating and assessing the options that could be advanced in the short-term to address existing risks and emerging trends. It will draw on the extensive number of studies already applied in Nepal.

The outputs will form the first part of the economic costs analysis, and also the climate compatible development pathway, focused on the existing climate resilience deficit and likely short-term variability trends from climate change.

In advancing this task, the review above has provided some important insights, notably:

- It is very difficult to work with aggregate metrics (such as GDP) at the national level, and generate clear and unambiguous relationships, not least because of the heterogeneous climate and agro-ecological zones across the country. Some sub-national disaggregation will be needed.
- The data on climate trends shows that outside of rising temperature, there are complex trends on the direction of short-term changes, i.e. in terms of average, variability or extremes. This uncertainty needs to be factored into short-term responses.
- The available information on the frequency and intensity of flood and drought events does not appear comprehensive, though on-going work is addressing this, and there does not seem to be good data on the (full) economic costs of these events or the effects of variability.
- Different risks and economic costs arise in different areas (and agro-ecological zones) – and thus adaptation measures will also need to reflect this with differentiated responses.

The practical activities in the task are:

1. Identifying the level of regional disaggregation for the study, i.e. agro-ecological zones[4].

2.Compilinghistorical climate data (including variability) and information on emerging trends for each of these zones.

3. Systematically assessing the risks, and impacts and economic costs in each zone. For agriculture, this will look at available agricultural statistics. For extreme events, the analysis will take the various databases of events, compile these, and undertake economic analysis to assess the full economic costs. Consistent with the second objective of the study, the analysis will also consider the potential responses to these economic risks.

4. Collating a list of adaptation options relevant for these risks, based on the literature. Furthermore, to complement this with a stock-taking analysis, compiling, where various options have been applied in Nepal, building up the evidence of applications split by agro-ecological zone, collating information on costs, etc. This will provide practical informationthat will better enable the Government and stakeholders to identify appropriate options to address risks, and provide information on the associated costs.

The workstream will involve a strong element of consultation with Government, donors and local technical intuitions, as well as stakeholder consultation with Nepal experts.

The outputs will be headline estimates of the impacts and economic costs of current climate risk, and an assessment of potential short-term options.

[4]An AEZ is a homogenous area in terms of bio-physical conditions, including climate, terrain, soil, vegetation and fauna. AEZs are normally defined using a range of metrics, such as elevation, climate (rainfall and temperature) and soil type.

Detailed Activity

As reported in the review, Nepal's economy is very dependent on the climate. A large proportion of GDP is associated with climate sensitive activities, particularly agriculture. Nepal is also highly vulnerable to natural climate disasters such as floods, landslides and drought. Current climate variability and climate-induced events, such as floods and including Glacial Lakes Outburst Floods (GLOF), landslides and droughts, already lead to major economic losses and costs in Nepal. Individual annual events have economic costs that are significant at the economy level, and affect people and livelihoods. The focus of this task is therefore to compile the economic costs for these current effects and examine existing adaptation options.

Task 1. Identifying spatial disaggregation agro-ecological zones

The first task will agree the agro-ecological zone (AEZ) classification for the study, working with a level of disaggregation that makes the study analysis manageable, whilst capturing important differences. The working proposal is that the study will usethree AEZ-Terai, Hills and Mountains. However, it is recognised that there are additional differences (East to West) that might necessitate consideration of greater spatial disaggregation, and thus information from a wider number of areas in each main zone will be taken and considered.

Task 2. Climate data and trends

This task will extract relevant climate data for each of the agro-ecological zones identified. It will build on the trend reviews considered in the inception report (e.g. the information from the NAPA, PAC (2009), etc.) and source appropriate climate data for the study. It will capture historical data sets of key climate relevant parameters, but also analysis of current and emerging trends. This will provide a baseline climate for analysis of adaptation options, and also allow some consideration of early trends that might alter the relative benefits of adaptation options in the short-term (i.e. against a background of possible changing conditions, noting the high uncertainty in trends identified in the inception review). It is anticipated that the data will be sourced from the new DHM climate portal (http://dhm.gov.np/dpc).

Task 3. Analysing historic risks

This task will synthesize the available information on current risks (from climate variability and extremes), considering the existing information on statistical and econometric analysis of agricultural data, and information on water induced hazards. Given the extensive work already in this area, the work of key development partners (notably the World Bank and IFC through key programmes) and the existing national and international databases, the focus will be on drawing together existing baseline information. These will be compiled to estimate the current economic costs of climate variability and extremes in Nepal. However, a key issue will be to draw up baseline risks for each of the agro-ecological zones identified above, noting that this will lead to a set of different risks, and different relative importance of different risks, in each zone. Furthermore, the work will also seek to take the existing information and express the impacts in economic costs. This will include translation of market-based losses (e.g. agriculture) but also full economic costs

associated with for example, fatalities or movement of people. The work will also consider the potential for case studies to provide more detailed examples.

Task 4. Compiling adaptation options

This task will initially generate a list of adaptation options that could address the risks identified in the tasks above, i.e. in the agriculture and water sectors. The study has already identified over a hundred potential options from the literature and it also found a number of projects that are advancing practical adaptation. The study will review this evidence base furtherand identify if this includes any qualitative or quantitative information.An important issue will also be to highlight if the options have been considered in a specific agro-ecological context, e.g. there are specific studies,which have advanced adaptation options for the Terai, and this is important information in reporting onpotentially relevant options for this agro-ecological zone. A finalstep will be taken to report existing information on the costs (and benefits if available) of options. It is stressed that this will not be a cost database. The task will then identify the most promising adaptation options to address the economic risks identified. A major focus will be onidentifying early actions that address the identified economic costs of climate change, and the promising options are likely to include:

- Existing coping strategies, building on existing studies.
- Capacity building, as a key precursor step to successful adaptation, providing the necessary architecture to enable future decision - making.
- Short-term options for resilience.
- No regret options such as productivity enhancing techniques that offer resilience and economic benefits, including options already identified in national plans and other studies.

Staff and Key Organisations

The key staffs across the team and key Government and development partners are shown below.

