

# **CHAPTER-ONE**

## **INTRODUCTION**

### **1.1 Background of the Study**

Climate change is defined as a variation in climatic parameters and is attributed directly or indirectly to human activities (Lange, 2005: as quoted in Crate and Nuttall, 2009). In the beginning of the 21<sup>st</sup> century, climate change has become a global issue for environmental scientists, policy makers and planners as well as academicians (Salick and Byg, 2007). Most of the researches have been carried out about the biophysical aspects by neglecting the local people or their perception, but how the physical manifestation of change are perceived, experienced, interpreted, and negotiated at community level (Crate and Nuttall, 2009).

All human experiences the variations in atmospheric conditions and in metrological phenomena, that we call weather and climate (Strauss and Orlove, 2003). Local people have been observing the changes in calendar of natural phenomena, shifting of time in snowfall, reduction in the intensity of snowfall, displaced of the monsoon rainfall beyond the ideal/actual period and shifting of temperature (Vedwan and Rhoades, 2001). Different People differently experiences and perceive climate change and respond to it differently. However, farmers do not only interpret the climatic shift as meteorologist through the visible but, they examine climate change through crops and weather interaction (Vedwan, 2006; Poudel, 2012).

The study mainly focuses on the effect of climate change in the agricultural crops on the one hand, and on the other hand, change in adaptive/coping mechanism, especially farming due to climate change in the hilly village of Nepal. This study also describes the local farmer's perception on climate change and due to effects of climate change existing pattern of farming has been changed and local farmers started working on poultry firm, brick factory as well as cash crop production.

### **1.2 Statement of Problem and Research Questions**

Anthropologists have been conducting ethnographic fieldwork as a way to gain insights into the relationship between climate and cultural changes (Rancoli et al. 2003, Crate, 2009; Vedwan, 2006). Furthermore, Rancoli et al. (2009) argued that the documentation of local peoples' perception, knowledge, valuation, and response on the climate change is the core issue of study for cultural anthropologists. Because the local

people are the key eyewitness of climate change (Salic and Byg, 2007), which have been monitoring and observing by them in their lifetime (Rancoli, 2006).

Traditionally, people of Bhakundebeshi rely upon the monsoon rainfall for agriculture especially paddy and wheat production. However, the change in climate especially erratic rainfall and drought in the study area people have been suffering a lot. As a result, they have been searching new coping mechanism to adjust with climatic uncertainties. Some of the people may search other adaptive strategies like foreign jobs, services and business, and some of them may other occupation to cope with drought. Thus, the present study will try to find out the coping mechanism or adaptive strategies that may have developed by the farmers in their surroundings.

Farmers of Bhakunebeshi do work in the field according to the seasonal calendar and weather fluctuation play vital role in agricultural activities. However, in the changing circumstances the knowledge of farmers may have changed about weather fluctuation and changing climate. Due to the changing temperature and rainfall they may do work in the field before the times of crops farming which is not according to their seasonal calendar. Furthermore, the production of seasonal crops may be decreased and off-seasonal crops may be increased due to changing weather and climate so that they may be practicing new agricultural activities.

In the Nepalese context the issues of climate change is talking about physical aspects as well as cultural aspects. Its impact on snowfall, melting of glacier, flood and green house gases can be seen in the context of Nepal (ICIMOD, 2011). The issue of climate change is first started in subject matter of physical aspects for example snowfall, melting of glacier but later on it started to focus on cultural aspects of local people. Farmer less understands the meteorological data and uses their own seasonal calendar so that changing climate and weather fluctuation badly affect to their farming system.

There is clear evidence and an increasing recognition among a number of sector for the importance of agro-biodiversity to build adaptability and resilience of ruler communities and agro-ecosystems and, thus, supporting adaptation to changing condition under climate change. The conservation of local crops and livestock and landraces and traditional practice can help farmers cope with many different types of adversity ([http://www.agro-biodiversityplatform.org/climate\\_change](http://www.agro-biodiversityplatform.org/climate_change)).

## **Research Questions**

The study will have the following research question to be addressed:

1. What are the indicators of climate change as reported by the local people?
2. How do local people perceive climate change?
3. What types of coping mechanism/adaptation strategies are made by the local people in the field of agriculture in the context of changing climate?

## **1.3 Objectives**

### **General Objective**

The general objective of this study is to understand the perception and knowledge in the changing agriculture practices, and their adaptive strategies to cope with climate change.

### **Specific Objectives**

- ) To explore the relationship between agriculture and weather among the farmers, and
- ) To analyze the local adaptive strategies or coping mechanism in climatic fluctuations over the last a few decades or more

## **1.4 Rationale of the Study**

Climate change is an overriding challenge issue. Nepal has expressed its commitments through international conventions and treaties to develop national strategies to minimize the impacts of climate change. However, inadequate understanding of climate change impacts particularly at community level is still less. Therefore, it is essential to study from community level. Bhakundebesi is highly sensitive to change in climate. Adaptation to climate change involves taking action either to reduce the negative effects or to capitalize on the positive effects of climate change. Adaptive action may be taken in anticipation of potential climate change. However, some adaptive action may have to be taken to deal with situations when actual impacts on climate change.

The hazard scenario of agriculture by the condition of climate change suggests that the studies are urgently needed for better understanding of the linkage between changing climatic pattern, increasing natural hazard and its effect on livelihood and agriculture. Although, few national level study and reports have been published on community vulnerability. Local level studies are sporadic in spite of the fact that micro

level assessment on climate change issue is more relevant than mega-scale in Nepal with high diversity in natural as well as human system within a short spatial variation. Hence, local level study is important.

Many researchers have been carried out on the aspect of biophysical i.e. melting of snow, increasing temperature and shifting of rainfall pattern. But this study has focused on the aspect of climate change and changing practice in agriculture from the perspectives of social sciences, and particularly forms the anthropology to trace the people's perception and changing agricultural practice in the context of climate change

The culture of man is steadily reducing selection pressure. There is need for making adjustments in human activities, especially of culture, as culture change the world rapidly (Majupuria, 1998). So that the study will be the contribution for anthropological work, NGOS/INGOS and national planners for planning to future, that how due to climate change local farmer have shifted their agricultural practices in to other like office job, poultry farm, etc. and it will help to understand the perception of the local farmers on climate change.

### **1.5 Theoretical Perspective**

Anthropology deals with the people, culture and human society. It is dynamic discipline and trends to be qualitative. Anthropology's potential contribution is rooted in its traditional holism (Fricke, 1993). The issue of climate change is directly related with people and culture and the issue has turned increasingly to adaptations as priority for research and policy, social and ecological resilience is crucial aspect of local livelihoods and resource utilization (Crate and Nutall, 2009).

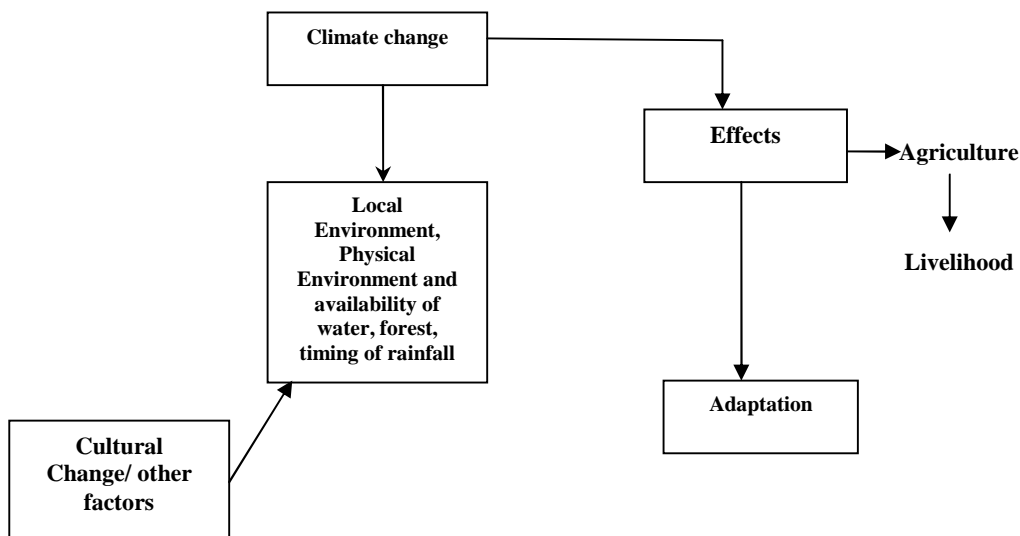
Many theoretical approaches have been developed in anthropology to examine the human-natural relationship. Among them, cognitive theoretical approach deals with people's knowledge system, and cultural ecological model seeks human's relationship with nature. In addition the concept of cultural model of is widely used within anthropology specially in the climate change research along with the tools of applied, advocacy oriented and public anthropology for the emic understanding of the people about the effects of climate change and their world and world view (Crate, 2008). In this study, I use cognitive theoretical model to seek people's knowledge system especially focusing on the agricultural practices in the context of drought and climate

change. Similarly cultural ecological model is use to understand about adaptation mechanism adapted by local people in their environment.

### 1. 6 Conceptual Framework

The generic conceptual model represents the key elements that shape the local people's perceptions of climate change, indicators (variables) to know climatic varieties and coping/strategies, which is made by local context. The conceptual framework of this study is given in figure 1.

Figure 1: Conceptual Framework



Agriculture is directly affected by climate change, so that the livelihood strategies of humans are also affected by these changes. People can interpret the changing climatic condition by their traditional knowledge and their perception, the conditions they seeking by locally available various indicators such as biophysical indicators, animal behavior, atmosphere, relief feature and human aliments. Local people also perceive climate change by their day-to-day agricultural practices and other cultural (ritual practices, norms, values etc.) and physical world i.e. water resources, soil, land etc. Finally, they have made coping/ adaptive strategies to cope and adapt with climate change. Moreover, that strategies are helpful for their cultural change (specially in agriculture).

## **1.7 Organization of the Study**

This study consists of seven chapters. The chapter one provides the introduction, statement of problem, objectives, rational of the study, conceptual framework, theoretical framework. The second chapter deals with the review of literature and provides ideas about the previous researcher and studies being done on the sources. The third chapter summarizes the methods and approaches applied by the researcher. The fourth chapter outlines the information about the study area. The chapter five includes local's experiences on climate change and its impacts on their life. The chapter six deals with coping and adaptive strategies which is followed by local people. Finally this study has been concluded in chapter seven. These major chapters are followed by references, appendices, acronyms and annexes related to the study.

## **CHAPTER TWO**

### **REVIEW OF THE RELATED LITERATURE**

#### **2. Literature Review**

In this chapter, brief analysis is presented about the theoretical review and review of related documents of the study. This chapter is basically divided into three parts. The literature review presented below describe about the climate change and agriculture, second part deals with the global scenario of the climate change and agriculture in the context of Nepal and finally last section deal with the anthropological engagement in the climate change.

#### **2.1 Climate Change And Anthropological Engagement**

Anthropology is trying to address people's perception and knowledge systems which are framed by cultural context (Roncoli et. al, 2009). It is one of the subjects that always reveal the problems of local people spreading over their future guided by local phenomena. This is a gradual process that people acknowledge and response in social world. People have a curiosity about the uncertain climate occurring frequently in the local ground. Anthropology to some extent tries to address the climatic hazards through the cultural values. It presents the cultural meaning guided in the human culture from past to ongoing climatic condition. The ongoing climate has brought seriousness in rural area on the other hand it is adding complexity in rural life. So, to understand general and specific meaning of climate on agriculture should be categorized in to three parts.

##### **2.1.1 Review of Existing Anthropological Literatures on Climate Change**

Climate change is defined as the variability in average weather and ultimately state of the climate system over a specified timeframe (Crate and Nuttal, 2009). This variability is normally evidenced by changes in the mean temperature, precipitation and rainfall levels among others. Changes in climate can be caused by natural factors such as sunlight intensity, and volcanic activity among others or anthropogenic factors such as burning fossil fuel, deforestation and other human activities (Crate and Nuttall, 2009).

Climate change and global warming (The enhanced greenhouse effect and trend in the increase of mean global surface temperatures) are often used interchangeably, particularly by the media, resulting in confused understanding the terms, but climate change can result in the cooling as well as the warming of the

earth's surface atmosphere (Crate and Nuttal, 2009). And climate change is having interrelationship with human culture, historically and now.

Societies do not interact with their environment but with their perceptions of that environment, the environment is only one of many actors in determining social change and plays a less important role than perception of nature (Miller R, 2007: cited in Crate and Nuttal, 2009).

Climate extremes of drought, flood cycles that will be experienced globally due to climate change, not the average that climate change models focus on will have the greatest impacts on Pargeran livelihoods. Due to the lack of seasonality in this part of the Papua New Guinea (PNG), highlands, there are no set and regular planting times but rather a constant rotation (Jacka, 2009).

