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USAID Climate Change Adaptation Project Preparation Facility for Asia and the Pacific (USAID Adapt Asia-Pacific)

CLIMATE CHANGE VULNERABILITY ASSESSMENT REPORT

DEVELOPING A DEMONSTRATION SITE IN NEPAL ON COMMUNITY FORESTRY, GENDER AND CLIMATE CHANGE ADAPTATION

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Title: Climate Change Vulnerability Assessment Report: Developing a Demonstration Site in Nepal on Community Forestry, Gender and Climate Change Adaptation

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DEVELOPING A DEMONSTRATION SITE IN NEPAL ON COMMUNITY FORESTRY, GENDER AND CLIMATE CHANGE ADAPTATION (CF-CCA)

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Executive Summary

The Asia-Pacific region has some of the highest absolute numbers of people dependent on forests for significant portions of their livelihoods, and also stands to suffer some of the greatest expected economic and loss of human life as a result of adverse climate change impacts. In numerous sites across the region, community forestry (CF) has proven to be an effective approach both for reducing forest loss and degradation and for sustainably managing forests for multiple benefits. These forests, however, continue to be subject to widespread degradation and conversion, and are becoming fragmented within increasingly diverse and intensively used landscapes, often with negative impacts on local people—particularly the poor and excluded—as well as on national and global priorities, such as mitigating and adapting to climate change. CF can be a powerful approach for improving rights, governance and fairer access to benefits for local communities and smallholders; all of which supports the adaptive capacity of communities and the resilience of ecosystems on which they rely. There is increasing policy support for this approach across the region and growing interest in how CF can simultaneously support climate change mitigation and adaptation goals.

In this context, RECOFTC and USAID Adapt Asia-Pacific have developed a framework for better understanding and assessing climate change vulnerabilities in a context of multiple competing interests in a CF landscape. The pilot site for developing this approach was a women-led Community Forestry User Group (CFUG) in the Terai of Nepal; the Bishnupur community forest. The context in Bishnupur reflects challenges associated with the ecologically fragile Chure Forest, but also one of growing opportunities for economic development due to the close proximity of the Indian border. The community has served as a valuable, and generous, testing ground for the approach and a continuing pilot site for the implementation of interventions identified through this Vulnerability Assessment process.

The community had demonstrated considerable commitment to the conservation and development of their community forest, while still being impacted on a regular basis by climatic and other natural disasters and growing vulnerabilities heightened by increasingly market-based livelihoods. The project has sought to build on the existing strengths of this women's group and use the context of growing climatic impacts as an opportunity to test an innovative framework and systematically identify options for responding to associated vulnerabilities. Forestry and local livelihoods do not exist in isolation from other sectors or cross-cutting priorities, and the best practices and learning process documented throughout and the approaches piloted here may be of broader use to the forestry (and adaptation) sector. The framework presented here may be applicable in a range of contexts not limited to community forestry and while further refinement will be undertaken, can serve as the foundation for a broader community-based approach to adapting to climate change.

Acronyms

ADB	Asian Development Bank
APP	Agriculture Perspective Plan
CAP	Community Adaptation Plan
CBD	Convention on Biological Diversity
CCA	Climate Change Adaptation
CF	Community Forestry
CF-CCA	Community Forestry-Climate Change Adaptation
CFUG	Community Forest User Group
CFOP	Community Forest User Group-Operational Plan
CO_2	Carbon dioxide
DDC	District Development Committee
DFID	Department for International Development of United Kingdom
DFO	District Forest Office
DSCO	District Soil Conservation Office
FAO	Food and Agriculture Organization of the United Nations
FECOFUN	Federation of Community Forest Users Nepal
GCAP	Guanylyl cyclase activator proteins
GCISC	Global Change Impact Studies Center
GDP	gross domestic product
ICEM	International Center for Environmental Management
ICIMOD	International Center for Integrated Mountain Development
IDS	Integrated Development Society
IPCC	Intergovernmental Panel on Climate Change
LAPA	Local Adaption Plan for Action
MoFSC	Ministry of Forest and Soil Conservation
MPFS	Master Plan for the Forestry Sector
NAPA	National Adaptation Program of Action
NGO	non-government organization
NPC	National Planning Commission
NTFPs	Non-Timber Forest Products
OECD	Organisation for Economic Co-operation and Development
OP	Operational Plan
PRECIS	Precision Assembly Technologies and System
RECOFTC	Regional Community Forestry Training Centre for Asia and the Pacific
USAID	United States Agency for International Development
VA	Vulnerability Assessment
VDCs	Village Development Councils
WMO	World Meteorological Organization

Terminology

Terminologies used in this document are derived from reports of the International Panel on Climate Change (IPCC).

Adaptation: Adaptation is an adjustment in natural or *human systems* to a new or changing environment. Adaptation to *climate change* refers to adjustment in natural or human systems in response to actual or expected climatic *stimuli* or their effects, which moderates harm or exploits beneficial opportunities

Adaptive Capacity: It is the ability of a system to adjust to *climate change* (including *climate variability* and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences

Climate Change: Climate change refers to a statistically significant variation in either the mean state of the *climate* or in its variability, persisting for an extended period (typically decades or longer)

Disaster: A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources

Exposure: The nature and degree to which a system is exposed to significant climatic variations. In this document exposure is considered as the characteristics and magnitudes of climate change, climate variability and associated hazards including the extreme events to which a system is exposed

Hazard: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage

Risk: Risk is the combination of the probability of an event and its negative consequences. The degree of risk is expressed in terms of monetary value in this document.

Sensitivity: Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli

Susceptibility: The state or fact of being likely or liable of a system or an element to be influenced or harmed by a particular thing or hazard (adopted from OED on line)

Variability: It is the state or characteristic of a system of being variable, in this case that of the climate. In this document variability will be mostly associated with climate.

Vulnerability: It is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity

1. INTRODUCTION

1.1 BACKGROUND

More than 450 million people in Asia and the Pacific are dependent on forests for at least part of their livelihoods—food, fuel, fodder and other forest products, as well as for environmental services such as water and micro-climate regulation, biodiversity and cultural conservation (FAO, 2003). Forests, however, continue to be subject to widespread degradation and conversion, and are becoming fragmented within increasingly diverse and intensively used landscapes, often with negative impacts on local people—particularly the poor and excluded—as well as on national and global priorities, such as mitigating and adapting to climate change.

Community forestry (CF) has proven to be an effective approach for both reducing forest loss and degradation and for sustainably managing forests for multiple benefits. It can be a powerful approach for protecting rights, improving governance and ensuring fairer access of local communities and small holders; all of which supports the adaptive capacity of the community and the resilience of the ecosystem on which they rely. Fortunately, there is increasing policy support for this approach in Asia and the Pacific and greater interest in how CF can support climate change mitigation and adaptation goals.

In 2012, the Regional Community Forestry Training Centre for Asia and the Pacific - Center for People and Forests (RECOFTC) published a series of regional, project-level case studies (Cambodia, Indonesia, Nepal, Thailand and Vietnam) in order to better understand the inter-relationships between climate change adaptation (CCA) and CF. The resulting case studies provided important insights into the potential role of CF in supporting adaptation as well as the impetus to establish demonstration sites. The Bishnupur community in Sarlahi District of Nepal's Terai, one of the case studies mentioned above, stood out as a model community with considerable potential for further exploration of how CF can contribute to adaptation and for the demonstration of lessons learned to interested stakeholders at local, national and international levels.

As part of its broader capacity building portfolio, USAID Adapt Asia-Pacific is collaborating with RECOFTC to build the capacity of women-only CF user groups (CFUGs) to develop and implement CF-related CCA activities through the establishment of the initial Bishnupur CFUG in Sarlahi District.

1.2 OBJECTIVES AND EXPECTED OUTCOMES

The primary objective in establishing this long-term demonstration site in Nepal is to identify CF-CCA interventions through participatory approaches, develop proposals for priority interventions, access external finance for a minimum of one intervention, and then implement the intervention(s) through the women-led CFUG. By using the site for piloting and demonstration, it will support the identification and replication of best practices and processes at the intersection of CF, CCA and female empowerment. The women-led CFUG will participate in all program activities, leading to benefits supporting climate change resilience primarily for women, but with benefits to all members of the community.

The project design includes developing a CF-CCA framework and associated tools for data collection and analysis.

1.3 CONTEXT AND APPROACH

One of the key achievements of this USAID Adapt Asia-Pacific-supported project has been the development and refinement of a CF-CCA framework. This framework represents a new approach developed by RECOFTC for understanding and responding to climate change impacts specific to the unit of the 'CF landscape.' Beyond the concept of CF, the CF landscape approach seeks to assess climate change vulnerabilities and initiate resilience building interventions through a framework

rooted in CF and a sustainable livelihoods approach. This framework interprets CF as a landscape-based approach which locates the physical dimensions of the recognized community forest at the center of an integrated landscape including agriculture, human settlement, infrastructure and a range of social and policy-oriented institutions and dynamics. As such, CF-based responses to CCA may address a range of vulnerabilities even in sectors outside of the community forest (such as water and agriculture-related sectors), primarily by seeking to build upon adaptive capacities which exist in relation to or as a result of CF assets, plans or institutions.

The CF landscape reflects the porous, inter-linked system which can be envisioned as concentric circles with the community forest at its center, surrounded by a broader, dynamic circle reflecting the landscape of influences on the community forest. The 'landscape' refers to all geographically situated systems and factors that impact the community forest 'system', whether directly or indirectly (though indirect influences would need to be considered as significant), and acknowledges that the community forest encompasses both ecological and social dimensions. This may include various upstream and downstream factors which affect the community forest such as agriculture, livestock, market access and neighboring community forests.

One priority dimension of this project, consistent with the RECOFTC cross-cutting area of Social Inclusion and Gender Equity, has been to ensure a strong gender focus. Extensive literature suggest that the success of development initiatives depends on equality between women and men and between different social groups. From a climate change perspective, this begins with an understanding of the differences in vulnerability and adaptive capacity between different groups, including between men and women, and the design of adaptation strategies that ensure vulnerable people have equal access to resources, rights and opportunities. It is increasingly recognized that women are more vulnerable to climate impacts than men for a variety of reasons. On average, women lack secure access to financial and other resources needed for adaptation. Women rarely have equal input in decision-making in households, communities or in national policymaking. At the same time, experience has shown that women are central to permanently improving the lives of their families and communities, and therefore must play a pivotal role in community-based adaptation initiatives. Similarly, marginalized groups tend to have less security in access to and control over resources, and this contributes to their vulnerability to climate change. These underlying causes of vulnerability must be addressed in order to have a sustainable impact in reducing vulnerability to climate shocks (CARE International, 2010). The project places women at the center of the approach, building upon a successful women-led CFUG and recognizing the potentially powerful role of women as agents of change.

1.4 PLACE WITHIN RECOFTC REGIONAL PILOTING AND DEMONSTRATION

In its current five-year Strategic Plan (2013-2018), RECOFTC plans to initiate piloting and demonstration sites in all of its eight focal countries (Cambodia, China, Indonesia, Lao PDR, Myanmar, Nepal, Thailand and Vietnam). For the strategic planning phase, piloting and demonstration sites with a climate change adaptation focus are planned for three countries: Myanmar, Nepal and Vietnam. USAID Adapt Asia-Pacific is supporting the establishment of the initial demonstration site in a women-led CFUG in Bishnupur, Sarlahi District of Nepal.

Vulnerability: The CF-CCA approach makes a useful contribution to the field of adaptation and is a central plank in the development of RECOFTC piloting and demonstration initiative. Its application in assessing pilot sites and implementing adaptation options cuts through all RECOFTC thematic areas (Securing Community Forestry; Enhancing Livelihoods and Markets; People, Forests and Climate Change; and Transforming Forest Conflicts), as well as functional approaches (Training and Learning Networks, Research and Analysis, Piloting and Demonstration and Strategic Communications). In addition, it strongly supports the RECOFTC cross-cutting areas of Social Inclusion and Gender Equity, as well as Community Forestry Leadership Development.

1.5 VULNERABILITY ASSESSMENT PROCESS AND FRAMEWORK

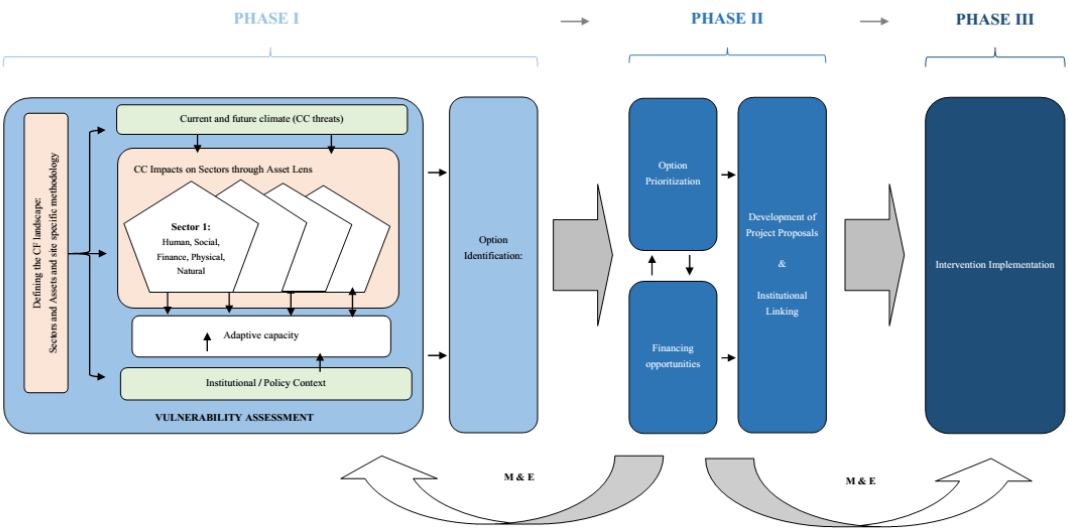
The purpose of this report is to present the results of the Bishnupur CFUG CF-CCA Vulnerability Assessment (VA). The VA process and report is considered to be a central output of this project. Specifically, it establishes a framework, approach and tools to assess climate change vulnerability in a CF landscape context, and provides the fundamental assessment for identifying the adaptation interventions to be undertaken in the course of the project.

The target site for the VA was defined as the Bishnupur CF landscape of the Sarlahi District, Nepal. The delineated area of the community forest (approximately 5 ha) served as the reference point for the analysis with relevant sectors and interactions beyond the strict confines of the community forest also included in the analysis (the CF landscape approach and delineation are discussed in greater detail in the following section).

Originally the assessment process was anticipated to require several months of intensive data collection and analysis, but through this process it became clear that greater coherence for the framework was required. As such, considerably more time was devoted to revising and refining the basic VA framework with support from the USAID Adapt Asia-Pacific team. Certain key pieces of information, such as downscaled climate modeling data, were found not to exist and required more intensive triangulation of other climate data sources (i.e. community perceptions, nearby meteorological precipitation and temperature records over the preceding 30 years, water table changes, etc.). In all, the process of developing the VA framework, collecting and analyzing the data, and writing up of the VA report took seven months. With trained and experienced staff, a similar process using the VA tools could be done in two months or less.

The VA framework comprises three major phases: I) assessment; II) intervention feasibility assessment; and III) implementation and monitoring of selected adaptation interventions (figure 1). This report presents the findings of phase I of the framework through the lens of sustainable livelihood assets organized according to sector (discussed in detail in later sections). The report ends with the identification of key adaptation 'topics' that will be subjected to feasibility assessment and further refinement in phase II.

Figure 1. Schematic depiction of the VA framework



1.6 DEFINING KEY CONCEPTS USED IN THIS REPORT

The following definitions are drawn from several different sources including the Intergovernmental Panel on Climate Change (IPCC) as well as the Climate Vulnerability Capacity Assessment Framework of CARE International and the sustainable livelihoods approach of the United Kingdom

Department for International Development (DFID). These are the working definitions used by the authors of this report.

Adaptive Capacity: According to the IPCC, adaptive capacity is the ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damage, to take advantage of opportunities, or to cope with the consequences. CARE International (2009) argued that one of the most important factors shaping the adaptive capacity of individuals, households and communities is their access to and control over natural, human, social, physical, and financial resources. Examples of resources that may be important to adaptive capacity are as follows:

- Human - Knowledge of climate risks, conservation agriculture skills, good health to enable labor;
- Social - Women's savings and loans groups, farmer-based organizations;
- Physical – Irrigation infrastructure, seed and grain storage facilities;
- Natural – Reliable water source, productive land; and
- Financial – Micro-insurance, diversified income source.

Assets: The sustainable livelihoods approach framework has five asset types, namely social, financial, physical, human and natural. These five assets are used in this report as the lens for VA. Assets, or 'capital assets' as variously referred to, can be understood as being the basis "… from which different productive streams are derived from which livelihoods are constructed" (Scoones 1998). 'Asset types' here refer to these five categories of assets, whereas 'components' of the asset types refer to a further breakdown, for example, microcredit, cooperatives, and so on under the asset type of finance (which may fall under priority sectors such as agriculture or poverty reduction).

Community Forestry: RECOFTC embraces a broad definition of CF that includes all aspects, initiatives, science, policies, institutions and processes that increase the role of all local peoples, including previously excluded women and disadvantaged groups, in governing and managing forest resources. It consists of informal, customary and indigenous and formal or government-led initiatives. CF includes a variety of institutional arrangements such as indigenous management of sacred sites of cultural importance, direct community control or management of forest areas, small-scale forest-based enterprises, forest out-grower schemes, company-community partnerships and other forms of decentralized and devolved forest management.

Sectors: The livelihood assets are the primary lens through which impacts on assets and adaptive capacity is assessed, and these assets are organized according to sector. This does not necessarily imply established departmental sectors (though it might parallel these), but rather, clearly definable systems upon which climate change impacts might be experienced. This may include agriculture, infrastructure, water, health, employment among others. As this is a CF approach, it is presumed that the forestry sector will be analyzed. In the Bishnupur CFUG context, the sectors included four: forestry, agriculture, water and livestock.

Sustainable Livelihood Approach: One of the foundational frameworks used by this project and the resulting CF-CCA approach as well as a number of other adaptation frameworks is the DFID sustainable livelihoods approach. The approach aims to improve understanding of the livelihoods of people and draws on the main factors that affect people's livelihoods and the typical relationships between these factors. It can be used in planning new development activities and in assessing the contribution that existing activities have made to sustaining livelihoods.

2. METHODOLOGY

There are two main components to the methodology: data collection and data analysis. A number of tools have been developed to support both aspects. The accompanying framework (flowchart) provides a visual schematic and structure, while the matrices serve two roles: first, as a tool for data collection and, second, as a method for data presentation and analysis. While RECOFTC is

developing a total of five matrices to support data analysis and decision-making within the overall CF-CCA framework, the latter two respond to phase II of adaptation intervention prioritization. Only the first three, which are specifically relevant to the VA process, or phase I, are included in the present document.

2.1 EXISTING APPROACHES INCORPORATED

A number of VA frameworks and guidelines have been drawn upon in the development of the CF-CCA approach. No single source was employed fully as none was entirely suited to the joint emphasis of social as well as ecological dimensions, in addition to the particular focus on CF in this project.

Some of the relevant approaches included the following:

- CARE International, Climate Vulnerability and Capacity Assessment Framework (2009)
- Organisation for Economic Co-operation and Development (OECD), Policy Guidance on Integrating Climate Change Adaptation into Development Co-operation (2009)
- International Centre for Integrated Mountain Development (ICIMOD), Framework for Community Based Climate Vulnerability and Capacity Assessment in Mountain Areas (2011)
- USAID Adapt Asia-Pacific, Draft Project Preparation Guidelines (unpublished)
- International Centre for Environmental Management (ICEM), Climate Change Adaptation Methodology (2011)
- DFID sustainable livelihoods approach.

Some, such as CARE International (2009), provide a strong community-based approach which for our purposes needed to be balanced with ecological/forestry components such as would be accounted for in an ecosystem approach. Not specific to climate change or VA, the DFID sustainable livelihoods approach underpins much of RECOFTC's work and serves as a central framework in the CF-CCA approach for understanding and interpreting the impacts of climate change on given asset types (in the Bishnupur site according to selected sectors).

CF-CCA is understood to bridge two key adaptation approaches: community-based adaptation and ecosystem-based adaptation. Methodological tools employed in the Bishnupur VA also relate to toolkits presented by these approaches and were shared by the project consultant, Mr Chhote Lal Chowdhary. These borrow strongly from existing participatory rural appraisal (PRA) tools and include the following: transect walks, focus group discussions, community historic timelines, hazard mapping, resource mapping, livelihood profiles, stakeholder mapping and gender mobility assessments among others.

The framework represents a new approach being developed by RECOFTC to assess climate change vulnerabilities and initiate resilience building interventions through a framework rooted in CF and a sustainable livelihoods approach. This framework understands CF as a landscape-based approach which locates the physical dimensions of the recognized community forest at the center of an integrated landscape including agriculture, human settlement, infrastructure and a range of social and policy oriented institutions and dynamics. As such, CF-based responses to climate change adaptation may address a range of vulnerabilities even if occurring in sectors outside of the community forest (such as water and agriculture-related sectors), but primarily by seeking to build upon adaptive capacities which exist in relation to or as a result of CF resources, plans or institutions.

2.2 DATA COLLECTION AND TOOLS

As noted previously, there is a strong emphasis on a participatory, community-driven approach to VA. The methodology has been influenced by the need to ensure maximum ownership and understanding by community members. In addition to ensuring the long-term relevance and

sustainability of any interventions, this doubly serves as a capacity building exercise for the community.

To collect the information required as outlined in the VA structure, the four matrices were used to order and ensure completeness and logical flow of information (the matrices are presented in the following section). Both primary and secondary information has been collected from various sources. The secondary information was collected from sources including the target community (Bishnupur), neighboring CFUGs, District Forestry Office (DFO), District Development Committee (DDC), CCA reports, CFUG Operational Plan (OP) and international development and academic institutions (including RECOFTC, the Food and Agriculture Organization of the United Nations (FAO), and USAID Adapt Asia-Pacific).

Primary data was collected by drawing upon VA methodology tools of other approaches and general participatory rural appraisal (PRA) and participatory action research (PAR) tools. Table 1 provides a list of the various tools employed in the VA data collection and analysis process, the sources of information, the tool or process through which it was collected, the timeframe required for collection and any additional relevant remarks. The table also presents the logic underlying the categorization of information types and how specific tools were employed to provide a balanced and comprehensive information base of the VA.

Table 1. Data collection process and timeline by information type

TYPE OF INFORMATION	SOURCE OF INFORMATION	PROCESS/ TOOLS	TIME REQUIRED	REMARKS
Selection of site	-District Forest Office, Sarlahi -Federation of Community Forest User Groups, Nepal -District Soil Conservation Office, Sarlahi -Previous research undertaken in the area.	-Discussions -3 Women-Led Community Forest site visits -Literature review that supported the community forest	Apr. 2014 June 2014	
Settlement history	Community Forest Operational Plan	-Historical time line -Review of operational plan -Focus group discussions (23 CFUG members participated in the process)	29 June, 2014 15-20 July 2014 (3 days)	Initially discussed June 29, in-depth discussion July 5-20
VA/disaster mapping	- Bishnupur Women's Community Forest User Group -Pragatisil CFUG, Harion	-Transect walk -Historical time line -Hazard mapping -Pairwise ranking -Seasonal calendar (63 members participated on 4 different days: 3 male and 27 female)	-2-8 July, 2014 -15-20 July 2014 (4 days)	Tools used in combination with resource mapping
CF landscape sector	-Bishnupur Women Community Forest User Group -Pragatisil CFUG, Harion -Manakamana CFUG, Harion (136 population of CFUG in 4 events of discussion)	-Field visit and interaction -Resource map -Social map -Discussion -Disaster map (2 events with RECOFTC team members)	-30 Aug. to 2 Sep. 2014 -June 2014 (2 days)	Area surrounding Bishnupur and upstream-downstream landscapes as well
Baseline survey	-52 households out of 65 of Bishnupur - Women respondents -CFUG users	Questionnaire (close ended questionnaire)	8-17 Aug. 2014 (9 days)	Separate survey was done

TYPE OF INFORMATION	SOURCE OF INFORMATION	PROCESS/ TOOLS	TIME REQUIRED	REMARKS
Current socio-economic situation	Forest Operational Plan Household survey (52 households)	-Review of Operational Plan -Questionnaire -Seasonal Calendar -Wellbeing ranking	8-17 Aug. 2014	
Gender-based social and power mapping	Community people 34 community people with 2 male and 22 female and 3 Dalits)	-Review of literatures -Focus group discussion -Women mobility mapping	19 July 2014 29 Aug. to 1Sep 2014	
Trend of: -Precipitation -Temperature	-Tropical Horticulture Centre, Nawalpur, Sarlahi -National Oil Seed Research Centre, Nawalpur, Sarlahi -Meteorological Station, Janakpur Airport, Janakpur -Department of Hydrology and Meteorology, Kathmandu	-Consultation with experts -Collected data from meteorological station of Janakpur -Purchased data of two stations (Karmaiya and Manusmara) from Department of Hydrology and Meterology, Babarmahal, Kathmandu	-17 July 2014 -3 Sep. 2014 -18-19 Dec. 2014	Department of Hydrology and Meteorology data was analyzed for this purpose.
Financial mapping	-Harion Municipality -District Forest Office, Sarlahi District Agriculture Development Office -District Livestock Office, Sarlahi -District Soil Conservation Office, Sarlahi -Civil Societies -Political Leaders -FECOFUN (46 participants (19 women and 27 men)	Stakeholders workshop	14 Dec. 2014	
Impact assessment of climate change	-Community -FECOFUN - Deep Boring Water Office, Jaleshwar -Naktajhij Agriculture Development Office, Dhanusha -District Soil Conservation Office, Sarlahi -District Agriculture Development Office, Sarlahi	-Interaction with community people -Office visits and discussion	22 Dec. 2014, 23 Dec. 2014, 28 Dec. 2014	Experience collected from concerned offices

The below points are a listing of topics addressed, specific tools employed and a narrative of how they were used.