Task	IDS/PAC/GCAP	Government/Other
1. Identify AEZ	Gehendra Gurung, Apar Paudyal (PAC)	Ministry of Agricultural Development and Cooperatives (MoAD)
2. Climate Data	Helen Greatrex (GCAP) Dr Michelle Slaney (PAC) Mr.A. Pokharel	Nepal Climate Portal
3. Analysis of risks	Paul Watkiss, Alistair Hunt (GCAP) Gehendra Gurung, Apar Paudyal, Dr Michelle Slaney (PAC), Dr Govinda Nepal, Dr Tara Nidhi Bhattarai,Dr.Dinesh Devkota, Ms.Prabha Pokharel(IDS), Prof.Dr.Ram Manohar Shrestha	Ministry of Home Affairs (MoHA) Ministry of Environment, Science and Technology (MoEST) Ministry of Energy (MoEn) MoAD World Bank/IFC
4.Compiling adaptation	Paul Watkiss, Alistair Hunt (GCAP)	MoHA, MoEn, MoEST, MoAD All development partners
5.Management, coordination and reporting	Ms. Prabha Pokharel, Dr. Govind Nepal and Dr. Dinesh Devkota, Mr. Prakash. Koirala (IDS), Moushumi Shrestha, Apar Poudel (PAC)	MoEST Concerned Ministries Civil Society CDKN All development partners

Workstream 2) Building Resilience: Addressing Risks and Costs for Development

Summary

This workstream focuses on the risks to current plans over the short-medium term in Nepal. It will provide an initial risk screening of the potential impacts of climate change on current plans, i.e. and the associated economic costs. For adaptation, the taskwill focus on building climate resilience (for the next 5-15 years) – focused pragmatically on incorporating climate change into existing plans, using insights from short-term and long-term climate risks.The key objectives, methods and outputs are summarized below.

Objectives	Data, Methods and Models	Outputs
Identify risks (and potential economic costs) of climate change to current plans, and potential scale of effects. Identify options to enhance resilience of plans.	Stock-take and review of major development and sector plans, UNDP Investment and Financial Flow Analysis (IFF), Analysis National Planning Commission climate-resilient planning,and other climate screening.	Assessment of climate resilience of current major plans. Additional activities for climate proofing current plans.

This second work stream aims to assess the risks to existing development plans, and looks to build resilience to these emerging risks. It concentrates on national level policy and looks over the next 5 – 15 years, consistent with planned development in Nepal. It has a strong focus on risk screening of the current development and sector plans and programs, looking at whether current plans are resilient, and where further strengthening is needed, including the cost implications. This draws on the existing risks from the first work stream, but also emerging climate change signals. The focus is on the short-medium term.

The review of existing policies and plans has provided some important insights, notably:

- National development plans anticipate very large changes in the country, which will dramatically affect the sectors here (e.g. in relation to proposed changes to agriculture). It is important to examine how these plans will change future risks and vulnerability, as well as assessing if the plans are at risk.
- There are a number of existing Government plans and policies, some of which are already moving to include climate resilience. It is noted that the National Planning Commission (NPC) has already introduced climate resilient planning and screening methods to advance this.

The practical activities in the task include:

1. Identifying a list of key existing national development policies, plus major sectoral policies and planned programmes in the agriculture and water sectors.

2. Building up a baseline analysis of each of these policies, e.g. looking at the planned investment (using an investment and financial flow assessment framework) to establish baseline flows.

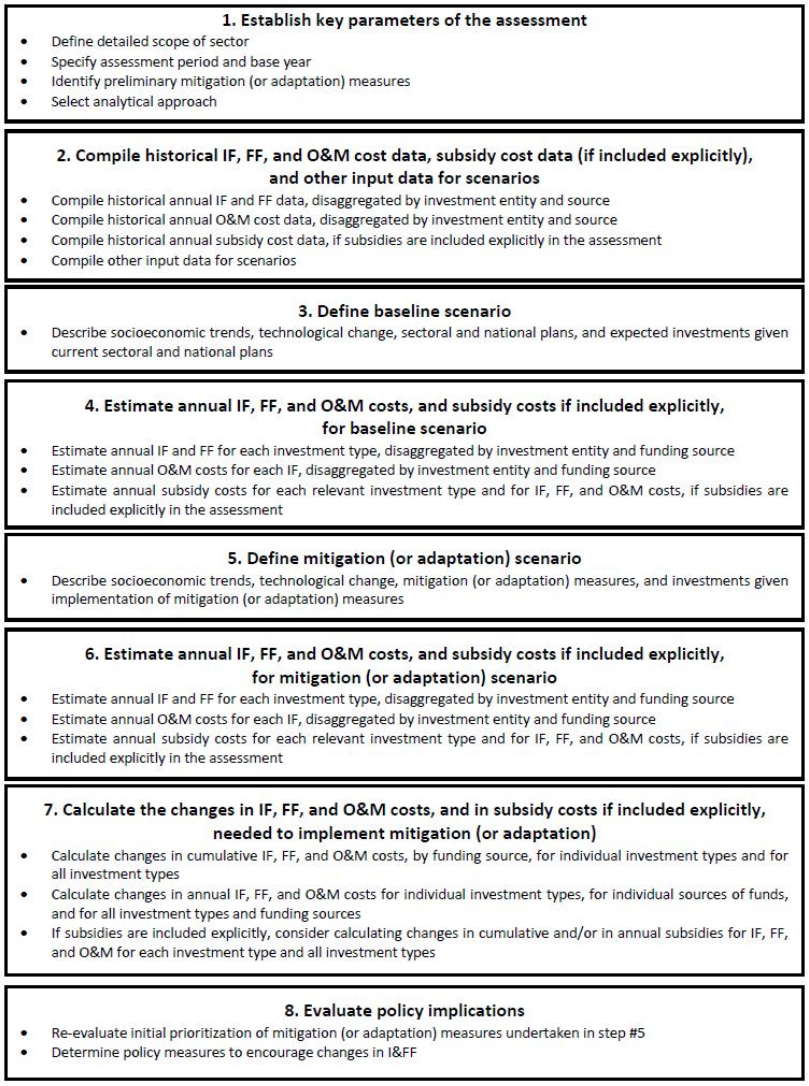
3. Assessing the risks to these plans, including the potential economic costs, drawing on the material from workstream 1 and the climate model projections from workstream 3, and examining if they have already included climate resilient options.

4. Assessing the potential adaptation responses that would enhance resilience to these risks, drawing on the information from stock-take of adaptation options from workstream 1 and supplementary analysis. This will be used to provide recommendations on how to make these plans more resilient.

The outputs will be an analysis of current risks, and potential costs of climate change to these plans, and guidance on how existing policies might need to be strengthened to make them more resilient.

Detailed Activities

A recent focus of climate compatible development has been to approach the issue of the risks of climate change from a different perspective. This considers the risks to on-going development progammes, and involves an assessment of the costs of '*climate-proofing*' future investment, or more accurately, enhancing climate resilience, often known as **investment and financial flow analysis (IFF).** This provides a way to bring climate change within existing development objectives and budget lines, ensuring that short-term development takes account of future climate change, and makes the most of emerging finance opportunities. This work-stream addresses these issues, drawing on the methods developed for the UNDP Investment and Financial Flow (I&FF) analysis. The method steps in the UNDP IFF framework are shown in the figure below.



Source: UNDP I&FF

The aim of such an assessment is to identify the additional costs of implementing a national sectoral adaptation strategy compared to a business as usual baseline. The relevant investment costs for a sector are projected for two future scenarios:

1. A *baseline scenario*, which reflects a continuation of current policies and plans, i.e., a future in which no new measures are taken to address climate change (a "business-as-usual" scenario), and
2. A *climate change scenario*, in which new adaptation measures are taken (an "adaptation scenario").