Steward argues that the cultural core that basic to the pertained band as a type is a result of environmental adaptation. He argued that the relevant environmental features depend upon the culture. The environment more directly conditions the simpler cultures than advanced once (Steward, 1988). Rappaport (1968) also support to know the relationship between environment and culture. The ancestors among the Tsembaga people of New Guinea, which produced operational change in physical factors, such as the size and spatial spread of human and animal population. The ritual of Tsembaga people controls and regulates the ecosystem. For it Tsembaga people sacrifice many pigs to control the mass of pigs and its burden on ecosystem which constantly maintain the balance environment between Tsembaga people and ecosystem which also fulfill the protein to Tsembaga people (Rappaport, 1968).

Crate (2009) discusses the significance of climate change for the Turkic – speaking Sakha horse and cattle breeders of northwestern Siberia. Yet as Crate argues as Sakha, people reflect on their observation of climate change. She reported on local observations of change that have compelling similarities to what anthropologists working elsewhere in the circumpolar north also say people are seeing. For Crate Anthropologists are strategically well placed to interpret, facilitate, translate, communicate and advocated (both in field and at home ) in response to condition giving rise to climate change, to the cultural implications facing communities as they cope with change, and for the actions needed in response to climate change(Crate and Nuttal, 2009).



Anthropology focuses upon the holistic study of human societies, their future and in all part of globe; it has a unique contribution to make the study of the impact of global warming on human societies (Baer and Singer, 2009; cited in Deuba, 2012). It always focuses on human culture that is based on social fact happening inside the community. The local climate determined the rural life strategies of people because of their direct relation with it. Anthropology research in this area also looks at how people's perceptions interact with different interest groups view and understood the climate crisis (Vedwan, 2006).

The another significant study is done by Marino and Schweitzer (2009) also discussed about the climate change in Northwestern Alaska with the objective of documenting the changes observed in the landscape and how those changes were perceived and understood on a local level. The study also revealed that the local informants have perceived the destruction of ozone layer, global warming, and satellite field as the responsible factors for such climate change, which made deep lakes, dried and the livelihood strategies have also been changed. One of the respondent during his study stated that the fish were unable to find in the lack.

The behavior of human being is associate with the culture (Strauss, 1960: cited in Bohannan and Glazer, 1988) and the culture is set in human mind. Anthropologists from the inception culture and changing behavior are studied through the lens of cognized model. Cultural meaning that underlines peoples understanding of climate is embedded in people's tradition that is underlying in their life ways (Roncoli, 2006). And our culture shape the way that we think and response to the weather; as we face the impact climate change process bring to our communities, we must realize that our perceptions as well as our reactions are shaped by our culture (Strauss and Orlove, 2003).

### **2.1.2 People's Perception on Climate Change**

To know climatic change, local people's perceptions are more important to trace their problem by changing pattern of culture. Here the most important question is "how people perceive climate change through cultural lenses (Perception)?" (Roncoli et al., 2009). By emphasizing collective experience and cultural framing, anthropologists give voice to folk narratives of climate change, expanding the discussion beyond the broader spheres of earth sciences, policy debates, and media headlines (Vedwan and Rhoades, 2001). Visual and sensory perceptions are key elements of the folk epistemology of climate (Strauss and Orlove, 2003).

Climate is always associated with particular place and region which is normally reflected through climatic and non-climatic indicators. People are always aware about the local events of their surroundings either that is climate or not but achieving it by an idea. Perception of climate change is informed and structured by the dynamic nature of human-environment relationships, farmers made sense of local climate through the use of categories that were not or determined by traditional weather cycles (Vedwan and Rhoades, 2001).

The perceptions of climate change is informed and structured by the dynamic nature of human-environment relationships, farmers made sense of local climate through the use of categories that were not limited to or determined by traditional weather cycles (Vedwan and Rhoades, 2001). At the discourse of climate change in anthropology: individual farmer's understanding and perception of climate assume critical importance. The perception of climate change in rainfall are influenced by both the visual salience of the phenomenon itself and the knowledge that paddy/wheat growers have of paddy/wheat – weather interaction (Vedwan and Rhoades, 2001).

Roncoli et al. (2003), suggest to know people's perception on their study by Burkina Faso, farmer's interpretation of seasonal rainfall forecasts are anchored in their remembrance desirable or dreaded situations they lived through, their observations about the condition that brought them about and their assessment of how they manage through them (Roncoli et al., 2003). They also suggest that local weather/climate forecasting draws from an assessment of phenomena and indicators that appear in the landscape and the spiritual world (Roncoli et al., 2002). Environmental forecasting knowledge tends to be available to most farmers, specialist in spiritual forecasting either inherit their skills or acquire them through initiation.

Agricultural calendar, everywhere in the world, may have developed base on seasons. Thus farmers generally understand and interpret weather, season, and climate by associating with agriculture. The ongoing weather fluctuations and climate change has been adversely threatening agricultural yields. Therefore change in the weather patterns and climate can be understood in terms of cognized structure of crop weather interaction (Vedwan and Rhoades, 2001), rather than actual amount of rainfall (Roncoli et al., 2003, Poudel, 2012).

Farmer's perception on climatic variation does not rest on physical visibility alone but cultural frame also plays vital role of shaping their understanding toward them (Poudel, 2012). At present, the climatic variability and changes have become

more critical in agriculture research and planning, thus climatic factors need to be included in any program which aims at maintaining and enhancing the agricultural sustainability of the Himalayan region (Vedwan and Rhodesh, 2001).

## **2.2 Global Scenario of Climate Change**

Climate change in IPCC usage refers to a change in the state of the climate that can identify (eg, statistical tests) by change in the mean and /or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time whether due to natural variability or as a result of human activity (IPCC, 2007).

Either climate change refers to a statistically significant variation in the mean state of the climate or its variability, which may be due to natural internal processes or external force, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2006). UNFCCC (2007) defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of global atmosphere and which is in addition to natural climate variability observed over comparable time period”.

Climate change popularly known, as global warming, but it is much broader than global warming. Temperature change is just one aspect of the broader subject of climate change. The scientific opinion on climate change as expressed by the UN Intergovernmental Panel on Climate Change (IPCC) and explicitly endorsed by the National Science Academies of the G8 Nations, is that the average global temperature has risen  $0.6 \pm 0.2$  Degree Celsius since the 19 century and that it is likely that most of the warming observed over the last 50 years is attributable to human activities (IPCC, 2001).

Global temperature is increasing by  $0.3^{\circ}\text{C}$  to  $0.6^{\circ}\text{C}$  since the last 19<sup>th</sup> century and  $0.2^{\circ}\text{C}$  to  $0.3^{\circ}\text{C}$  over the last 40 years (1960-2000) indicating that the global temperature will increase further in the upcoming days (Xiaodong & Baode, 2000; cited in Parajuli, 2012). Global GHGs emissions due to human activities have grown since pre-industrial times, with an increase of 70% between 1970 and 2004. Continued GHGs emissions at or above current rates would cause further warming and induce many change in the global climate system during the 21<sup>st</sup> century that would very likely be larger than those observed during the 20<sup>th</sup> century (IPCC,2007).

Climate change will reduce the stream flow and ground water recharge. Demand for water is generally increasing due to population growth and economic development. Higher temperatures, hence higher crop evaporative demand, mean that the general tendency would be towards an increase in irrigation demands (IPCC, 2001).

It is reported that the developing countries are more susceptible to climate change impacts as they have limited capacity to adapt. The least developed countries are among the most vulnerable to extreme weather events and the adverse effects of climate change. Also, these countries have a very least capacity to cope with and adapt to adverse effects of climate change. The major risk reduction approach is adaptation to global change (UNFCCC, 2006).

## **2.3 Climate Change in Nepalese Context**

### **2.3.1 Study of Climate Change in Relation to Physical Environment**

IPCC (2007) has listed three key sectors, food and fiber, land degradation and biodiversity as the most vulnerable to climate change in the South Asian region. The most vulnerable population to climate change and variability have been rural communities with few resources to cope with extreme weather events like landslides, erosion, and drought (IPCC, 2007) particularly, in the mountain and flooding, sedimentation as well as drought in the low land regions of Nepal. Assessing the potential climate change impacts and economic analysis are urgently needed for the survival of these rural communities.

According to IPCC(2007) data, the glacier retreat in the Himalaya since 1978, snow that annual average arctic sea ice extent has shrunk by 2.7(2.1 to 3.3)% per decade, with larger decrease in summer of 7.4(5.0 to 9.8)% per decade. Mountain glaciers and snow cover on average have declined in both hemispheres.

Shrestha and Wake (2000) analyzed the maximum temperature trends in the Himalaya and its vicinity, reports an average warming in annual temperature between 1977 and 1994 was 0.06 degree C/year and that in Terai and Himalayas was 0.04 degree C/year and 0.08 degree/year respectively. The warming is found to be more pronounced in the high altitude regions of Nepal, while the warming is significantly lower or even lacking in the Terai and Siwalik regions

Agarawal, (2003) analyzed recent climatic trends that reveal a significant warming trend in recent decades, which has been even more pronounced at higher altitudes. Climate change scenarios for Nepal across multiple general circulation models meanwhile show considerable convergence on continued warming, with country averaged mean temperature increase of 1.2°C and 3°C projected by 2050 and 2100. Warming trends have already had significant impacts in the Nepal Himalayas. Although Nepal's contribution to the GHGs emissions is very less, it is among the countries where its impacts are very high (Chalise, 1994).

Farmers in Nepal are aware of the changing climate and are actively planning response actions based on traditional knowledge and wisdom (Manandhar, et al.; cited in Shrestha, 2011) . Many of the measures are carried out at individual level in response to events like drought; flood or changing temperature and their perception match with the scientific reality (Manandhar, et al. 2010; cited in shrestha, 2011). Rural Nepal primarily relies on agriculture for livelihood. Communities in villages in Nepal have their own traditional way of forecasting rain and harvest dates.

### **2.3.2 Study of Climate Change in Relation to Cultural Environment**

In the context of Nepal, some anthropologists and sociologists recently engaged in climate change. Poudel (2012) studied farmer's perception by using interpretive perspective, which focuses on insider's perspective, which is cognized and culturally framed. He explored farmer's varied and wider knowledge about climatic variability in the local context of Kathmandu valley. His study showed farmers understand climatic variability by weather- crop interaction and events associating with climatic fluctuations and perceptions are shaped by both physical visibility and cultural frame. His study illustrates that local system are more meaningful, subjective and contextual to interpret the climatic variability in local context. This study suggests to linkage between two knowledge system (metrological data and local system) for better understanding of climatic variability.

Poudel (2011) in his article "*Eyewitness Accounts on Climate Variability and the Responses: Perspectives from Farmers*" studied at Khatri-chhap of Kirtipur located at the Kathmandu valley. In this article he explored that people with different socio-cultural arrangements have different experiences and responses to climatic variability. In this paper, he argued that local experiences of climatic variability, which have been monitoring by locals in their lifetime. He explored their responses or coping

mechanisms, which they have been practicing to mitigate with climatic risks. By using eyewitness accounts and hearsays, he explored and documented the experiences about climatic variability of local people. His article suggests that farmers of Kirtipur also have felt more threaten in their livelihood during drought years. The farmers have several experiences about the effects of climate change in local level. In this context, farmers, in rural community, develop alternative way to cope with the uncertainty based on their indigenous environmental knowledge as well as strong social fabric that help the local community to mitigate with the climate risks and uncertainty in the local context.

Rai (2010) studied among Mustang people attempts to analyze on how a micro socio-economic dynamics and discourses occurring in a local setting is interrelated with national and international political dynamics of global climate change. He explored the local experiences of climate change, causes of climate change and its perception and impacts of climate change in local context of Mustang. In this study he concluded that there are lot of knowledge, perception and experiences with the local people. So, the attempts to advance for the adaptation to climate change highly requires the insights developed and enriched from vary local to the global societies. Thus, there is need to look and understand the climate change with the links of discourses developing from micro-macro phenomenon.

Poudel (2010) studied about perception of local people on climate change and impact of such change on agricultural and livestock management practices among the people of two different ecological and social setting from local people's perspective. In this study he used cultural model for the emic understanding of people about the effects of climate change. His study attempted to understand the perception of the people on climate change through the change in climate related parameters. His study clearly explored difference in the perception among local people about climate change, climate related risk and disaster, their impacts on agriculture and livestock and present coping and adaptive strategies followed by the people in their surroundings.

Those researchers like Sapkota (2013) and Chpagain (2013) who have conducted their research on the issue of climate change have focused on the issues how climate change is occurring in the rural area and its effects on local people. Sapkota has focused his research on people perception that how people forecast weather and

rainfall however, Chapagain has focused about effects of climate change on livestock and its directly impact on the local people. Here to some extent, my research issues is similar to that of Sapkota and Chapagain but my research has basically focused on the farming and agricultural system and how due to the effects of climate change farmers should have to change their traditional farming system and how they have been shifting their farming system and how they have been adopting to brick factory, poultry farm, and cash crops as well.