1. **Settlement history:** Mainly focuses on the historical background of Bishnupur village especially as related to the community forest. The settlement history was documented using historical timelines, resource and participatory maps. The settlement history details migration and the establishment of relevant settlements, and major natural disasters that have occurred in the vicinity. A total of 23 CFUG members, both men and women, participated in the discussion.

2. **Disaster mapping:** As a component of VA was carried out using transect walks, historical time lines, hazard mapping, pair-wise ranking and seasonal calendars. Sixty-three community members participated in the discussion.

3. **CF landscape sector analysis:** The main purpose of the CF landscape sector analysis was to identify key interacting sectors affecting the community and significant impacts or potential impacts upon the community forest area. These include agriculture, forest areas, the Harion River (upstream and downstream), settlements, infrastructure, social points of notice and major hazards. Major tools for the landscape analysis included field visits, resource mapping, social mapping, discussions and disaster mapping. More than 136 members of the CFUG participated in four events including two events during RECOFTC team missions.

4. **Current socio-economic situation:** The Community Forestry Operational Plan (CFOP), now expired, was reviewed for socio-economic information. Education, gender, physical resources and land holding status was also referenced from the CFOP. Household surveys were done using closed ended questionnaires. Seasonal calendars, well-being ranking and women's mobility were used to analyze socio-economic status. Fifty-two members participated in the discussion process.

5. **Gender-based social and power mapping:** Social dynamics were assessed through focus group discussions. Focus groups were conducted with gender segregated groups and according to other differentiating criteria such as their status as sugarcane farmers, single females, individuals possessing buffalo and biogas generators (these are linked as energy sources), and those directly affected by flooding. Mobility assessment tools were used to analyze access of service provision by women members. A total of 34 community members, including 12 males and, 22 females, with three of 34 identifying as Dalits, participated in the discussion.

6. **Trends related to precipitation and temperature:** In order to understand climatic variability, monthly minimum and maximum temperature and rainfall records were examined for a period of 30 years (1984-2013). Rainfall and temperature data were collected from Karmaiya and Manusmara meteorological stations located in Sarlahi District. Karmaiya is a 'closed' meteorological station located approximately 5 km west of Bishnupur and of comparable elevation (131 m above sea level). Manusmara meteorological station is situated about 20 km south of Bishnupur at an elevation of 100 m above sea level.

The basis for considering 30 years of climatic records is based in part on the need for timeframes paralleling those of the local community. Thirty-year increments are also considered a normal baseline period according to the World Meteorological Organization (WMO) and IPCC (Carter et al., 1994). Overall, the community's perceptions of temperature and precipitation over the 30-year period appear validated by the climatic records. It bears note that many climate experts consider 30 years too short (as well as insufficient based on new and additional climatic factors) to draw conclusions about current and future climatic trends. However, in the absence of robust downscaled climatic forecasting, records on recent historic patterns and the validation of community perceptions may be useful tools in overall VAs.

In order to understand the pattern of temperature during the course of 30 years, trend analysis of the time series (monthly maximum temperature and monthly minimum temperature data) were analyzed through linear trend analysis equations. The central tendency value (represented by value *a*) and rate of incremental value (represented by value *b*) were computed by using a $Y = a + bx$ relationship. Simple statistical analysis, according to parameters of mean, range, standard deviation and coefficient of variation were then calculated. Based on the time series records of temperature available for 30 years (1984-2013), linear trend line equations were computed by using the following relationships:

$$Y = a + bx \quad \text{---------- (1)}$$

Thus, for a given time t, estimated value Y_e, of Y (temperature axis) can be written as;

$$Y_e = a + bx \quad \text{---------- (2)}$$

The value of *a* and *b* was computed by using the following equations 3 and 4, respectively;

$$\sum Y = na + b\sum x \quad \text{---------- (3)}$$

Hence, $a = \frac{\sum Y}{n}$ as b becomes zero.

$$\sum xy = a\sum x + b\sum x^2 \quad \text{---------- (4)}$$

Hence, $b = \frac{\sum XY}{\sum x^2}$

and, $X = 2(t - 1984.5)$ ---------- (5)

Where, *n* is 30 (climatic data series of 30 years), the year 1984.5 is considered middle year of the data series, and *t* is the corresponding time. For the analysis of rainfall data, Microsoft Excel was used. In order to track trends of rainfall, data were grouped into three time series periods of 10 years each. Periodic rainfall was compared to analyze the changes of three periods.

Deep tube well data were analyzed using various trend analysis tools offered by Microsoft Excel. For this study, all the deep tube well data of Sarlahi District, provided by the Agriculture Development Office, Janakpur (Naktajhij), were analyzed according to four major trend characteristics: trends of reduction in water level; trends of filter size requirements; trends of static water levels; and trends of water discharge.

2.3 MATRICES FOR DATA COLLECTION AND ANALYSIS

Both qualitative and quantitative data were collected and analyzed through the use of the four matrices, which are guided by the framework flowchart in section 1.5), and which serve as the primary analytical tools. The four matrices below go in sequence, each one building on the information captured and analyzed in the previous matrix. The purposes they serve are set out below.

Matrix 1 - Identifying Climatic Threats and Impacts *(Community Perceptions and Empirical Data Combined Analysis)*

The first matrix responds to a constraint that may be expected to emerge in highly participatory approaches to VA, but for which the existing range of methodologies and tools do not appear to provide a response. This matrix supports a reconciliation of different types of knowledge, namely community perceptions and existing empirical data, in order that the existence or nature of climate 'threats' can be more clearly assessed. While the need to clarify 'climate threats' through assessing experienced impacts might not be obvious, based on experiences in the field, there can be discrepancies and a lack of clarity on whether certain perceived 'impacts' are in fact occurring, and if so, are due to climate threats. This can be compounded by shortages in downscaled climate modeling data or even accurate historic climatic records. Through the Bishnupur VA process, questions were raised as to whether certain climate 'variables' were mutually understood to be threats by different knowledge holders. For example, the Bishnupur community believed that drought was the most significant climate threat confronting them. However, what is experienced as ' climate threat', may in fact not be substantiated by empirical data and in fact, there may be a range of factors contributing to the perception of drought. In the case of the Bishnupur community, after careful comparison of community-related data, historic precipitation and temperature records and national scale trends, the evidence pointed to an overall increase in rainfall. However, there was support for the community perceptions in that the total number of rainfall days had decreased, suggesting higher degrees of run-off and lower absorptive capacity of the soil and agricultural land to retain the more intense rainfall. As such, either set of information, if taken in isolation, might have led to incorrect conclusions; however the combination and interpretation of both allows for a more complete deciphering of patterns. Particularly in cases with limited availability of climate modelling scenarios, and where VA information is heavily drawn from local perceptions, it is advisable to not presume negative 'threats', but rather treat each variable as neutral until there it is substantiated through several data sources.

Matrix 2 - Assessing Threats and Impacts through an Asset Lens

The second matrix is intended as a twofold summary assessment. First, it lists which sectors (in the case of Bishnupur the sectors of forestry, agriculture, livestock and water have been identified by the community as key sectors of climate vulnerability) are seen as impacted by changes to a given climatic threat (determined and amalgamated from the last column of the first matrix). Then, for each sector, this matrix assesses both community-based and empirical information on impacts through the lens of the different asset types (namely the assets under the sustainable livelihoods approach: social, financial, physical, human and natural) and the components of each of these asset types (for example, a listing of all social assets under forestry includes the CFUG committee, the membership of this community forest users group within the Federation of Community Forest Users Nepal (FECOFUN) as a national federation, and so on). Through this asset-based breakdown, it is possible to understand how each of the sectors is impacted (or potentially impacted) by climate change. In addition to incorporating climatic trends and policies, processes and institutions, these asset types are seen to cover well the various livelihood dimensions relevant to CF. The assessment of impacts on sectoral assets is binary (yes or no) and therefore does not indicate either the direction or degree of change, but the final column for remarks provides the opportunity to elaborate as required. The final column is intended to capture impacts in terms of the specific assets impacted (i.e. explicitly 'female farmers' rather than generally as 'human assets').

Matrix 3 – Identifying Vulnerabilities

The third matrix is largely based on standard VA tools, with a view to listing impacts (understood to be a function of exposure and sensitivity to climate threats in each of the priority sectors) and adaptive capacities (including the sectoral assets but referring more specifically to the capacity of the population to mobilize these, including existing positive responses and innovations and potential ones), in order to reach an assessment of vulnerabilities (corresponding to a particular sector and on the basis of specific climate threats). The impacts listed here are a synthesis of those identified in the first two matrices. This third matrix is the backbone of the VA component of the analysis.

Matrix 4 - Identifying Response Options to Vulnerabilities

This final matrix serves two purposes. First, it provides a structure through which to arrive at a vulnerability rating, necessary for later prioritization and selection of adaptation options. Second, it tries to fill a gap in existing VA frameworks which do not explicitly link vulnerabilities to possible adaptation responses. This final column is aimed at generating general adaptation option 'topics' in response to identified vulnerabilities (which will be direct responses to climate threats, but may cut across both threats as well as sectors). This matrix provides the final step in the phase I VA process (and inclusion in the VA report). The refinement (or elimination) of these options through subsequent feasibility studies will serve as phase II of option prioritization and selection.

3. DESCRIPTION OF STUDY AREA

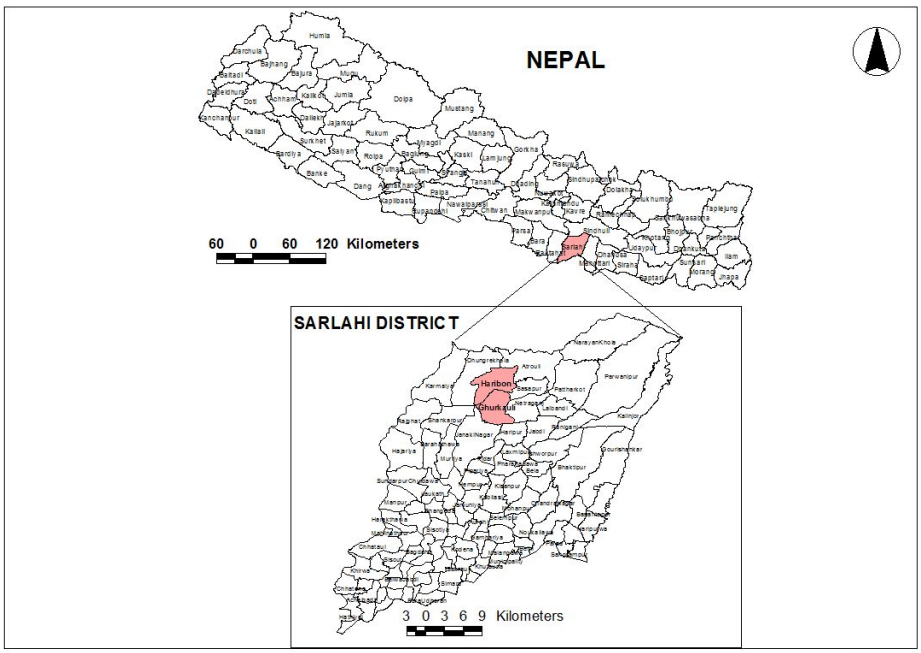
3.1 GEOGRAPHY

Bishnupur village, and the community forest from which it draws its name, is situated within Harion Municipality in the northwest of Sarlahi District (figures 2 and 3). The district is at the intersection of two geographic zones within the country: the *Chure* foothills, characterized by its fragile ecosystems of arid hills, silty rocks and sandy soils; and the Terai, notable for clay-based fertile plains suitable for agriculture. Sarlahi District sits at a relatively low altitude ranging from the Terai plains to the Chure foothills at 60 m to 659 m from mean sea level. The district borders the nationally significant East West Highway, also known as the Mahendra Highway, which serves as the major longitudinal transportation route in Nepal and also links to the nearby Indian border. The presence of the East West Highway has triggered increasing settlement in this area and a corresponding loss of forest and biodiversity. Currently forest cover in the district is 23.61% of 125,948 total area (29,736.13 ha). The

Bagmati River is the largest river system in the district with the tributary river, the Harion, bordering the Bishnupur community.

The seasons are marked by heavy rains during the monsoon season, which typically begins in June and ends in October. A second minor rainy season occurs during winter, from December to March. About 80% of total rainfall occurs during the monsoon period. Average annual maximum temperature is 31°C and average minimum temperature is 20°C, although recorded maximums and minimums are 42°C and 4°C, respectively (DFO, 2013).

Figure 2. Map of Nepal showing Sarlahi District



Source: Adapted from maps developed by the Survey Department, Government of Nepal

Figure 3. Map of Sarlahi District

Source: Adapted from maps developed by the Survey Department, Government of Nepal

3.2 COMMUNITY HISTORY AND COMPOSITION

The Sarlahi District is located in a politically sensitive area adjacent to the Indian border. It was originally inhabited by indigenous peoples including Tharu, Danuwar, Tamang, Magar, Rai, Hayu and Madhesh. However, over the past 50 years, in an effort to secure sovereignty over this region as well as in response to poverty in the mid-hills, large-scale resettlement has taken place from the mid-hills and Kathmandu valley regions to the Terai. This was promoted by the Government through a range of incentives, including land title provision, and was expedited by the construction of the East West Highway. Simultaneously, indigenous peoples were displaced toward the less suitable and ecologically fragile Churia region. The majority of residents in Bishnupur are migrants or descendants of migrants from these mid-hill ethnicities and castes (RECOFTC, 2012). The ethnic composition of the Bishnupur community is as follows: migrant high caste groups such as Brahmin and Chhetri (76%), indigenous ethnic groups such as Subba (22%) and lower caste groups such as Dalits (2%).

3.3 CONTEXT OF CF IN THE AREA

The forestry context in the Terai differs greatly from the rest of the country. In most of the country, deforestation is decreasing, while in the Terai it is on the rise (Paudel, et al., 2013). There are several reasons for this. The Terai contains significant amounts of high value timber, in particular *Sal (Shorea robusta)*, and road construction has increased accessibility both for migrants from other parts of the country as well as to nearby Indian markets. Given the high value of forest products in the Terai, there are powerful incentives for elite capture and corruption. As a result, the national government has prioritized the more centralized Collaborative Forest Management model for the Terai rather than CF approaches, leaving villagers with less direct involvement in forest management than they have secured in other parts of the country (RECOFTC, 2012). The Bishnupur community, however, employs the CF model and has established a CFUG.

In the past, Sarlahi District was known for the collective forest management practiced by its many indigenous communities. However, following the 1957 nationalization of Nepal's forests, all communal forests came under central government control. Overnight, traditional subsistence uses of forest land and products became prohibited (RECOFTC, 2012). The lowland forests of the Terai and the forests of the Churia region, hilly areas adjacent to the Terai, came under threat during the subsequent waves of migration and, by the 1990s, were highly degraded. This has contributed to the area's vulnerability, for example, to flooding and soil erosion. In 1993, a large flood in the district resulted in significant damage and loss of human lives. This led to a range of local-level responses, most notably reforestation near rivers and, ultimately, the formation of several community forests including Bishnupur (RECOFTC, 2012).

CF approaches in the area have tended towards stricter conservation measures than other parts of the country. These include operational management plans which limit collection of forest products, free grazing of livestock and other subsistence activities. In an effort to support local-level resilience, a number of development service providers, including the District Livestock Support Office, CARE International and FECOFUN, have been working intensively with several CFUGs in the area, including Bishnupur.

3.4 BISHNUPUR COMMUNITY FOREST

Bishnupur community forest is situated along the banks of the Harion River, about 500 m from the East West Highway. In recent history, the Bishnupur community forest area was grazing commons for cattle and other livestock. The unsustainable settlement and use of the fragile upstream Churia region has led to a number of impacts on downstream land management. One of the implications has been large-scale sedimentation leading to the widening of the river base. In the Bishnupur area, the community has seen continuous erosion of the riverbank and former grazing areas as a result. This consequently created a significant natural disaster risk. Specifically, the areas surrounding the river were at high risk of periodic flash floods. In response, the community sought to directly manage the risk and initiated riverbank plantations to both reduce bank erosion and to mitigate the impacts of flash flooding.

In light of the active leadership roles played by the women of the community in establishing these riverbank plantations, what eventually grew to become a forest was designated as the 'Shree Bishnupur Women's CFUG'. The Shree Bishnupur Women's CFUG is the first women-led community forest in Sarlahi District, although several more have been approved in the years following the Bishnupur CFUG. The CFUG stands out as a model in the district and beyond, with requests from other users groups to visit and learn from the Bishnupur experience of rehabilitating land that was previously heavily degraded. The main objectives in the development of the community forest at the time of its establishment were sustainable management of the community forest and sustainable use of forest products, which were aimed at fulfilling basic needs such as firewood, fodder, and grass while mitigating erosion of the riverbank (Bishnupur CFOP, 2005).

3.5 SUMMARY OF BISHNUPUR COMMUNITY FORESTRY OPERATIONAL PLAN

The total area of the community forest is relatively small. At the time it was handed over to the community, it was 2.94 ha. Following restoration of surrounding riverbanks and barren land, the total size reached 5 ha. While the Operational Plan (OP) does not address climate change explicitly, its objectives support ecosystem functions and principles of sustainable forest management. It aims to improve the condition of the forest through its protection, improve conservation of soil erosion and fulfill basic requirements for firewood, timber, fodder and grass for community forest users. It also aims to increase diversity of non-timber forest products (NTFPs) and fruit tree species, improve livelihood conditions of poor community members and Dalits, conserve biodiversity and conduct income generating and skill development activities (Bishnupur CFOP, 2005). These provisions, while not explicitly aimed at mitigation and adaptation goals, provide benefits that indirectly support each of these. To meet OP objectives, CFUG members have begun to plant a range of tree species, both

native and introduced. The present conditions and size of the community forest is not sufficient, however, to fulfill the firewood and timber needs of the community, thus the CFUG encouraged members to establish private plantations, to use cement pillars instead of timber for home construction and to use biogas and liquefied petroleum gas for cooking to reduce pressures on the forest.

To manage the forest, it has been divided into two partitions, and management activities are carried outs in these respective blocks. Users are expected to undertake silvicultural operations such as removal of invasive species and thinning and pruning on a regular basis. They also engage in plantation, weeding, replacement, construction of forest fire breaks, demarcation of forest boundaries and activities to control soil erosion. The users have initiated income generation activities organized by the CFUG as a measure to decrease dependency on forest resources (Bishnupur CFOP, 2005).

3.6 KEY SPECIES (WILD AND PLANTED) WITHIN COMMUNITY FORESTS AND SURROUNDING AREAS

Both deciduous and tropical tree species are found in Sarlahi. Sal (*Shorea robusta*) dominates mixed with the Katha tree (*Acacia catechu*), Sisoo (*Dalbergia sisoo*), Karma (*Adina cordifolia*), Harro (*Terminalia chebula*), Barro (*Terminalia bellirica*), Sindure (*Mallotus phillipinensis*), Satisal (*Dalbergia latifolia*), Simal (*Bambax ceiba*), Botdhairo (*Lagerstroemia parviflora*), Dabdabe (*Guruga pinnata*). Likewise, major NTFPs are Satabari (*Asparagus racemosus*), Sarpagandha (*Rauvolfia serpentina*), Pipla (*Piper longum*), Sikakai (*Acacia ruguta*), Tarul (*Dioscorea spp*), Cotton tree (*Bambax ceiba*), Babio (*Elaliopsis binnata*), Bhorla ko pat (*Bauhina vahilii*), Kans (*Sacchrum sponteneus*), Amriso (*Thysoleana maxima*), Thakal (*Phoenix* spp), Bhalayo (*Rhus wallichii*) and Amla (*Emblica officinalis*). Major wild fauna in the area include bear, elephant, chital, Bandel, peacock and pheasant.

The forest planted by the Bishnupur community is plantation forest. The users have planted tree species including Kapok, Eucalyptus, Broom grass (Amriso), Ipil Ipil, Sissoo, Tanki, Mango, Jamun, Khayer and Bamboo in the community forest. The group has also planted a number of agroforestry species such as Eucalyptus, Champ (*Michelia champaca*), Mango (*Mangifera indica*), Amriso (*Thysoleana maxima*), Guava (*Psidium guava*), Ipil Ipil (*Leauceana leucocephala*), Tanki (*Bauhinia variegata)*, Jamun (*Sigyzium jambolana*), Katha (*Acacia catechu*) and Sissoo (*Dalbergia sissoo*) on their private lands. Out of the 65 households, 25 households have established home gardens that serve as a form of small-scale agroforestry.

In addition to multiple use tree species, major NTFP species found in the forest include fruit trees, species with multiple use leaves, seeds, bamboo, broom grass and a range of other grasses. The species and their uses are further detailed in the table 2.

Table 2. Non-timber forest products in Bishnupur Community Forest and locality

Sn	Local name	Scientific name	Part used	Place of availability	Availability status
1	Kapok	*Ceiba pentendra*	Seed fiber	Community Forest	Medium
2	Amla	*Phyllanthus emblica*	Fruit	Community Forest	Poor
3	Khanyu	*Ficus cuminii*	Fruit	Community Forest	Poor
4	Tanki	*Bauhinia variagata*	Seed	Community Forest, Private Land	Poor
6	Karri Jhar	*Keunea Sp*	Leaf	Community Forest	Poor
7	Bhyakur- Githa	*Dioscorea*	Tuber	Community Forest, Private Land	Medium
8	Broom grass	*Thysoleana maxima*	Flower	Private Land	Poor

3.7 SOCIAL STATUS OF BISHNUPUR COMMUNITY

The well-being of Bishnupur community households with reference to literacy, access to physical facilities, health conditions, prosperity and population growth was assessed. According to the Bishnupur CFUG's own well-being ranking,[1] three categories of households are used as parameters: rich, medium and poor. The categories are relative, determined through participatory processes based on criteria provided by the Nepal Community Forestry Guideline (MoFSC, 2008). The percentage of each of these groups was determined to be 46%, 28% and 26%, respectively. The rate of poor households is just above the national average which lists 25.2% of the population as under the poverty line in Nepal (CBS, 2012).

There are relatively high literacy rates in Bishnupur. Among the total population of 359, 70.46% are literate. It is significantly higher than the district average of 42.13%. Among the literate, three individuals have completed master's degrees, 23 have completed bachelor's degrees (Women - 10 (44%), Men - 13 (56%) and 111 completed high school equivalency (Women - 55 (50%), Men - 56 (50%)). The literacy rate among older females and Dalits is much lower than the younger generation of women. The wealthier families in the community tend to send their children to private schools for higher quality education whereas lower income and Dalit families send their children to the local government schools. There is one primary school located within Bishnupur community.

Table 3. Educational status based on ethnicity

Ethnicity	Illiterate	Literate	High school and above
Chhetry	45	101	30
Brahmin	53	93	14
Bishwakarma (Dalit)	5	12	0
Subba (Janajati)	3	0	3
Total	106	206	47

Source: Bishnupur CFOP, 2005.

Food insecurity in the mid hills was one of the initial migration triggers for many of Bishnupur's inhabitants. A significant livelihood shift which occurred within the lifetimes of the current residents was the movement away from food production for subsistence to cash crops or other sources of income in order to secure food from the market. The primary source of income for the community is sugarcane production which generates income for food staples, education and other essentials such as health care.