Task 1. Identifying key policies

The first task will be the identification of key sector strategies. The team will conduct a stocktaking of existing information, data, national strategies and plans, and modelling/forecasting exercises that are available for supporting the assessment (noting this will draw on information collated for work streams 1 and 3). Once the list of potential strategies is compiled, the team will focus on which areas to prioritise. It is normal in such assessments to limit or focus the scope of the project in some way (otherwise the number of plans and strategies can make the analysis unmanageable). This may be through a focus on sub-sectors or important focus areas. In the case of Nepal, the starting point is likely to be the key agricultural, livestock, hydro and disaster risk management policies, as well as the overall 3 year plan and Vision 2030 document. The study will consider key sector development plans, noting that the policies and strategies selected will be discussed and agreed with Government beforehand. It also highlighted that a number of the major programmes (e.g. disaster risk reduction) are already undertaking climate resilience screening analysis, and therefore it important for the study to avoid duplicating such activities.

Task 2. Baseline analysis

This task will assess historic investment data into the sector (normally taking 2005 as a baseline), and assess finance trends and sectoral plans. The baseline scenario describes what level of investment is likely to occur in each agricultural component without additional measures to adapt to climate change over the assessment period. It reflects current sectoral and national plans, expected socio-economic trends and expected investments in the components. It should include a quantitative description of the socio-economic factors that affect the components (e.g. demographic change, economic growth), as well as other relevant characteristics (domestic food consumption, imports and exports, water and land availability).

The projections for changes in financing requirements are mapped out to 2030. The methodology distinguishes between three distinct types of investments: investment and financial flows, and operating and maintenance costs.

- An *"investment flow" (IF)* is the capital cost of a new physical asset with a life of more than one year, such as the capital cost of a new agricultural irrigation system. Investment flows are limited to new physical assets because such investments have climate change implications for the duration of the operating lives of the facilities and equipment purchased. In the agriculture sector, investment flows would include assets such as machinery (e.g. ploughs, planters, harvesters, milking machines), wells and irrigation equipment, buildings and food processing facilities (e.g., slaughter, sugar production, canning). Investment flows would also include assets for research, education, assistance and institutional adaptation options
- A *"financial flow" (FF*) is an on-going expenditure on programmatic measures; financial flows encompass expenditures other than those for expansion or installation of new physical assets. Examples of financial flows include expenditures for an agricultural extension program for farmers, a malaria prevention program to distribute mosquito nets, or the implementation of improved forest management techniques. These expenditures are "operation and maintenance" type costs, e.g., salaries and raw materials.
- *Operating and Maintenance* (O&M)*Costs*: Operating and Maintenance data reflect the costs of operating machinery and pumps, annual remediation work. O&M costs are particularly important for agricultural

baseline and adaptation since many field level costs are O&M, such as agricultural inputs (seeds, plants, fertilisers, animal stock, animal feed, energy inputs and land costs.

Not all of this information is likely to reside in the Ministry of Agricultural Development and Cooperatives (MoAD)or Ministry of Energy (MoEn), etc. or solely in the ministry where the focal point is established – other Ministries will have their own data banks and planning and strategic assessments.This is also likely to need some form of written agreement (e.g., letter of understanding, letter of intent or a formal agreement) be established between the sectoral team and the institutions that hold the most critical data sets. An example of the data set for hydro is shown below.

Example: Baseline Data for the Hydropower Sector

- Relevant contacts, reports, and databases at national/international agencies and other organizations
- Types of models that are suitable for your country
- Current inventory of water resources characteristics, including dams,
- Data for 10-year period prior to Reference Year of the assessment (or longer data quality permitting) in as great a level of detail as possible
- National (and/or utility) water availability forecasts to 2030 by region/province, as possible
- Schedule of capital improvements to 2030
- Major recent policies or expected actions that might affect Reference Case projections
- Information on resource potentials and costs for alternative water management strategies
- Commissioning and retirement dates for existing infrastructure (to ensure that any replacement and upgrades are factored into the baseline scenario)
- Demand forecasts

Once the sources of information and data sets are compiled, the teams will:

- Ensure they have authorization to access specific data sets and information banks;
- Assess the quality and reliability of available information;
- Determine the missing or additional information requirements.

The task will also consider key methodological steps. As an example, the treatment of agricultural subsidies should also be decided, as changes in agricultural resilience may allow existing transfers (grants, concessional loans, preferential tax treatments) to be reduced as the commercial returns in certain sectors improve, and changes in power generation capacity may also improve the scope for a shift towards market pricing of electricity.

For the purposes of the IFF assessment, the outputs of such models are normally put into a standalone spread sheet as such models are unlikely to be set up to monitor investment requirements associated with hydroelectricity or agricultural production.

Task 3. Analysis of risks and costs

The analysis of climate risks to existing plans will be undertaken, and the implications in terms of costs, drawing on the material on current climate variability and emerging trends from workstream 1 and the climate model projections and impacts assessment modelling work from workstream 3.

Task 4. Adaptation analysis and costs

The ultimate aim of anI&FF is to provide policy makers with an overview of the likely scale of incremental investment and financing requirements, and where the burden for these costs will lie. This task will identify the possible adaptation options to build resilience into the plans identified.

This step entails describing what is likely to occur in each relevant agriculture component over the assessment period, with the implementation of additional adaptation measures. The adaptation measures should reflect assessments made in national level assessments, and seek to meet both development deficits in the agriculture sector, but also respond to specific climate threats. It reflects the incremental costs associated with the adaptation scenario or other national strategies and projections. This would include comprehensive descriptions of the specific adaptation measures that could be implemented, and the implications of those measures for the evolution of selected subsectors and components (e.g. introduction of less intensive crop varieties). This task will also start to consider the costs of these plans, drawing on the adaptation inventory (and cost information) compiled in workstream 1 and information from workstream 3. Again, the prioritisation of adaptation options will use the information from other work-streams on costs, benefits, and wider issues, as well as practicality, acceptability, etc. The investment costs of the baseline and adaptation scenarios will then be compared to determine the changes in investments needed to adapt to the impacts to the sector.

Is it highlighted that one of the challenges in water resource related adaptation assessment arises from uncertainties in climate change projections at country and sub-national spatial scales, especially for precipitation. As highlighted from the review, the current models produce different sub-national geographic patterns of climate change, especially precipitation change, and in some cases, model results do not even agree on the direction (sign) of change i.e., whether precipitation will increase or decrease. As a result, previous studies have focused on adaptation measures that will increase the ability of water management systems to meet projected changes in water (and irrigation) demand, that produce economic benefits under a wide regime of future changes (e.g. in upgrades for hydro-generation that improve current efficiency) and that address existing weaknesses in the water management sector, as well as strengthening existing issues in relation to disaster risk management.