#### **2.4 Research Gap**

Anthropologists are involved to seek climate change knowledge and perception in people's cognitive map. Anthropological research projects illustrate that climate change adaptation and mitigation needs to consider on the local socio-cultural context. They have found ground reality of climate change. However, anthropological research and studies of climate change in Nepal very rare and rural people of Nepal are not responsible for climate change and are not familiar with the international conferences, agreements and with scientific information. This study has explored how climate change is introduced in local people's cognitive map seeking impacts of climate change and responses in local socio-cultural context of Nepal.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

In this chapter includes rationale of the research site selection, sources of data, data methods, types of data, part of analysis is described in this research and lastly the limitation of the study was mentioned.

#### **3.1. Rationale of the Research Site Selection**

Climate change is global phenomenon but its impact is always at local level. Local farmers are facing many problems. Hence local level study is most important to examine ‘how the local farmers perceive climate by local knowledge?’ and ‘how the traditional agriculture practices are change by the impact of climate change?’ The site, Bhakundebesi (situated in Khanalthok VDC) was selected as a study area because people were traditionally depended on agriculture for their livelihood. However, their agriculture production was largely depended on seasonal rainfall (and small irrigation). There were some reasons for selecting this site for the study. First, most of the local farmers have been depending on agriculture, but the prolonged drought occurred during 2003-2005 affected paddy and wheat production in the locality that created hazard in their livelihood. Second, lack of irrigation facility for farming in the study area. Therefore, the area was more suitable to researcher for better understanding of farmers’ experiences on the impact of climate change through the conceptual framework of crop-weather relationship.

People of Bhakundebesi, which experienced the haphazard of drought during the years 2003-2005. The cause of drought farmers cannot plant crops on their field. Since the period, the livelihood strategies of the local people have been in a process of change. Thus, the area is a fertile for me to the study of climatic upheavals and to grab the perception of people towards climate change.

#### **3.2. Research Design**

This study uses both the qualitative and quantitative techniques depending on the nature and source of data and information using the longitudinal research based on the people’s monitoring and experiencing. Qualitative and quantitative data are collected for making the research study reliable and comprehensive. Qualitative data is generated from directly talking with the respondent and documenting their experiences whose narrative account about climatic fluctuation agriculture pattern and coping mechanism contributes to this research for making valid.



### **3.3. Nature and Sources of Data**

Both primary and secondary data were used in the study to make the study more qualitative rather than the quantitative. The required primary data is generated through the field study. Both qualitative and quantitative data are used, but major concern is paid on the qualitative information, as of the research is to explore and document the local perspective and adaptive strategies followed by the community to reduce the impacts of climate change on agricultural production.

### **3.4 Sampling**

I used purposive sampling for completing my research. According to my research needs to collect and generate data I used purposive sampling. I was taken 15 respondents on key informant in my research. I have paid special attention to selecting the key informants of the study area. For this, I have selected the elder members of the community, assuming that they are the witness of the ongoing change and have gained valuable information and experience about changing pattern of the climatic regime of their locality during their lifespan. Unstructured interview was taken with local herders and farmers who were purposively selected.

### **3.5. Tools of Data Collection**

I used several anthropological tools of data collections like observation, key informant interview, and oral tradition for collecting primary data. Similarly, the necessary secondary data were collected from different government offices and non-government organizations, published journals, media, and internet.

#### **3.5.1. Field Observation**

Anthropologist to get the primary data and relevant information traditionally applied the observation method. Despite the fact achieved from respondents' reply, the researcher himself observed the agricultural practices adopted by the villagers. Moreover, researcher also observed the small irrigation system, which is constructed villagers by use of traditional knowledge, socio-cultural setting, and Parma (labor work reciprocity) system of the area.

The aim of this research was examine the changing practices in agriculture as well as farmer's other exercises which are directly affected by climate change, so the researcher also observed traditional farming processes to paddy and wheat and recent farming processes, i.e. cash crop vegetable plantation, leasehold field for brick factory,

poultry farms which are key coping strategy for them. . Mainly the researcher observed the techniques and practices of agriculture farming in the sites. Furthermore, researcher carefully observed the fodder, and water resources such as ponds, streams, and land, which the villagers are using to farm. Researcher also observed the climatic extremes such as the disease on plants, effect of drought on agriculture crops. In addition to this researcher have also observed the present coping alternatives of the people.

### **3.5.2. Key Informant Interview**

The key informant interview is a standard anthropological method that is widely used in agricultural related and other social development inquiry. This is one method used in rapid assessment for gathering information from the affected community. The term “key informant” refers to anyone who can provide detailed information and opinion based on his or her knowledge of a particular issue. Key informant Interviews seek qualitative information that can be narrated and cross-checked with quantitative data, a method called “triangulation” (Chicago, 2005).



The primary data is collected by talking interview with the local elderly people. The key informant interviews were conducted with villagers and especially farmers, who have huge knowledge about the community and about the management. I collected most of information by conducting interviews with villagers who have

lifetime experiences and observation about the environment what happened to their agriculture system.

### **3.5.3. Oral Tradition**

In the study of weather and climate change, anthropologist considered oral tradition as major tools/method of data collection (Poudel, 2012). Following these, the researcher documented the oral tradition - “hearsay” and “eye witness” account as sources of primary data about the changing practices of agriculture and adaptation process directly encountering with the local people that they have for a long time who have spent their few decades watching different weather condition and impeding climatic change.

### **3.6. Data Presentation and Analysis**

Analysis is necessary for the data interpreting and analyzing data. Analysis is a continuous process of reviewing the information as it is collected, classifying it, formulating additional questions, verifying information and drawing conclusions. Analysis is the process of making sense of the collected information's are two kinds of the data (qualitative and quantitative) will be collected through the use various methods and techniques (Baker, 1999). All the collected quantitative data are presented in tabular form. These included population structure, age-sex composition of the households, size and structure of the household, household is income, and so on. The next important data is qualitative data. For the meaningful generalization of the unorganized qualitative data, I made systematic and thematic classification in other words all the collected qualitative data is thematically categorized. Then, the categorized data are described and interpreted.

### **3.7. Limitations of the Study**

Every study does have its own constraint with respect to discipline, resources, methodology, etc and this study is no exception. This study has following limitations:

- ) This study has covered only the specific area like Bhakundebesi village of kavrepalanchowk district. The finding of this research may not implement to other places.

- ) This research has implemented mostly anthropological theories (cognitive theoretical approach and cultural ecological model), tools and methodologies.
- ) Most of the data are qualitative in nature.

## CHAPTER FOUR

### PROFILE OF THE STUDY SETTING: THE AREA, PEOPLE AND THE FARMING PRACTICES

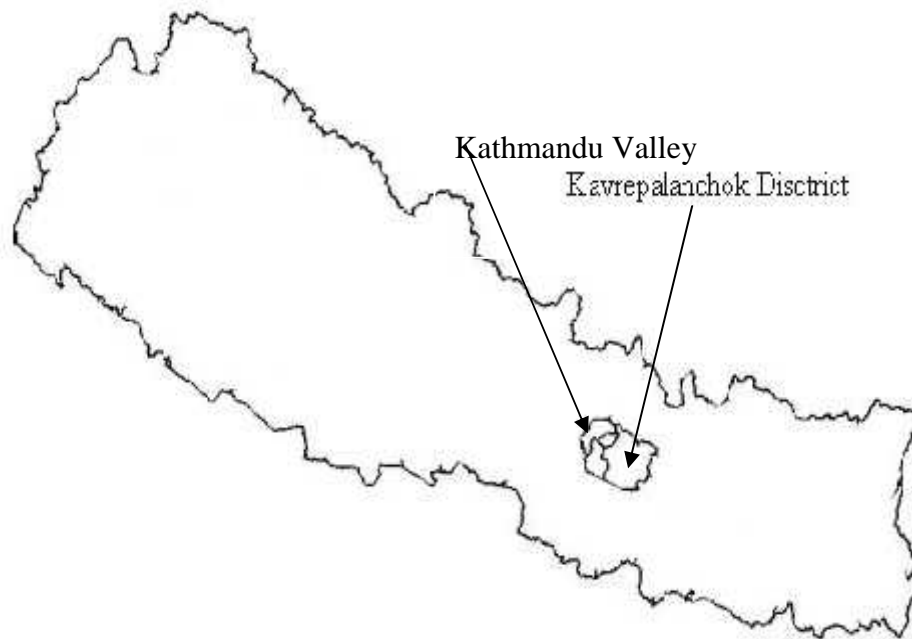
This chapter present about the basic features of the study area, location, demographic feature and village economy and agriculture. This chapter deals with the geography and people of the study site. It begins with the general information about Khanalthok VDC.

#### 4.1 The Setting: Khanalthok VDC

Khanalthok, where I carried out my study is located in central part of Kavrepalanchok District. Katunjabesi VDC to Methinkot VDC borders it at the east, Daraunepokhari VDC and Shikhar Ambote VDC to the west, Mathurapati Phulbari VDC to the north, and Mahadevtar VDC and Sishakhani VDC to the south. It has plain agricultural land surrounded by small hills. Geographically the village is situated in 27°34'12.71" North Latitude and 85°40'12.00" East Longitude the total area of the village is 124203 hectare, and large area has favorable agricultural land it highly depends on rain fed agricultural system as well as semi irrigated system (VDC profile, 2011).

According to the 2011 census, the total population of this VDC was 6750, with 3387 males and 3363 females and 1035 household, dominated by the Tamang. In addition to Tamang, other ethnic groups like Newar, Kami, Damai Magar, Chhetri, and Brahamin are also settled. Linguistically, the village is diversifying. There are three major languages are spoken by the villagers (Tamang, Newari and Nepali). The economic condition of this VDC is medium due to its semi irrigated landscape and lack of infrastructure of the development (VDC profile, 2011).

**Figure 1: Map of Nepal and Kavrepalanchok District**



Bhakundebsi Village

**4.2 Bhakundebsi Village: General Information**

Bhakundebsi is located in the lap of low land range facing towards the northeast direction. Among the nine administrative wards of the Khanalthok VDC, Bhakundebsi lies in ward no. 7. It is in the elevation of 880 meter from the sea level

(VDC profile, 2011). The majority of the population is dependent on natural resources and monsoon rainfall for livelihoods. Farming and livestock is mainstay of the majority of the people. Agricultural land is mainly of two types: upland *bari*, without surface irrigation, and terraced rice fields known as *khet* with surface semi-irrigation from local streams. Farmers consider *khet* more valuable land than *bari*. Local streams and seasonal rainfall are main source of irrigation purpose. Local streams are irrigation source of paddy field. In my observation, I found that people have less paddy field comparing with *bari* and *pakhobari*. Every household owned 18 Ropani in average where 6 ropani approximately was *Pakhobari*, 8 ropani *bari* and 4 ropani was paddy field (VDC profile, 2011). People did not totally depend on paddy crop for their livelihood because product is very except paddy low. Main agro products in the village are maize, wheat, millet and potato.

### **4.3 Natural Resources**

There are various types of natural resources available in Bhakundebesi area. The respondent told me that natural resources are the primary and viable instruments for rural livelihood. There are different kinds of natural resources like water, forest, timber, and, land.

#### **4.3.1 Water Resources**

The main source of water in the study sites are traditional ponds, seasonal rainfall and local stream water. Stream water resource is used for irrigation to their paddy field. In addition, rainfall water is used for sanitation, and for drinking for their livestock. People believed that the amount and intensity of water sources are decreasing rapidly by year. In the early days, people could easily irrigate and plant before monsoon but now they bring water lifting by pump from near side stream, and some of them are awaiting monsoon at present for deserted land. People never relying in the erratic rainfall in the past but now it is becoming hard compulsion to wait rain even for the plain land. The VDC profile mentioned the 46.96% household (each of 1035 HH) are paying half and more hours time once and three times in a day, to collect water for purpose drinking and sanitation (VDC profile, 2011).

In the study area, the impact of climate change on water resources has directly experienced by local people in their agriculture and livestock management. In the study site, the majority of farmers primarily depend on monsoon rainfall for cultivation of major crops like maize, wheat and paddy. In cope with scarcity of water peoples

developed piped drinking water in village and distributed water every household per as half an hour by turn by turn. But it is not fulfill the demand of water for the local people. People also collected the wastewater flowed by spring and irrigated their *karesabari*, but they cannot buy that water because of the springs are far from their house. Now a day's especially women's workload was ultimately increased in the study area. One of the respondents Januka khalal(39) present the voice of women's as follows:

“We females are becomes much troubled by the scarcity of water, our duty is to facilitate and store water in the house so that other family members do not get troubled with the problem of water. Now, we have to spend more time for carry water from its source. We have to wake 2 o'clock in the morning for water. It we delay than we have to stay in a quarter hours. We have to spend about one to one and half hour for that. It becomes more problematic at the time of worriers in the field. Our main task is to smoothly tough household works and goes for mutual exchange of labor. Sometimes it becomes late due to the problem of water and we have to face scolders from households, father in law and mother in law”.