The annual population growth rate of Nepal from 2011-15 was 1.2% (World Bank, 2016) whereas in Sarlahi District it was 2.55% (DDC, 2010); 0.55% higher than the national growth rate.

3.8 GENDERED DIVISION OF WORK, ENGAGEMENT IN COMMUNITY FORESTS AND ACCESS TO RESOURCES

3.8.1 Status of women in the area

In Nepal, the social roles and responsibilities of women differ according to age, position in the family (e.g. daughter-in-law or mother-in-law), marital status (single, married or widowed), and ethnic/caste group. In a traditional Brahman family, for example, a woman's behavior is determined by rules of purity and impurity and she is generally considered to be of lower status than her husband (ICIMOD, 2014). In general, women have more limited access to the assets (physical, financial, human, social and natural capital) that would enhance their capacity to adapt to climate change. This typically includes land, credit, decision-making with respect to agriculture inputs and technologies (Anguilar, 2009). Climate change is negatively affecting food, water and energy security, particularly in poor and marginalized households. Longer periods of drought are depleting natural resources both in terms

[1] An exercise required by the Community Forestry Guidelines (MoFSC, 2008).

of quality and quantity of available water, fuel wood and fodder. As it is typically women's responsibility to gather these resources, reduced availability thereby increases women's drudgery (ICIMOD, 2014). It bears note that not all women are more vulnerable than all men. However, given the reasons above, women in Bishnupur are typically more vulnerable than men of the same socio-economic class. There is differentiation among women in the community, with single women and widows being particularly vulnerable with markedly lower adaptive capacity.

An assessment of the different workloads of men and women in the community is presented in table 4 in order to better understand prospective differentiated impacts according to gender. The table shows the work days of women typically begin at 4 a.m. or 5 a.m., ending at 10 p.m. or 11 p.m. This is in contrast to typical daily schedules for men who on average wake up at 5 a.m. or 6 a.m. and go to bed earlier at 8 p.m. or 9 p.m. Average daily working hours for women in Bishnupur are 12 to 13 hours whereas for men it is eight hours on average.

Table 4. Work load of women and men in Bishnupur

Time	Women	Men
4	Get up from bed, clean houses and kitchen, worship	
5	Light fire, cook grain for cattle, clean cattle shed	Get up from bed, toilet, brush, take care cattle
6	Prepare tea, milk buffalo, sell milk in the dairy, cook breakfast for children	Take bath, milk buffalo, take tea, go to dairy to sell milk
7	Prepare children to send school, clean kitchen	Prepare for field work according to season
8	Go to field to collect grass and farm work	Go to field
9	Prepare breakfast for workers in the farm and go to field with breakfast	Eat breakfast
10	Cook food, serve food to family members and take food	Work in the field
11	Clean kitchen pots, wash clothes of children and family members	Work in the field
12	Take rest	Eat lunch
13	Go to meeting or discussion	Take rest
14	Cook grain for cattle, clean cowshed	Take rest
15	Prepare breakfast for family members and serve to them	Go to field
16	Collect kitchen goods from market or hat	Work in the farm
17	Milk buffalo, and go to field to for work	Work in the farm
18	Take care of cattle, start kitchen work, worship	Back to home, take care of cattle
19	Heat milk, cook food	Do work in home
20	Serve food to family members and take food	Take food and rest, watch TV
21	Clean kitchen and pots	Go to bed
22	Take care of children, prepare bed for family members	
23	Go to bed	

While there are clearly defined roles for household activities, there is some degree of overlap in outdoor work. Within the household women are predominantly responsible for cooking, care of children, support for schooling and raising domestic livestock. Through gender-segregated focus

group discussions, data were gathered to create a comparison of the contributions of men and women to external, public activities as listed in table 5.

Table 5. Role of men and women in Bishnupur

	Functions	Women	Men
1	**Farming works**		
	Farming of sugarcane	000	000
2	**Cattle rearing works**		
	Buffalo rearing	0000	00
	Fodder collection	000	0000
3	**Natural resources conservation work**		
	Fodder tree plantation in private land	000	000
	Control of river bank cutting	00	000
	Bamboo plantation in river bank	000	000
	Amriso plantation	000	00
	NTFP collection	00	000
	Firewood collection	00	0000
4	**Public works**		
	Construction of public road	000	00
5	**Economic development and marketing works**		
	Selling of milk	000	00
	Selling of vegetable	000	000
	Selling of fruits	000	000

Note: Highest, 0000; Medium, 000; Low, 00; Least, 0.

On the basis of the comparative chart for outdoor labor according to gender, the following observations can be made:

- Men and women equally contribute to agriculture, though women play a greater role in livestock husbandry, namely the feeding and care of cattle.
- Both genders work in the community forest though roles are differentiated.
- Women mostly are engaged in direct forest management activities (plantation, weeding).
- Men will go greater distances to collect firewood and NTFPs, as well as more physically exertive activities such as cutting fodder branches from trees and construction work such as riverbank enforcements.
- Women are typically organized into groups, and these groups are responsible for cleaning local roads and pathways and collecting waste.
- Women are directly involved in dairy enterprises and are active in a dairy established within the community where they sell their milk directly.
- For the sale and marketing of vegetables and fruits, which requires greater travel to markets, both men and women contribute equally.

The workload of women from wealthier households, and drudgery related to agriculture in particular, has decreased significantly over the past several years. As the number of cattle fell almost by half partially as a result of the establishment of the community forest (though the negative impacts of the restrictions of common grazing land on poorer women in the community are not assessed here), the women no longer needed to spend time collecting fodder in the forest. Furthermore, 47 households have established biogas generators and are less reliant on the forest for fuelwood for household energy. Construction of biogas generators and improved cook stoves as well as the introduction of improved cattle varieties have contributed to reducing the workload of wealthier women in the community. Similarly, the transition away from rice production to sugarcane initially reduced the agricultural workload as sugarcane production is largely mechanized. Labor inputs have been growing

however with the increasing incidence of weeds and other pests. Overall however, the workload and drudgery of poor women in the community remains high. They must spend considerable time collecting fuelwood (now possibly restricted due to the community forest establishment), fetching drinking water for households and livestock from communal wells, cultivating crops for consumption and sale and carrying out agricultural wage labor. Moreover, the workload of single women (including widows and women whose husbands have migrated for work) has increased.

Changes are also being observed in household level decision-making and power relations between men and women. This is impacting the involvement of women in the broader community, market and political interactions which has increased significantly over the past decade. Wealthier women in the community are actively engaged in dairy production and marketing. They are members, as well as leaders and managers, of different community groups such as savings and credit, CF, dairy cooperatives, and women's support organizations. They are closely involved in the decision-making processes of these groups and liaise with the various external organizations which support them. The poorer women in the community are involved in wage labor such as factories and construction. The involvement of these poorer women in community decision-making is comparatively limited in large part due to having little free time to devote to community activities.

Single women experience both considerable vulnerability as well as significant opportunities dependent on the assets and resources to which they have access. Poor single women, such as widows and those with children below working age, struggle with a heavy workload in an effort to sustain the family. Single women coming from wealthier households have greater opportunities for involvement in community affairs as well as significant influence in household level decision-making.

Considering the disproportionate burdens imposed on poorer and single female members of the community as a result of the time requirements imposed by this project, several observations can be made. First, it is true that the extensive and protracted nature of this project's consultation process required a considerable investment of time on the part of women in the community. As can be seen from the gendered daily schedule, while men would typically be relaxing in the afternoon period, women are increasingly expected to participate in meetings and consultations. The poorest women may be excluded from the consultation process entirely due to the time it takes to participate. Ways to minimize this burden should be considered in subsequent VA endeavors.

On the other hand, as pointed out by the site-based consultant, Mr. Chowdhary, the project is being looked to as an opportunity to equalize the distribution of benefits and access to credit and income-generating activities that would on a longer-term basis offset the short-term costs to women.

3.8.2 Gender and forest access

Bishnupur CFUG is the first recognized model for a women-led community forest in the district. Although there is another community forest also managed by Bishnupur community members, it is managed exclusively by male members. As such, the Bishnupur women's community forest is notable for having an exclusively female management committee, though the user group itself is comprised of both genders. The influence of male members in the CFUG's decision-making is not overt or immediately apparent. The women do genuinely seem to determine matters related to this CFUG. Leadership opportunities that have accompanied the community forest have provided entry points for women to lead and actively engage in other sectors. Women in the community point to their recent representation in Village Development Committees (VDCs) and district level political forums such as the women's wings of political parties, inter-party women's forums, non-governmental organizations (NGOs), cooperatives including dairy, user groups and other institutions as a result of being seen to be very effective in their leadership of the Bishnupur community forest. This women-led community forest is an important model within Sarlahi and neighboring districts as the women in the community have initiated successful CF and directly led its development since it was established.

3.8.3 Gender and tenure

Despite the successes of CF, women's access to land, or lack thereof, remains unchanged. This is paralleled, however, by a growing awareness among the women that there should be equal rights over land between men and women. Single women have in a number of instances tried to assert tenurial rights in their own names. Previously, there were entrenched practices of land ownership being transferred directly from father to son once age of inheritance was reached. Some of the wealthier families have registered purchased land in the names of women as female 'owned' registration results in a 30% waiving of registration fees (a female empowerment initiative of the Government).

4. CLIMATIC TRENDS IN THE STUDY AREA

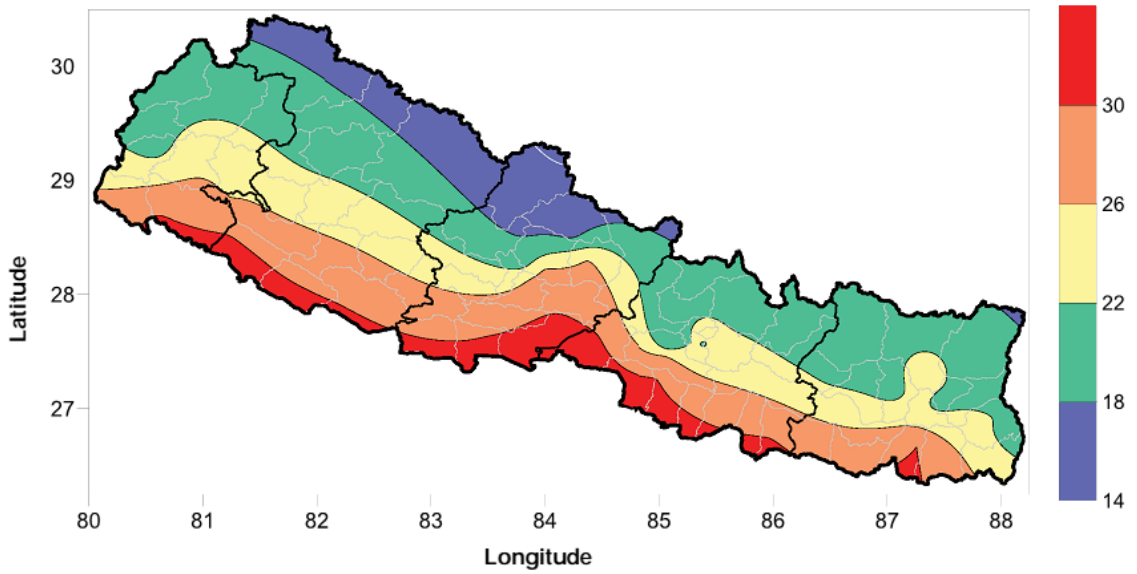
4.1. GENERAL CLIMATE CHANGE TRENDS, ASSESSMENTS AND DATA

4.1.1 Overall climate change status and predictions for Nepal

Nepal has an extremely varied and complex climate, driven by the contrasting terrain and regional weather systems. Within a few hundred kilometers, the country rises from the flat Terai plains, with a low point of only 70 m above sea level, to the top of Mount Everest (8,848 m). This drives strong temperature gradients across the country, from the hot plains to the cold mountains, as shown by the temperature profile in figure 4. Nepal also experiences complex seasonal weather patterns, which are heavily influenced by the Himalayan mountain range and include the annual monsoon. This leads to high rainfall variability across seasons and regions of the country, as well as between years.

Downscaled general circulation model scenarios for Nepal, and in particular for the southern Terai region, remain limited. While general trends are mapped out in Nepal's 2010 National Adaptation Programme of Action (NAPA), and several significant climate modeling studies have been conducted in the period since the NAPA was produced, the best recent synthesis of the state of climate knowledge is that produced by the Climate and Development Knowledge Network for the Ministry of Science, Technology and Environment on Economic Impact Assessment of Climate Change in Key Sectors in Nepal (2014). The report compares several key climate trend analysis studies. While some of these are aimed at Nepal at a regional scale, others provide downscaled data on multiple selected sites, with three of the eight study sites representing the Terai region. While none of these are specific to Sarlahi District, they represent a sampling of comparable climate zones and provide imperfect but still comparable trend indicators for the target district. Particularly noteworthy is the extremely wide range of predicted trends suggested by the downscaled modeling, which indicates high levels of uncertainty and risks associated with reliance on any of the predictive downscaled models.

Figure 4. Anticipated temperature average (degrees Celsius) by 2030



Source: IDS-Nepal, PAC and GCAP, 2014.

Nepal's NAPA (2010) indicates a number of likely trends. Among these are that days and nights are likely to be become warmer than in the past. From 1975 to 2006, maximum temperature in Nepal showed an increase of 1.80°C (Baidya et al., 2008). There are several families of Regional Climate Models that have been applied in Nepal (NCVST, 2009; Karmacharya et al., 2007; GCISC et al., 2009). The Nepal Department of Hydrology and Meteorology study forecasts warming in all seasons in the mid-21st century (2039-2069) with the warming in the northern part over the high Himalayas being greater than that in the southern part (Karmacharya et al., 2007). It also forecasts the highest increase in temperature in the winter and lowest in the pre-monsoon season in both the east and west of Nepal. The annual mean temperature was predicted to rise in the range of 1.7°C in the southern region of the country to 2.5°C in the northern region, while annual precipitation was predicted to decrease in large parts of the country, mainly in eastern and southern Nepal, by up to -30%, but with no change in precipitation over north-central and north-west Nepal, and with varied seasonal changes.

The Ministry of Science, Technology and Environment's 2014 Economic Impact Assessment anticipates annual direct costs of current climate variability in Nepal to be, on average, equivalent to 1.5% to 2% of current gross domestic product (GDP)/year (approximately US$270 million to 360 million/year in 2013 prices). They expect that in extreme flood years this can rise to 5% or more, which is high in comparison to international levels. The 2014 report concludes that Nepal is not adequately adapted to the current climate, and that the country has a large existing adaptation deficit, which is a priority for early action.

There are three main sources of climate projection data available, produced by different models, with different time series, at different spatial scales and for different climate scenarios. These include:

1. The analysis undertaken for the Second National Communication, which has Precision Assembly Technologies and System (PRECIS) output for A1B for a full-time transect from 1961-2098;
2. The Department of Hydrology and Meteorology Climate Portal, which has three regional climate model outputs for the A1B scenario for 2030-2060 (the PRECIS model, the Weather Research and Forecasting model and the regional climate model RegCM4; and
3. The regional climate model output (PRECIS) from the Asian Development Bank (ADB) climate projections used in the second study on *Regional Economics of Climate Change in South Asia* (RECCSA II).

The latter of the three reveals interesting results, both in relation to the changing climate trends over time (such as temperature and long-term rainfall trends), but also in relation to the changing variability (of rainfall).

In the Terai, the short-term analysis (2030s) indicates a combination of lower rainfall and higher temperature during the growing season. It is likely that the changes that are projected, especially for high emission scenarios and warming models, will lead to major shifts in agro-ecological zones. This has the potential for some benefits, as new areas open up and seasonal lengths increase. However, the changes in climatic zones will also affect the range and prevalence/incidence of pests and diseases. While there are uncertainties, it seems likely that climate change will increase the range of these pests and diseases into the hills and mountains, where current cold conditions limit their spread (IDS-Nepal, PAC and GCAP, 2014).

4.1.2 Climate change impacts on forestry, agriculture and other land uses

Further to the anticipated regional climatic changes and the more localized predicted impacts, there are additional analyses of sector-specific climate trends. The target sector for this project, forestry, however, has received relatively limited attention as compared to other sectors and as a result there is less available analytical data. For example, the 2014 Ministry of Science, Technology and Environment report conducted an analysis on identified priority sectors of agriculture, hydropower and water-related disasters. It is also noteworthy that in the recent IPCC Fifth Assessment Report (2014), sectors responsible for climate change causing emissions have been collated from the previously disaggregated forestry, agriculture and other land-use sectors. This treatment of these sectors collectively reflects the interconnected relationship between ecosystems and also the cross-sectoral nature of causes of emissions. It is sensible to interpret impacts of climate change on forestry along with impacts on agriculture and other land-use changes for the same reasons.

There are a number of anticipated impacts on agriculture, forests and other land uses globally and within the region, both positive and adverse. Changing temperatures, rainfall patterns and other climatic changes will affect not only landscapes, but also the biodiversity of plants and animals within these landscapes. Maintaining and restoring biodiversity in forests promotes their resilience to human-induced pressures and is an essential insurance policy and safeguard against expected climate change impacts (CBD, 2011). Primary forests are generally more resilient (and stable, resistant, and adaptive) than modified natural forests or plantations. Noting the dual roles of forest ecosystems in adaptation and climate change mitigation, about 50% of terrestrial carbon stocks reside in forest ecosystems: biomass living and dead, both above and below ground and soil carbon (IPCC 2002).

Warming will inevitably shift the geographic ranges of many tree species in forest contexts. Habitats of some types of trees will move northward or to higher altitudes (USDA Forest Service, 2012). Tree lines are documented as shifting northwards incrementally, on average, at a rate of 150 m–500 m per year (Huntley, 1991). Other impacts on soil quality and fertility are expected. Soil quality is critical to the agriculture sector, but is influenced deeply by overall land-use practices including, at a landscape level, the role of forests and trees in soil conservation practices. Severe drought may cause loss of microbial activities, which release N_2O into the atmosphere mainly due to the microbial transformation of nitrogen fertilizers in soils (Babinszky et al., 2011).

Drought increases wildfire risk, given the susceptibility of dry trees and shrubs to fire risks (USDA Forest Service, 2012). It also reduces the ability of trees to produce sap, which has protective qualities against destructive insects such as pine beetles. Diminishing natural controls, such as predators, or pathogens or inadequate defenses in trees can allow insects to spread and temperature changes can lead to increased severity of future insect outbreaks (Swanston and Janowiak, 2012; Babinszky et al., 2011).

Similar to potential benefits of climate change on the agricultural sector in high latitudinal boundaries, one expected positive impact of climate change on forests is that higher levels of atmospheric CO_2,

given sufficient water and nutrients, may enable trees to be more productive. The higher future CO_2 levels could lead to benefits to forests including increased soil fertility (Babinszky et al., 2011).

Climate change can be expected to increase global water demand while reducing available water supplies (IPCC, 2014). The nature of the relationship between forests and water availability remains unclear and highly contested (Gilmour, 2014). The impacts of forests on total water flows and availability, on saturation and water retention in soil and in mitigating the impacts of flooding are highly dependent on a number of factors including geomorphology and tree species among others. As climate change impacts water and demand for water grows, it is likely that there may be tradeoffs between mitigation objectives (in maximizing water intensive biomass accumulation) and adaptation objectives (including ensuring the availability of water for agriculture and household purposes) (Gilmour, 2014). This shifting balance will challenge water managers to simultaneously meet the needs of growing communities, sensitive ecosystems, farmers, ranchers, energy producers and manufacturers with shrinking water supplies. Forest landscape management may increasingly need to assess and incorporate competing interests and local level priorities when considering optimal forest landscape management strategies.

4.2 SITE SPECIFIC CLIMATE TRENDS AND DATA

A 30-year continuous record of climate data is widely used to create a baseline (e.g., Rosenzweig and Parry, 1994). As a 30-year period is likely to contain wet, dry, warm and cool periods, it is therefore considered to be sufficiently long to define a region's climate. The 30-year normal period, as defined by the WMO, is recommended by the IPCC for use as a baseline period (Carter et al., 1994).

Scenarios estimate a sufficient number of variables on a spatial and temporal scale that allow for impacts assessment (Smith and Tirpak, 1989; Viner and Hulme, 1992). Typically, such impact models include meteorological variables such as temperature, precipitation, solar radiation, humidity and winds. For this analysis, temperature, rainfall, humidity and water table have been assessed.

As mentioned in the methodology section, climatic data on rainfall and temperature over the past 30 years were collected and analyzed from Karmaiya and Manusmara meteorological stations located in Sarlahi District. Karmaiya is a 'closed' meteorological station located approximately 5 km west of Bishnupur and of comparable elevation (131 m above sea level). Manusmara meteorological station is situated about 20 km south of Bishnupur with an elevation of 100 m above sea level.

4.2.1 Temperature

Data for the period 1984-2013 from the Manusmara and Karmaiya stations were obtained directly from the Department of Hydrology and Meteorology, Kathmandu. Some of the challenges in analyzing the three-decade data sets include temperature fluctuations for each 10-year period that did not following consistent trends and thus may reflect climate variability rather than change. Predictions drawn from climate modeling would be required to develop a more robust assessment of likely future scenarios for temperature. Nevertheless, the monthly maximum temperature records in 2013 have not increased in a linear fashion as compared to 1984. However; the monthly minimum temperature has made a linear increase for all the months in 2013 as compared to 1984. The fluctuation in temperature provides support to the observed frequency and magnitude of extreme weather events, a function of global warming.

The results are presented in figures 5 and 6 as representation of monthly temperature and precipitation records from two snapshot years (1984 and 2013) as well as of the climate variability over the 30-year period. The monthly maximum and minimum temperatures for each decadal period are plotted in the figures below. As noted in the methodology section, the 30 years of historical records cannot be considered predictive of future climate trends, given that the period would be too short and that much of the anticipated impacts of climate change have yet to fully be evidenced. The historical records are

presented to show recent patterns, if any, and determine the degree to which community perceptions may reflect actual trends.