Staff and Key Organisations

The key staff members across the team are shown below. The task will need to build an IFF team, which involves Government, from a data access and policy uptake perspective. Team members should be able to identify the necessary public and private sector data sets. This will ideally include national expert(s) from the relevant line ministries (e.g. Agriculture) or government departments that have knowledge of national plans and strategies for the selected sector, plus some experts on finance and investments (preferably from the National Planning Commission or Ministry of Finance), as well as expert(s) on economic data and statistics (preferably from the institution responsible for maintaining national statistics (Central Bureau of Statistics) or the central bank (Nepal Rastra Bank)). There is also a need for relevant experts, and also input from the private sector from institutions (particularly for hydro) with decision-making power over investments in the selected sector and/or with access to information on the sector.

Task	IDS/PAC/GCAP	Government/Other
1. Identify policies	Dr. Dinesh Devkota, Dr Govinda Nepal, Dr Tara Nidhi Bhattarai, Ms. Prabha Shrestha(IDS), Gehendra Gurung, Apar Paudyal (PAC),Matt Savage, Paul Watkiss (GCAP)	MoAD, MoEn, MoEST, MoHA, NPC, MoF
2. Baseline analysis	Matt Savage (GCAP),Dr.R. Kharel, Dr.K. Panta	MoAD, MoEn, MoEST, MoHA, NPC, MoF, CBS
3. Analysis of risks	Inputs from workstreams 1 and 3	MoAD, MoEn, MoEST, MoHA, NPC, MoF
4. Adaptation and costing	Inputs from workstream 1 Matt Savage, Paul Watkiss (GCAP), Dr. Govind Nepal	MoAD, MoEn, MoEST, MoHA, MPC, MoF
5.Management, coordination and Reporting	Ms. Prabha Pokharel, Mr. Prakash. Koirala,Dr. Govind Nepal and Dr. Dinesh Devkota, (IDS), Moushumi Shrestha, Apar Poudel (PAC)	MoEST Concerned Ministries Civil Society CDKN All development partners

Workstream 3) Preparing for the Medium to Long-term Impacts and Economic Costs

Summary

This workstream focuses on longer term impacts and economic costs of climate change to Nepal. It will provide an analysis of the more traditional impacts and economic costs of climate change in key sectors, using information from scenario-based impact assessments and modelling. For adaptation, the focus will be on planning for medium to long-term climate change (2025 and beyond) – identifying priorities for early action.The key objectives, methods and outputs are summarized below.

Objectives	Data, Methods and Models	Outputs
Assess medium-longer term issues and economic costs. Assess adaptation options for early action to address these potential risks.	Data on downscaled climate change projections. Interpretation of existing impact models. New Impact Assessment analysis (agricultural and water sector modelling). Investigation of Computable General Equilibrium and Input-Output modelling. Scenario of future changes. Identification of options and future pathways.	Identification of key risks and potential economic costs in the medium-long term of Nepal. Identification of short-term actions to address longer-term risks.

The aim of this work stream is to assess the medium-longer term impacts and economic costs from climate change, and longer term strategic issues, then to work back and assess what the priorities are for early (adaptation) action to address these risks. This includes a more traditional longer-term analysis of climate change, considering future climate model projections, and potential impacts.

However, it is stressed thatwhile the approach uses the same approach and models as a classic impact assessment, which undertakes detailed modeling studies of the impacts and potential economic costs (and traditional optimized analysis of the costs of adaptation to specific future projections), the proposal differs from a standard Impact Assessment in one critical way: it will consider a much wider range of uncertainty from the use of different RCMs and alternative impact assessments, complementing modelling work with interpretation. This will build up a range of possible future outcomes and economic costs. It will then identify the key issues in the long-term that might require early adaptation, i.e. to identify the long-term issues that need to be built into a climate resilience plan today. This involves consideration of options that allow learning,early activities to enable later actions, and ensure early actions involve flexibility and do not prevent important longer-term adaptation (i.e. cutting off options).

The review has provided some important insights for this task:

- There is very high uncertainty in the future projected climate change from the climate models, across the range of scenarios and models, even for downscaled model outputs. A focus should be on capturing this uncertainty and considering the implications for the longer-term, rather than trying to predict central trends or outcomes and then optimise long-term strategies to these.
- There remains important additional uncertainty when progressing to impact assessment, e.g. in terms of effects on crop yields or hydrological flows, and it is important to recognise this additional uncertainty, i.e. not just in relation to climate model uncertainty.
- There is already an impact assessment (and economic cost) study being undertaken for Nepal as part of the ADB project. It is important for the study to avoid duplication with this study and linkages between the two studies will be explored.

- For adaptation, the results of the impact modelling work (e.g. crop models, or detailed water management models) need to be combined with wider interpretation of key risks to maximize information for practical adaptation, i.e. examining plausible changes and uncertainty across a wide range of information, identifying thresholds or switching points where different policies might be relevant. This will ensure a focus on robustness and resilience, rather than thinking about adaptation as an optimization to a central projection.
- There are strong cross-sectoral linkages in the risks of climate change to the agricultural and water sectors (notably in relation to demand) and it will be important to align the analysis across the two sectors.

The practical activities in the task include:

1. Collate the climate model projections for Nepal, drawing together the existing climate model projections for the key agro-ecological and climatic zones.

2. Synthesize the existing information on climate model projections, future impacts and economic costs.

3. Undertake new impact assessment runs, with agricultural and water sector models, to assess the impacts and economic costs of climate change.

4. Assess the potential wider economic, indirect and macro-economic costs of the impacts of climate change.

5. Use the overall information from all the steps above to draw together a set of scenarios of key long-term issues and work back and identify where early actions are needed, particularly over the next five to ten years to ensure early resilience measures are progressed and options are kept open.

The outputs will be headline estimates of the impacts and economic costs of long-term climate risks, identification of key risks, and an assessment of early actions needed to start planning for – and monitoring – these risks.

Detailed Activities

The final stream of analysis is to assess the medium to longer-term impacts of climate change, i.e. the assessment of losses and benefits from climate change in various geographical areas and development sectors. It is stressed that a number of the major projects (notably the ADB six country RECCSA study) are already undertaking assessments of the economics of climate change in Nepal, and there is a need to build upon rather than duplicate these studies.

Task 1. Climate Model Projections

The first task will compile a set of future climate model projections for each of the identified agro-ecological zones in Nepal(i.e. Himalayas, Middle mountain, and Terai) and development regions (i.e. far west, mid-west, central, and eastern). This will focus on downscaled data, using the statistically downscaled projections and available regional climate model projections from the new Departmental portal (Department of Hydrology and Meteorology-DHM) and also from the 2nd National Communication.

A key focus of the work will be to bring multi-model information together, rather than using one climate model output. The existing information from regional climate models (including the existing PRECIS model), includes the recent 2nd National Communication, which has PRECIS output for A1B for short (2010-2040) and medium (2040-2060/70) time horizons., and the DHM climate portal, which has three RCM outputs for the A1B scenario for the 2030-2060 period, and finally the RCM output from the ADB RECSSA regional climate modelling work.Spatial and temporal disaggregated data will be considered, using parameters and metrics (e.g. daily vs. monthly data) that are needed for the subsequent impact models.