In the discourse of climate change while we talk about natural resources specifically the issue of water resources is used to be raised and the people of Bhakundebeshi understand about the water resources on the basis of level of water on the river before and now. In the context, Dahal (52) said that there was enough water on the Dapche River.

“As I remembered a water mill would be run easily even in the winter season but now an ant can easily across the river in the winter”.

This not only the information about the dry up of water resource in the river but also gave lifetime experiences of local people about the environmental change in their surroundings. The major sources of water for irrigation from Dapcha khola. Regarding the dried up of water sources in the study area. Elderly person Muktinahat Humagain (60) has some perception about the drying Dapcha khola:

“When we were in our childhood we used to go with our parents to the plantation and sow seeds. Brothers and sisters used to swim in the Dapcha River after plantation of crops. In the winter, we also used to go there and wash clothes, not only bathe and plant water on paddy fields through canal. Now a day, it is almost impossible to see water flow in the river in winter and sometimes summer. Summer, when it rains we see that the water level has degraded than on those years. The drains are day to day going to dry and it becomes hard for us to plant seeds on the field”.



These experiences and eyewitness account clarifies that drying of springs had fact caused major problems to agricultural irrigation. Famers also mentioned that the water level in the river during the dry season has drastically decreased.

#### **4.3.2 Forest Resources**

In Bhakundebesi two community forests are situated which are *Dalit utthan community forestry* and *Devisthan Dhuwakot community forestry*. These communities forestry consist 32.56 hectors in total. There are diverse types of the plants species containing herbs along with animal and birds according to the local climatic condition. People were dependent on forest products for their livelihood. In the Bhakundebesi, there were presence of leafed to pine forest, however dominated vegetations are pine (*Pinus wallichina*), Chilaune (*Schima wallichiana*) and Rhododendron (*Rhododendron arboreum*), Kaphal (*Mulberry*), Aishelu (*Wild berry*) katus (*Castanopis indica*) in their private land.

People use to local forest food products for feeding their cattle, but I found that there was no open access to collect the forest product. They took the permission from the CF to collect the fodder from the forest. Sometimes peoples are dependent on meat production to fulfill calorie on their body (but not very dependent), they catch *Kalij and Chyakhura* (local wild birds). Now a day they filling such types of wild birds are decreasing or available of low rate by the causes of weather fluctuation or climatic condition as well as by illegal killing. Local people considered less rainfall as extreme weather events because of their destructive impact on local species and crops. Most of the herders, when asked about the role of climate in grass and forest production, attributed poor production and earlier flowering to reduced rainfall and its changed timing.

By their day-to-day observation, they get knowledge based on their experience. The small and big kinds of injuries (figure, leg, and in body) are treated at home to human and non human beings as well from the available herbal plants in the seasonal time. Now such herbal plants have been losing and thinning due to the local climatic condition.

#### **4.3.3 Land and Soil**

The land of Bhakundebesi is settled as plain area. The respondent told me that the land was moisture until the last 2003. After that, the drought took place from 2003-2005, that become dry. Now the plane area is changing into drought field and no vegetation in winter

season. The local people categorized their land into four categories a *Taar* (none irrigate low land), *Bari* (upland), *Pakho* (none cultivate) and Forest land.

According to local people they were used the different land to different crop vegetation. Traditionally they plant paddy and wheat in their *khet*, Maize in *Bari*, *pakho* for grass and hay and forest for firewood and fodder. Their rural livelihood is depending on forest and agriculture was sufficient in the past but now it is becoming hard because the causes of climate change.

#### 4.4 Social setting

There are many communities inside this Bhakundebesi area but among them are known as Bramhin, Chhetri, and Dalits have been living for the long age duration. These all claimed as a forth arrival groups but expert the history of Newar and Tamang, other are migrated from other part of the country. These two community groups have different language and other has same language. VDC profile (2011) shows demographical conditions of based on martial language.

**Table 1: Demographical condition of based on language**

Martial language	Male		Female		Total	
	No.	%	No.	%	No.	%
Nepali	2424	35.91%	2393	35.45%	4817	71.36%
Tamang	750	11.11%	774	11.47%	1524	22.58%
Newari	211	3.13%	195	2.89%	406	6.015%
Hindi	2	0.03%	1	0.01%	3	0.04%
Total	3387	50.18%	3363	49.82%	6750	100%

**Source:** VDC Profile, 2011.

According to social structure usually Newars are found in Bhakundebesi market for trade. In the same way, Bramhins and Chhetris are found in plateau and the Tamangs stay wherever it is good for maize production, i.e. top area. It is because Tamangs need Jaad (homemade alcohol) in their cultural ceremonies. So far, it is good even it is a place where there is less rainfall. If we observe this way we found cultures being affected by climate.

#### 4.5 Village economy

The village economy of the Bhakundebesi as primarily based on subsistence agriculture and animal husbandry. Agriculture is their primary occupation from which they earn their livelihood and livestock is the occupation from which they earn cash for

daily expenses spend for their children. Local people inform me that almost all the households have enough land to feed the family in the few years ago. A key informant Vidhya Kumari Humagai (75) informed me that now it is becoming hard to yield in our farming land due to low rainfall. Agricultural production like paddy, maize and wheat is decreasing. In the past, most of the villagers used their product by themselves. However, in these years above sixty-three percent households even cannot earn the livelihood from their field (VDC Profile, 2011). Only elderly people are remaining in the village because most youths are migrating to Kathmandu valley and foreign country for the education and opportunity to earn money. Most of the villagers whose children are ready to get higher education have sent their children to Kathmandu even though there is a campus near the village after SLC. Young populations are migrated from there and today they are facing problem in the agriculture and as well as in the development Village of due to shortage of labor force. By the effect of climate change, regularly decrease on agricultural production, Peoples must choices other occupation like business, driving, cash labor and foreign labor too. From 2005 to 2011, 104 peoples are goes foreign country such as India and Golf countries (VDC Profile, 2011).

Now the villagers of Bhakundebesi are engaged in co-operative organization of Bhakundebesi market, from where they can save the money and get loan. Presence of co-operative organization in such a remote area is the sign of rising economic activity in that area. This shows the rising economic opportunity related with agriculture in the villages. Because of low rice production there is low production of straw, which is the main food for cow and buffalo in the villages. Therefore, they have to buy all the materials to feed for the cattle. cash is earned by selling local products such as milk, potato, *siltimur*, soybean and cauliflower and this trend also affecting the village economy Table 1 shows the primary occupation of the villagers of the Bhakundebesi.

**Table: 2 Primary Occupation of Local People in the Study Site (Age Group of 16-45)**

Occupation	No.		No.	
	Male	Percent	Female	Percent
Agriculture and livestock	1013	50%	1131	72.13%
Foreign labor	99	4.89%	4	0.30%
Business	225	11.1%	127	8.09%
Government sector	314	15.50%	67	4.26%
Private sector	249	12.30%	114	7.27%
Furniture and fixture	15	0.74%	4	0.25%
No work/No Work	111	5.47%	121	7.70%
Total	2026	100%	1568	100%

Source: VDC Profile, 2011.

As shown in Table 2, 50% male and 72.13% female of the populations follow agriculture and livestock as a primary occupation. Here agriculture includes both farming and livestock keeping. Each household kept cattle with them for cash earning and to supply manure for their field. 11.1% male and 8.09% female of the population is depending on business for their livelihood. In my field study I found that 103 person were working as labor in another country. There were 314 male and 67 female are government sector and 249 male and 114 female are worked in private sector job, who worked in public schools, private organizations and government offices in near the village. People who work as businessperson are also very low. There are many households who have sent their children to Kathmandu and Banepa(nearest town from Bhakundebesi)for study. After the completion of their study, they settled at the Kathmandu for the better employment than return back to village as a student. Agriculture has gradually become a secondary livelihood option for young people.

#### 4.5.1 Impact of Road Construction on Village Economy

After the construction of BP Highway through Bhakundebesi, the financial activities of the surrounding villages have dramatically increased. People in the villages who used to sell their agricultural products such as milk, vegetables, and other crops at low prices got value after the arrival of the highway. Today Bhakundebesi and the surrounding places are among the top places, which supply the milk to the Kathmandu valley. Milk is the main cash-earning source for the villagers. There is one private milk collection center Bhakundebesi where two persons work as labor and one as intermediary who buy milk from the villagers and sell it to dairy. Here, the increase of economic condition is not only positive for people's livelihood but also negative impacts on their health too. According to them they sale their hygienic crops and pure milk and buy chemically food like rice for men, and *dhuto*, *pina* for cattle. The key informant Sambhu Prasad Khanal (45) told me about this,

“Now, how can we say we sell milk? If we try to consume grains only from our land, it does not support for the whole year. So, we consume rice, paddy and other grains from other sides of our VDC, when ultimately affects our health and the another things. If we could feed our animals the local hay, it helps motives' the milk more and it would be goods for their health too. The new diseases attack our cattle's health because of the hay, bran and oil cake imported from outside. If it becomes changed as it was in 2050/55, it would be better for cattle's as well as for us but we can't make it happen so. In addition, how can we make progress by selling milk? if there is no favorable climate for cattle's”.

Mr. Khanal also told me about the situation of labor migration for foreign country “*kam chaina ielam chaina kheti garera jivika dhannai garho bhayo bhanera bidesh jane dherai bhaisake ni.*” (There is no work in land and no other employment, here is hazard condition to regulate livelihood from agricultural production. So many people have gone to foreign country to labor work).

#### 4.6 Village Agriculture

Agriculture is the means of livelihood of the most of the villagers as most of the people of the nation. Youth peoples (age of 16-24) Primary occupation of the 42.30% of the total population is agriculture. Rice, wheat, maize and vegetable is the main production but the production of the wheat is dramatically decreased since last ten years because of low rainfall. They plant paddy in the field called khet (irrigated

lowlands, with rice-cropping system) where they can supply water in the rainy season whereas plant maize in the dry field which they called *Bari* (rain fed uplands, with maize-based cropping system). Paddy planted in June/July, and harvested in October/November. Khumal-4 is the main variety of rice in this area as in other hill areas but some farmer plant Taichung too. Almost all of the villagers depend upon rainfall water for the irrigation of their field. That's why anomalies in the rainfall pattern due to climate change in the village have affected the agriculture system of the village greatly. Few irrigation facility as there is no source of water near the village. Nearest river in village is a small river called, Dapcha Khola, where flow of water is very low which not enough for them. Another river is very far from village, named Dundi River, where amount of water is also low and a cliff between the *khet* and the river. According to villagers, irrigation from this river is also not viable option for them.

Maize is the second largest cereal crop in Nepal and Bhakundebesi also after rice. It planted in April and harvested in August/November. People use maize as a food for themselves as well as livestock. According to a informant, last year planted maize in their *bari* just in July. He also noticed that Millet have been disappearing now a days. "*Kodo ta lop bhai sakyofatta futta dekhda ni achamma lagcha*"(millet have been totally disappeared now a days, it is are wonder to see millet in the village). Traditionally, wheat planted in November/December and harvested in may/June. Now there is no cultivate wheat, last year they planted wheat in the last of January and harvested in the last of June. *Dpcha khola* (a local stream), *Dundee khola* and local tap which is situated in the local place of *thulo dhara* are the main sources of water, but according to locals intensity of water in stream are decreasing during these 10-12 years and local springs are drying up gradually. Their remember last year they cannot buy their investment for wheat production.

Above mention perception clearly indicate that local practices has changed cultivate as well as harvesting period. After shifting time of agricultural practices local people felt that their perception of climatic forecasting have been declining gradually.

## CHAPTER FIVE

### LOCAL PERCEPTIONS AND IMPACT OF CLIMATE CHANGE

This chapter describes that the local's experiences on climate by focusing on natural climatic events such as precipitation, temperature, drought etc. I have documented the experiences of climate based on lifelong observation of local people. In the second, it describes about how the changing climate affects agricultural practice system of the communities in the context of Bhakundebesi region.

#### 5.1 Indicators of Climate Change: From Farmers' Perception

In the field observation, I found that farmers used multiple indicators to examine the climate change in their surroundings. Local rural people interact and understand the local climatic phenomena according to the significance of landscape. They are aware about climatic fluctuation while doing subsistence practices in their living world. People have varied perception on local level based on their observation. They observed climate event from the courtyard in one hand and another hand they used to do their agricultural activity based on time boundary. People perceive the local change in their life ways either in the local resources or in agricultural production too (Vedwan, 2006; Roncli et.al 2003; Poudel, 2012).