Figure 5. Variation of monthly maximum temperature 1984-2013

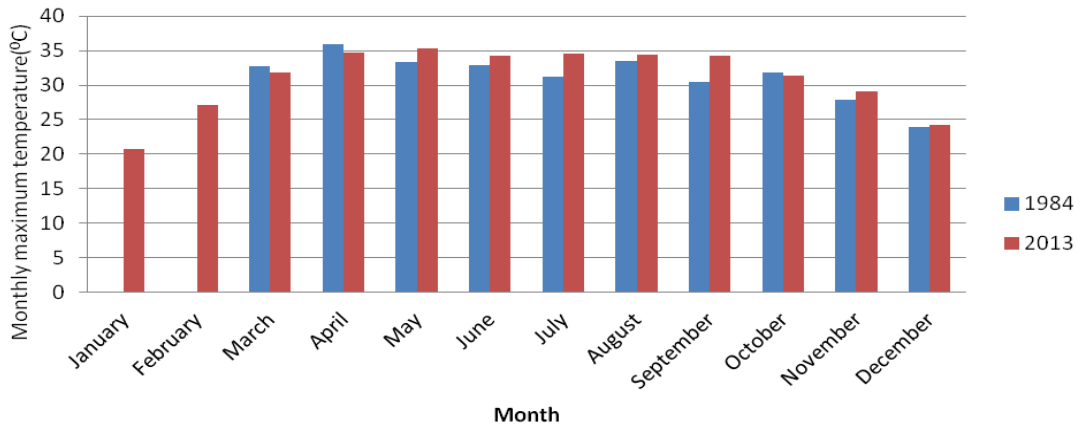
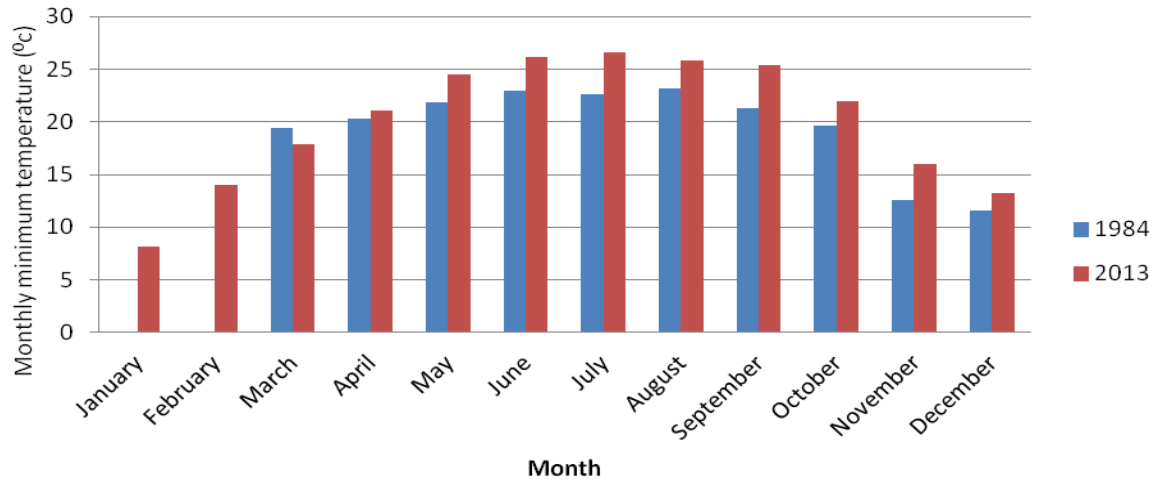


Figure 6. Variation of monthly minimum temperature 1984-2013



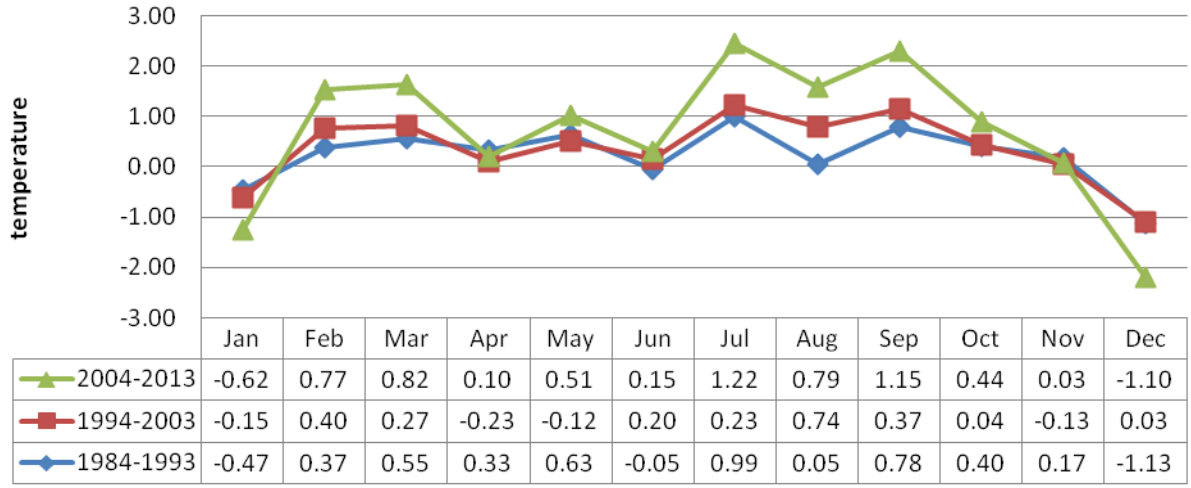
Bearing in mind the challenges of making predictive conclusions, some general observations can be made on patterns in the recent past. First, no strong or definitive trends emerge from the temperature data over the past 30 years. Rather, there are month-specific incidences recorded that may or may not reflect broader trends. These include the decrease in the maximum temperature for April and the increase in the maximum temperature from May to November. There is a notable increase of temperature in the months of July and September.

Concerning figures 7 and 8 depicting variation in temperature for decadal periods, the following observations can be made:

- Maximum temperatures in January and December decreased, on average by 0.62°C and 1.10°C, respectively, for these months over the 30-year period.
- Temperature has increased for the period February to November over the past 30 years.
- The increment of temperature can be placed in three categories - normal increments (0°C to 0.50°C), medium (0.50°C to 1.00°C) and maximum (over 1.00°C).
- On the basis of this categorization, April, June, October and November have normal increments, February, March, May and August have medium increments, and July and September have maximum increments.

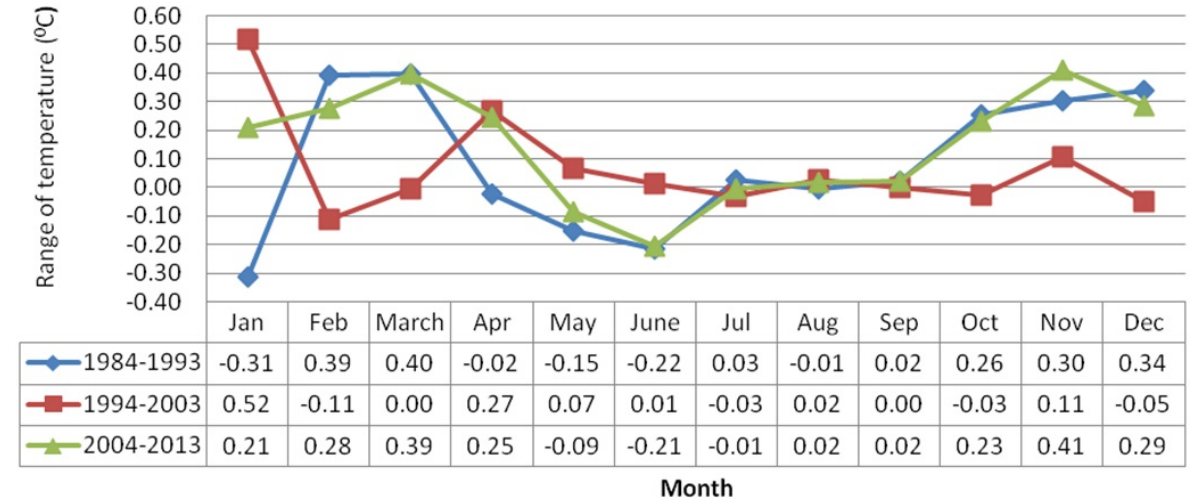
Regarding minimum temperatures, we note an increase in all months except for May, June and July.

Figure 7. Variation of maximum temperature in 10-year periods



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004-2013	-0.62	0.77	0.82	0.10	0.51	0.15	1.22	0.79	1.15	0.44	0.03	-1.10
1994-2003	-0.15	0.40	0.27	-0.23	-0.12	0.20	0.23	0.74	0.37	0.04	-0.13	0.03
1984-1993	-0.47	0.37	0.55	0.33	0.63	-0.05	0.99	0.05	0.78	0.40	0.17	-1.13

Figure 8. Variation of temperature range over 10-year periods

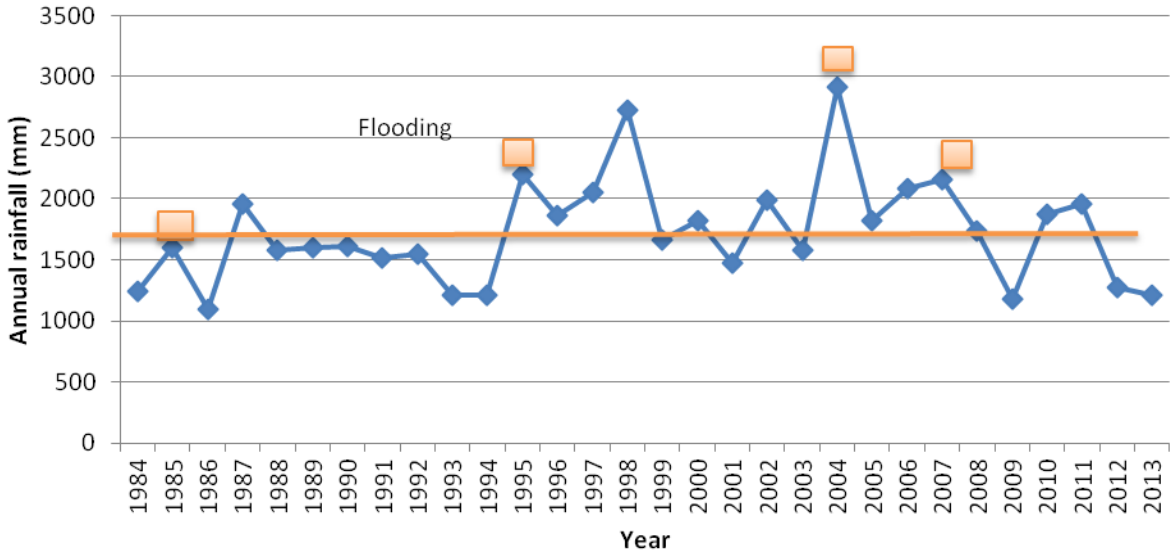


	Jan	Feb	March	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
1984-1993	-0.31	0.39	0.40	-0.02	-0.15	-0.22	0.03	-0.01	0.02	0.26	0.30	0.34
1994-2003	0.52	-0.11	0.00	0.27	0.07	0.01	-0.03	0.02	0.00	-0.03	0.11	-0.05
2004-2013	0.21	0.28	0.39	0.25	-0.09	-0.21	-0.01	0.02	0.02	0.23	0.41	0.29

4.2.2 Rainfall

The average annual rainfall in the Churia region of Nepal varies from 1,500 mm to about 2,500 mm. In the data sets from the two meteorological sites, the annual rainfall for the 30-year period ranged from 1,094.1 mm to 2,919.5 mm with an average annual rainfall of about 1,580 mm. The trend for the total amount of rainfall indicated a slight increase over 30 years. The total amount from 1984 to 1993 was 14,980.3 mm, from 1994 to 2003 it was 18,564.5 mm, and from 2004 to 2013 it was 18,212.7 mm. Generally, for each 10-year period, July consistently has the largest amount of rainfall (1984-1993, 3,829 mm; 1994-2003, 5,850 mm; and 2004-2013, 6,092 mm). Seasonal rainfall trends are somewhat flat beginning in March and ending in November. Other notable trends included the gradually decreasing duration of rainy days each decade. Local respondents report that major flooding events in the study area occurred in years 1985, 1996, 2004 and 2007. These years correspond roughly to years with higher than average rainfall as shown in figure 9.

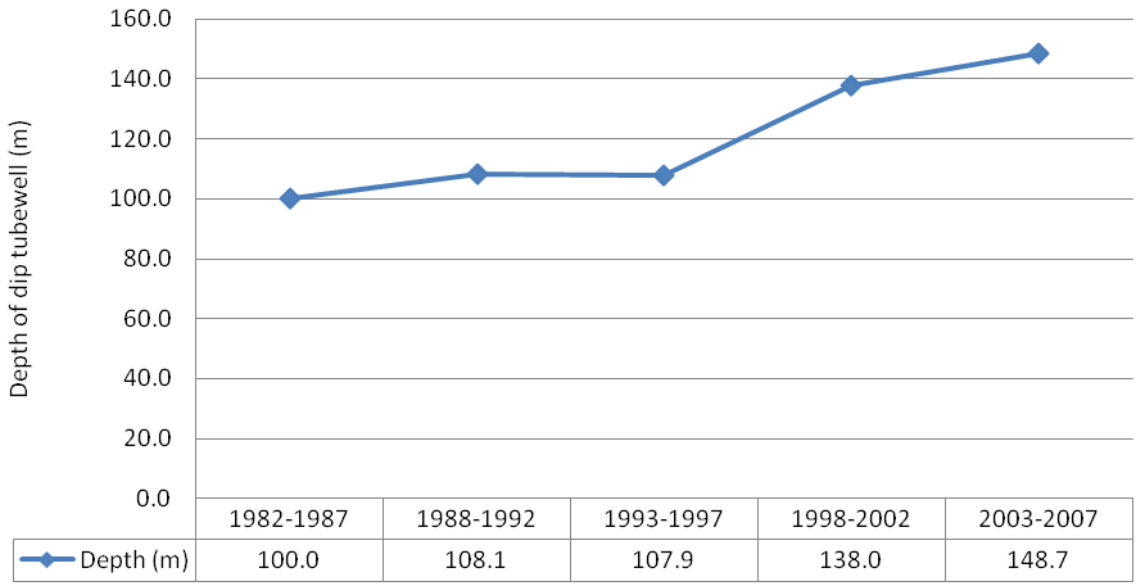
Figure 9. Trend of rainfall 1984-2013



4.2.3 Ground water level

Nepal's NAPA outlines declining ground water tables as one of the significant expected climatic impacts (2010). This corresponds with one of the dominant environmental changes experienced by the Bishnupur community: declining (or perceived declining) water access, and in particular lowering water tables. Without a significantly more rigorous technical assessment of changes in ground water use at the watershed level, it is not possible to determine direct attribution to climate change. However, even without clear causal links to climate change, this is a strongly anticipated impact of climate change in the Terai area, and this has been repeatedly documented by the Bishnupur community and Sarlahi District as a primary concern.

Figure 10. Trends in depth of deep tube wells, 1982-1987



Ground water levels were assessed based on data from the Agriculture Development Office, Naktajhij, Janakpur, and the Ground Water Development Board, Jaleshwar. There are 28 ground water tube wells in Sarlahi District supplied by the Agriculture Development Office, Naktajhij. Negative impacts on the water table were assessed by examining three parameters: water level depth,

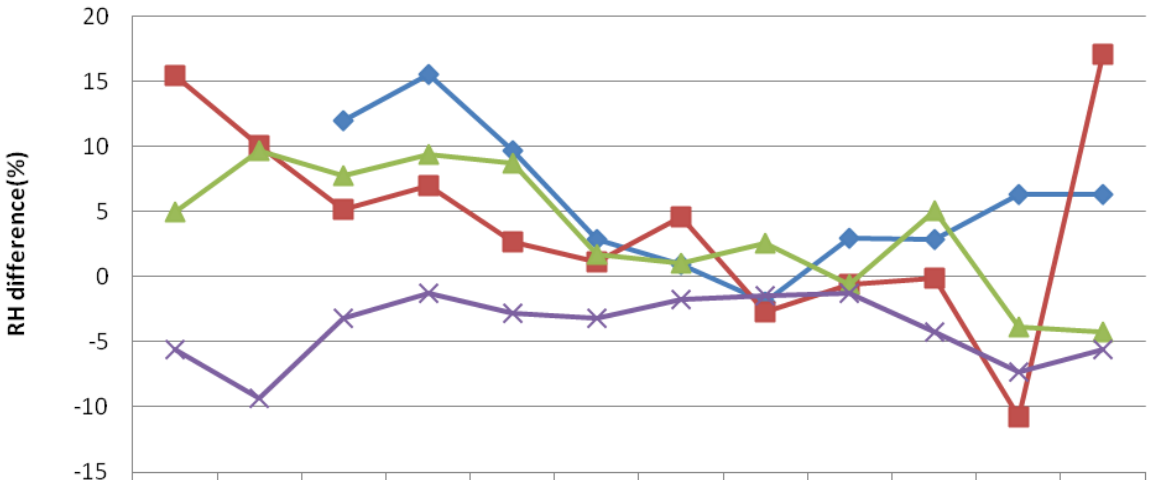
length of filter used and discharge of water. The first of these parameters is illustrated in figure 10. Upon reviewing deep tube well data, observations indicate that the depth of tube wells has increased continuously. In the 27-year period for which data exist, tube well depth has increased by 48.7 m. Significantly, tube well depth increased dramatically from 1998 to 2007.

4.2.4 Humidity

Relative humidity is an important indicator of climate change. Relative humidity is also directly related to amounts of CO_2 increasing in the atmosphere. It is assumed that even minor CO_2 -induced warming will create substantial increases in atmospheric water vapor. Water vapor is a much more potent greenhouse gas than CO_2 (Lindzen, 1997).

Historical (30-year period) relative humidity was assessed using the $Y = a + bx$ relationship equation. Relative humidity was measured at a given time in morning (8:45 a.m.) and afternoon (5:45 p.m.). The *R2* value was then calculated to assess the degree of correlation. A monthly variation graph of humidity in 10-year periods is presented in figure 11.

Figure 11. Monthly comparative relative humidity of different 10-year periods



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1984			12	15.5	9.7	2.9	0.9	-1.9	3	2.9	6.3	6.3
1993	15.4	10.1	5.2	7	2.7	1.1	4.6	-2.7	-0.6	-0.1	-10.8	17.1
1995	5	9.7	7.8	9.4	8.7	1.7	1	2.6	-0.6	5.1	-3.9	-4.2
2013	-5.6	-9.3	-3.2	-1.3	-2.8	-3.2	-1.7	-1.5	-1.3	-4.2	-7.3	-5.6

Records indicate that there has been a dramatic increase in relative humidity for the months of March and April, particularly during the afternoons. Average morning humidity is increasing by 0.58%

annually whereas relative humidity during the afternoon is increasing by 1.15% per annum. As a result, afternoons feel considerably warmer than mornings. There is much variability in relative humidity during January and December over each 10-year period whereas the months of July and August demonstrate much less variation.

4.3 SUMMARY OF KEY EMPIRICAL TRENDS OVER PRECEDING 30 YEARS

The limitations of the 30-year meteorological data in making generalizations about climatic trends have already been noted, along with limitations in making predictive assumptions about future conditions. Despite this, efforts to discern patterns that might be attributed to climate as opposed to weather are useful as a counterpoint to community perceptions of recent changes.

Notably, given the emphasis by the community on rainfall and water availability, there have been slight overall increases in rainfall over the preceding 30 years. This is consistent with national climate modeling scenarios which indicate overall increases in precipitation. It is at odds, however, with community perceptions of 'drought' and declining rainfall. The interpretation of differing data on a single climate variable is further discussed in section 4.4.

Temperature changes in the empirical data for the past 30 years show less clearly defined trends. However, maximum temperatures for certain months such as April have consistently decreased, while hot season maximums have become longer with increasingly high temperature extremes. The variability of temperature is in keeping with community perceptions, although nuances according to seasonality must be recognized.

Other variables such as increases in humidity during certain periods and lowering water tables show community perceptions validated by the empirical data.

4.4 FROM CLIMATE VARIABLES TO CLIMATE THREATS

Through the use of tools such as the first matrix (presented in tabular form in Annex 1), a systematic effort was made to bring together different information sets, namely community perceptions and empirical data, in order to assess the validity of assumptions around climate threats. Specifically, significant climate variables are listed, and through assessment and comparison of different information types, conclusions are drawn on whether given climate variables represent threats (or rather, if perceived threats might be due to factors external to climate).

In the case of Bishnupur, while humidity and wind factors present some form of climate threat, these are significantly less than factors of temperature and precipitation. Both community perceptions and empirical data indicate temperature is a growing threat to a number of critical sectors. Specifically, meteorological records are substantiated by community experiences of increasingly cold winter seasons and increasingly hot summer seasons. In particular, the very high hot season temperatures have a range of adverse impacts on forestry, livestock, agriculture and water, and particularly on human health and capacity to work. The assessment of community perceptions of precipitation and those of empirical data revealed some interesting differences. The community complained consistently of drought, and yet the prior 30-year precipitation records did not show a decline in total rainfall. Rather, empirical evidence demonstrated growing periods of intense rainfall and reduced total number of days of precipitation. This, combined with changing seasonality, suggests that the community is unable to capture the excess rainfall and run-off associated with intense precipitation. This is experienced as water shortage and drought. Without the combination of the two data sets, this assessment and conclusion would not be reached.

5. POLICY AND INSTITUTIONAL STRUCTURES

5.1 INSTITUTIONALIZING ADAPTATION AT NATIONAL AND LOCAL LEVELS

Both Nepal's 2010 NAPA and 2011 Climate Change Policy advocate for direct community-level adaptation plans, such as Community Adaptation Plans (CAPs) to be coordinated by Village Development Councils (VDCs). The specific guidance or financing to do so however remains unclear. The NAPA also tends to anticipate that adaptation planning will be mainstreamed within sectoral line departments as opposed to standalone, separate sector-level adaptation plans. In contrast, Nepal's Local Adaptation Plans for Action (LAPAs) focus directly on VDC-driven and -coordinated adaptation planning, although there appear to be multiple practical challenges given limited knowledge and expertise on the topic of CCA within VDCs, in addition to the optional nature of incorporating adaptation within planning processes.

There have been prior CFUG-based adaptation activities in Bishnupur, most notably a FECOFUN supported CAP using the CFUG as the basic institutional unit. However, few in the community are familiar with CCA much less CAP.

While the decision has been made to focus on the forestry sector and CF (through an ongoing revision process to the Operational Plan) as the most viable option for institutionalizing adaptation in Bishnupur, it is evident that the term community forest must be interpreted at the landscape level in order for the full measure of community vulnerabilities to be accounted for. In the Bishnupur context, this means considering and including in the vulnerability analysis potential hazards and areas of other climatic risks sites that may fall outside of the forest area (flooding, wells that may be running dry, access roads which may be cut off, agricultural crops for both subsistence and cash purposes, etc.).

5.2 KEY NEPAL INSTITUTIONS AND GOVERNMENT STAKEHOLDERS RELATING TO FORESTS, DEVELOPMENT AND ADAPTATION (NATIONAL, DISTRICT AND LOCAL)

Table 6. Key institutions and stakeholders

Sectors	Key stakeholders	Provisions and activities
National level stakeholders relating to forests		
Government	Ministry of Forest and Soil Conservation (MoFSC)	Policy and strategy formulation for forest management, conservation and use
	President Chure Terai Madhesh conservation program	Protection of Chure forest and soil
Civil society	FECOFUN	Protect right of CFUGs
	Himalayan Women Network International	Protect right of women CFUGs
District and local level stakeholders relating to forests		
Government	District Forest Office	Forest protection; community forest management
	District Soil Conservation Office	Protection of soil; control of hazard
Civil society	FECOFUN	Conflict resolution; OP and constituent amendment; awareness raising
	Himalayan Women Network International	
Private sectors	NTFP and Herbs Network	
	Sambhala Herbs	NTFP promotion
National level stakeholders relating to development and adaptation		
Government	National Planning Commission	Climate Finance Working Group at National Planning Commission established under the

Sectors	Key stakeholders	Provisions and activities
		coordination of Joint Secretary.
	Ministry of Urban Development	Urban planning and settlement management
	Ministry of Irrigation	Surface and ground water irrigation
	Ministry of Science and Technology	Promotion of science and technology
	Ministry of Environment	Environment management and conservation; act as focal ministry for climate change
	Ministry of Federal Affairs and Local Development	Implementation of LAPA; provision of DDC and VDC fund
	Ministry of Agricultural Development	
	Ministry of Energy	
	Ministry of Education	
Civil society	Heifer International	Improved variety of goat and buffalo; saving and credit; milk cooperative formation
	Churia Catchment Conservation project	Saving and credit; income generating activities; women and Dalit empowerment
	CARE-Chuli	Women and Dalit empowerment; climate change adaptation; Operational Plan amendment
	Red Cross	Emergency support; saving and credit
Private sectors	Nepal Biogass company	Construction of biogass
Local level stakeholders relating to development and adaptation		
Government	Hariban municipality	Local road construction; spur and check dam construction; conflict resolution; drinking water; irrigation
	District Livestock Development Office	Breeding of improved varieties of livestock; livestock health and medicine; improved grass cultivation in community forests
	District Agriculture Development Office	Improved agricultural varieties; chemical fertilizer; skill and technology transfer; small irrigation
	District Forest Office	Forest management training; Operational Plan preparation and implementation; improved grass; legal services
	Electricity Office	Electricity pole establishment
	Small Cottage Development Office	Skill development training (bee keeping, furniture, beehive briquette)
Civil society	Nepal Milk Dairy, Bishnupur Upreti Milk Dairy, Bishnupur	Purchase milk Provide loan
	Nawajagaran Women Group, Bishnupur; Didi Women Group, Bishnupur; Sirjanshil Women Group, Bishnupur; Local Club, Bishnupur	Women empowerment; saving and credit for women
Private sectors	Indushankar Sugar Mill, Harion	Loan to grow sugarcane; improved variety of sugarcane seedling
	Sagun Saving and Credit Cooperative, Harion	Saving and credit for women
	Agro-veterinary	Service to animal health; medicine to animal
	Nepal Bank, Harion	Provision of loan
	Gravel exporter	Tax payer
	Brick industry Kiln	Tax payer

Sectors	Key stakeholders	Provisions and activities
	Market	Provision of goods and services

5.3 KEY POLICIES, PROCESSES AND INSTITUTIONAL SUPPORT FOR FORESTS, DEVELOPMENT OR CLIMATE CHANGE (DISTRICT, PROVINCIAL, NATIONAL)

The Master Plan for the Forestry Sector (HMGN, 1988) set long-term objectives to meet the population's basic needs for forest products on a sustained basis and to contribute to local and national economic growth. However, this plan did not adequately address the social dimensions of forest management. The Forestry Sector Policy (2000) served as an updated version of the Master Plan, giving priority to underprivileged groups within communities. It placed a stronger emphasis on improving livelihoods of the poor through the forestry sector.

The Forest Act (1993) and Forest Regulations (1995) have provided a range of different forest management options within the over-arching forest categories of national and private. National forests are further categorized into four types: community forests, leasehold forests, protected forests and religious forests. Private forest refers to forests on private land. Community forests are one of the categories managed by local user groups based on the basis of demonstrated capacity.