It will also consider the uncertainty across the wider model suite at GCM level (AR5), considering a range of socio-economic (emission) scenarios, and a wider set of model projections, and the implications for the future changes. It is stressed that the study will not undertake any new regional climate model runs.

The study will work with 30 year climate model time slices (as in the data above) to capture the variability in the models, comparing historical baseline periods (1971-2000) to future short (2011-2040) and medium (2041-2070 or 2030-2060) time periods.

The wider range of socio-economic and emission scenarios from the IPCC SRES scenarios will be captured by analysis of the emerging AR5 CMIP5 information. These are particularly important for the 2041-2070 time period (when the climate model outputs start to diverge).

The early work as part of this task – in combination with discussion with the climate model impact teams – will lead to an agreed set of scenarios and time periods for the study to consider, which will be used consistently in the subsequent modelling analysis.

Task 2. Synthesize the existing information on future impacts

This task will analyze the available impact assessment (IA) literature, for example, collating together the crop model and Ricardiananalysis, relevant water management outputs, etc. and building up envelopes of possible changes across the climate model projections and impact assessment information (e.g. crop production losses, potential shifts in agro-ecological zones, etc.) and economic costs. It will also take account of future socio-economic trends, e.g. in population and GDP, and extend the information on key factors such as energy and water demand from workstream 2.

For agriculture, there are a large number of international assessments of agriculture, which produce national level estimates. Much of the work uses variations of the leading process-based crop models (e.g. CROPWAT and DSSAT). The results of these can be combined with international trade or wider economic models, to give the likely changes in economic terms alongside global climate impacts on agriculture. There are also a number of studies that use econometric and Ricardian methods. At the opposite extreme, there are some much localized studies.

There are also a number of water studies, at international, regional and local level, though these cover a wide variety of effects of climate change, including water availability, extreme events and cross-sectoral linkages to energy (hydro) and agriculture. A number of large water models are available, many of which have been applied regionally to Nepal. There is also a need to review the available information on river basins and existing modelling work in Nepal, including water balance analysis.

Task 3.New Impact assessment analysis

This task will undertake new impact assessment modelling, using the regional climate model outputs identified above.

The study will use the DSSAT model to look at the agricultural sector, considering the potential effects on crop productivity from climate change for suitable crop varieties across the agro-ecological [and development] regions, and analyze the changes in future crop production, under different scenarios up to 2050. The productivity outputs will be considered in terms of changes in yield to allow consideration of initial impacts and costs.

It is highlighted that there is already an impact assessment project on-going in Nepal (the ADB six country study, which is using RCMs, DSSAT and hydrological models), and contacts and linkages will be made with this study. It is stressed that the geographical disaggregation (by agro-ecological zone) in this study will be one of the major differences between the projects. Furthermore, the task will also consider the extension of

additional modelling or analysis to provide additional information, which will provide complementary results: as example, this could include the consideration of modelling changes in agro-ecological zones (as well as crop productivity) to consider long-term land-use issues.

The analysis of livestock is more challenging, because of the lack of existing quantified studies in Nepal, and indeed, globally, which makes it impossible to leverage of existing work as with crops above. What is proposed is to combine existing information on future climatic changes in Nepal with the available literature on effects (e.g. combining information on heat extremes and heat tolerance levels in cattle and yaks) to scope out potential effects.

The study will also use a set of models to consider the effects on hydro-power generation. This will use basin wise temporal patterns of runoff up to 2050 using runoff models (TANK/HEC HMS).and subsequently assess the impact on long term Hydro Power development in Nepal using a long-term power system /generation investment planning model (Valoragua/WASP-4) linked to hydrological models. The analysis will assess the likely future change in capacity mix for power generation (i.e. capacity of runoff river vs. storage hydro, capacity of other technologies). These will be compared to existing energy demand projections, using the NEA Hydropower projections, and extending these through to longer time-periods.

Finally, the study will consider the potential effects on water-induced disasters. This will consider existing on-going modelling work for Nepal, and interpret the results of climate model and hydrological models including heavy precipitation and high flows (linked to loss assessments). The study will aim to also assess the potential economic costs of these changes, linking to the baseline information on climate-induced events.

Task 4.Wider and macro-economic costs

The information from the previous task will generate estimates of direct economic costs, linked to physical outputs from the models. However, the effects will also lead to additional wider economic effects. These include indirect effects (multiplier effects) as impacts in one sector affect other sectors, and effects from changes to demand. It is also important to capture macro-economic effects (measured through macro-economic metrics such as GDP, or other important macro-economic factors such as employment and investment, imports and exports). These effects can be accessed through the use of Computable General Equilibrium (CGE) modelling, however, such an analysis is only possible if these models are already set up for Nepal and have a structure that lends itself to the analysis of climate related outputs. The potential for using CGEs in the study will be explored early on in the implementation phase, but the inclusion of these models in the analysis will depend on the results of this review. If CGE analysis is not possible, Input-Output analysis will be explored to capture the potential for cross-sectoral effects. It is also highlighted that in some sectors – notablyin agriculture – the economic costs of changes in productivity in Nepal will be heavily influenced by regional and global scale effects, and changes in production, prices and trade. While detailed regional or global modelling will not be possible, the study will consider the literature and available evidence in this area and consider the potential effects in light of the results for Nepal.

Task 5.Development of economic costs, scenarios and key long-term issuesfor early adaptation

This task will use the information from the tasks above to assess the overall economic costs of climate change over the medium to long-term. It will identify the main issues in the agricultural and water sectors, reporting on the magnitude of the estimates, and also on the key long-term issues. This will consider the full range of outcomes, rather than trying to predict only central outcomes). The analysis will then be used to consider how these long-term issues could evolve, including whether there are major thresholds or switching/tipping points (e.g. where costs rise rapidly), and to identify majorrisks. This is likely to focus on key case studies, examining major areas of potential interest. As examples, this is likely to include:

- Major changes in agro-ecological zones that affect the viability of current forest stocks, or major export crops such as coffee that would require pro-active adaptation.

- Cross-sectoral limitations for water, that involves competing demands across agriculture, energy and household/industrial demand (e.g. and that might involve major storage projects).

It will then work back and identify where early actions are needed, particularly over the next five –ten years to ensure early resilience measures are progressed and options are kept open. This will include analysis of what needs to be measured and monitored to provide information to track these changes and respond appropriately, where capacity building or research is needed, or where early action is needed to prevent long-term impacts, or keep future options open. As examples, it will involve

- Decisions that are irreversible (such as land-use change) and how to respond to agro-ecological shifts that that goes beyond farm level adaptive responses (i.e. that require some level of planned national thinking).
- Decisions that take a long time, and thus need to be planned for in advance, such as major water projects.
- Decisions on infrastructure, which due to the long life-times involved, may require consideration of longer-term effects.