##### 5.1.1 Rainfall

From the interviews with the respondents, it was informed that the rainfall has been decreasing in amount and also shifting in time. Most of the farmers, when asked about the role of climate in agriculture production, attributed poor production to reduced summer rain feed and it's changing timing. Summer rainfall pattern in the village is widely perceived to have decrease in amount, as well as to have been displaced in time. When asked about the changing in climate, respondents most often began their response by describing the change pattern of rainfall as well as time. Moreover, a shift reported in the distribution of rain cross time. Local people were highly believable on monsoon rain because it was regular and enough in late *Jestha* (June) to beginning of *Bhadra* (September). That time was very important to involve in farming activity in terms of other months and it was raining until *Bhadra* (August). Now the monsoon only seen after 15<sup>th</sup> of *Ashad* (July) in tiny amount as it is more active after this month and remaining over the *Bhadra* (September). Now local peoples

said the monsoon rains slightly displaced to the period beyond *Shrawan* (mid August).

Hari Devi Humagain (61)

Almost 10/15 years ago, rainfall used to start from the third weeks of Chaitra and it was easy to farming maize and paddy. After the rainfall, maize would have showed in the field on Baishakh and it would be weed on Jestha. From the second or third weeks of Jestha the work of spreading of paddy seeds would be done and after growing of paddy seeds it is farmed for paddy production on Asar, during working in the field monsoon rain fall used to happen all the day and we would use Ghum (a traditional type umbrella, used to wrap on the back made up of from the plant's leaves) but now a days it is not need to use Ghum because rain fall is not so heavy. In the first week of Asar maize were weed again and are harvested in the first week of Bhadra now a days, which used to be harvested in the last week of Bhadra before some years ago and paddy are harvested completely now on kartik which used to be beat only on Mangsir before.

To understand what aspects of seasonal rainfall are most relevant to farmers, I asked respondents to describe in detail the rainy season. Farmers used to characterized the rainy season were associate with the duration of the season ( the timing and nature of the onset and end of the rains). Local people were aware of monsoon rainfall because it was huge of flood seen at the evening time. 'bihana ko pani pardaina , rati ko pani tardaina'(rainfall is not sure in the morning but evening's rainfall is fixed at any cost). In their perception, the starting of rainfall at night was most heavy and it was rain long period then morning started rainfall. Other hand farmers were associated with the distribution of rainfall during the season (the number of 'important' rain events, and the timing and duration of dry spell at key point of growth for crops). Now they are in a condition to pray for rainfall to irrigate their field. Such are Raksha Devi pooja and Mahankal pooja in *Baisakh*. Their knowledge of monsoon rainfall more different than metrological record. They categories the types of rainfall and so, how long will go it. Chitra Bdr. Adhikari (63)

The way of rainfall, time and day was first conformed for working in the field. The heavy rainfall, the rainfall that creates tool of water, dizzying rainfall, torrential etc. are the types of rain. When it was time for planting paddy, the rainfall used to be creating of a root of water. This type of rainfall longs for several days. And the abundant water remains on the ground. Furthermore, counting according to day, when it starts raining from Friday it used to last until the next Friday. Moreover, in count number 4, it is Wednesday and if it starts raining, it looks for four days. In torrential, the abundant water focus at one time but it looks only for some hours. It



makes the ground soil wet on the one hand and sweeps the fertile soil on the other.

But now a days it does not happen.

In all their observation, farmers defined rainfall event and water deficits in terms of their observation of plant climate interactions, farmer's evaluations reflected on understanding of rainfall as a process, inseparable from its temporal dimensions, rather than a quantity, abstracted into a set of static categories such as the terciles of seasonal precipitation forecasts (Roncoli et. al, 2003). Other elderly people said that total rainfall period have been declining day by day. They also informed me that, in the past the rainy seasons would start in the month of June and rainfall has also continued to September. At that time many springs were appeared and ponds were full with water. Nowadays pond *Thulodharo pokhari* and *bhot kuwa* is empty and many monsoon springs had dried. In this context, Ganga Datta Khanal (70) local resident of Khanalthok did not hear about the term 'climate change' or 'global warming'. However, he also have been monitoring and observing of shift in rainfall. he shares his experiences as follows:

"I don't know whether it is by climate change or something else but the days are becoming changed a lot than in the previous years. Those wells and ponds have gone dried. They need maintenance but no care has been given to them. All there it in the pond is grass. After the huge rainfall in 1965 (2022 BS), there is no rainfall that can be compared with it. If it rains in wintertime, the grains would grow good and harvesting will have increased. The winter rainfall also eliminates the diseases of grains".

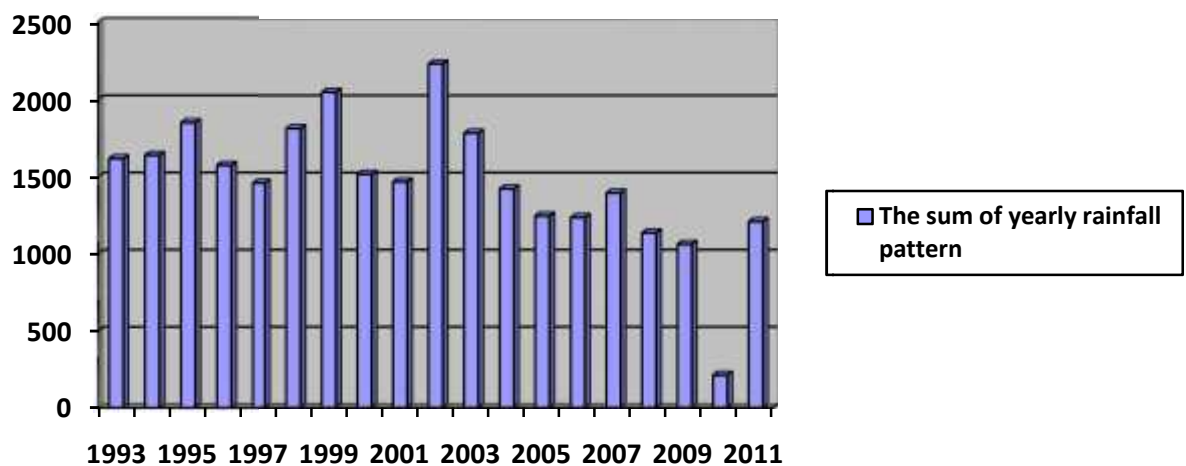
People are worried with this declining and shifting trend of rainfall, because it poses a threat to their agricultural activities. People experienced that erratic and less rainfall has been increased since the last decade. People compared the frequencies and amount of the rainfall they have noticed during the course of their lifetime. Chandra Jung Adhikari (76 years) a local resident of Bhakundebesi shares his experiences as follows:

"The rainfall is quite different compared to the past. Our winter crops almost fail which is the only one means for us to earn cash. Monsoon and winter rainfall has decreased during last 10 years. Due to the late monsoon, the production of rice was reduced to half in amount. Since 1992 the winter rainfall is almost rare where as the summer monsoon is also uncertain and is decreasing. During my whole life span, I never experienced such a drought as we experienced in year 2001. During winter, there was enough rain. In summer, the monsoon also started late so we faced problem in paddy cropping".

Weather and climate are understood as part of a universe infused with spiritual significance in many communities. Alterations are often interpreted in terms of violation of religious, moral, and social norms. This understanding matches here in Bhakundebesi. Many elderly people in the village believe that the problem of water and anomalies in rainfall is because of violation of the religious rule. According to them two women (call Gargi sisters), from outside the area came here in Bhakundebesi and read the Shiva Puran in 2002 which is traditionally prohibited for the women. This is the reason of rainfall anomalies for them. But the young generation and the women of the village don't agree with elder people and argue that it is not because of religious cause but because of environmental cause.

The rain was regular and adequate for sustaining their life but the altering nature of rain has sturdiness in livelihood strategies in one hand and the other hand it has been demanding local need of people. The rainfall and seasonality is alerting altogether in their views. It is also examined and analyzed from 1993 to 2011 is presented below.

**Fig. 2 The Following Figure Indicates The Sum of Data Over a Year From 1993 to 2011 at Dhulikhel Station.**



**Source: Department of Metrology, 2013.**

This statement clearly indicates that the context of Bhakundebesi it is very difficult to differentiate seasons to the villagers at present. It was shift in rainfall and storm time in the study area. The respondents said that precipitation has completely

changed and people experienced that erratic rainfall has increased since the last decade.

### 5.1.2 Temperature

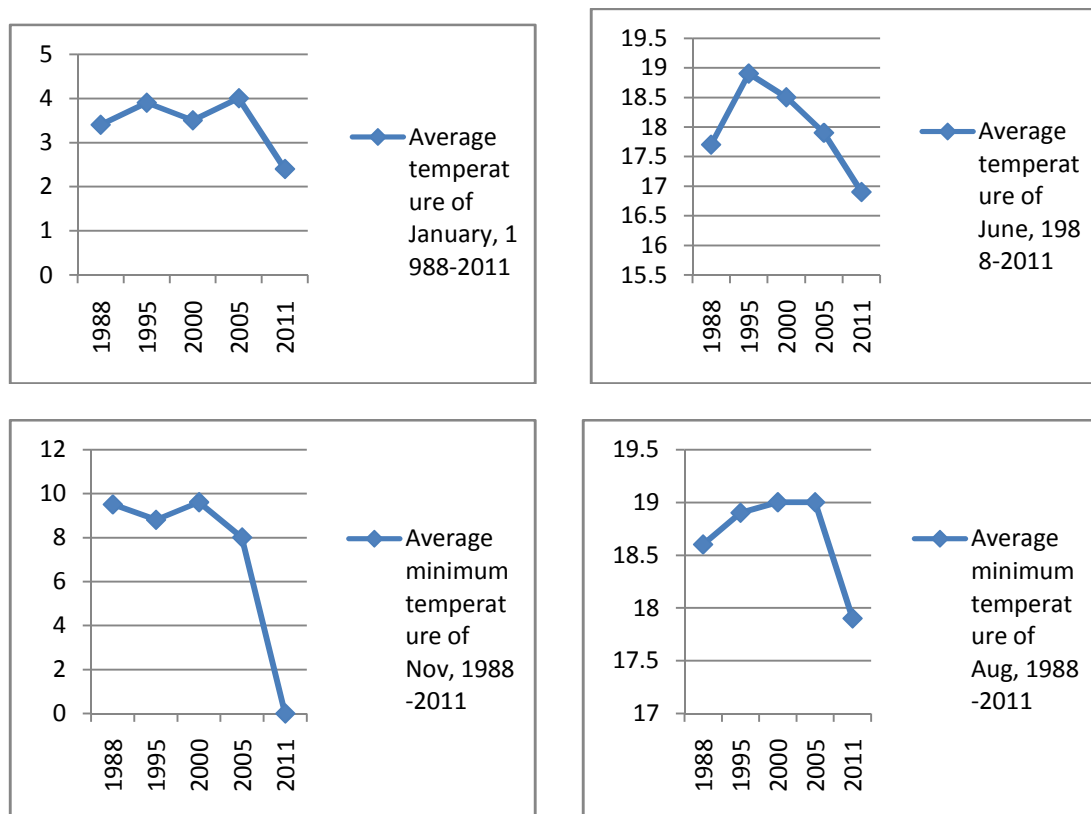
Like change in the rainfall pattern, people of the study area, the elder people in particular mentioned that they have noticed a significant change in the temperature regime of their area. Respondents from study site claimed that the place is getting warmer in comparison to the past days. According to them the days and night in the winter season used to be very chill in the past but during recent year they are experiencing less chilled winter days and nights. Similarly, during summer season, the days are becoming hotter. They follow the season as winter and summer, people used to wear the slightly thick clothes even in summer season but now it astonishes them. One of the respondents Achyut Khanal(42) explains his observation about the temperature like this:

I memorize that we used to go to school in the morning and return at 11am and we would have worn thick cloth even in the summer season but now we cannot use the same sorts of cloth here. Even being an old we use to wear thin cloth now a days in the evening and morning in summer season and still it sweats in the body.

There is a perception that the temperature distribution has undergone a significant shift in addition to an overall increase in temperature. For example, the hottest period of the year is no longer the month of *Jeth* (15 May to 15 June), but has shifted ahead. The months of March and early April, on the other hand, are colder than usual. The periodicity of temperature is believed to be influenced by the timing of rainfall. The respondent Netra Bdr. BK (81) told me of his experience:

Specially summer season used to be from Chaitra (march) and Jestha (june) to Bhadra and coldness had to be left even after rainfall in the last of Magh but now a days it can be experienced of summer in the last of Magh and early of Falgun (early February). Similarly, summer can be experienced during the weed of paddy and harvesting of maize on Bhadra, which shows the increasing temperature of our village. Now a day we can feel coldness from the starting of Aswin (September) which is started immediately after the rainfall of Dashain Nauratha. This type of changing temperatures have made us difficulties for farming in the field and harvesting our produced crops by which we should only work in the morning and evening in the field now a days but before we also used to work in the field even in mid day.