The Leasehold Forestry Policy (2002) has given priority to landless peoples. The Policy has provisions for allocating degraded land to the poor for 40-year leases. Conservation policies of Nepal have typically focused on conservation of forest resources, however, with notably less focus on livelihoods of the poor. The 1995 Forest Regulation provided detailed guidance on handing over steps and procedures of community forests in support of long-term sustainability, biodiversity and fulfilling the livelihood needs of local communities. The Forest Act and Forest Regulations, however, do not account for forest diversity and treat the stocking of all community forests as equal. In reality, there are significant differences between community forests, forest species and growing stock. The lack of recognition of these differences can, and has, led to elite capture with regards to membership exclusion of Dalits and other marginalized groups as well as multiple memberships of other relatively privileged groups.

The Forest Sector Gender and Social Inclusion Strategy (2008) has provisions targeted at improving the livelihoods of poor, women and other excluded groups. However, there remains limited coordination and linkages between these various strategies and their associated outcomes. On the other hand, CF policies such as the Development Programme Guidelines (2007) have relatively well developed and expansive social provisions, including conducting of a well-being ranking, proportionate representation in executive committees and equitable forest resource distribution systems. The provisions are strongly supportive of sustainable forest management, livelihoods of the poor and climate change objectives. For example, there are provisions that 35% of total income of the CFUG is to be expended for the empowerment and development of women, Dalits, indigenous people and Janjatis below the poverty line established by the well-being ranking.

Similarly, periodic national Five-Year Plans of Nepal directly or indirectly address the issues of sustainable forest management and livelihoods of the poor. The Tenth Five-Year Plan (1997-2002) focused on the role of forestry in achieving poverty reduction goals (NPC, 2003). The Three-Year Interim Plan (2007/08 – 2009/10) focused on reducing poverty through equitable distribution of forest resources (NPC, 2007).

5.3.1 Key policies, process and institutional support for general development

Nepal is an agricultural country. As such, policies regarding agriculture play an important role in the development aspirations of the country. The Ninth Five-Year Plan (1997-2002) of Nepal introduced a crucial plan for agricultural development and food security known as the Agricultural Perspective Plan (APP). This was a 20-year Master Plan formulated by the Government of Nepal in 1995 with the support of the ADB. The main aim of the Plan was to increase food production and reduce the poverty

of marginal farmers in Nepal (NPC, 1995). It has four priority inputs, e.g. irrigation, roads, technology and fertilizer. However, the objectives of the plan have yet to be achieved. Cameron (1998) argued that the APP lacks systematic efforts to ensure livelihood opportunities for rural poor.

The Government introduced the National Agricultural Policy in 2004. It draws from the APP and outlines the implementation mechanisms to achieve key targets. It includes specific objectives to increase agricultural production and productivity and to make agriculture competitive with regional and world markets by developing commercial agriculture systems. It included the provision of contract farming using degraded forestland, riparian land and ponds to increase the access of skilled landless, marginal and small farmers on government land. The Agri-business Promotion Policy (GoN, 2006), had the objective of transforming current subsistence-oriented and dispersed agricultural production systems into a modern, competitive and commercially-oriented production system. However, the extent of agricultural commercialization has not been as expected. There is currently a need to integrate approaches to commercialization of agriculture by which farmers can learn through applied experience in situ.

Regarding farming policies, the seed sector in Nepal is regulated under the Seed Act (1988) and the National Seed Policy (GoN, 2000). The National Seed Policy aims to ensure the availability of quality seeds in the required quantity for various crops. The policy also emphasizes varietal development, seed multiplication, quality control and promotion of the private sector (Government of Nepal, 2000). Similarly, the Irrigation Policy (2003) and the Irrigation Regulations (2003) serve as the basic policy framework for irrigation. These policies focus on surface and ground water irrigation as well as conventional and non-conventional irrigation systems. The Irrigation Policy (2003) envisages involvement of the private sector in irrigation investments. The involvement of the private sector in the sector has not happened in the region. There remain virtually no large irrigation projects. Large and reservoir-backed irrigation schemes have not been initiated as envisioned by the Water Resources Strategy (Government of Nepal, 2011) and the National Water Plan for scaling up agricultural productivity.

The Local Self-Governance Act (1998), the Local Self-Governance Regulations (1999) and the Local Bodies Fiscal Administration Regulations (2007), have granted authority to local levels of governance (District Development Committees, Municipality and Village Development Committees) to levy various taxes and fees in their jurisdictions and operate projects and programs in support of local people's needs through these earnings. The Ministry of Federal Affairs and Local Development provides grants (conditional/unconditional) to local bodies (VDCs) with the objectives of making these institutions competent, strong, responsible and accountable in service delivery and ensuring maximum participation of the public in governance through the means of decentralization. Each VDC receives minimum NPR 1.5 million to NPR 3 million (approximately US$15,000 to US$30,000) grants from national budgetary allocations. The grant amount is determined based on population, cost and area-related indicators of the concerned VDCs. The Local Body Gender Responsive and Social Inclusion Budget Formulation Guideline (2012) is the guiding document for fund dispersal at decentralized levels of government. Of the total program budget, 50% is allocated for infrastructure development. Of the remaining 50% of the budget, 15% is allocated for agriculture development, while 35% is allocated for targeted activities. VDCs typically allocate this money at 10% for children's development, 10% for women's development and 15% for others (Dalit, differently abled peoples, Janjati, Madhesi, youth and senior citizens).

The Government provides social security allowances for senior citizens, single women and differently abled peoples. Since 2010, the VDC under the Ministry of Federal Affairs and Local Development has been providing monthly allowances to all citizens above 70 years, all Dalits above 60 years, all citizens above 60 years of age in the Karnali zone, all single women above 60 years and all widows below 60 years under its Social Security Program. It provides NPR 500 (US$5) monthly for them. The poor use a major part of these allowances to purchase food. The Social Security Operational Manual (2012) made the allowance distribution system more systematic and effective, however, there are still many practical hurdles to obtaining these allowances.

5.3.2 Key policies, process and institutional support for climate change

A key finding is that the Government of Nepal is already mainstreaming climate change considerations into national level planning frameworks and has developed a strong package of climate change strategies (e.g. NAPA, LAPA and the Climate Change Policy). At sectoral levels there is less mainstreaming, with objectives and actions often not framed in the context of climate change. Less progress has been made in updating policies to fully reflect current, and especially future, risks (IDS-Nepal, PAC and GCAP, 2014). However, a number of strategy documents have been produced that explicitly consider and address climate change impacts, and progress has been particularly strong in the agricultural sector with climate resilience at the core of the Priority Framework for Action and the draft Agricultural Development Strategy. Moreover, many of the policies and programs relevant to the forestry sector promote, implicitly or explicitly, activities that support resilience, and this offers a solid basis for the reframing the existing legislation going forward.

Nepal Environment Policy (1992) is considered as the first policy dealing directly with environmental issues in Nepal. The Nepal Environmental Policy and Action Plan analyzes the country's environmental issues through a multi-sectoral framework and sets forth a strategy for maintaining the country's natural environment, the health and safety of its population and its cultural heritage in the context of growing economic development. It was prepared in response to the growing awareness around maintaining a balance between economic development and environmental conservation, which culminated in the United Nations Conference on Environment and Development in 1992 (Earth Summit).

Nepal prepared a NAPA in 2010. The plan has six thematic areas including forests and biodiversity, agriculture, health, drinking water, energy and infrastructure. The NAPA implementation framework envisages that the operating costs will be kept to a minimum and at least 80% of the available financial resources will reach local levels to fund activities on the ground. In the NAPA, nine integrated projects have been identified as the urgent and immediate national adaptation priorities. Promotion of community-based adaptation through integrated management of agriculture, water, forest and biodiversity is considered the first sectoral priority.

In line with Nepal's Climate Change Policy and as a means of implementing the NAPA, Nepal approved the LAPA framework. It has prepared a National Framework for LAPAs with the objectives of **e**nabling communities to understand the changing and uncertain future climatic conditions and engaging them effectively in the process of developing adaptation priorities, to implement climate-resilient plans that are flexible enough for responding to changing and uncertain climatic conditions and to inform sectoral programs (such as forestry) and catalyzing integrated approaches between various sectors and sub-sectors. There are a number of initiatives in Nepal which build upon the institutional platform of CF in supporting adaptation actions. Two of the most notable of these are the Multi-Stakeholder Forestry Program (MSFP) and USAID-funded Hariyo Ban.

6. CLIMATE CHANGE IMPACTS, ADAPTIVE CAPACITY AND VULNERABILITIES

6.1 SUMMARY ANALYSIS OF RESULTS FROM VA MATRICES

Matrix 1 (see Annex 1 for tabular results)

As discussed in section 4.4, Matrix 1 brings together different information sets, namely community perceptions and empirical data, in order to assess the validity of assumptions around climate threats. Significant climate variables are listed, and through assessment and comparison of different information types, conclusions are drawn on whether given climate variables represent threats (or rather, if perceived threats might be due to factors external to climate). The research team was concerned about errors in interpretation that might occur if certain climatic conditions (or variables)

were presumed to have causal links to adverse impacts – which may, upon closer investigation, be attributed to other factors.

Matrix 2 (see Annex 1 for tabular results)

This matrix is intended to detail climate change impacts on sustainable livelihood assets, organized according to sector. Significant climate threats identified in the final column of Matrix 1 center around temperature extremes, changing precipitation patterns, leading to flooding and a range of other impacts on the priority sectors. Significant impacts are felt most acutely in the agriculture, livestock and water sectors. Immediate impacts of the increased temperatures are compounded by changing precipitation patterns and include declines in soil moisture and fertility and availability of water for irrigation and household use. The loss of water in the river for prolonged periods of the year has implications for groundwater and for ecosystems broadly including forests and associated plantations and nurseries. Livestock are adversely impacted by the combined effects of temperature increase and changing precipitation patterns, suffering from heat stress, loss of water dependent fodder sources and new diseases.

Matrix 3 (see Annex 1 for tabular results)

By listing the impacts according to asset (and sector) and providing an associated list of adaptive capacities possessed by the community, it is possible to develop an assessment of vulnerabilities according to climate threat. Adaptive capacities build upon the livelihood assets detailed in Matrix 2 and add the range of existing adaptive practices as well as prospective and possible innovations. Key vulnerabilities for the community center around agricultural production and dependence on a single, highly market-dependent crop with broader impacts on ecosystems in a context of climate change. Vulnerabilities associated with the CF landscape tend to emphasize a loss of biodiversity. This is evident in agricultural systems where sugarcane has displaced mixed cropping and home garden systems are relied upon for subsistence, medicine and a range of multiple purposes as well, as loss of biodiversity in forest ecosystems due in part to changing climatic conditions as well as management patterns. The loss of biodiversity can be seen in increased vulnerabilities in income, food security, health maintenance options, management of insects and pests, and gradual loss of a range of potentially climate resilient species for experimentation and promotion.

Matrix 4

This matrix presents the crux of the results relevant to this VA, namely proposed broad responses to the identified vulnerabilities, thus it is presented here in full tabular form. Of note is that although all preceding matrices listed possible adaptive responses categorized according to sector, many interventions can and should respond not only to multiple climate threats simultaneously, but must cut across sectors. As such, Matrix 4 includes broad responses to threats and vulnerabilities with consideration of additional assessment factors such as frequency of threat, seriousness and subjective measures of vulnerability rating.

6.2 TABULAR PRESENTATION AND ANALYSIS OF VA RESULTS

Matrix 4: Identifying Response Options to Vulnerabilities

CLIMATE CHANGE THREATS (from Matrix 1, Column E & Matrix 2 and 3, Column A)	FREQUENCY OF THREAT	VULNERABILITIES (synthesized from Matrix 3, Column E)	SERIOUSNESS OF IMPACTS (evidence according to indicators)	VULNERABILITY RATING (by the community)	POSSIBLE BROAD OPTION RESPONSES (result of other tools)*
Temperature increase, more intense dry season	Prolonged drought, typically every 2-3 years Temperature rise is continuous, but extreme peaks periodically every 5-6 years Fire in sugarcane fields occurs periodically every 2-3 years	Declining productivity of agricultural crops due to decreasing quality of soil (a function of extended periods of dryness, current cropping practices and chemical fertilizers) Reliance on a single monocrop (sugarcane) More labor intensive and increasing labor costs associated with sugarcane	More than 40% hand pumps are now dry for 4 months of the year Reduced cropping cycle of sugarcane to 2 years from 3	High Medium	Development of agroforestry plots on private land Planting of fast growing fodder and multipurpose tree species Introduction of no or low till agriculture practices to reduce soil evaporation Water retention pond construction Agroforestry within community forests, within home gardens Shift in agriculture crops to incorporating integrated farming systems which include agroforestry
Changing seasonality (agriculture)	Continuously decreasing agricultural productivity Erratic rainfall Rainy season being pushed back several weeks	Decreasing agricultural productivity and income due to changing rainfall patterns Decreasing income from sugarcane due to loss of productivity (result of multiple factors including pests, weeds, soil fertility and also capped prices by the sugar mill)	Invasive weeds and grasshoppers damaged more than 50 ha Declining price paid per kg of sugarcane as result of high weed composition	Medium High	Diversification of agriculture crops Natural buffers and pest breaks by interspersing crops and/or agroforestry Natural pest predators Conventional pest management Usage of compost manure as pest management strategy Capacity building of local people in integrated pest management Enterprise development to diversify income Delay of planting timing by 20 to 25 days

CLIMATE CHANGE THREATS (from Matrix 1, Column E & Matrix 2 and 3, Column A)	FREQUENCY OF THREAT	VULNERABILITIES (synthesized from Matrix 3, Column E)	SERIOUSNESS OF IMPACTS (evidence according to indicators)	VULNERABILITY RATING (by the community)	POSSIBLE BROAD OPTION RESPONSES (result of other tools)*
Changing seasonality (forest ecosystem) Changing forest composition	Gradual, incremental change	Changing forest composition Decreasing availability of useful multipurpose tree species Declining biodiversity within small forest Loss of original forest ecosystem through the entire district (conversion to agriculture or plantation)	Dabdabe, Kuphindo, Phosro and indigenous tree species such as Simal are disappearing Shift of tree species northward	Low-Medium	Supporting forest ecosystem corridors to higher altitude or latitude forests Tree seed bank Afforestation Agroforestry Implementation of silvicultural management methods in community forests, including replanting and protection of rarer indigenous species Encourage bees and other natural pollinators
Drying up of water resources	Incremental decline in water tables and seasonal drying up of surface water sources	Increasing workload of women by 1-2 hours daily No water available for home garden or for diversifying agricultural-based sources of livelihood Poorer households tend to be less economically diversified and more vulnerable to growing threat of water shortage Health implications of water shortage for humans and livestock	Tube well depth to access water has deepened to 70-80 feet from 30 feet over the past 10 years	Very high	Deep tube well digging Upstream water and landscape conservation Activities to recharge water tables Suite of water conservation landscape management practices
Flash flooding	Major floods every 8-10 years, whereas small floods typically every 3-4 years	Decreased forest lands and agriculture lands Upstream deforestation and unsustainable land management practices Human settlements located near rivers	Approximately 30 ha of agriculture land damaged, more than 100 plants (bamboo and sissoo) washed away	Medium	Construction of bioengineering structures in river side Construction of other infrastructure-based riverbank supports Increasing forest cover in community forests and outside along riverbanks Advocacy for improved upstream land

CLIMATE CHANGE THREATS (from Matrix 1, Column E & Matrix 2 and 3, Column A)	FREQUENCY OF THREAT	VULNERABILITIES (synthesized from Matrix 3, Column E)	SERIOUSNESS OF IMPACTS (evidence according to indicators)	VULNERABILITY RATING (by the community)	POSSIBLE BROAD OPTION RESPONSES (result of other tools)*
		Village and district relatively low lying and prone to flood Extreme flooding has potential to destroy bridges and prevent road access with multiple secondary implications			management
Loss of productivity of livestock	Outbreaks of livestock disease periodically occurring every 3 to 4 years	Decreasing condition of cattle health due to less availability of fodder, infestation of diseases Increasing labor intensity of stall kept livestock (entirely a burden for women) as a result of the CF establishment	3 buffalo and 2 goats have died in past several years due to livestock disease	Medium	Fodder and feed management Use of vaccination and anti-worm Veterinary doctors accessibility Cattle shed management Requesting livestock department support in identifying and responding to new diseases

* Based on consultations with community members, technical experts, desk research, experiences of project staff and comparable practices employed elsewhere.

6.2 SUMMARY ANALYSIS OF CLIMATIC IMPACTS, ADAPTIVE CAPACITIES AND VULNERABILITIES ACCORDING TO SECTOR

6.2.1 Agriculture sector

i. Description
Agriculture is the backbone of Nepal's economy, and the largest sector, contributing around 40% of Nepal's GDP. It employs 71% of the population directly and supports livelihoods of more than 75% of the population who are dependent on agriculture to varying degrees. While there are moves to commercialize agriculture, it remains largely subsistence-based. Agricultural productivity and levels of technology adoption are low. By far, the largest subsectors within agriculture are cereal, horticulture and livestock. Horticulture crops are grown mainly for sale while cereals are grown primarily for subsistence.

ii. Impacts
Agriculture has been, and stands to continue to be, one of the hardest hit sectors in the context of climate change. Climate change impacts on agriculture may take many forms. Flooding, for example, is a common threat throughout the country, often in the form of glacial lake outburst flooding. Bishnupur has not been immune to flashfloods and has consequently lost some 30 ha of farm land over the past decade due to flood-related damage. Increasing temperatures are resulting in a loss of soil moisture and fertility, which has been compounded by growing use of chemical fertilizers and other inputs. Soil biota and microorganisms (earth worms, azotobacter, etc.) have been in decline due to a combination of climatic and cropping (also climate induced) factors resulting in overall soil fertility decline.

A major issue in Bishnupur has been the widespread conversion about a decade ago from subsistence rice to sugarcane cash cropping. While the profits were initially high, the quantity and quality of the sugarcane have been in steady decline. This has been exacerbated by restrictive price ceilings set by the local sugar mills and by the growing costs of chemical and labor inputs required to produce the sugarcane. The community is now at a point where they are interested in considering alternative agricultural/agroforestry practices that would ensure a minimum income generation while still resilient to climatic and other shocks.

Other climatic impacts relate to labor required for agricultural production. The increasing temperatures prevent agricultural laborers from working the same number of hours and with the same efficiency as they would be able to under cooler conditions.

iii. Adaptive capacities
On a national level, adaptive capacity in the agricultural sector is reflected through key enabling and supportive policies. Examples of this include the Country Strategy and Program (2005-2009), which focused on providing assistance to rural areas to: 1) build or rehabilitate rural infrastructure; 2) improve access to credit; and 3) improve livelihoods through improving productivity, diversifying crops and raising livestock in line with location-specific needs.

At the community level, efforts to cope and positively respond to climate change impacts include employing rotational agriculture practices, which leave areas of farmland fallow periodically, and use of compost manure, legume-crop inter-cropping and introducing agroforestry practices. Other possibilities which exist but have not yet been employed include the delaying of seeding crops by up to a month in order to be better aligned with changing seasonal rains. Efforts to combat soil moisture loss could include low tillage agricultural practices, the use of organic manure and compost, mulching, cover crop and mixed cropping practices.

As water availability (or the lack thereof) is a primary concern, adaptation options might include drip irrigation, drilling of deep tube wells in order to access ground water, experimenting with drought resistant crop varieties and promoting deep rooted crops. Broader land use options might include the introduction of shelter trees into sugarcane farms, developing upstream and downstream water management strategies and the application of integrated, landscape management for water conservation objectives.

Integrated pest management is an angle which may be included and may involve agroforestry or the introduction of other natural barriers to pests. Fundamentally, however, it will likely be necessary to diversify not only crops, but also sources of livelihoods. Capacity building of farmers both in adaptive agricultural practices and other livelihood activities would be helpful.

CASE 1. Invasive weeds and sugarcane production

Indu's two ha of sugarcane farm are rented land. This land has now been used for seven to eight years for farming sugarcane. Originally, there were no climbers (invasive species) observed in the sugarcane farm. Now they are abundant. More specifically, the weeds take over the fields immediately after rains. The weeds create a dense thicket of stems that covers the canopy, providing less chance of aeration for the sugarcane inside.

Due to an increasingly dense infestation of weeds, production has been reduced each year. Five years ago, production was 900 quintal for the two ha. Last year 600 quintal was produced for the same two ha and this year it is expected to be closer to 300 quintal given the rise in insect pests. Contractors (from the sugar mills) and labor costs associated with weed removal will increase - further reducing the total income.

Indu Gautam
Lead farmer and secretary of Bishnupur CFUG

iv. Vulnerabilities

Given Nepal's heavy dependence on agriculture in conjunction with chronic borderline poverty, mirrored in Bishnupur, there are high levels of vulnerability to even minor climatic changes or shocks. Agriculture sector vulnerabilities in the community can be understood according to several key vulnerabilities. Of first order is water availability and the range of options that secure access to it would open up. The second significant vulnerability is dependence of a single cash crop and the resulting vulnerability it creates to a web of climate-related threats such as pests, weeds, declining soil fertility and increasing costs of production, including labor. While there is interest in moving away from community dependence on a single crop, exploring other integrated land management strategies depends on the availability of sufficient water to support other cropping alternatives. A major factor underlying the vulnerability of the Bishnupur community is that while they are somewhat better off financially from neighboring communities, many members can still be considered to be only slightly above the poverty level. They lack the savings and other financial assets that would be needed to springboard them into other income generating activities, or to even withstand prolonged climatic stress and loss of income.

6.2.2 Forestry sector

i. Description

Forestry is a sector that is prioritized for its links with environmental protection. There is about 5.83 million ha of forest nation-wide, comprising 39.6% of the total land area in Nepal. The rate of forest loss, however, is relatively high at 1.7% per annum. Macro level studies and visual interpretations revealed that Nepal's forest coverage and condition has improved by 0.06%, attributed largely to CF interventions.

Forestry is also closely interlinked with agriculture, energy production and rural livelihoods. Fuelwood is the principal source of rural energy within the country. NTFPs have become an important source of income for rural poor, medicines for primary health care and revenue for the government treasury. The forest sector contributes significantly to the livelihoods of rural poor; up to one-third of rural income is forest generated globally according to a study by the Center for International Forestry Research (Angelsen, 2011). Forests are increasingly being viewed through a lens of multi-functionality, providing important regulatory functions and provisioning ecosystem services, mitigating climate change and generating raw materials for industry, in addition to livelihoods of rural communities. According to government data, the forestry sector contributes approximately 15% of the national GDP.

ii. Impacts

Climatic impacts on forests, while not as dramatic as on the agricultural sector, have been noteworthy. These include phenomenological impacts on the fruiting and flowering cycles of trees as a result of changing seasonality, loss of soil moisture in the forest areas which is believed to be cause for loss of a range of fodder grasses and temperature increases ,which are likely responsible for shifting eco-zones and forest species composition. A number of species, including *Sisso*, are being observed to be shifting northward. The productivity of the forests has been negatively impacted by declining rivers (and possibly ground water) levels. Conversely, the forests have been damaged and multiple seedlings lost as a result of flash floods. In addition to these threats, the problem with invasive weeds and pest species in the farmland is also witnessed, to a lesser degree, within the forest areas, limiting regeneration of trees.

Specifically, the community has expressed concern at the loss of important livestock fodder species within the forest such as *Salimo, Padari, Arthunge, Kuvinde, Fosro, Dhus, Muse Kharki, Kharki and Khari*. These grasses were predominantly found in forest areas such as depressions that were often wet year round. However, due to growing dryness and drought, these grasses have become extremely difficult to find. Those forest tree species requiring higher amounts of water such as *Dabdabe, Sadhan, Kubhindo, and Foshro* are no longer being seen.

As mentioned, changes in the phenomenology of tree species are also observed in the area. Early shedding of leaves of *Sal* and *Asna* can be seen. Previously leaf shedding occurred in late March, but now it happens in late February. With this is the associated change in forest composition. There is evidence that the production of summer fruiting trees (mango, *Lichi, Jamun, Kusum*) has decreased while the production of fruits that ripen in the winter season (December/January) like *Amla and Amaro* have increased. Additionally, the community has observed the occurrence of new types of disease in fruit such as *Amla*, where up to 70% of fruit is infected. A new disease is also similarly affecting forest mango. Availability of wild mushrooms, relied upon by the community for consumption and sale has also been significantly reduced, presumed to be a result of changing rainfall patterns.

iii. Adaptive capacities

One of the main assets and mechanisms for leveraging adaptive capacity in Bishnupur is the institution of CF itself. CF practices, whether explicit or otherwise, have been addressing climate change impacts and supporting adaptation needs for years. Reforestation has long been a tool to mitigate localized flooding and landslide events, and to improve water quality and quantity within watershed areas (surface and ground water). Improved grass cultivation in forest areas, livestock provisions, land allocation for fodder collection in favor of the poor, to equitable NTFP distribution have all been standing practices within CF in Nepal.