The final part of this task will look at the short-term areas identified, and consider the costs of these actions, noting this is likely to involve a mix of low cost options such as monitoring and measurement, but also more expensive options which involve opportunity costs in the short-term.

Staff and Key Organisations

The key staff members across the team are shown below.

Task	Team	Government/Other
1. Climate models	Helen Greatrex (GCAP) Mr. A. Pokharel Dr Michelle Slaney (PAC)	Climate portal
2. Synthesis	Dr Govind Nepal, Dr.Dinesh Devkota, Dr Tara Nidhi Bhattarai, Ms. Prabha Pokharel(IDS), Gehendra Gurung, Apar Paudyal (PAC), Paul Watkiss, Tom Downing (GCAP), Prof.Dr.Ram Manohar Shrestha	Various (MoAD, MoEn, MoEST, MoHA)
3. Impact assessment	Paul Watkiss, Mr.A . Sharma and DSSAT team, Dr. D. Basnyat and Water modelling team, Prof.Dr.Ram Manohar Shrestha	MoAD, MoEn, MoEST, MoHA
4. Wider Economic costs	Alistair Hunt, Dr R. Kharel, Dr.K. Panta. Dr.Govind Nepal, Prof.Dr. Ram Manohar Shrestha	
5. Scenariosand early adaptation	Paul Watkiss, Alistair Hunt	MoAD, MoEn, MoEST, MoHA
6.Management, coordination and Reporting	Ms. Prabha Pokharel, Dr. Govind Nepal and Dr. Dinesh Devkota, Mr. Prakash. Koirala (IDS), Moushumi Shrestha, Apar Poudel (PAC)	MoEST Concerned Ministries Civil Society CDKN All development partners

Bringing it All Together: Assessment of Economic Costs Over Time -Climate Compatible Development Pathways

Summary

This task will bring the previous information together, assessing the evolution of potential costs of climate change over time, and building up a climate compatible development pathway to address these risks. The key objectives, methods and outputs are summarized below.

Objectives	Data, Methods and Models	Outputs
Assessment of evolution of economic costs over time (for crop production, livestock, arable land, irrigation, hydropower, and water-induced disasters). Analysis of adaptation options (pathway).	Expert analysis and workshops.	Economic impacts of climate change on key sectors. Climate compatible development pathway, outlining steps in addressing risks over time.

The aim of this workstream is to synthesize the results from the three work streams above, and compile the cost estimates and response options – taking into account the inter-linkages. It will compile the information from the three work streams to provide headline and sectoral estimates of the impacts and economic costs over time (from the current to the future), and then, consider the potential options to address these identified risks, identifying the complementary activities over time, which together form an '**adaptation** or **climate compatible development pathway**'.

The pathway will use a very simple categorization, which lends itself to the temporal dimension above, i.e. considering options in terms of:

- Capacity building.
- Short-term measures, which may include benefits in addressing current climate variability, and is likely to include the types of options classified as 'no regrets', 'win-win' or 'low cost'.
- Medium-long term measures, which may need early action due to the long-term nature of the exposure of investment (lifetime of infrastructure), the length of the decision process, or the need for planning to keep later options open (particularly for major or irreversible effects in the long-term).

The practical steps in this task will be to:

1. Draw the information together to provide pathways of emerging risks and economic costs on key sectors over time. The first step is to derive the economic costs of the above mentioned climate impact assessments on key sectors. Total cost implications (for the various climate change scenarios) for crop production, arable land, livestock, and irrigation, hydropower and water-induced disasters) will be produced.

2. Bring together individual options from each time period and compile these together against each risk, looking at inter-linkages and synergies, and taking account of any information on potential costs, benefits and wider attributes of the options.

This output will be a series of climate compatible pathways, which reflect the mix of different sectors, risks and national vs. regional issues.

Staff and Key Organisations

The key staff members across the team are shown below.

Task	Team	Government/Other
1. Headline and sectoral estimates of the impacts and economic costs over time	Paul Watkiss, Alistair Hunt (GCAP) Dr. K Panta, Dr. Govind Nepal (IDS), Prof.Dr. Ram Manohar Shrestha	MoEST, NPC, MoF, MoEn, MoAD
2. Identifying options for Climate compatible development pathway	Paul Watkiss, Alistair Hunt (GCAP) Dr Michelle Slaney (PAC)	MoAD, MoEn, MoEST, MoHA
3.Management, coordination and Reporting	Ms. Prabha Pokharel, Dr. Govind Nepal and Dr. Dinesh Devkota, Mr. Prakash. Koirala (IDS), Moushumi Shrestha, Apar Poudel, (PAC)	MoEST Concerned Ministries CDKN

Consultation, Communication and Capacity Building

Consultation Plan

An additional theme of the project is to ensure the effective **stakeholder consultation**.

Objectives	Methods	Outputs
Hold consultation meetings with Government and other relevant actors. Agree overall project governance.	Steering Committee meetings. Thematic Working Groups. Consultation, in country visit and review of existing studies.	Formation of the National team. National team / stakeholder workshops.

The stakeholder engagement focuses on working directly with key Government and wider stakeholders to address the key challenges and issues.Two key stakeholder processes have been set up.

- **A Steering Committee**- In order to ensure full Government ownership and that the outputs will be relevant and useful to Government policy-makers, the project will report to a high-level Government Steering Committee. The Steering Committee will provide guidance and leadership to the study team on project scope and direction, throughout the process, helping the team to identify sub-sectors that are of highest priority.
- **Thematic Groups**- in addition to the SC, an additional level of consultation will be advanced through technical thematic groups. The team has established two thematic groups, representing individuals related to the key sectors of this study, i) Agriculture and ii) Water/energy.Through a participatory consultation process, these thematic groups will help provide input on selection of sub-sectors, provide relevant data and information to the study team, provide technical comments and inputs on the reports, and ensure a common ownership of the project. A key aim will be to bring experts and organisations that are conducting related research, to explore ways of building synergies.

Detailed Activities

The consortium believes that a key success factor for this study will be the level of stakeholder engagement and consultation. The project has the best chance of succeeding if it allows for feedback and input from major stakeholders, representing Government, academia, and civil society, including communities. To ensure that the study is participatory and to create common ownership of its outcome, national stakeholders will be consulted to help in identifying priority issues (relevant for different stakeholders), to ensure that the study is grounded within the national physical and political context, and to help identify feasible potential options for addressing climate change impacts. This will ensure full ownership and that the outputs will be relevant and useful to policy-makers and stakeholders. The participation of government staff, thematic experts and academia on a representative basis in the analysis, and their engagement in the work, will also help on-site capacity building.

The study team has already undertaken a series of stakeholder consultations, and intends to undertake additional discussions during each phase of the project to ensure that stakeholders have the opportunity to discuss the work-plan, and the results, at each stage.