**Figure 3 The average monthly average minimum temperature records of Dhulikhel Station.**



**Source:** Department of Metrology, 2013.

Metrological data shows increasing minimum temperature from 1988 to 2000 and gradually decreasing from 2005 to 2011. In this way, it shows temperature fluctuation between two decades. For example, temperature has been increased from 3.4° c to 4.0°c in January. Similarly in 1988 minimum temperature were 17.7°c and 16.9°c in 2011. Average temperature of 1988 was 9.5°c and of 2005 was 8.0°c. Accordingly, average temperature of August in 1988 was 18.6 ° c, average temperature was related to 19.0 ° c in 2000 and 2005, and it came to 17.0 ° c having decreased in 2011.

In this situation, local people understand their traditional knowledge and changing fluctuation of climate from their own local perception and do their activities. According to them local perception are very useful for agricultural activities than metrological record.

### 5.1.3 Drought

Drought is one of the natural disasters. People feel that they have been affected with drought especially during last 7-8 years. People said drought normally appears during the month of *Chaitra-Baisakha* (April to May) and in case of no rainfall, the duration of drought gets prolonged. Apart from immediate crops and grasses loss drought has long term implications for deterioration of soil quality, decrease vegetation and dry water resources.

People mentioned that it is very difficult to cultivate maize and paddy crops prolonged. Erratic precipitation during rainy season or no rainfall in the winter has made the soil dryer. A key informant told me that “maize is nature dependent crop, if no rainfall it is very difficult to cultivate maize crop, I have less paddy field, maize is our life, if any delay or decline in maize crop we will get starvation.”

While talking about wheat farming, a villager named Bhairab Prasad Khanal (58), he is working in VDC office on the post of secretary told an interesting incident. He said,

Last year a bureaucrat from National Planning Commission came to their village to observe the problem they are facing. He saw the fallow land in the village and listened to the villagers about their problem. Then he distributed wheat seed to villagers as subsidy for the drought. Every villager got 10 kg of wheat seed as subsidy. I too got 20 kg of wheat for my 2 ropanis (19.66 ropanies = 1 hectore) of khet and broadcasted it to my field. I am convinced that the production would be around 40 kg because the problem is not the seeds but the water. We can buy improved seeds from anywhere but couldn't bring water from our own initiation. It is beyond our capacity. He also said “pani kam parera kheti garnai garho bhayo tehi bhayara baru khet bajhai chhodiyo” (by the lack of rainfall, it is hard for farming so that land are barrel itself).

According to above statement local people and bureaucrat understand the same and single matter differently. According to local people, they are not worried about seeds but worried about inadequate of water for irrigation, which is their main problem for farming. So that if local problem and events of farmers and farming system can not be understand, it is difficult to find out the solution of any existing problem in the village.

#### 5.1.4 Experiences on Non-climatic indicators

In every step of people, they have their own knowledge and perception to view the present situation. People are interpreting the non-climatic variable as climatic indicator in their physical world. People have their transmitted knowledge along with sensory perception to interpret the local phenomena. Non-climatic indicators are deeply rooted in their day-to-day life and activities. Those types of variables are seasonal along to the seasonality and they interpret the non-climatic indicators as this: Flowering, ripening, maturing, and growing along with size, taste, color, and quality and quantity too. One respondent Sambhu Prasad Khanal (45) told me his memorable condition of blooming of *Lali guransh*(rhododendron) and taste of *kafal*(raspberry):

When I was student, I used to go school through the way as jungle, usually in the month of chaitra(Mar-Apr) and Baisakh(Apr-May) we notice the rhododendron and we used to pluck it and bring home. Sometimes we chew it as is it tasted honey. So far as I knew the rhododendron never bloomed before Chaitra but from last few years, in the recent days it started bloomers before Chaitra. We can notice rhododendron blooming in Poush(Jan-Feb). in the same way, the raspberry and strawberry was only available after Baisakh. It was still sweeter and we mix salt on it then take it. But nowadays the taste of raspberry and strawberry has become no tastier as it used to be.

Another respondent Badri Prasad Khanal (38) told about plant and species behavior, to know climatic condition, which his parents say:

Our father and grandfather would have known whether rainfall or by the behavior of insects and birds. When so many flies occur around house, if bite to people and if people's body become lazy after having, when in the morning then rainfalls. Similarly, when someone see a snake walking through the slope, ant carry their egg from one place to another as well as the playing the sparrow on the dry soil are the indicators of traditional rainfall prediction. Mosquito would occur only after the cutting of wheat from the field on Jestha (May/June) before some years ago but not mosquitoes have come very soon, which may be the causes of increasing temperature in the summer seasons.

Like that local people believe Atmospheric features and indicators are also can use to know climate which indicators also use other place of Nepal, the respondent Sadharam Khanal(54):

If clouds appear being black, rain will fall, if sun set itself in clouds, rain will fall at that night. When cold wind blow in the morning from north and in the evening from east than other times, rain will fall are the local perceptions. Moreover, elderly people watching the shape and lightness of the stars and moon can predict the changing climate/weather. Now a day's young generations have no idea about these things. Instead of trying to know about it they deliberately, tease to elders.

## 5.2 Changed in the Weather Calendar and its Impact on Agricultural Calendar

The traditional calendar of Bhakundebesi farmers represents ideal types or pristine, undistributed climates. Different periods in the calendar year are usually described in conjunction with corresponding weather activities. The ideal cycle shown in table was created from interviews with elderly informants.

**Table: 3 Weather calendar and the associate cycle of agriculture activity**

Local term	Approximate period	Description (traditional)	Description (present)
Magh	Jan 15-Feb 15	Agricultural activity based on season with rain	Agricultural activity are rare and cold without rain
Falgun	Feb 15-Mar 15	Continue cold but easy for agricultural activity	Some rain
Chaitra	Mar 15-Apr 15	Blowing cold wind	Blowing hot wind and increasing temperature
Baisakh	Apr 15-May 15	No rain, clear skies (paddy sown)	Dry with some rain
Jeth	May 15- Jun 15	Begins raining and preparation of seed plantation	Hot and dry
Ashar	Jun 15- Jul. 15	Time of monsoon Rain and plantation period of paddy	Hot and dry, waiting for paddy plantation
Shrawan	Jul 15- Aug 15	Continuity of rain	Starting monsoon rainfall

Bhadra	Aug 15- Sep 15	Rain(until 30 Aug), decreasing monsoon rain	Continuity of rain over this month
Ashoj	Sep 15- Oct 15	Clear(corn, dal harvest)	First half rainy and second half dry
Kartik	Oct 15- Nov 15	Mostly clear(busy in paddy harvest) with sunny days	Very clumsy days with scattered rain
Mangsir	Nov 15- Dec 15	Cold and sunny days (wheat broadcast on 1 <sup>st</sup> week)	Sunny and clumsy day, (wheat broadcast only last week)
Poush	Dec 15- Jan 15	Maximum cold but days are sunny	Unusual sunshine due to the mist

**Source:** Field Survey, 2012.

### 5.3 Impact on Labour Exchange

People have been using local knowledge and experiences for interpretive world which is guided from local contextual event. They follow the traditional living strategies and they used to do in local area with social and cultural practices. Local knowledge and exercises are under the circumstance of the local events on agricultural practices as one of the most is Parma (labor exchange) system. Since the extreme events of 2003/2005, they had lost many things from their community. At that time, they were help in any kinds of agricultural exercises for local cultural traditions to solve their scarcity of labor and difficulties in natural calamities.

after the staring of monsoon rainfall, paddy farming will start, during the time neighbor people use to do labor exchange for paddy farming which is called 'Parma' in Nepali. Local people have decreased their farming in field due to the changing climate and weather and most of people in Bhakundebesi started real estate business, by sold their land, which has affected to labor exchange system among local people. But now a day's wage labor is to be paid for workers but also labor cannot be get easily in time. Its effect is causing labor exchange system to be demolished day by day and future generation will be the unknown about 'Parma' and will be the story in once upon a time for future generation.



In the past, such activities were usual inside the community, which was essential for the local agricultural practices protection. It was viable instruments for local livelihood strategies in their lifetime. Moreover the causes of displacement parma system is some people are converting their fertile land into real state because of the impact of climate change. They are valuing their land as investment they have to offer for the production which is becoming lower and lower in these days because of the impact of climate change.

A well-known businessperson who does the business of milk in this area, Sambhu khalal (45), told me that

why they should not change their land into real state when there is so much money. He further said that the land is so expensive that doing agriculture in this land is also expensive. In his opinion, the productions they have produced from their land should have high value, which is not possible practically as the value of land has not risen naturally like in the other parts of the country.

But I remember the native American saying quoted by Vandana Shiva in her article 'Resources' that 'Only when you have felled the last tree, caught the last fish and polluted the last river, will you realize that you can't eat money' (Shiva 1992). If she was in this context she wouldn't have forgot to mention the land and say only when you sell the last piece of land and make building there then only you realize that you can't eat money and then you also realize what is the importance of parma system in community solidarity.

## **CHAPTER SIX**

### **ADAPTATION AND COPING STRATEGIES TO CLIMATE CHANGE IN BHAKUNDEBESI**

One of the main objectives of the study is to seek rural people's adaptation strategies to cope with climatic change and climate change induced disasters. In the case of Nepal, poor and marginalized communities are more vulnerable to climate threats. Poor farmers are unable to afford irrigation systems and are prone to delay in rainfall or extended drought compare to rich farmers who can afford to irrigate their field (Manandhar, et. al 2010; cited in shrestha). Societal and cultural aspects of risk rather than the physical aspects (Morcer, et.al; cited in Shrestha, 2010). Farmers action are not entirely in response to changing climate but also wider social change and adapting to technological innovation at their disposal (Shrestha,2010). Thus, this chapter describes the existing coping and adaptation strategies followed at community level which help to increase the adaptive capacity and resilience in response to risks and hazards related to climate. Some local intervention and initiatives in resilient path are explored as following:

#### **6.1. Adaptation to Climate Change in Bhakundebesi: Strategies and Options**

Farmers are exposed to recurring droughts; they need to adapt their farming systems from year to year to the differing conditions caused by droughts. For most, however, agricultural adjustment is a costly option, as investment is need in re-sowing, crop replacement, intercropping or irrigation. Now I will discuss here the adaptations strategies, which the villagers have applied to cope with the changes they are facing due to climatic variability and options they have to develop for the better adaptation to this variability.

##### **6.1.1 Application of Genetically Adaptive Varieties**

Farmers here are trying to adapt through applying new variety of rice for the erratic rainfall. Some farmers have tried new variety of rice in last two years in place of the seed they were traditionally using. Khumal-4 was the main rice breed for them for last several years but some farmers tried Taichung (new rice breed) for last two years because of delay in rainfall. Local people of Bhakundebesi, Taichung is more adaptive for the late rainfall condition. Khumal-4 was planted June 15 to July 15 in monsoon but the Taichung can planted late July to first week of Aug too. The

production of Taichung was satisfactory enough for them whereas the production of Khumal-4 was least when there was delay in rain.

### **6.1.2 Full Scale Production System of Hybrid Maize**

Traditionally the farmers here plant maize in their upland (bari) as maize doesn't need more water for its improvement. According to them large amount of water in soil is harmful for the maize. So, maize production is not affected more by climate change. However, when they tried maize in their low land field (khet) the result was very negative. In 2006 when the rainfall here was very much least and delayed, farmers broadcasted maize in their *khet* but they could not produce maize as they expected. There is problem in the land of Bhakundebeshi because land does not dry up soon when it got heavy rainfall. What happened here in words of a woman, Yasodha Khanal (40): (Treasurer of Village Development Programme, Khanalthok VDC).

In the year 2006, rain did not fall till the last of Asar (June/July). At last, we had sowed maize in our khet. But the rainfall happened in first week of Shrawan (July/August). Because of this heavy rainfall, all plants died because of the wetness in soil, which remained for longer period than needed. It is because of the type of soil here, we could not grow maize in our khet. Rice is the only option for us in rainy season and it is suitable here but it also could not farm in last two years because of low rainfall.

The impact of climate change was varied according to geographical location. Therefore, the use of maize as alternative to rice in rainy season on their *khet* is not a viable option for them. Untimely rainfalls have become the problem for farming maize in rainy season because the farming fields wet for long time. As a result farmers of Bhakundebesi are primarily engaged in the field for paddy crops in rainy seasons July/August due to heavy rainfall.

### **6.1.3 Management of the Livestock Population**

Livestock keeping is the secondary occupation of the villagers even though they are not keeping livestock as profession. Every household keep livestock for manure and fulfill cash needs, as it is the only source of cash for rural farmers. However, they are not keeping livestock as the option to adapt with changing condition. They have their own problem in doing so. They argue that without good farming livestock keeping is not possible. Moreover, it becomes impossible to do it

professionally when there is scarcity of water for irrigation and household use. Rice straw is becoming more and more expensive and scarce in the area because of declining rice farming, which is the main food for the cattle. Due to the scarcity of grass and hay, the local villagers could not feed their domestic animals.