In recent years, CFUGs, such as Bishnupur's, have played an important role in disseminating knowledge and information on climate change to its members. Following a bottom-up process, constitutions and operational plans are formulated with the participation of each household through surveys and group discussions, including through CFUG general assemblies. Representation in CFUG

committees is drawn from all social, caste and economic categories, and individuals are selected based on their capacities to share information easily with all members.

As part of the CFUG directive, the aforementioned activities are more focused on reducing the vulnerability of the poorest. CFUGs have also been able to connect the poorer members to alternative livelihoods to compensate for limited adaptive assets. Examples include establishing bamboo plantations near the houses of poorer community members and providing skills development training and equipment support for a bamboo-based enterprise. Additionally, the CFUG has established a revolving fund for the purchase of goats, another income earning opportunity for the poor.

CFUGs have been noted to build cohesiveness among different caste groups and reduce discrimination based on caste, gender and other social categories. Importantly, CFUGs are also connected to Nepal's political systems for improved representation and development service delivery through their national body, FECOFUN, as well as other forest and interest-based networks. The structure and process of CFUGs has improved the inclusiveness of governance in rural areas; there is mandated proportionate representation based on the population of the indigenous people, Janjatis, Madhesi, Dalits and women within its executive committees.

CFUGs are entry points for development service providers, providing valuable linkages with most state and local government agencies, NGOs and market-based institutions working in respective areas. These development-orientated organizations are implementing their services through CFUGs. CFUGs are viewed as stable and legitimate institutions in rural areas capable of facilitating a range of activities, including CCA and resilience building.

Finance has been a major barrier to CCA for the poor. Unable to make use of biogas or alternative fuel technologies, CFUGs have improved access to financial assets for the poorest of the poor through rural financial institutions. To obtain a loan from the Agricultural Development Bank, a villager needs to mortgage land at 12% interest. With the Sawalamban Bikas Bank, a local financial institution in Bishnupur, there is a 25% interest rate charged, but it does not require collateral. However, this still puts landless people in a vulnerable state given the higher interest rate. CFUGs provide low interest rate loans at 6% for the purchasing of sewing machines, medicine for cattle and people, scholarships, three-wheel bicycles for work, funding migrant work travel, etc. Clear guidelines to mobilize funds are provided through the CFUG governance system. Accordingly, 25% of all funds allocated are for forest management activities, such as forest fire line preparation, operational plan preparations and tree thinning and pruning. 35% are allocated for pro-poor focused activities, such as goat keeping, forest-based enterprise, such as bamboo crafts, bee hive briquette making, and *pamarosa* oil processing, and 40% are used for operational and rural development needs, such as office management, road construction, schools teacher wages and electrification. Thus, CFUGs do more than help facilitate CCA and rural development in Nepal; they build social capital for the poor and put in place the building blocks of climate change resilience.

iv. Vulnerabilities

The forest is a crucial component of landscape level functions. The role of forests in the Nepal context is significant given high poverty levels and the reliance on forests both as a safety net and source of much needed income or food sources as well as for its ecosystem regulating and provisioning services, upon which critical agricultural systems depend. Rural communities, and notably the poorest members of these, rely disproportionately on forests for firewood, fodder and NTFPs for sale, consumption and medicine, and for the water regulatory services the forest provides. All of these will increasingly be impacted by climate change.

The availability of fuelwood, particularly for the poor, has been drastically reduced. The major cause of this has been the expiration of the Operational Plan in 2010, but also the broader impacts of deforestation and forest degradation. In Bishnupur, members of the CFUG are from wealthier households and are able to generate fuelwood from the trees grown on private land, rather than relying exclusively on the community forest as well as having the means to purchase gas cylinders for

cooking, and/or have access to biogas through the waste produced by livestock. Poorer communities and poorer members of Bishnupur remain, however, disproportionately dependent on forest-based fuelwood and are extremely vulnerable to any restrictions of this. Women and children are almost exclusively responsible for fuelwood collection and for household energy security.

6.2.3 Livestock sector

i. Description

While typically considered a part of agriculture, the livestock sector is particularly significant in Nepal. This is especially evident in analyzing climatic vulnerabilities in Bishnupur and identifying the direct linkages between livestock and gender. Most rural families depend on livestock, in addition to agricultural crops, to support and send their children to schools and colleges. The education of the children tends to be the responsibility of the mother, and dairy and other livestock-generated sources of income are one of the few sources of income over which women have direct claim. Buffalo are the most important of the livestock, contributing 71.3% of the total milk production, and 65.3% of total meat production. The livestock sector contributes to 25% of the GDP.

ii. Impacts

Climate change strongly affects the livestock sector. Livestock, along with humans, are susceptible to temperature extremes, whether prolonged heat exposure or cold snaps. Cattle in particular appear to have been negatively impacted by extreme heat, with milk production reduced by 33% in Bishnupur. The second interlinked climate threat affecting livestock is drought, and the lowering of the water tables results in a growing scarcity of drinking water. Erratic rainfall has also reduced the total amounts available for vegetative growth, such as grass and leguminous fodder, which is necessary for feeding livestock. The decline in quantity and quality of fodder has impacted overall animal health and has led to declining milk production and income generated for the households. Further disturbances to the livestock such as a proliferation of biting insects stem from a growth in changing precipitation, temperatures, humidity and related cropping systems. Flooding has also affected livestock, killing a number of goats, increasing the stress on livestock through links to restraint in stalls, affecting access to fodder and compromising the market for dairy sales.

iii. Adaptive capacities

The ownership of one to two head of each cattle and buffalo per household are significant sources of household income as well as subsistence. Dairy production is consumed within the household and sold to the small dairy situated within Bishnupur as well as sold to larger markets in Harion or elsewhere. Access to dairy products for subsistence is culturally and nutritionally important. Given the prevalence of conservative Hinduism in the area, dairy can provide one of the few sources of animal protein. As earlier mentioned, there is a strong gender dimension to livestock raising, with the labor associated being the responsibility of women, but likewise any profits generated also accrue to women. This income source is often critical for household expenses, especially those relating to health and to children's education, which are also traditionally deemed women's responsibilities.

The assets associated with livestock include the healthful labor force of women to maintain and process milk, and the proximity of the community forest with fodder grasses and leaves for the cattle to consume. More recently, in a meeting organized by this project, it was announced that Bishnupur would become a priority piloting site for the district livestock department. Support from responsible line agencies may play an important role in developing sufficient appropriate fodder, in finding the optimal mix of hardy and high producing breeds as well as management strategies to reduce the labor burdens on women.

Case 2. Buffalo milk and household resilience

The household of Shanta Mainali has generated an average of NPR 9,600 (approximately US$10) in monthly income from the sale of buffalo milk. On a monthly basis she sells around 8 liters of milk at a rate of NPR 40 per liter. The rate has remained more or less stable over the past 10 years. However, investment costs have gone up. Veterinary expenditures and specialized feeds needed to supplement the loss of high quality fodder began to be significant costs over the past five to six years. Previously, natural grass and fodder was sufficient, and medicines and other veterinary costs were not required.

While income from buffalo milk was not traditionally a large amount, it was enough to cover education costs, medicine and other household expenses. There was no need to depend on borrowing money, including loans from the landlord.

Over the past few years, however, in addition to rising costs of keeping livestock, Shanta has been experiencing difficulties in meeting the basic needs of her livestock due to decreasing fodder, grass and other feedstuffs, due in large part to increasing drought.

Shanta Mainali
Bishnupur, Sarlahi

iv. Vulnerabilities

An important trade-off that has occurred in Bishnupur and has the potential to occur in other community forest contexts where adaptation is a goal, particularly in Nepal, has been the association of community forest establishment with a closing off of the public grazing commons. This is typically seen by forestry extension officers and land management experts as a positive and necessary step, preventing compaction of soil (a cause of flooding and poor soil saturation) and regeneration of trees. While true, the unintended consequences tend to impact the most vulnerable members of the community, (namely the poorest, and women) and thus are rarely factored into the decision-making process.

By restricting grazing land, livestock owners will be forced to stall rear their livestock, hand collect from forest areas (allowable amounts) of fodder and leaves for livestock as well as carrying water during periods when hand pumps are dry. As described earlier, the daily workload of women in the community is already onerous and the burden of stall raising livestock can easily add several hours of drudgery onto her daily schedule. This is evidenced by the dramatic halving of livestock owned by households in the community subsequent to the closing off of the grazing commons for community forest use. In addition to unforeseen negative impacts on both the income generating capacity of women through dairy and the increase in labor load, the corresponding reduction in livestock also leads to a reduction in organic manure, even more essential in the context of drought and declining soil fertility.

6.2.4 Water sector

i. Description

Water resources are a significant asset for Nepal's current economic development. The abundance of glacier fed water resources and Nepal's geo-physical features provide ample opportunities for hydropower production in Nepal. There are about 6,000 rivers in Nepal with a drainage area of 191,000 km^2, 74% of which lie in Nepal alone. About 83,000 megawatt (MW) hydropower generation capacity is available, which makes Nepal the second largest potential hydropower energy source in the world. If this natural resource is properly harnessed, it could generate hydropower, provide water for irrigation, industrial purposes and provide water for domestic purposes. However, despite the huge potential of hydropower in Nepal, it has only been developed to generate 0.1% of the national GDP.

ii. Impacts

Degradation of upland forests in the ecologically fragile Chure foothills, in combination with repeated exposure to drought, has led to negative impacts on the hydrological systems of Bishnupur. Previously (50 years or more) there was dense forest in the upper Chure, adjacent to Bishnupur. When the forest was converted to human settlement, the impacts of drought worsened. This coincided with declines in quality of water (heavy sedimentation) and then, eventually, an increase in the incidence of flooding. Community perceptions suggest that the loss of the upstream forest has led to noticeable and rapid changes in the local environment.

Pronounced drought and erratic rainfall has coincided with a growing demand for water within the area for irrigation and household use. This has also coincided with a growing incidence of pollution and other factors that limit the availability of potable water and increase the potential for future water resource conflicts. Local agriculture is mainly rain fed, and over the past few years, rain fed as well as irrigated crops are being badly affected by drought, flooding, erratic rainfall and other extreme weather events. In addition to growing industrial and population demands, the water sector has been one of the hardest hit by the impacts of climate change.

iii. Adaptive capacities

The adaptive capacities of the community with regard to the water sector are both in the form of hard infrastructure (tube wells, shallow hand pump wells, irrigation pipes, retention ponds, etc.) and also social capital, which is required for organizing and lobbying for water-related extension support. The community currently has 42 hand pumps, but 20 of them are dry November through December and again April through May. In addition the community has an abandoned well within the forest area which fell into disuse as river water piping was broken and the forest-based well was found to be too far from the agricultural fields to be directly useful. Repair and re-use for activities within and surrounding the forest may be potential options. In addition to shallow water sources, there is also the ground table which is lowering, but may be accessible through deep boring or through watershed level efforts to recharge the ground water table.

The community is relatively well connected to district level bodies of government and to political parties. They have organized previously around infrastructure issues and lobbied to have a feeder road put in. With strong and organized advocacy, the community was successful in having their infrastructure needs met.

iv. Vulnerabilities

The need for secure access to water for irrigation, livestock and human consumption are major vulnerabilities for the community. There is considerable worry and anxiety for the community associated with the gradual drying up of natural water bodies and the community wells. Previously (approximately 10-15 years ago) there were 58 ponds within the Village District Committee jurisdiction. Of these 18 are now permanently dried up. In peak heat periods of the year, all of the ponds may temporarily dry up, creating major concerns for community members in meeting the water needs of livestock, agriculture and households. Households with higher numbers of livestock are most vulnerable and as a coping measure, a number of farmers have reduced their cattle herds.

6.3 IDENTIFYING ADAPTATION OPTIONS

While a number of other important sectors and assets – such as education, health, employment and infrastructure – are also impacted by the effects of climate change, we consider that this targeted analysis of the forestry, agriculture, livelihood and water sectors has allowed for systematic assessment of climate change vulnerabilities in the CF landscape and determination of direct causal links between climate change threats and possible adaptation options for the Bishnupur community.

Despite the CF angle of this VA, there are both impacts as well as potential options that fall outside of the expertise of the project team. As such, this VA identifies general adaptation response ‘topics’ or areas in this report and as part of phase I (the VA phase) of the three-phase CF-CCA approach. Phase

II will then consist of a feasibility assessment involving relevant technical experts in the selection of the precise interventions and the development of activity work plans (and financing proposals where appropriate).

On the basis of Matrix 4, which identifies priority vulnerabilities, a selection of possible adaptation options has been identified. The options are linked specifically to the vulnerabilities identified, as opposed to a specific climate change threat or sector, as many of these potential responses cross-cut sectors and respond to vulnerabilities which result from a combination of climate (and non-climate) threats, which would be both difficult and unnecessary to disaggregate.

High priority **vulnerabilities** and/or those with obvious CF linkages include:

1. Declining productivity of agricultural crops due to decreasing quality of soil, changing rainfall patterns, increased pests and weeds.
2. Decreasing income from sugarcane due to loss of productivity as well as capped prices imposed by the sugar mill.
3. Reliance on a single monocrop (sugarcane) leaves the community without alternative sources of income.
4. Decreasing availability of useful multipurpose tree species within the community forest.
5. Increasing workload of women by 1-2 hours daily as a result of decreased nearby household water sources.
6. No water available for home gardens or for diversifying agricultural-based sources of livelihood.
7. Village and district are relatively low lying and prone to flood, which has the potential to destroy bridges and prevent road access with multiple secondary implications.

Potential **adaptation response areas** identified and prioritized with the community for further refinement and feasibility assessment have been narrowed down to the following three topics:

1. *Agro-forestry systems:* In order to support both ecosystem and livelihood resilience, one adaptation response area identified is in the strengthening of agro-forestry systems. The purpose would be to diversify cropping and land-use systems in order to meet multiple objectives such as reduced dependence on a single crop, increased overall forest cover for ecosystem services, and increased multi-functionality including trees for livestock fodder and income generation (e.g. bamboo, honey, medicinal or essential oils). These activities may take place within the community forest itself, in the areas surrounding it, on private lands including home gardens and agricultural lands and/or on communal lands (e.g. around wells, schools, roadways).

2. *Response to water shortage*: Despite evidence and forecasting of increased rainfall, a water shortage is perceived by the community to be one of their most prominent vulnerabilities. Tackling this problem requires an eye towards a short-term solution with long-term sustainability. It will likely involve a ‘suite’ of options possibly intersecting with agroforestry systems in that it would incorporate water conservation-oriented landscape management. This package of activities may include, but is not limited to, well drilling, retention pond construction, agricultural practices to conserve water and discussions at district and watershed level of management strategies for the ground water table. Responding to the issue of water shortage would have especially positive benefits for women in the community given that increased workload and drudgery is attributed directly to water collection or activities indirectly related, such as collection of fodder for livestock.

3. *Riverbank stabilization:* River flooding has been an ongoing challenge in Bishnupur community, so much so that it was the flooding that originally instigated the planting of the community forest as a protection measure. With a forecasted increased likelihood of more intense rainfall, there is a need to stabilize the riverbanks in and around the community in order to minimize soil and land erosion, maintain the integrity of the community forest and

reduce the impacts of flash flooding. This adaptation response area will likely involve one or more options related to bioengineering or conventional infrastructure along riverbanks adjacent to community forests.

6.4 NATIONAL AND LOCAL LEVEL FINANCING OPPORTUNITIES FOR ADAPTATION

Adapting to climate change is not a one-off activity, but rather requires consistent, continual efforts to understand vulnerabilities and invest time and resources in reducing them. An essential component of successful, ongoing adaptation at the community level is developing the capacities to link communities with domestic technical and financial resources, and vice versa, and strengthen capacities of government service providers to meet their departmental mandates. A lack of access to these resources contributes to a community's vulnerability.

An assessment of the potential funding sources available to the Bishnupur community reveals that the community has a myriad of potential options for adaptation support (See Annex 2 for more details on individual sources).

The best and most easily accessible sources of financing are also the most local, found in the DDC, the VDC and Municipality administrations (see table 7). The decentralized district offices of relevant ministries are also a reliable source of funding; however, the adaptation options that can be requested will depend upon the scope of each office. Below, these potential funding sources are matched with the options identified in table 7.

1. *Agro-forestry*: The District Soil Conservation Office (DSCO) can support agro-forestry providing saplings of fruit trees, indigenous species and other agroforestry or NTFP appropriate species, while the DFO can similarly provide saplings for income generation and subsistence use as well as providing technical support for forest management and operational plan development. The District Livestock Support Office can provide support around fodder and forage, potentially with relation to agro-forestry and overall land-use planning. Bagmati Sewa Samaj Nepal, which is one of the NGOs, can also support in design and layout.

2. *Water Shortages*: DSCO can support the establishment of water retention ponds while the Agriculture Development Project can provide technical and potentially some degree of financial assistance to establishing and supporting ground water supply systems (deep tube wells). The Harion Municipality Administration can support community development initiatives related to drinking water supply and irrigation.

3. *Riverbank Stabilization*: Both the DDC and the Harion Municipality Administration can provide resources for general awareness raising as well as disaster risk management and specifically riverbank stabilization. DSCO can also provide support in riverbank stabilization, and would be a good office to approach where technical assistance is also necessary (in addition to the financial resources).

Additionally, the DFO can provide direct technical support in the development of a revised CFOP for renewal. A number of agencies (DDC, Harion Municipality, Women and Child Development Office) can support awareness raising related to climate change and adaptation.

As the options listed above are all public sources of financing, the ideal time to submit requests and applications is during the months of June and July, at the beginning of the annual budget cycle. However, in some cases, applications can be received on a rolling basis.

Identification of the best sources of financing for various adaptation options will depend on the options identified jointly with the community during the phase II feasibility assessments and upon close consultation with the representatives of the funding source.

Table 7. Financing/in-kind support options for CF-based adaptation

Source	Description	Remarks
National level financing options		
Climate change adaptation fund	• Ministry of Federal Affairs and Local Development has been made the focal point to implement LAPA. • According to Nepal's climate change policy, over 80% of the climate change budget needs to be allocated to the local level.	There is debate on the share of total budget, and 80% allocation may need to be changed.
Ministry budget	• National Planning Commission has identified 11 ministries that have allocated budget for climate change: Urban Development, Irrigation, Finance, Science and Technology, Environment, Forest and Soil Conservation, Federal Affairs and Local Development, Energy, Education and Agriculture. • Climate budget lines were introduced in the 2011/12 annual budget. • Total climate change budget allocated for the fiscal year 2013/14 is NPR 53,482,516,000 or equivalent to 10.3% of total budget and 3.1% of total GDP. • Climate Finance Working Group at National Planning Commission was established under the coordination of the Joint Secretary.	Climate budgets were not implemented because of unsystematic budget transfer from center.
Key district level financing institutions for Bishnupur		
District Development Committee	• DDC has a climate change section. It can coordinate support from NGOs, private sector and public institutions for climate change.	
District Soil Conservation Office	• Can finance flood control, income generation of the poor through livestock promotion, upstream-downstream linkage management, and sub-watershed management.	
District Irrigation Office	• Can support sustainable irrigation systems to respond to drought.	
District Agriculture Office	• Can support CCA activities such as provision of drought resistance seed.	
District Forest Office	• Can finance adaptive forest management in community forests, institutional development of CFUGs, renewal of Operational Plans, provision of seedlings for private plantations, etc.	
Key local level financing institutions for Bishnupur		
CFUG	• CFUGs themselves can be credible financial institutions providing credits and grants. • It needs to spend at least 15% of total funds for forest management and 35% of total funds for poor-focused activities. • CFUGs are self-regulated and autonomous institutions. They can mortgage the community forest and can receive loans from banks.	
VDC or new Haribon Municipality in the case of Bishnupur	• VDCs need to spend 15% of total budget for environment and forestry sectors, especially in area of disaster risk management. • Recent municipality of Haribon has a lump sum of NPR 1.5 million budget for the DRR sector. It can address adaptation through CFUGs.	

Note: See also Annex 2 for further details.

7. CONCLUSION

As referenced in the 2014 report by Ministry of Science, Technology and Environment, Nepal has a large existing adaptation deficit and efforts to improve its resilience are urgently needed. The Ministry report identifies building capacity to respond to emerging risks as a priority area. One of the focal areas of such capacity building is research and pilot-testing of promising options, given the time required to implement sectoral, policy or other shifts in response to impacts. This USAID Adapt Asia-

Pacific-supported project contributes to these priority areas by: a) developing and piloting an innovative CF landscape approach to CCA which recognizes the dependence of vulnerable rural communities on integrated ecosystem services; and b) building on strong existing institutional foundations of CF by proposing an assessment framework and process through which CF-based interventions can be identified and implemented to support adaptive capacity.

While there are trade-offs associated with a sectoral approach to adaptation, there are also some clear benefits. By ensuring that opportunities for adaptation interventions are captured within institutional and regulatory frameworks, such as individual CFUG operational plans, the chances of successful uptake of the interventions is significantly increased. The interventions and climate sensitization of the CF landscape, which many communities rely upon to varying degrees for their livelihoods, has a good likelihood of finding a 'home' where the forestry sector is strongly validated and supported by national policies and institutions. The forestry sector, and CF in particular, is widely recognized to be of vital importance in Nepal. As such, CF-based adaptation may provide a range of capacity-building options which meet the immediate needs of its most vulnerable communities while also building in the long-term sustainability of ecosystem regulating and provisioning services. Thus it takes a more holistic, integrated approach than may be the case in the agriculture sector.

There is growing interest and support for the concept of linking CF to adaptation at national and district levels in Nepal and similar initiatives are being piloted as part of other programs and projects (such as the USAID-supported Hariyo Ban, the Multi-Sector Forest Programme and the Chure Conservation initiative among others). This project is timely in that it coincides with these initiatives and there is opportunity to share, learn and upscale successful practices within other programs. While the Bishnupur site is not sufficiently representative to generate a set of broader conclusions applicable to other sites, site-specific lessons learned may contribute to a broader national process of climate sensitive adaptation planning.

With regards to the specific methodology and tools developed and used in this project, the development of the VA framework and methodology required considerably more work than initially anticipated. While this resulted in some delays with project implementation, the overall VA framework is considered to be stronger and of broader relevance and application than expected. The effort invested was worthwhile given that RECOFTC intends to replicate this approach in other project countries. A significant milestone has been reached with the development and testing of this framework. While the methodology and especially the matrices remain too complicated for wider replication in other countries, the testing of the methodology was an important aspect of identifying potential areas for future adjustment and simplification. RECOFTC plans to replicate and further streamline the framework in adjacent, watershed-level sites in Sarlahi District where it is hoped that building upon experiences and data already collected will reduce VA timeframes considerably and strengthen the overall conclusions drawn by the project.