Steering Committee- In order to ensure full Government ownership and that the outputs will be relevant and useful to Government policy-makers, the project will be most relevant and highly benefit from the guidance of a high-level Government Steering Committee. The Steering Committee will provide guidance and leadership to the study team on project scope and direction, throughout the process, helping the team to identify sub-sectors that are of highest priority.

The Steering Committee, which was established in April 2012, is based at a high level in Government and is comprised of representation from all relevant Government Ministries and Departments, as climate change is cross-cutting and impacts all sectors and policy making across all disciplines. The Steering Committee is headed by the Joint Secretary of the Ministry of Environment, and includes Joint Secretaries from concerned sectoral Ministries, the Climate Change Council, and CDKN. In addition to guiding the project team and providing valuable comments on the work, the Steering Committee will also critically be involved with the launch of the final study and awareness raising.

The study team proposes that the Steering Committee be consulted at regular intervals during the progression of the project, from the inception phase through to the final launching and dissemination of the final report.

Proposed frequency of Steering Committee meetings

Project phase	Proposed Date
Project Kick off	29 April, 2012
Orientation and discussion of Project Plan	4 May, 2012
Consultation on Inception Report and Implementation Plan	September, 2012
Project Progress Review and Consultation	January, 2012
Consultation on Draft Final Report	July, 2013

Thematic Groups- The team established two thematic groups, representing individuals related to the key sectors of this study, i) Agriculture and ii) Water/energy. These groups include expert individuals from relevant government departments and research institutes, academia, and civil society. In addition to thematic experts, the groups include key cross-cutting members who are familiar with modeling, disaster risk reduction, and other related expertise.

Through an inclusive and participatory consultation process, these thematic groups will help provide input on selection of sub-sectors (in the initial phase of the study), provide relevant data and information to the study team, provide technical comments and inputs on the reports (i.e. draft inception report, and draft final report), and ensure a common ownership of the project. Individual experts and organizations that have recently completed, are currently conducting related research, or are involved in relevant projects have been, and will be, consulted individual to explore ways of building synergies.

Proposed Composition of Thematic Stakeholder Groups

Agriculture	Water and Energy	Cross-cutting
Climate Change Council	Climate Change Council	Ministry of Irrigation, Department of Water-Induced Disaster Prevention
Ministry of Agriculture Development (MoAD)	Ministry of Water Resources	
Ministry of Agriculture Development, Department of Agriculture (DoA)	Ministry of Energy	
Ministry of Environment, Science and Technology (MoEST)	Department of Water Induced Disaster Prevention	
Department of Hydrology and Meteorology (DHM)	Department of Hydrology and Meteorology (DHM)	
Ministry of Irrigation	Water and Energy Commission Secretariat (WECS)	
Nepal Agricultural Research Council (NARC)	National Academy of Science and Technology (NAST)	

National Academy of Science and Technology (NAST)	Nepal Development Research Institute (NDRI)	
Tribhuvan University, Institute of Engineering (IOE)	Institute for Social and Environmental Transition (ISET)	
Tribhuvan University, Institute of Agriculture and Animal Science (IAAS)	International Water Management Institute (IWMI)	
Tribhuvan University, Central Department of Environmental Science	International Centre for Integrated Mountain Development (ICIMOD)	
Rural Reconstruction Nepal (RRN)	World Wide Fund for Nature (WWF)	
Centre for International Studies and Cooperation (CECI)	Adapt Nepal	
Local Initiatives for Biodiversity, Research and Development (Li-Bird)	Himalayan Alliance for Climate Change (HIMCCA)	
Adapt Nepal		
Forum for Rural Welfare and Agricultural Reform for Development (FORWARD Nepal)		

Proposed frequency of Thematic Group Consultations

Consultation	**Agriculture**	**Water and Energy**
Initial consultation with relevant organizations and experts	May/June 2012	May/June 2012
Initial Group Consultation on project plan and synthesis of existing information	June, 2012	June, 2012
Joint Consultation workshop to discuss draft inception report and implementation plan	September 2012	
Joint Consultation on project progress review	January, 2012	
Joint Consultation on Draft Final Report and Dissemination Plan	July 2013	

Communication Plan

As this is a national study, which aims to develop a climate compatible cost effective policy framework, as well as an effective institutional framework capable of implementing the policies and policy guided programs, the communication and dissemination strategy will focus firstly on national ***policy makers***. The second, but equally important, targeted audiences are the ***local institutions and communities*** who have to participate in the planning, implementation and monitoring and evaluation of the climate compatible programs at local level, and who must know why the change in policies are urgent for climate change adaptation and mitigation. A third group of stakeholders include ***development partners***, who also need to be informed about the national strategic policies and road maps so that they can develop their country assistance programmes in line with the

requirements/need of the country. ***UN agencies*** and other regional and international forums/funds will also be within the communication channel.

Given that there are different audiences to whom the outputs of this study should be communicated, the language, media, and the delivery approach should be different and relevant, and a variety of approaches needs to be adopted to reach/influence them effectively. This may include a range of activities from web page communication and peer-reviewed journal articles, to the translation of key messages in local languages of target communities. The consortium will ensure a high quality standard of knowledge products and create a knowledge management dissemination strategy for public and internal documents.

Our approach

Internal documents (such as meeting minutes and project updates) will be distributed by IDS Nepal to the Steering Committee and CDKN. Public documents, which includes the final report, policy briefs, and blogs, will be distributed by the consortium through the Climate Change Network Nepal (CCNN) website, the CDKN website, the Climate Change Portal of Nepal, the Nepal Climate Change Knowledge Management Centre (NCCKMC), and climate change- related mail servers (such as Climate-L.org and Climate Discussion). Hard copies of policy briefs and final reports will be distributed to government officials, local government offices, UN agencies and development partners, and all relevant civil society organizations, through the consortium and NCCKMC. To disseminate products and information within the region, the Climate Action Network South Asia (CANSA) can also be used.

In addition to the above-mentioned websites, the project team will design and develop a web page – within Ministry of Environment, Science and Technology's web page, as a separate project page. This will be an efficient way to update thematic stakeholder groups, raise awareness of interested organizations and other stakeholders, and provide a space for a discussion forum on issues related to the study. This may provide a useful channel for valuable input to the study, and will increase the outreach of the study, gain wider acceptability of study recommendations.

When the draft final report is complete, it will be submitted to the Steering Committee and simultaneously conduct a wider consultation and all comments will be used to revise the report. The final report will be published and launched at a series of high profile events (one in Kathmandu, and internationally at the 19th Conference of the Parties (COP) meeting of the United Nations Framework Convention on Climate Change). It is anticipated that relevant ministers launch the study, and the study team will provided a range of briefing materials to accompany the launch. These materials will include a press briefing, a flyer – outlining the overall study in 2 pages, a high-level briefing package- comprising a 20 page summary brochure, sector briefing notes (4 pages each), and a high quality technical document with executive summary. The technical expert team also intends to publish the study findings in an international scientific journal.