During my fieldwork, the respondent told me that livestock husbandry is very difficult now a day. The informant told me:

Livestock husbandry is very difficult now a days due to the less production of hay in the field. Wheat farming was totally replaced. We should also buy maize for feeding to cattle then how can we keep livestock. We should also buy Feed for animal and a bundle cost was five Rs before some years ago but now, its cost is 15 to 20 Rs per bundle by which we keep livestock only for economies of our cost in daily livelihood but not as a family occupation.

I also observed that the villagers could not get hay and grass even they want to buy fodders for their livestock. Other food supply like maize and wheat is also decreasing which they used to feed their cattle. Therefore, they could not keep more livestock by which its effects occur for supplying manure to their field. They are not in a condition to apply it as profession. While there were easily, access to fodders and green grasses from forest resources and the production of hay was high. Farmers of Bhakundebesi used to pet livestock for example, cows, buffalos, goats, hens for the intention of selling and home use however, the changing climate and weather fluctuation local area causes lack of fodder and grasses from forest and decreasing production of hay from produced paddy. so that now a days local farmers started keeping more or less three or four livestock at home which the intention of their daily subsistence livelihood.

#### **6.1.4 Change in Crop-cycle and Pattern**

Farmers from Bhakundebeshi have been practicing crop cycle system to make their life standard easier and normal which is different than traditional farming practices. Among the farmers from Bhakundebashi, Indra Bahadur Dahal (52) expressed his experiences in his way to my question why are you using crop cycle system.

Most of the elderly people and our father, grand-father used to say that just as we can easily lift the newborn buffalo's calf everyday till 5/6 months so as use of urea in the field everyday and increasing amount of it spontaneously decreases the fertilizing power of the land and it gives very low production of the crops which is

gradually affects to the traditional farming system. I memorize that last year paddy production had been highly decreased and produced paddy provided only half of the rice so that we have started to use crop cycle system by which a disease which is occurred in a single plants does not transmit to the other plants. Particularly after starting crop cycle system it reduces the use of urea in the land and pure organic farming can be done. I have also done organic farming in which constantly radish, carrot, apple which is produced under the land are farmed. But we have a problem of soil, if there is fertilizing soil crop cycle system is very beneficial for us.

The Bhakundebesi farmers are able to predict quite well, when the rain will come and plan their planting season to coincide with the rains. This has, however, become difficult in recent years due to changing rainfall pattern. To this, the farmers are adapting by changing types of crop, they used to grow. A key informant informed me about a case in point is shifting from wheat cultivation to drought resistant crop such as Peas.

## **6.2 Diversification of the Economic Strategies**

Diversification of available opportunities for livelihood income source has important role to cope with changing climate. Once the impact of climate change narrows down the scope of traditional livelihood people seeks alternatives. They give first priority to make the existing livelihood source more resilient. The second priority is to seek alternatives livelihood like income generation from the available resource and opportunities (Gurung and Bhandari 2009; cited in Parajuli, 2012). From the field study, the impact of climate change was severe on livelihoods of communities in the study area. Many diversifications strategies that communities practice earn minimal incomes, rarely strengthen the livelihood.

The local people of study area is attracting towards cash crops from subsistence farming. They have commercialized local product such as cauliflower, cabbage, potatoes, peas, local chickens etc. Now village people trying to farm tomato in winter season, which need less water than wheat and potato product. People are commercialized in recent time due to the climate change which process has diversified rural income source and people have become more resilient. Instead of paddy and wheat farming people are attracting towards above mentioned cash crops after the changing condition of environment in past 5-10 years. Now local persons of Bhakundebesi established a seed bank to collect and sale good category seed like paddy wheat maize and other vegetable seeds too. Some people take lease other

people's land and starting tomato farming in winter season. Beginning 2006, they organized in 15 users group and demand hybrid vegetable seed from District Agriculture Office (DAO). Now the DAO providing hybrid vegetable seeds to them.

### **6.3 Arrangement of Rain Making Rituals**

The local inhabitants celebrate different rituals in order to cope with the changing climate. These rituals are especially performed with the parsing of lord Shiva, Indra, Bhairaba, and other goddesses. These gods and goddesses were considered as the symbols in order to make rainfall. In addition to make rainfalls, they also perform such rituals so as to make their tradition continue. This fact is also proven by the environment of youths in such rituals. In order to protect their traditional norms, values, and traditions, they celebrate some rituals regularly and some occasionally. Badri Prasad Khanal (38), who also participated in such rituals exclaims;

We believe in the religions and spiritual power of god. Because our fathers and forefathers have done so and in order to make continuation at such traditions, the youths are also taught by the older ones about the process of making god happy so that no crisis falls upon us. For that we usually praise the defending goddesses, and Mahankal with enchantress some hymns. By making praise of such gods and goddesses, we are indirectly benefitted which also increased our trust upon god.

About statement explicitly clarify that even young generation talk about modern age, they are ready to cope with changing climatic circumstances by assimilating divine power, traditional rituals and they also celebrate rain making rituals.

#### **6.3.1 In praise of Defense Goddess (Raksha Devi)**

There are religious organizations, which function to accomplish the expected task during the ritual ceremonies. In such rituals the priest of such organization, one who is guiding character, stays for a whole day fasting before the day of ritual. Not only that, he is hells to blade his head and beard. In the day of performs ritual, all the villagers gathering the house of priest. The main feature of this ritual is that a goat is sacrificed. These people are guided by the saying that their god is factors because his thrust is not quenched so he decides to make drought. In order to make him happy, he is to be pleased by giving sacrifice of blood.

The villagers pay the cost amount of sacrificed goat. In addition, other materials used in that ritual by dividing the total cost, For all the involved members.

Then after the leader of that ritual (Bramhin priest) rules ahead towards the place where they make sacrifice and other members strictly follow him with the proposed goat for sacrifice behind him. However, Mahankal and defense goddesses rituals are performed in different days but the process, method and involvement are the same. Mahankal ritual is performed in a lawn nearby the village where as defense Goddesses ritual is performed in Phurke pone forest. When the priest and other devote reach in the pone forest, the priest charts some hymns with strong determination to please the goddess by making sacrifice of goat. When the goat is sacrificed in front of the sculpture of goddess (made of stone), the blood is pared in it thinking that goddess will drink it when they make sacrifice and will be pleased.

The significance of such scarifies is that people of the village, believe that the defense goddesses please with blood; she will definitely make the prosperous, happy and cheerful by making rain. After enchainment are over the devotes of scarified goat and take it as a “Prasad.”After all the scarified rituals ends and the devotes, once again praise for rain as they say, “Saune Mahankal gives us water as rain” “defense goddess makes rain”.

These rituals have become the coping strategy for the villagers of Bhakundebesi. They celebrate these rituals on the month of Chaitra, Baishak and Jestha at once in three months if rain does not fall as per their expectation and traditional time.

### **6.3.2 Frog Marriage**

It is mysterious to learn about the spiritual power that people believe not only in god but also in nature. The extreme hazards and accompanied by some kind of extreme and Erie celebrations. Some of these traditions, asinine but the genuine and realistic portrayals of such rituals are of much importance in anthropological study. In general, people are habituate with the process process method and significance of marriage between opposite sex *i.e.* male and female. in general between human beings, but this very marriage does not belongs to human tradition of marriage. Between male and female of human beings rather it explores the tradition of “Frog Marriage” which is celebrate in Bhakundebesi village of Kavrepalanchok, which is detailed here with.

In the year 2003, the people of Bhakundebesi village suffer from the great problem called “Drought”. Traditionally when frog started to make sounds in the

month of Baisakh, Jestha and early Ashad the rain used to fall. In this sense, frog was taken as a symbol of rainfall when it makes sound. Since no rainfall blessed the Bhakundebesi the people started a different and mysterious ceremony as a coping strategy which is known as marriage of frogs. This ritual begins and the people find rain falling from the sky. A local villager Indra Bahadur Dahal (53) matters the process and importance of marriage as:

Increment in population create dust, pollution as a result fertile and agricultural land turned to houses, factories and at last it turned into a big city with number of people. That not only the jungle has been deforested but also the forest goddess (Bandevi) used to live in the jungle, but also due to presence of human civilization and deforestation jungle goddess became angry crisis ruled over our village. For about 4 years, we cannot plant paddy in our field due to drought. Then after we asked for help from VDC office and District Agricultural Office (DAO) for irrigation and seed, the agricultural office provided seed of wheat costing 10 hundred thousand to the villagers. We further headed to the Irrigation Department, but they cannot make any help instantly. They only promised that they will instant deep boaring as soon as possible. However, the help did not come as they promised. Then as per the suggestion of one by the priest of village, we decided to please praise at kotdevi than we praised at the place but nothing changed at all. Finally, we came to make celebration of marriage of frog. As for the tales of our ancestors, we dug Bhairab Kunda. Actually, Bhakundebesi come from the disclosed from of Bhairab Kunda. We celebrate the marriage of frogs that kunda.

While making marriage ceremony almost all the processes and methods of human marriage have been adopted. At first the Bramhin fixes date of marriage according to the lunar calendar. The help as veterinarian identified the male and female frog. While dully so, the male frog was brought from Bhairab pond and the female frog from Pate pond. For the marriage propose, the two priests were selected from the village. Two Brahmin priests played the representative role of guardian of male frog and female frog. The marriage was celebrated with traditional panche Baja. In that, ritual the representative of male frog from the pond of Bhairab went to the Pate pond for marriage procession. In that, procession farmers from the Bhakundebesi were involved and to welcome some of the farmers also represented than the side of female frog. For the whole day the priest's enchanted hymns and the marriage procession was finished after the female frog was taken to the Bhairab pond. For



completing the marriage procession, it took almost eight hours. Since it was, a religious ceremony meat was organized.

The importance of such marriage was to make rain. The slogan behind was this “oh god give us rain” and “Hara Hara Mahadeu, Pani Deu”. The praise was made to the different gods and goddesses. The interesting thing is that after some hours when the marriage ceremony finished, it started rains. However, it was not heavy rainfall, but it showed that their ceremony and praise become heard by god as one as, the villagers said.

Particularly, the worshiping of Rakshadevi (goddess) and Mahankal (god) is done each year on Baisakh and Jestha for the purpose of making rainfall in time and high production of crops. However, rain making ritual takes place when there is a prolonged drought and less rainfall in the season of farming. In this way, the villagers have adopted interesting traditional practice of rain making ritual as a coping mechanism. The local villagers believe the existence of god and practicing their traditional rituals. So that, the villagers do not want to break the relationship that have made to god and ritual related to frog’s marriage.

#### **6.4 Social Network**

Social networks in the study area play crucial role to climate change adaptation. According to Ensor and Berger, social networks are the glue between many of the elements of adaptation. They drew attention to the relationship between actors and can be visualized as a web either of connection that link diverse individuals and institutions directly or via other actor (Ensor and Berger, 2009, cited in Chapagain, 2013).

Adaptation is associated with planned action. People of Bhakundebesi, they have also updated use of high yielding varieties, multiple cropping and change of local seeds to improved seeds of vegetables. Similarly there is trend of replacing local varieties of crops with hybrid, which is long run can threat to be the agro-biodiversity. Now the people of Bhakundebesi are have formed many groups such as mother’s group, community forest user group (CFUG), vegetable farmer’s group for community level. Now they are organized 15 farmers groups in two VDCs (such as Khanaltho and Daraunepokhai). The District Agriculture Office sends to them hybrid vegetable seeds, and now in village, there is hybrid seed centre established by local farmers. In this center, not only sale hybrid seeds but also buys the local good seeds production such as paddy wheat maize etc. In 2011, maize crop was damaged by leaf-burn disease. People informed that hybrid maize was high drought tolerance; as a result, leaves of hybrid

maize were not burned in 2012. Farmers said that disease and pests did not affect it. Farmers have actively involved in agricultural group and these groups are creating platform to unite local productions.

### **6.5 Establishing of Brick Factory**



Due to the change in climate, the local villagers abandoned their agricultural practices and gave their land on rent for establishing brick factory. According to one of the villagers of Khanalthok Badri Prasad Khanal (38),

It is hard to plant rice, paddy and other agricultural products due to the climatic upheavals; so many villagers gave their land for running brick factory including me.

It is also informed by the brick factory runners that establishment of brick factory increased their income level than through agricultural products.

### **6.6 Use of Alternate Sources of Water**

Adaptation to climate variability and change is not only a matter of individual and household decisions. It also requires institutional and policy measures that support agricultural production, food security, water resource management, and infrastructural development. So for developing better adaptation options for the studied area and any other parts of the country, the interdisciplinary research about the area is necessary.