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ANNEX 1

Matrix 1: Identifying Climatic Threats and Impacts *(Community Perceptions and Data Combined Analysis)*

A	B	C	D	E
CLIMATIC VARIABLE	**EMPIRICAL DATA (according to sub-parameters)**	**EXPOSED SECTOR**	**IMPACT ASSESSMENT**	**CLIMATE CHANGE THREAT**
Temperature	**Maximum, minimum over 30 years, distribution of temperature extremes, changing patterns of temperature extremes** Maximum temperature years were 1994 (37.3°C May), 1995 (38.7°C May) Minimum temperature Years were 2003 (8.7°C Jan.), 2013 (8.1°C Jan.) Average temperature in Jan. decreases by 1.38% or 0.62°C per decade over 30-year period (1984-2013). Average decadal temperature increase in July and Sep. was 1.88% 1.22°C and 1.15°C over the 30-year period, respectively.	**Agriculture**	**Community perception**: • High and increasing temperatures in hot season makes it difficult to work in the fields • Decreasing temperature in the cool season also decreases productivity of agriculture crops • Continued intense temperature for more than one month that leads to crop productivity loss is defined by the community as drought. Frequent fires in sugarcane farm • Invasive species agriculture farm • "Jyanti" grass and Gandhejhar are seen in the sugarcane farm. These weeds are seen after increased planting of sugarcane **Empirical data**: • Meteorological temperature in period 1984-2013 shows that temperature in Dec and Jan. decreased by 0.62°C and 1.10°C, respectively, while temperature increased from 1.15°C in July and 1.22°C in Sep • Higher CO_2 levels can increase yields. The yields for some crops, like wheat and soybeans, could increase by 30% or more under a doubling of CO_2 concentrations	-More intense/ hotter dry seasons -Changing seasonality -Increase in cold waves
		Forestry	**Community perception**: • For last 15 years, the river, which borders much of the forest, only has water for only 3 to 4 months instead of whole year • Invasive species within forest • Changing forest composition • Increased mortality of young seedlings, e.g. many bamboo rhizomes planted in river side died • Some indigenous forest species such as Dabdabe (Guruga pinnata), highly commercial trees such as Simal (Bambax ceiba) and Sandan (Oogenia ogensis) and Gingat were once food sources for local people, but in recent history have vanished from the areas • Some wild grasses used as feed, such as Phosre grass, Banso grass, Ankura and Tauke Jhar, are now endangered. Habitat of Sissoo (Dalbergia sissoo) has shifted to higher elevations, from below 750 m to 1,500 m. Round mushroom (Dale Chyau) and	-More intense dry seasons -Changing seasonality

			Umbrella mushroom (Chhatre Chyau), which were common in this locality, have disappeared • Wild ferns (Nigro) were not found in the past, but are now available in this area	
		Livestock	**Empirical data**: • Regular intense heat can cause lethal damage to plants, increase evapo-transpiration, wilting, changes of composition of vegetation and disruption of photosynthesis • Temperatures of 30°C to 35°C promote growth of plants; concentration of CO_2 is increased, higher concentrations of CO_2 may reduce transpiration (i.e. water loss) as plants reduce their stomatal apertures	-More intense heat -Changing seasonality
			Community perception: • Regular heat intensity negatively affects domestic livestock • Buffaloes are sensitive to high temperature. They generally need more water, including water to reduce body temperature • The deficit of green grass and fodder due to heat and drought is resulting in nutrient deficiency. Many of the milking buffaloes suffer from "milk fever", reducing production of milk. The community has perceived that milk production has fallen by 25% to 40% • New diseases, such as reproductive diseases are being seen and increasing in occurrence	
			Empirical data: • Heat stress affects animals both directly and indirectly. Over time, heat stress can increase vulnerability to disease, reduce fertility and reduce milk production in cattle and buffalo • Studies have reported a strong negative correlation between rectal temperature and feed intake in pigs, poultry and dairy cows during times of heat stress. High ambient temperature causes hyperthermia, which reduces the activity of the appetite center in the medulla oblongata. In order to combat the high temperatures farm animals reduce their physical activity and spend less time eating Above 30°C the feed and energy intake declines to such an extent that domestic poultry are not able to compensate for it, and production declines rapidly with mortality rate increasing • In a comfortable temperature range, heat production of the animal is controlled and thus the dietary energy can be used for production (growth, egg and milk production) efficiently	
		Water	**Community perception**: • Increased demand for water for household work, domestic animals and plants. Agriculture farm requires more water to produce better yield • Numerous wells in the community have dried up (or are no longer deep enough to	-More intense dry season -Changing seasonality

			access water table **Empirical data**: • As temperatures rise, people and animals need more water to maintain their functions • Prolonged periods of high temperature, with low precipitation (i.e. drought) resulting in decreased water levels of shallow tube-wells and deep tube wells, as well as ponds drying up • Ground water level is raised in the year if long rainy season takes place. In the Chure area ground water levels rise by 0.5 m to 1 m if there is continuous rainfall for at least 3 months	
Precipitation	Amount of rainfall is increasing per decade over the past 30 years. -rainfall trends for Sarlahi are not linear (e.g. 1994 to 2003 was the peak decade for rainfall and temp – may be simply climatic variable. -Rainfall trends were sigmoid over previous 20 years, whereas since then it has been triangle in shape, e.g. distribution of rainfall saw more months with steady amounts in the past whereas rainfall has been erratic in recent years. -Rainfall in the month of July has been increasing continuously-Ground water tables have lowered by 12.2 m (10.89%) over the last 25 years (may or may not be attributed to climate change)	**Agriculture**	**Community perception:** • Due to reduced rainfall and seasonal shifts of rainfall by 15 to 30 days from the traditional cultivation months the community has replaced rice, wheat, mustard and pulse crops with sugarcane • Experiences of drought and heavy rainfall in the same year • Inundation of sugarcane fields due to heavy rain in July with a resulting 15%-20% decline in production. Also sugarcane crops have demonstrated reduced sugar and increased salt content making them less marketable, and resulting in loss of income. • After the rainy season, an abundance of invasive species such as Gandhe and Jyanti have increased significantly. This has led to reduced production of sugarcane by up to 50% • The sugarcane harvesting contractor is charging 10% to 15% more price per unit area due to the abundance of weeds • Three households from Bishnupur have migrated from the area as a result of damage to agriculture land **Empirical data:** • Precipitation data from the past 30 years from Bishnupur area shows that total amount of water increased (conflicting with community perception), however, total number of rainy months has been reduced by one month compared to before 30 years • Rainy season is now beginning one month earlier • Normally July is the rainiest month, though in recent years September has become the wettest • Heavy rainfall damages agricultural crops and land, more than 30 ha over the period 1984-2013 • On the other hand, in recent decades, production of rice, maize and wheat has declined in many parts of Asia due to increasing water stress, arising partly from increasing temperatures, increasing frequency of El Niño events and reductions in the	- Reduction in water resources - Flash floods - Inundation - Decreasing water quality

			number of rainy days • A 25% rainfall decrease and a 5% evapotranspiration increase could reduce the irrigated area by 75%. There could be a significant alteration of the balance between water supplies and water needs in major irrigation areas of arid zones due to climate change, many of these areas are located in developing countries	
		Forestry	**Community perception:** • Eucalyptus species absorbs more water and lowers water table, if water sources, such as hand pumps are nearby, they become dry • A large number of seedlings in plantation areas died in the first and second years due to reduced moisture available in the river bed soil. The replacement of the dead seedlings increased costs, including those associated with purchasing additional seedlings, transportation and labor costs • Fodder trees do not produce as many leaves as previously • Fruit trees bear fruit earlier, with less juice • More insects and pests during flowering and fruiting seasons	- Flooding - Inundation - Less rainfall
			Empirical data: • The effect of fluctuating rainfall has negative impacts on vegetation, forest area and tree functions • As a result of significant riverbank erosion events every 3-4 years community forest land has reduced. Trees are also washed away by the Harion river breaking its banks. More than 50 bamboo rhizomes were washed away from forest area • After CF was established, soil moisture in the forest area increased, forest stocks reached 2,260 trees, diversity increased with a range of NTFPs, trees and fruit trees (e.g. broom grass, gooseberry, curry leaf, katha tree, mango, guava, etc.) in the community forest • It is estimated that 10% decline in precipitation has raised the irrigation water requirements by at least 7%-8% subject to the crop species and environmental conditions	
		Livestock	**Community perception:** • Scarcity of fodder and grasses for livestock from private and public lands • Stress associated with seeking sufficient water to feed livestock • Intense and long days of rainfall leads to diseases such as fungal mouth and hoof disease, increases houseflies, stink flies and cattle worms. Various types of animal diseases have impacted cattle health and reduced milk production	-More intense dry season -Changing seasonality -Cold waves
			Empirical data: Regular and optimum precipitation creates favorable conditions for production of palatable grasses. Total dry nutrients available in forest areas are 25,000 kg, which is substantially less than required for the current livestock population. The typical	

			requirements of total dry nutrients are as follows: • Cow (48)= 32,064 kg • Buffalo (154)= 159,853 kg • Goat/sheep (189) = 13,239 kg Feed crop production influences the feed base of farm animals because it affects the yield, quality and price of forage and concentrate crops. The photosynthesis of C4 feed crops (corn, sorghum, millet) is more efficient, their heat and drought tolerance is better than those of the C3 crops (wheat, barley, rye, oat, sunflower, alfalfa, soy)	
		Water	**Community perception**: • Amount of rainfall has gradually decreased • Erratic rainfall, drought and excessive rain in the same year • Most of the shallow tube wells are dry from February to May. • Women need to spend 2 to 3 hours extra a day to collect water from neighboring hand pumps for domestic and livestock use • Livestock needs more water in the summer season	-More intense dry seasons -Changing seasonality -Decreasing water table
			Empirical data: • Ground water level is decreasing by 50 to 100 cm per year if adequate rainfall does not occur • 40% of the hand pumps are dry in the summer season • Discharge of water in both hand pumps and deep tube wells have decreased by 5 liters per second • Rainfall patterns have changed where excessive rainfall occurs periodically in July and August rather than previous uniform rainfall • Most of the streams, ponds and water sources in Chure and downstream are drying up • Temperature rise will melt glacial and ice caps currently depended upon for irrigation for most of the agricultural land in low latitude countries	
Humidity	Relative humidity (RH) in March and April is increasing rapidly, especially mid-day. In an average morning RH increases by 0.58%. In afternoons RH increases by 1.15% per annum. As a result afternoon feels	**Agriculture**	**Community perception**: • Water vapor in the form of mist and fog has increased in the atmosphere over the last few years • There is vegetable wastage due to prolonged fog with sugarcane harvesting being greatly affected, leading to serious losses in agriculture production • Potato, mustard and pigeon pea crops are most sensitive to prolonged fog with corresponding high mortality rates • Wage labor efficiency has decreased due to dense fog and cold • The humidity affects experiences of cold leading to deaths and other illnesses for impoverished individuals in particular	- Intense heat - More intense dry season - Change seasonality

	warmer than mornings. There was substantial variation between the RH levels of January and December over the 3 10-year periods documented, whereas July and August have much less variation.		**Empirical data**: • Relative humidity in March and April is increasing rapidly. On average, morning RH is increasing by 0.58% whereas afternoon RH is increasing by 1.15% per annum. As a result afternoons feel warmer than morning in summer and cooler in winter Particularly there is great variation in the relative humidity of January and December in each 10-year period whereas July and August have much less variation • Leaf blight, fusarium and stem rot diseases are observed if there is prolonged high humidity	
		Forestry	**Community perception**: • Growth of small plants is affected, may suffer from greater exposure due to ground fog • Bamboo forests serve as a buffer against severe cold in winter and intense heat in summer season • Trees and related plants protect agriculture crops from intense heat and severe cold	-More intense dry season -Change seasonality -Increase water vapor in the air
			Empirical data: N/A	
		Livestock	**Community perception**: • Buffaloes and goats are sensitive to fluctuations in temperature and humidity	-Changing seasonality -Cold waves -Drying up of water levels in tube wells -
			Empirical data: • Livestock produce more calves in optimum temperature and humidity as they are sexually more active. Unfavorable temperatures (too cold or too hot environments) lead to an increased heat production by the animal, i.e. there is more loss of energy, and in consequence less energy remains for production at the same level of energy intake, and the efficiency of energy use deteriorates	
		Water	**Community perception**: • Experiencing greater heat with high humidity, and increased sweating, requiring increased water intake • More moisture in the atmosphere helps to increase life of water sources (e.g. wells)	-More intense dry season -Cold waves
			Empirical data: • It is assumed that CO_2-induced warming will create a substantial increase in atmospheric water vapor. Water vapor is a much more potent greenhouse gas than CO_2, so substantial increases in atmospheric water vapor can certainly cause significant warming • Warmer air is able to hold more water than cooler air, so absolute water vapor would have to increase quite substantially for relative humidity to remain constant or increase in a warming world	

Wind		**Agriculture**	**Community perception**: • Frequency of strong winds (hurricanes) has reduced after establishment of forests However, there are unusually strong winds in September –October which damage sugarcane and other agriculture crops	Windstorms
			Empirical data: • April is the peak season for wind in the Terai • Strong winds with rainfall occur in September- October, damaging sugarcane and other agriculture crops • Monsoon winds happen due to low pressure in the Bay of Bengal	
		Forestry	**Community perception**: • Forests act as wind breakers and also protect against dust and other airborne pollutants. Before forest establishment, stronger impacts from wind occurred. For example, in the past, strong winds caused damage to structures such as houses • Previously hurricanes damaged and uprooted trees, and damaged fruit from trees	Windstorms
			Empirical data: • Trees provide a valuable shelterbelt that provides protection from the wind. The shelterbelt controls wind velocity up to 10 times the tree height in the front side and 30 to 50 times the leeward side of the tree • Wind is also an important factor in dispersing seed of some tree species	
		Livestock	**Community perception:** • Wind generally carries sand, pebbles and foreign material from one place to another, with possible impacts on livestock • Strong winds (hurricanes) can be fatal for livestock	Windstorms

Matrix 2: Assessing Threats and Impacts through an Asset Lens

A	B	C	D	E	F
CLIMATE CHANGE THREAT ***(from Matrix 1, Column E)***	**EXPOSED SECTOR** ***(from Matrix 1, Column C)***	**ASSETS**	**ASSET DESCRIPTION**	**IMPA-CTED?**	**DESCRIPTION OF IMPACTS ON SECTORAL ASSETS**
(Temperature) Intense heat More intense dry seasons Changing seasonality Cold waves	**Agriculture**	**Natural**	Land, crops including local seed varieties, seed stocks, organic manure, water table, rivers	Yes	• Soil losing moisture and becoming hard due to factors including regular intense heat • Subsistence and cash cropping of maize, paddy, wheat, mustard, lentil, pigeon pea, cow pea farming no longer viable • Loss of water for irrigation, high dependency on rain • Less juicy sugarcane with declining market value • Invasive species in agriculture fields • Frequent fire in sugarcane farm
		Social	Local knowledge of indigenous species and attributes	No	
		Financial	Crop yields, cash income, seed stock for future years as capital, loans and credit available	Yes	
		Physical	Tube wells, connecting roads and East West Highway for easy market access	No	
		Human	Agriculture wage labor, local entrepreneurs and individuals with higher education relevant to agriculture	Yes	
	Forestry	**Natural**	Trees, forest lands, rivers	Yes	• Low survival rate of seedlings in plantation • Rivers dried and moisture lost in rivers • Forest lands less productive due to dryness • Increased incidence of fires in forest and surrounding areas including sugarcane crops • Increased temperatures reducing periods for collective meetings • Former forest inventory and management practices may no longer be suitable
		Social	CFUGs, collective action in responding to fires, forest management, regular meetings and Community Forest OP with sustainable use regulations, association with members of FECOFUN, strong FECOFUN presence and support	Yes	
		Financial	CFUG account, credit and grants available from DFO, DSCO and others for forest initiatives, interest in 'model site' visits offering potential for income	No	
		Physical	Tube wells, disabled well within community forests that could potentially be connected to river, adjacent river, connecting road and East West Highway for easy market access	No	
		Human	Association with FECOFUN brings in skills and knowledge in forest management, DFO is supportive and has trained and capable staff	No	
	Livestock	**Natural**	Cattle (including improved varieties and hybrid mixes), buffalo (hardy but low heat resistance), grasses for fodder, surrounding forest for bedding, fodder and fuel for livestock feed production, adjacent river	Yes	• Loss of grass and fodder for feeding livestock • Due to heat stress in livestock, milk production decreased by 33%, loss of NPR 150 to NPR 200 per day per farmer • Loss of income to farmers
		Social	Women's dairy cooperative, strong gendered dimension providing validation and self-support to women in Bishnupur	No	
		Financial	Cash income from dairy, direct market access within community itself	Yes	
		Physical	Roads to nearby markets, community-based dairy	No	
		Human	Extensive local and gender-based knowledge on livestock raising and husbandry, respected by community	No	

	Water	**Natural**	Ponds, lakes, water tables, natural depressions in forest areas, seasonal mists and fogs, high humidity levels	Yes	• Decreased water level of hand pumps, drying up of water ponds and wells • Hand pumps being offline for 3 to 4 months of the year • Loss of fish in the river due to intense heat
		Social	Membership in water management collective	No	
		Financial	Potential support through DSCO, municipality and communities own collective fundraising to support improved water access	No	
		Physical	Hand pumps, tube wells, river irrigation systems, disabled well in forest	Yes	
		Human	Knowledgeable technical staff in DSCO and deep tube well department, former underground oil surveys have indicated presence of deep water sources	No	

(Precipitation) Drought (extended periods without rain) Flash flooding Due to intense inundation	**Agriculture**	**Natural**	Land, crops including local seed varieties, seed stocks, organic manure, water tables, rivers	Yes	• Damaged agriculture lands and crops due to flooding (30 ha land lost in past decade) • Reduced productivity of agriculture crops due to precipitation extremes • Increasing infestation of insect pest in agriculture crops • Drought and crop failure leading to migration of local labor
		Social	Local knowledge of indigenous species and attributes	No	
		Financial	Yield, cash income, seed stock for future years as capital, loans and credit available	No	
		Physical	Tube wells, connecting road and East West Highway for easy market access	Yes	
		Human	Agriculture wage labor, local entrepreneurs and individuals with higher education relevant to agriculture	Yes	
	Forestry	**Natural**	Trees, forests land, rivers	Yes	• Damage of forest lands and trees due to flash flooding (sissoo and bamboo plants in particular have been damaged previously) • Deceasing quality and diversity of forest trees • Increasing invasive species
		Social	CFUG, collective action in responding to fires, forest management, regular meetings and Community Forest OP with sustainable use regulations, association with members of FECOFUN, strong FECOFUN presence and support	No	
		Financial	CFUG account, credit and grants available from DFO, DSCO and others for forest initiatives, interest in 'model site' visits offering potential for income	No	
		Physical	Tube wells, disabled well within community forest that could potentially be connected to river, adjacent river, connecting road and East West Highway for easy market access	Yes	
		Human	Association with FECOFUN brings in skills and knowledge in forest management, DFO is supportive and has trained and capable staff	No	
	Livestock	**Natural**	Cattle (including improved varieties and hybrid mixes), buffalo (hardy but low heat resistance), grasses for fodder, surrounding forest for bedding, fodder and fuel for livestock feed production, adjacent river	Yes	• Increasing water shortage stress to livestock in dry season • Increasing incidence of fungal infections in livestock including mouth and hoof diseases during rainy season • Increasing insect population including stink flies and mosquitos creating stress on milking buffalo
		Social	Women's dairy cooperative, strong gendered dimension providing validation and self-support to women in Bishnupur	No	
		Financial	Cash income from dairy, direct market access within community itself	No	
		Physical	Roads to nearby markets, community-based dairy	Yes	

		Human	Extensive local and gender-based knowledge on livestock raising and husbandry, respected by community	No	and reducing milk production • Worsening hygienic conditions in cow sheds due to continuous rain
	Water	**Natural**	Ponds, lakes, water tables, natural depressions in forest areas, seasonal mists and fogs, high humidity levels	Yes	• Increasing frequency of erratic rainfall, high run off and less water retention capacity in soil • Increasing evidence of drying up of river and ponds • Decreased discharge rate of hand pumps and deep tube wells
		Social	Membership in water management collective	No	
		Financial	Potential support through DSCO, municipality and communities own collective fundraising to support improved water access	No	
		Physical	Hand pumps, tube wells, river irrigation systems, disabled well in forest	Yes	
		Human	Knowledgeable technical staff in DSCO and deep tube well department, former underground oil surveys have indicated presence of deep water sources	No	
(Humidity) Changing seasonality (increasing fog and mist, increasing atmospheric water vapor during cold season)	**Agriculture**	**Natural**	Land, crops including local seed varieties, seed stocks, organic manure, water tables, river	Yes	• Decreasing soil moisture and organic matter in soil of agricultural lands • Decreasing usability of agricultural lands due to declining soil fertility • Decreasing soil biota (earth worms, azotobacter, etc.) • Agricultural laborers are not able to work at full capacity due to cold (related to fog)
		Social	Local knowledge of indigenous species and attributes	No	
		Financial	Yield, cash income, seed stock for future years as capital, loans and credit available	No	
		Physical	Tube wells, connecting road and East West Highway for easy market access	No	
		Human	Agriculture wage labor, local entrepreneurs and individuals with higher education relevant to agriculture	Yes	
	Forestry	**Natural**	Trees, forest lands, rivers	Yes	• Changing habitat of tree species composition • Shifting of several species northwards • Disappearance of some tree species including needed fodder species (Dabdabe, Phosro, Simal, Gingat)
		Social	CFUG, collective action in responding to fires, forest management, regular meetings and CF OP with sustainable use regulations, association with members of FECOFUN, strong FECOFUN presence and support	No	
		Financial	CFUG account, credit and grants available from DFO, DSCO and others for forest initiatives, interest in 'model site' visits offering potential for income	No	
		Physical	Tube wells, disabled well within community forest that could potentially be connected to river, adjacent river, connecting road and East West Highway for easy market access	No	
		Human	Association with FECOFUN brings in skills and knowledge in forest management, DFO is supportive and has trained and capable staff	No	
	Livestock	**Natural**	Cattle (including improved varieties and hybrid mixes), buffalo (hardy but low heat resistance), grasses for fodder, surrounding forest for bedding, fodder and fuel for livestock feed production, adjacent river	Yes	• Decreasing health of livestock (prevalence of infectious disease) • Reduction of milk production by 33% • More care intensive livestock business
		Social	Women's dairy cooperative, strong gendered dimension providing validation and self-support to women in Bishnupur	No	
		Financial	Cash income from dairy, direct market access within community itself	Yes	

		Physical	Roads to nearby markets, community-based dairy	No	
		Human	Extensive local and gender-based knowledge on livestock raising and husbandry, respected by community	No	
	Water	**Natural**	Ponds, lakes, water tables, natural depressions in forest area, seasonal mists and fogs, high humidity levels	Yes	• Decreasing water quality • Hand pumps being offline for 3-4 months a year due to wells drying up • Increase of water vapor in the atmosphere, especially during cold season
		Social	Membership in water management collective	No	
		Financial	Potential support through DSCO, municipality and communities own collective fundraising to support improved water access	No	
		Physical	Hand pumps, tube wells, river irrigation systems, disabled well in forest	Yes	
		Human	Knowledgeable technical staff in DSCO and deep tube well department, former underground oil surveys have indicated presence of deep water sources	No	
(Wind) Drying up of water sources due to evaporation	**Agriculture**	**Natural**	Land, crops including local seed varieties, seed stocks, organic manure, water tables, rivers	Yes	• Sugarcane damaged by strong winds leading to reduced production/ income generation
		Social	Local knowledge of indigenous species and attributes	No	
		Financial	Yield, cash income, seed stock for future years as capital, loans and credit available?	No	
		Physical	Tube wells, connecting road and East West Highway for easy market access	Yes	
		Human	Agriculture wage labor, local entrepreneurs and individuals with higher education relevant to agriculture	No	
	Forestry	**Natural**	Trees, forest lands, rivers	Yes	• Positive impacts (reduction of sand pollution in homes due to buffering effect of forests) • Decreased damage to homes from direct effect of wind • Loss of some top soil due to strong winds
		Social	CFUG, collective action in responding to fires, forest management, regular meetings and CF OP with sustainable use regulations, association with members of FECOFUN, strong FECOFUN presence and support	No	
		Financial	CFUG account, credit and grants available from DFO, DSCO and others for forest initiatives, interest in 'model site' visits offering potential for income	No	
		Physical	Tube wells, disabled well within community forests that could potentially be connected to river, adjacent river, connecting road and East West Highway for easy market access	No	
		Human	Association with FECOFUN brings in skills and knowledge in forest management, DFO is supportive and has trained and capable staff	No	
	Livestock	**Natural**	Cattle (including improved varieties and hybrid mixes), buffalo (hardy but low heat resistance), grasses for fodder, surrounding forest for bedding, fodder and fuel for livestock feed production, adjacent river	No	N/A
		Social	Women's dairy cooperative, strong gendered dimension providing validation and self-support to women in Bishnupur	No	
		Financial	Cash income from dairy, direct market access within community itself	No	
		Physical	Roads to nearby markets, community-based dairy	No	