Communication with CDKN

The consortium will keep CDKN up to date through quarterly progress reports, and through the submission of all relevant reports/deliverables. When and as issues arise, the consortium will alert CDKN to discuss matters through Skype meetings.

As per CDKN's Monitoring and Evaluation requirements to assess what is being done over the course of the project, and to what extent longer-term outcomes are being achieved, the consortium have completed an objectives form. The objectives form contains a series of agreed outputs (deliverables) and outcomes against which assessments of progress will be made.

The following table outlines the progress reports and project outputs, which will be submitted and communicated to CDKN.

Report	Description	Responsibility	Frequency	Dates
Quarterly progress reports	Description of initial changes resulting from the project, including analysis of risks and changes in the external environment	PAC	Quarterly	End of July 2012, End of October 2012, January 2013, April 2013, July 2013
Draft Inception Report and Implementation Plan	Inception report will contain review of key sectors of Nepal from the perspective of climate variability and vulnerability and national initiative. It will also include capacity building plan, stakeholder communication plan and implementation plan.	IDS	Once	16 July 2012
Final Inception Report and Implementation Plan		IDS	Once	20 August 2012
Draft Report of 3 work streams	The reports will contain: ***Stream 1*** will provide the analysis of near term economic costs, including potential impacts from changes in climate variability. It will identify and cost immediate short-term actions, focusing on no-regret options. ***Stream 2*** will provide an initial risk screening of the potential impacts of climate change on current plans, i.e. the associated economic costs, and will then look at the options for addressing these. The project team also include an option to extend this analysis to a full Investment and Financial Flow analysis for either or both of the sectors of interest. ***Stream 3*** will provide an analysis of the impacts and economic costs of climate change in key sectors, using a scenario- based impact assessment approach, and then look at the options to address these, where possible, assessing the costs and benefits of alternative options.	IDS	Once	30 April 2013
Final Report of 3 work streams		IDS	Once	30 May 2013
Draft Final Report	The analytical report on economic impact assessment of climate change in key sectors of Nepal, with modelling results and ranking of climate compatible development options. Project team learning and briefing notes will accompany this report.	IDS	Once,	30 June 2013
Final Project Report		IDS	Once	30 July 2013
Final Progress Report	Final report of progress against outputs and outcomes described on objectives form	PAC	Once	September 2013

Communication with the Government of Nepal

The study team will communicate with the Government of Nepal, as represented by the Steering Committee, through the consultation meetings proposed above. As and when necessary, the Steering Committee can request further updates and information, which will be provided through IDS. The Steering Committee will be consulted on the draft inception report and implementation plan, stakeholder feedback, to review project progress at midway through the implementation phase, and for the draft final report. One of the most critical consultations with the Steering Committee will be to review the draft inception report and implementation plan. This is the Steering Committee's opportunity to influence the direction of the study and decide on options for how the study should be focused.

Communication with key stakeholders and a wider audience

Key stakeholders will contribute greatly to this study through stakeholder consultation meetings, individual consultations, and through contributing to a wider dissemination of the study outputs. In addition to the series of consultation workshops proposed above, the study team will communicate with stakeholders through the dedicated project website, through email updates (quarterly), and through participation in the planned capacity building activities (e.g. training workshops).

Capacity Building Plan

A key focus of this project is **capacity building**. Indeed, the transfer of skills runs throughout the entire project. The study is a collaborative project (joint venture) with IDS Nepal in the lead role in Nepal, but involving many others, and sharing of knowledge is one of the main aims of the project: between experts and practitioners, between experts with state-of-the-art methodologies and those with real-world data sets and applications.

Objectives	Methods	Outputs
Development of a capacity building program for Government and local partners. Production of material to ensure local capacity and leave legacy. Hands-on training and online resources.	Expert workshops and study tours. Participatory stakeholder workshops. Day-to-day, on-the-job knowledge transfer and capability building.	Expert Workshops. Training event on the study (September). Online training resources / knowledge base. Plan for further capacity building.

A strong aim of the work is therefore to build capacity in country, and the inception phase has developed a capacity building plan. The plan involves a range of activities, including:

- Ensuring tasks are undertaken collaboratively by local and international teams.
- Building-in training and hands on transfer of methods, models, results, with local partners and with Government during the project.
- Bringing in selected international lead experts to provide specialist advice on specific issues and to support the national team.
- Holding specific training workshops, to go through the approaches and methods.
- Providing wider access to climate change impacts and adaptation training.
- Facilitating on-the-job training for national team members (from government, or third parties).

The key activities identified are as follows

- Early knowledge transfer national – international team. May 2012.
- October2012. Training workshops on approaches and methods agreed in inception report and implementation plan. A half-day workshop will be conducted with relevant government officials, and a 1.5-3day workshop will be conducted for the national modeling team, with relevant Government officials (as agreed by the Steering Committee), and other institutions/organizations conducting related analysis.
- June 2013. Knowledge transfer data sets, final models to Government.
- Need to get key contacts (names) in Government to attend workshops.

Staff and Key Organisations

The key staff members across the team are shown below.

Task	Team	Government/Other
1 Stakeholder consultations	Dr Govind Nepal, Dr. Dinesh Devkota, Dr Tara Nidhi Bhattarai, Ms. Prabha Pokharel, Team of National Modellers (IDS), Gehendra Gurung, Apar Paudyal, Ms. Moushumi shrestha, Apar Poudel, Dr. Michelle Slaney ((PAC), Paul Watkiss, (GCAP)	
1. Development of a capacity building program for Government and local partners.	Ms. Moushumi shrestha, Apar Poudel, Dr. Michelle Slaney (PAC) Dr. Dinesh Devkota, Dr. Govind Nepal	MoEST, NPC, MoF, MoEn, MoAD
2. Production of material to ensure local capacity and leave legacy.	IDS with PAC	MoAD, MoEn, MoEST, MoHA
Hands-on training and online resources	GCAP with National experts	
3.Management, coordination and Reporting	Ms. Prabha Pokharel, Dr. Govind Nepal and Dr. Dinesh Devkota, Mr. Prakash. Koirala (IDS), Moushumi Shrestha, Apar Poudel (PAC)	MoEST Concerned Ministries CDKN

Work plan and timing

The overall work timing proposed is shown below.

Task	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13
Implementation Phase														
1. Current clmate variability														
Data and costs of climate variability	----------	----------	----------	----------	----------	----------								
Option identification						----------	----------	----------						
2. Building resilience														
Assessment	----------	----------	----------	----------	----------	----------								
Option						----------	----------	----------						
3. Planning for the future														
Climate model outputs	----------	----------												
Socio-economic projections	----------	----------												
Impact synthesis and new runs			----------	----------	----------	----------	----------	----------						
Option identification						----------	----------	----------						
4. CCD Pathways														
									----------	----------	----------			
Consultation, reporting and launch														
Training workshops				X						X				
Draft final report												X		
Consultation												M		
Review												----------		
Final report and briefing notes													X	
Printing														----------
Launch														L