The first option they have identified is making deep tube well in their field side for irrigation. They have not yet made any tube well in their field as it is not affordable for individual farmers. They have made two tube wells in their field for the purpose of drinking water, and it is satisfactory for them. The use of ground water is

viable and necessary option for adaptation with changing condition. They delay it as it is the new condition they are in. further delay in this may cause further problem. In recent days, the sub-branch of Dhulikhel Hospital is planning to provide drinking water to the villagers by pumping up water from Haledi Khola to Dharmasal. For this project, the hospital is funding 100 milion.

The effects of global climate change can be seen in the local level and local people because the impacts of climate change has been occurred in different things for example paddy, maize and wheat so that on behalf of government have applied many policy i.e. tube-well as an alternative source of drinking water, donation for seeds and chemical fertilizer to mitigate the effects of climate change.

## CHAPTER SEVEN

### SUMMARY AND CONCLUSIONS

#### 7.1 Summary

Climate change is now becoming public issue arising vigorously in local and global level with many aspects like; for environmental scientist, policy maker and planers as well as academicians. Climate change is defined as a variation in climatic parameters and is attributed directly or indirectly to human activities. Most of the researches have been carried out about the biophysical aspects by neglecting the local people or their perception, but how the physical manifestation of change are perceived, experienced, interpreted, and negotiated at community level.

This study has conducted in Bhakundebesi village of Kavrepalanchowk to address the research objective and research problem of the subject matter, which is conducted through Anthropological perspective. It explores the climate change and its consequences in the ongoing period and local people and culture were primary concern of the study. The main study of this study was to explore and document the local perception on climate change in the study area by focusing on agriculture and analyzed the local adaptive or coping mechanism developed by local people with changing weather/climatic fluctuation over the last a few decade or more. Therefore, this study clearly indicates that the climate is changing in the study area and local communities are already experiencing unusual rainfall and increasing temperature pattern in 10-15 years. Which are indicated by frequent occurrence of long drought, increased temperature, intensity and duration of rainfall uncertain, drying up streams/ponds, and disappearing some local crops (eg. millet). Due to climate change, seasonal calendar also been changed. This has caused significant impact on livelihood assets, particularly on traditional agricultural practices, production and likely that in to come in future.

The impact of climate change on water resources has directly experienced by local people in their agriculture and livestock management. In the study site, the majority of farmers primarily depend on monsoon rainfall for cultivation of major crops like maize, wheat and paddy.

Farmers would use multiple indicators to examine the climate change in their surroundings. Local rural people interact and understand the local climatic phenomena according to the significance of landscape. They are aware about climatic fluctuation while doing subsistence practices in their living world. People have varied perception on local level based on their observation. They observed climate event from the courtyard in one hand and another hand they used to do their agricultural activity based on time boundary. People perceive the local change in their life ways either in the local resources or in agricultural production too. Local practices has changed cultivate as well as harvesting period. After shifting time of agricultural practices local people felt that, their perceptions of climatic forecasting have been declining gradually.

Bhakundebesi is one of the area encountering climatic uncertainties around village. People are most aware about the absurdity of climate in their local level. In this study, in order to examine the impact of climate change on agricultural sector and investigation the current coping and adaptive strategies employed by local people, this will ultimately increase their adaptive capacity and resilience in changing scenario. Local calendar of people was more systematic in the past and all over, they followed their culture. Based on their knowledge they understood the local climate from their cultural interpretation. They categorize the year based on climatic events. Due to climate change, seasonal calendar also been changed because the timing is uncertain with changing calendar.

Based on research finding in order to examine the local perception on climate change and coping/adaptive strategies, which is applied by local people, which they have been monitoring and practices in a lifetime in their local ecological setting. The rainfall, storms, temperature and other climatic indicators are changing in amount and intensity over a year. Local people are expecting the climatic events untimely in their lifetime. Climatic indicators and the local culture of their community are shifting together in rural area. People perceive knowledge and experience in local system by their own culture. The day-to-day observation and interaction of people reflects the characteristics of climate calamities with agricultural activities. They act and prepare the forthcoming event according to the seasonality.

People have adopted spontaneous (without effort) ways to respond with ongoing climate change. They are diversified in terms of income sources. some people are trying to adapt to the changing condition by applying some new tools and

like they they have tried to new variety of rice, full scale production system of hybrid maize, management of livestock population, crop cycle system and being social networks, establishing the brick factory and use of alternative source of drinking water. Which are central ways of adopting and coping with climatic uncertainties adapted by the local communities especially Bhakundebesi people in the context of my study.

## **7.2 Conclusions**

Finally, to sum up the study I have drawn my conclusion based on the empirical data found in the field. The study shows that the causes of climate change and weather fluctuation in the Bhakundebeshi is prolonged issues and its effects have been seen on the life of local people and local pattern of farming system including the changing crops patterns, changing in their weather forecasting system, fluctuation of temperature and drying up of the river and stream as well. Due to the changing climate and fluctuation of weather, people have been substituting their own traditional farming system with other occupation like establishing brick factory, poultry farm, cash crops and other business. Except these, I have particularly drawn up the following conclusions:

1. In my fieldwork, I have found some specific adaptation tool applied by the farmers to better fight with the challenges posed by climate change. I have seen smallholder and subsistence farmers are suffering from the impacts of climate change that is locally specific and hard to predict. They perceived climate change as disturbances of their close relationship with nature and it disturbed the daily/seasonal activities, and ethno biodiversity.
2. Due to climate change, local traditional farming practices have been changed. Local farmers have started farming of Taichun paddy instead of their traditional Khumal-4 paddy and leaving their wheat farming those crops eg. Vegetable and organic farming. Climate change has shifted local perception and weather-crops interaction as well as it has also changed their seasonal calendar of farming. It can be said that the local farmers' perception and meteorological record shows the similarity in changing climate scenario and weather fluctuation. Even the effect of global climate change can be measured

in the local level but also local farmers constantly follow their traditional norms/values and believe on super natural rituals which have become coping mechanism to them.

3. The local people of the Bhakundebesi are practicing various means to cope with the impacts created by climate change but these are not enough to accommodate all those consequences. If scientific predictions are to be believed, environmental changes are going to be extreme, more frequent and more widespread than previously experiences in human history. The discourses of climate change with its scientific, economic, political and moral dimensions is a relatively recent arrival in the global arena and it is changing the way local event are framed and understood. So public policy should address socio-cultural resilience and vulnerability. Implementation of public policy is necessary to climate change adaptation.

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<http://www.wfp.org>.

## ANNEX-I

### Key Informant Interview- Checklist

#### 1. Rainfall/Temperature

- A) What are the most risks and hazards in your area?
- B) What are your experiences on change in temperature and rainfall in your area?
- C) What is the duration and events of rainfall?
- D) Do you think, temperature decreased or increased now than before some years ago?
- E) How do you know about rainfall pattern in different seasons?
- F) What is the situation of water resources of last few decades?

#### 2. Indicators of Climate Change

- A) What are the indicators to know about climatic events?
  - i) What are the climatic indicators?
  - ii) What are the non-climatic indicators?
- B) Are there animals and birds now a days as early or before some years ago?
- C) Have you noticed any appear or disappear of new species (plants, crops, birds and insects)?
- D) What kinds of animal behavior do you watch to identify the season?

#### 3. Agriculture

- A) Do you feel any change in agricultural production over 10-15 years or so?  
Y/N  
If yes what kinds of changes have you noticed in agricultural production?
- B) In your opinion what kind of impacts of climate changes occurring on agricultural land management over the last few years?
- C) Have you changed types of crops in your surrounding during the last 10-15 years?
- D) What would be the possible causes for changing rainfall and drought pattern? And what is its impacts on land (khet)?
- E) What is the timing of plantation and harvest of major crops (paddy, maize, wheat)?
- F) How people exercising agricultural activities?

#### 4. Coping Mechanism/Adopting Strategies Among Bhakundebesi People

- A) In your community what are the things mostly affected by climate change?
- B) How new climatic condition affect to the livelihood?
- C) What kinds of activities do you follow to be prevented from the impact of climate change?
- D) ANNEX II: RAINFALL DATA OF DHULIKHEL STATION, KAVREPALANCHOK

E) Latitude (deg/min): 2737

F) Longitude (deg/min): 8533

G) Elevation (m): 1552

H) Rainfall (mm) for: DHULIKHEL

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1993	DN A	3.2	34.9	50.5	165.5	369.4	297.0	542.8	112.1	36.6	0.0	0.0
1994	30.1	26.1	11.3	2.4	162.0	249.5	433.4	398.1	297.8	0.0	24.0	0.0
1995	6.5	41.4	15.6	5.0	182.5	442.1	560.0	397.1	104.6	19.8	58.3	13.2
1996	71.9	11.6	14.2	8.9	67.7	321.6	483.8	398.6	143.3	48.0	0.0	0.0
1997	22.2	8.2	10.0	92.3	113.6	225.2	438.2	324.9	87.7	10.7	6.0	99.1
1998	0.0	27.2	56.9	78.5	152.6	197.2	447.8	625.8	182.8	26.8	13.0	0.0
1999	0.0	0.0	0.0	0.0	149.6	534.6	522.7	398.3	174.2	26.4	0.0	0.0
2000	0.0	4.0	18.6	70.5	218.6	218.8	373.5	430.0	172.4	4.4	0.0	2.0
2001	2.0	16.0	4.0	21.6	178.3	265.4	384.6	340.6	190.3	4.2	0.0	0.0
2002	30.0	34.2	80.6	105.4	244.2	194.0	668.3	569.5	273.8	60.0	4.0	0.0
2003	22.4	84.3	58.3	93.4	50.8	275.6	542.2	377.2	237.0	24.4	0.0	24.4
2004	40.2	0.0	2.0	53.4	137.6	281.0	144.4	226.8	233.3	13.2	3.2	0.0
2005	54.6	11.6	39.8	43.5	57.8	119.8	230.1	506.2	58.8	25.8	0.0	0.0
2006	0.0	0.0	20.2	118.6	148.0	224.8	280.4	176.2	187.8	120.2	0.0	44.5
2007	0.0	110.6	35.6	116.2	90.4	171.4	286.9	237.0	283.2	31.8	4.0	0.0
2008	6.0	0.0	17.0	37.4	105.3	216.0	174.1	317.3	239.2	49.2	0.0	2.0
2009	0.0	0.0	14.42	18.2	135.0	134.2	231.4	313.0	73.7	18.0	0.0	7.5
2010	DN A	DNA	DNA	DNA	DNA	DNA	DNA	DNA	174.2	48.7	0.0	0.0
2011	3.5	47.2	16.3	64.2	207.9	267.4	287.3	276.2	0.0	37.2	DN A	0.0

I)

J)

K)

L)

- M)  
 N)  
 O)  
 P) ANNEX III: MAXIMUM TEMPERATURE DATA OF DHULIKHEL STATION,  
 KAVREPALANCHOK  
 Q) Latitude (deg/min): 2737  
 R) Longitude (deg/min): 8533  
 S) Elevation (m): 1552  
 T) Temperature (°c) for: DHULIKHEL  
 U)

Year	Jan	Feb	Mar	Apr	Ma y	Jun	Jul	Au g	Sep	Oct	Nov	Dec
1988	16.1	18.6	20.9	26.2	26.3	26.9	26.5	25.2	26.6	24.5	19.9	DN A
1995	12.2	14.9	21.9	27.0	29.1	24.9	25.1	25.7	25.5	22.7	18.6	15.6
2000	14.5	16.0	21.0	25.8	25.5	26.0	26.1	27.3	25.6	23.3	19.0	15.1
2005	13.2	17.5	21.7	25.4	26.6	28.2	25.9	25.0	25.2	21.8	17.8	15.0
2011	14.6	17.8	22.4	24.3	25.3	26.1	25.3	26.0	DN A	23.0	DN A	16.1

- V)  
 W) ANNEX IV: MINIMUM TEMPERATURE DATA OF DHULIKHEL STATION,  
 KAVREPALANCHOK  
 X) Latitude (deg/min): 2737  
 Y) Longitude (deg/min): 8533  
 Z) Elevation (m): 1552  
 AA) Temperature (°c) for: DHULIKHEL

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1988	3.4	6.6	9.0	12.3	15.4	17.7	19.2	18.6	18.3	14.9	9.5	DNA
1995	2.2	4.8	8.8	12.2	16.9	18.9	18.9	18.9	17.6	13.4	8.8	5.5
2000	3.9	3.8	7.8	12.4	16.3	18.5	19	19	17.4	13.3	9.6	4.7
2005	4.0	5.9	9.7	11.8	14.0	17.9	19.1	19.0	18.1	13.1	8.0	4.7
2011	2.4	4.9	8.0	10.6	14.3	16.9	18.1	17.9	DNA	13.4	DNA	4.1

- BB)  
 CC)