		Human	Extensive local and gender-based knowledge on livestock raising and husbandry, respected by community	No	
	Water	**Natural**	Ponds, lakes, water tables, natural depressions in forest area, seasonal mists and fogs, high humidity levels	Yes	• Water contaminated by blown in pollutants (sand, dust, etc.) in wells, ponds • Reduced amounts of water in rivers and wells • Increased water needs by people and domestic animals
		Social	Membership in water management collective	No	
		Financial	Potential support through DSCO, municipality and communities own collective fundraising to support improved water access	No	
		Physical	Hand pumps, tube wells, river irrigation systems, disabled well in forest	Yes	
		Human	Knowledgeable technical staff in DSCO and deep tube well department, former underground oil surveys have indicated presence of deep water sources	No	
(Flooding – associated with, but not limited to precipitation)	**Agriculture**	**Natural**	Land, crops including local seed varieties, seed stocks (??) organic manure, water table, river	Yes	• Periodic damage of agricultural crops and lands (30 ha land) • 3 households displaced due to loss of agriculture land in past • Poor quality of roads required for market access due to inundation of road
		Social	Local knowledge of indigenous species and attributes	No	
		Financial	Yield, cash income, seed stock for future years as capital, loans and credit available	No	
		Physical	Tube wells, connecting road and East West Highway for easy market access	Yes	
		Human	Agriculture wage labor, local entrepreneurs and individuals with higher education relevant to agriculture	No	
	Forestry	**Natural**	Trees, forest lands, rivers	Yes	• Damage of trees on riverbanks (bamboo and other trees) • Damage to forest lands (impacting annual allowable cut) • Increasing insecurity of forest access due to probability of flooding
		Social	CFUG, collective action in responding to fires, forest management, regular meetings and CF OP with sustainable use regulations, association with members of FECOFUN, strong FECOFUN presence and support	No	
		Financial	CFUG account, credit and grants available from DFO, DSCO and others for forest initiatives, interest in 'model site' visits offering potential for income	No	
		Physical	Tube wells, disabled well within community forests that could potentially be connected to river, adjacent river, connecting road and East West Highway for easy market access	No	
		Human	Association with FECOFUN brings in skills and knowledge in forest management, DFO is supportive and has trained and capable staff	No	
	Livestock	**Natural**	Cattle (including improved varieties and hybrid mixes), buffalo (hardy but low heat resistance), grasses for fodder, surrounding forest for bedding, fodder and fuel for livestock feed production, adjacent river	Yes	• Loss of goats due to flooding • Poor quality of riverside grass and fodder due to inundation
		Social	Women's dairy cooperative, strong gendered dimension providing validation and self-support to women in Bishnupur	No	
		Financial	Cash income from dairy, direct market access within community itself	No	
		Physical	Roads to nearby markets, community-based dairy	No	
		Human	Extensive local and gender-based knowledge on livestock raising and	No	

			husbandry, respected by community		
	Water	**Natural**	Ponds, lakes, water tables, natural depressions in forest areas, seasonal mists and fogs, high humidity levels	Yes	• Sudden increase in well water levels • Increased water borne insects and pests (mosquito) • Loss of agricultural land due to riverbank erosion, exacerbated by flooding
		Social	Membership in water management collective	No	
		Financial	Potential support through DSCO, municipality and communities own collective fundraising to support improved water access	No	
		Physical	Hand pumps, tube wells, river irrigation systems, disabled well in forest	Yes	
		Human	Knowledgeable technical staff in DSCO and deep tube well department, former underground oil surveys have indicated presence of deep water sources	No	

Matrix 3: Identifying Vulnerabilities

A **CLIMATE CHANGE THREAT** ***(from Matrix 1, Column E & Matrix 2, Column A)***	B **EXPOSED SECTOR** ***(from Matrix 1, Column C & Matrix 2, Column B)***	C **IMPACTS** ***(synthesized from Matrix 2, Column F)***	D **EXISTING ADAPTIVE CAPACITIES**	E **VULNERABILITIES**
Increasing temperatures, intense heat	**Agriculture**	**Decrease in soil moisture,** decreased agricultural production **Loss of soil fertility,** decreased agricultural production **Reduced work hours,** decreased work efficiency, decreased income generation	• Existing water sources • Mulching potential • Low/no till agricultural practices • Traditional agricultural practices, including rotational agriculture, use of manure for compost, legume use in inter-cropping, strengthening agroforestry practices • Drip irrigation practices • Promotion of deep rooted crops • Shelter-wood trees in sugarcane fields • Upstream and downstream water management approaches • Integrated, landscape level farming systems • Construction of retention ponds	• Declining availability of irrigation, limited forest-based and other forms of mulch. Dependence on single commercial crop requiring intensive management and high economic/ climatic risk • Decreasing agricultural productivity and income due to changing rainfall patterns and shifting seasonality • Decreased lifespan of sugarcane to only 2-3 years after planting • Drying up of hand pumps for household and livestock water consumption • Declining water levels in wells • Dependence on mono-cropping • Dependence on upstream water usage • Loss of traditional agricultural crop seed • Loss of quality of agricultural land • More labor intensive agricultural crops and increasing. labor costs
	Forestry	**Low survival rates of seedlings** - increased cost of plantation **Drying up of river** - shortage of irrigation water **Decreased productivity of forest**- inadequate availability of firewood, fodder and timber	• Planting of indigenous species • Planting cycles coinciding with changing seasonality and monsoon • Use of compost • Promoting indigenous tree species rather than exotics • Promoting private orchards and home gardens • Promoting private forestry in bunds, orchards and fallow land • Multi-layer forest cropping system • Fire lines • Diversification of forest tree species • Interest in multipurpose tree plantation • Abundant local knowledge on	• Increased costs and wasted labor from loss of seedlings. • Negative impacts of forest quality, quantity and diversity. • Policy and procedure constraints that hinder forest management and sustainable forest use. • Disappearance of some useful fodder tree species from locality

			characteristics of indigenous species and multiple benefits provided	
	Livestock	**Loss of grass and fodder to feed livestock** - decreased milk production, reduced health immunity **Heat stress to livestock** - reduced milk production by 33%, loss of NPR 150 to NPR 200 per day per farmer **Loss of income to farmers** - decreased income contribution from milk	• Agroforestry, planting of fodder, *Napier*, broom grass and multipurpose trees in bund, and private land. • Indigenous breeds of hardy cattle, buffalo and access to improved, high yielding varieties • Alternative feed, corn, husk, wastage • Social capital of women's group involved with dairy production • Access to local dairy with direct market linkages • Manure production with potential benefits both as fertilizer and for biogas energy production • Use and experiment with NTFPs, fodder and grass that may work as coolants during high heat • Improve cattle shed construction so as to improve airflow circulation and increase comfort of livestock. • Explore new ways of trying to ensure adequate water for livestock consumption and bathing • Experiment with feeding bamboo leaves mixed with grass to cattle. • Vaccinate animal with anti-PPR and other disease vaccines • Promote crossbreeding with indigenous breeds for more resilience in local environment • Insurance of livestock	• Declining health conditions of cattle • Women are required to fetch water at least three times per day to provide for cattle's consumption • Cattle were previously allowed free range and to seek water on their own, now with the establishment of community forests they must be kept in stalls • Reduction of quantity of milk production and corresponding loss of income • Death of livestock due to new diseases being experienced • Women are required to spend more time collecting fodder and grasses from distant forests/lands to feed cattle (currently they are not officially allowed to extract from community forests due to expired OP)
	Water	**Decreased water levels** - drying up of hand pumps for 3 to 4 months of the year **Increased water stress** - Increased workload of women by 2 hours to collect water for household and livestock purposes **Loss of fish in the river** - decreased aquatic biodiversity and total numbers	• Retention pond construction is an option • Rivers • Natural ponds and depressions in forest lands • Upstream conservation movements and organization • Increasing depth of tube wells	• Inadequate water for farming, livestock and household use

			• Interest and commitment of male members in addressing these concerns	
(Precipitation) Drought (extended periods without rain)	**Agriculture**	**Loss of agriculture lands and crops** - 30 ha of agricultural land lost in past decade	• Deep tube wells for ground water sourced irrigation • Water table (though declining) • Good drainage system in case of low land • Upstream and downstream linkage for recharging downstream water access • Capacity building opportunities with farmers related to adaptive technologies (participatory action research) • Integrated pest management • Use of organic manure • Delay planting of corn by 25 to 30 days to synchronize with shifting rainy season.	• Decreased production of sugarcane combined with deteriorating quality • Loss of fertility and productivity of agriculture farm lands (soil) • Emergence of new and aggressive types of weeds, insects and other pests damaging crops • Lowering of water table by 0.5 m per year in downstream areas in particular • Intensifying cold snaps in January and greater heat intensity in July and September. Reduction of efficiency and productivity of laborers
		Reduced productivity of agricultural crops and increasingly restricted selection of crop types - shift towards rain fed crops e.g. sugarcane	• Rotational cropping system to use moisture and nutrients of soil. • Use of organic manure and compost to retain soil moisture and fertility. • Change crop planting practices to synchronize with changing seasons (e.g. late sowing of paddy, wheat and maize) • Investing in disease resistant varieties	
		Increasing infestation of insects and other pests - decreased production of agriculture crops and increased labor and other investments		
	Forestry	**Changes in fruiting and other tree behaviors** - lower quality of fruits and other products, or none produced at all in some cases	• Shelterbelt on the windward side to protect small trees. • Silvicultural practices to create space for regeneration and proper aeration • Indigenous fodder tree species such as Badahar, Kutmiro, Phosro, Khari, Khanyu • Planting of broadleaved fodder tree species with multiple - uses in community forests as well as private farm land • Plant more deep rooted and hardy indigenous tree species • Ensure mixed planting of tree species to enhance biodiversity – reduce initial plantation species like eucalyptus	• Loss of fodder and other multiple function tree species (*Dabdabe, Kubhindo, simal, phosre*) • More invasive species in the forest • Disproportionate impacts on livelihoods of poorest members of community (e.g. those with few options other than forest dependence) • Less predictable and negatively impacted fruiting and other cycles in forest trees
		Poor quality of forest trees - inadequate supply of basic forest products for fodder, livestock bedding, fuelwood, construction materials and other NTFPs		
		Increase in invasive species - decreased productivity		

			• Actively plant NTFPs and species with multiple functions inside and outside the community focus	
	Livestock	**Shortage of water** - livestock water stress **Increased cattle disease** - increased medical costs and death of livestock due in part to limited and low quality water sources **Increased pests such as stink flies** - disturbance to livestock and reduced milk production	• Opportunities for cattle shed improvement that allow greater comfort for cattle and disease reduction • Promote grasses such as Napier, Vetiver, broom grass and Stylo that are more nutritious and palatable • Strong support from district livestock department which has nominated Bishnupur as priority pilot sites • Promotion and line agency support for crossbreeding of cattle to seek optimal hardiness and productivity • Vaccination of cattle against PPR and other diseases • Spraying of pesticide and possibilities for natural pesticides	• 2-3 hours more time required for water collection per day for livestock consumption • Disproportionate burdens on poorer women for water collection • Less opportunities for income and subsistence food security due to no water for home gardens • Water born disease and impacts on sanitation
	Water	**Increasing frequency of erratic rainfall** - high run off and less water retention in soil **Decreasing water levels** - Decreased discharge of hand pumps and deep tube wells	• Agroforestry, plantation, retention pond	• Drought and flooding both occurring in short period. Loss of assets and condition of chronic stress and insecurity, affecting poor women in community disproportionately
(Humidity)	**Agriculture**	**Loss of soil moisture due to less humidity during hot season** - decreasing production **Loss of organic matter** - decreasing soil fertility **Loss of soil organisms** - decreasing soil fertility (earth worms, azotobactor, etc.) **Cold snaps associated with high cold season humidity – increased illness** **Cold associated with humidity during winter** - increasing cost of production and loss of laborers' work efficiency	• Mulching, cover crop, mixed cropping • Compost manure, low tillage, • Humus, compost • Development of construction of housing to mitigate cold snaps	• Erosion of soil fertility, decreasing productivity • Poor members of community suffer disproportionately from exposure and cold. Poorer individuals die in the Terai each cold season due to exposure and lack of suitable housing and clothing.
	Forestry	**Loss of soil moisture during hot season** - changing habitat of tree species, shifting some species towards the north	• Planting of indigenous species • Planting cycles coinciding with changing seasonality and monsoon • Use of compost	• Negative impacts of forest quality, quantity and diversity. • Policy and procedure constraints that hinder forest management and

		Loss of species - Disappearance of some tree species (*Dabdabe, Phosro, Simal, Gingat*)	• Promoting indigenous tree species rather than exotics • Diversification of forest tree species • Interest in multipurpose tree plantation • Abundant local knowledge on characteristics of indigenous species and multiple benefits provided	sustainable forest use • Disappearance of some useful fodder tree species from locality
	Livestock	**Increased disease infection** - Decreasing health conditions of livestock (infectious diseases)	• Improved shed management, hygienic shed, • Diversification of income sources	• Greater numbers of livestock being effected, fear of epidemics and mass death
		Reduction of milk production - decreased household income		
	Water	**Decreasing water quality** - increased risk of disease	• Overall land management to support water conservation and retention	• Women's workload more intense, increased water stress
		Unuseability of hand pumps - loss of investment and increased hardship in securing water from alternative sources		
		Increasing water vapor in the atmosphere during winter - increased temperature		
(Wind)	**Agriculture**	**Loss of sugarcane** - decreased production	• Crop rotation, diversification	
	Forestry	**Reduced sand carrying by wind** - reduction of sand pollution in the home area	• Multilayer tree crops • Possible opportunities for energy production	
		Maintain air temperature - improvement of atmospheric weather responsible in part for wind generation		
	Livestock			
	Water	**Soil erosion** - Contaminated water in springs and ponds	• Bamboo, Salix, and Jamun plantation to improve water filtration	• Negative impacts of even further quality water access restrictions
		Loss of water as a water vapor- Reduced water levels in rivers and wells		
(Flooding)	**Agriculture**	**Loss of lands and crops** - 30 ha of cropland damaged	• Bamboo plantation, river side control, bioengineering, small check dams, sand	• Loss of land and trees continued, food insecurity more intense

			bag dams • Enterprise development for vulnerable households, alternative income sources	
		Insecure food security - 3 households displaced due to loss of agricultural lands in past, repeated loss of crops		
	Forestry	**Damage of trees and plantations?** - loss of bamboo and other trees	• River bank control, bioengineering, check dam, box check dams, plantation • Vegetative check-dam, bioengineering and concrete check-dam. • Riverside plantations • Shelterbelt on the windward side to protect small trees. • Silvicultural practices to create space for regeneration and proper aeration • Indigenous fodder tree species such as Badahar, Kutmiro, Phosro, Khari and Khanyu	• Decreasing indigenous useful species, more infestation by insects and pests • Damage of forest areas and deposition of sand in agriculture lands • Damage of embankments and other forms of river control • Loss of assets and life
		Damage of forest lands - loss of forest areas		
		Increased flood damages - Loss of forest lands and trees (Sissoo and Bamboo plants)		
	Livestock	**Loss of goats due to flooding**	• Retain livestock in sheds/high ground during flood period • River bank control, bioengineering, check dam, box check dams, plantation	
	Water	**Increased water table level, hand pumps,** ponds	• Vegetative check-dams, bioengineering and concrete check-dams • Drilling of new wells • Greater depth of hand pump	• More vulnerable members of community, elderly, women and children may be more susceptible to risks from flash flooding. • Poorer members have less financial assets to buffer against losses due to flooding
		Increased incidence of water borne insects - (mosquitos) and disease impacts on health quality		
		Loss of water quality - increased erosion of riverbanks and topsoil into water sources		

ANNEX 2

ASSESSMENT OF FUNDING SOURCES AND OPPORTUNITIES

1. Department of Forests

FUNDING SOURCE	
NAME AND CONTACT INFO	*Department of Forests*
CONTACT PERSON	*Dr. Rajan Kumar Pokhrel, Director General* *Babarmahal, Kathmandu* *Email: rajan-p@hotmail.com, info@dof.gov.np* *Tel: 014216379*
BRIEF DESCRIPTION	*This is the department under which District Forest Offices (DFO) sit. It provides support for REDD + and climate change adaptation, primarily forest-based adaptation. Activities are in terms of training, seedling production, support for income generation activities, plantation and providing support for renewal of operational plans. DFOs are authorized to apply for the associated funds.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget release: by April 15* *Budget approval: by the end of July (in general).* *Disbursal of budget (1st quarter): August-September.* *Implementation of field activities: starts from August in principle but generally begins from Nov-Dec.*
FUNDING PERIOD	*Event or activity specific* *Possibly not renewable: regular but depends on the resources and activity type for example: Seedling production activities will be in regular basis.*
WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST AREAS	*Forest management* *Capacity development/empowerment* *Income generation* *Group management and governance* *Forest-based climate change*
NATURE OF THE SUPPORT	*Most of the support is through the RED BOOK (as approved from the parliament and national planning commission). Some support is from non-government organizations but mainly donor agencies based on the nature of activity. Funds are managed through District Forest Offices and District Soil Conservation Offices.*
REQUIREMENTS	
EXECUTING ENTITY	*District Forest Officers can decide or implement through staff.*
PROPOSAL FORMAT	*Flexible, based on the nature of activity and as prescribed by guidelines.*
REPORTING	*Final reporting after completion of work.*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Requires coordination with DFO associated with CFUG. Possible support but dependent on priorities of DFO.*
RECOMMENDATION?	*Activities outlined in the OP (or revised OP) would be of higher interest for the DFO to support, seek to ensure alignment between OP-committed activities and hoped for funding.*

2. District Development Committee, Sarlahi

FUNDING SOURCE	
NAME AND	*District Development Committee, Sarlahi*

CONTACT INFO	
CONTACT PERSON	*Name: Local Development Officer, Malangwa, Sarlahi* *Tel: 520131, 520132*
BRIEF DESCRIPTION	*DDCs have a climate change section. They have the mandate to coordinate funding coming from NGOs, private sector and public institutions for climate change.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget release: activities start from June after approval of budget.* *Budget approval: after the DDC council meeting, generally in September.* *Generally 3-4 months from start of the project.*
FUNDING PERIOD	*Depends on the nature of the project, lasts until the project has been completed (within a fiscal year).*
WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST AREAS	*Community development* *Technical support for other line agency activities* *Disaster risk management* *River embankment control* *Biogas and improved cook stoves* *Sanitation* *Awareness*
NATURE OF THE SUPPORT	*Both in cash and technical support through their own staff to the respective user committees.*
REQUIREMENTS	
EXECUTING ENTITY	*User committee in technical support of DDC.*
PROPOSAL FORMAT	*Application and for some projects need brief concept note.*
REPORTING	*Final reporting after completion of work.*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Highly likely*
RECOMMENDATION?	*Community should apply*

3. District Soil Conservation Office

FUNDING SOURCE	
NAME AND CONTACT INFO	*District Soil Conservation Office (DSCO)*
CONTACT PERSON	*Name: Hriday Kumar Jha* *Malangwa, Sarlahi* *Mobile: 9855021129*
BRIEF DESCRIPTION	*Sarlahi is priority no. 1 district for the office. The Office follows a watershed management approach to implement its activities. Major activities are for supporting land productivity enhancement, providing fruit and fodder trees for income generation, river bank control, conservation pond construction, income generation of the poor through livestock promotion, upstream downstream linkage through whole river system and sub-watershed management.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget release: activities start from June after approval of budget.* *Budget approval: July* *Generally 3-4 months from start of the project.*
FUNDING PERIOD	*Need to apply between July and September.*
WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST	*Landslide control*

AREAS	*River embankment control* *Irrigation canal construction and renovation* *Agro-forestry* *Retention pond*
NATURE OF THE SUPPORT	*Technical and cash through user committees. Support to communities through projects.*
REQUIREMENTS	
EXECUTING ENTITY	*DSCO*
PROPOSAL FORMAT	*Application*
REPORTING	*Monitoring by DSCO office and completion report.*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Some level of support likely.*
RECOMMENDATION?	*Recommended to facilitate the community application process as most of DSCO's priority activities are in line with climate change adaptation and increasing land productivity.*

4. Agriculture Development Office

FUNDING SOURCE	
NAME AND CONTACT INFO	*Agriculture Development Office*
CONTACT PERSON	*Name: Agriculture Development Officer* *Naktajhij, Dhanusha*
BRIEF DESCRIPTION	*Agriculture Development Office supports boring of deep tube well water systems.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget release: activities start from June after approval of budget.* *Budget approval: Generally 3-4 months from start of the project.*
FUNDING PERIOD	*Need to apply from July to September for regular activities and funds can be received for the period of that specific activity.*
WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST AREAS	*Ground water supply system establishment and support* *Increasing agriculture production through irrigation facility* *Promoting agri-business and food security*
NATURE OF THE SUPPORT	*Support in establishing ground water system.*
REQUIREMENTS	
EXECUTING ENTITY	*Agriculture development user committee of the community in direct technical support of Agriculture Development Office.*
PROPOSAL FORMAT	*Application from the community mentioning the need and relevance.*
REPORTING	*Reporting to Office of Monitoring*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Likely once program is approved in the annual program.*
RECOMMENDATION?	*Community should submit an application.*

5. Harion Municipality

FUNDING SOURCE	
NAME AND CONTACT INFO	*Harion Municipality*

CONTACT PERSON	*Name: Municipal Chief, Hom Bahadur Thapa* *Harion, Sarlahi* *Tel: 046430499* *Mobile: 9844018877*
BRIEF DESCRIPTION	*The Municipality has proposed a lump sum of NPR 1.5 million budget for the environment and forestry sector for this fiscal year until July. The amount may increase next year when the Municipality is more established (this Municipality was only recently declared). It can expend only some of its allocated adaptation sector funding via community forest user groups.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget release: activities start from June following approval of budget.* *Budget approval: after the meeting of Municipal council, usually August-September.*
FUNDING PERIOD	*From March to September for this year and after September-October in general.*
WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST AREAS	*Community development (drinking water supply, irrigation)* *Disaster risk management* *River bank control* *Awareness raising*
NATURE OF THE SUPPORT	*Technical and financial support after the feasibility study. Funds are managed through Municipality. Sometimes need to form the local user committee for specific project.*
REQUIREMENTS	
EXECUTING ENTITY	*Municipality*
PROPOSAL FORMAT	*Application and a brief proposal with need and relevance of the activity.*
REPORTING	*Monitoring report*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Likely*
RECOMMENDATION?	*Community should submit an application.*

6. District Forest Office

FUNDING SOURCE	
NAME AND CONTACT INFO	*District Forest Office (DFO)*
CONTACT PERSON	*Name: Kedar Nath Dahal* *Lalbandi, Sarlahi* *Mobile: 9854036113*
BRIEF DESCRIPTION	*It can finance adaptive forest management in community forests. Institutional development of the CFUG, renewal of the Community Forest Operational Plan, providing seedling for private plantation, providing income generation support and capacity building. Regular technical backstopping to CFUG in forest management is the key responsibility of the DFO.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget release: activities begin from June after approval of budget* *Budget approval: July* *Generally 3-4 months from start of the project.*
FUNDING PERIOD	*Community can approach, apply and follow up from July to September and the activities can be funded as per the nature of the activity.*

WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST AREAS	*Forest management* *Plantation* *Training on forest governance, group management, forest-based enterprises* *FOP renewal* *Income generation activities*
NATURE OF THE SUPPORT	*Technical and financial. Funds are managed through DFO.*
REQUIREMENTS	
EXECUTING ENTITY	*DFO staff*
PROPOSAL FORMAT	*Application*
REPORTING	*Final reporting after completion of work.*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Likely*
RECOMMENDATION?	*Community needs to submit an application.*

7. District Livestock Support Office

FUNDING SOURCE	
NAME AND CONTACT INFO	*District Livestock Support Office*
CONTACT PERSON	*Name:* *Lalbandi, Sarlahi* *Email:* *Tel:* *Mobile:*
BRIEF DESCRIPTION	*District Livestock Support Office supports livestock development for production of milk and meat. For livestock, DLO supports fodder and forage development, animal health, shed management, and livestock group formation.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget release: activities start from June after approval of budget* *Budget approval: July* *Generally 3-4 months from start of the project.*
FUNDING PERIOD	*Community can approach, apply and follow up from July to September.*
WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST AREAS	*Livestock development* *Fodder and forage* *Vaccination* *Animal health*
NATURE OF THE SUPPORT	*Technical and financial. Funds are managed through the District Livestock Support Office.*
REQUIREMENTS	
EXECUTING ENTITY	*District Livestock Support Office staff*
PROPOSAL FORMAT	*Application*
REPORTING	*Not specific*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Likely*
RECOMMENDATION?	*Community needs to submit an application.*

8. ***Women and Child Development Office (WDO)***

FUNDING SOURCE	
NAME AND CONTACT INFO	*Women and Child Development Office (WDO)*
CONTACT PERSON	*Name:* *Lalbandi, Sarlahi* *Email:* *Tel:* *Mobile:*
BRIEF DESCRIPTION	*WDO supports capacity building and income generation activities to women's groups.*
FUNDING TIMELINE	
FUNDING CYCLE	*Budget speech: activities start from June after approval of budget.* *Budget approval: July* *Generally 3-4 months from start of the project.*
FUNDING PERIOD	*Community can approach, apply and follow up from July to September.*
WHAT WOULD THE FUNDING LOOK LIKE?	
SPECIFIC INTEREST AREAS	*Income generation (skill, goat raising, etc.)* *Group strengthening* *Microfinance*
NATURE OF THE SUPPORT	*Technical and financial. Funds are managed through WDO.*
REQUIREMENTS	
EXECUTING ENTITY	*WDO staff*
PROPOSAL FORMAT	*Application*
REPORTING	*Final reporting after completion of work.*
STRENGTH OF OPPORTUNITY?	
LIKELIHOOD OF SUCCESS	*Likely*
RECOMMENDATION?	*Community needs to submit an application.*