Perception of Climate Change, Impact and Adaptation Practices

(A Case Study of Daderi Community Forest Users Group,

Bangesal, Pyuthan District, Nepal)

A Dissertation Submitted to the Faculty of Humanities and Social Sciences

Department of Sociology/Anthropology for the

Partial Fulfillment of Master Degree

in *Sociology*

By

Basanti Kumari Pariyar

Roll No: 93/2062

Registered No. 3899-91

Tribhuvan University

Prithvi Narayan Campus

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LETTER OF RECOMMENDATION

This is to certify that Mrs. Basanti Kumari Pariyar has completed this Dissertation entitled **"Perception of Climate Change, Impact and Adaptation Practices"** under my supervision and guidance. This is an original research work and I recommend this dissertation for final approval and acceptance by dissertation committee.

Mr. Mukunda Lamsal
(Research supervisor)
Department of sociology/Anthropology
Prithvi Narayan campus
Pokhara, Nepal

Date: 26 Feb, 2013

LETTER OF APPROVAL

We hereby certify that the dissertation entitled **"Perception of Climate Change, Impact and Adaptation Practices"** in Daderi Community forest user group, Bangesal - 7 and 8, Pyuthan District, Nepal submitted by Ms. Basanti Kumari Pariyar to the Department of Sociology/Anthropology, Prithvi Narayan Campus, Pokhara, in the partial fulfillment of the requirements for the Degree of Master's of Arts in Sociology has been found satisfactory in scope and quality. Therefore, we accept this dissertation as a part of the mentioned degree

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ABSTRACT

Climate change is no more a new expression for any human as its effect is visible all over the world. Several authors have provided evidences regarding its impact on different sectors such as forestry, natural resources, livestock, water, agriculture, environment, health, etc which directly affect the livelihood of people. It can be said that the vulnerabilities of CC at local level is realized more severe, therefore there is a need for adaptive strategies. This particular study entitled ***"Perception of Climate Change, Impact and adaptation practices"*** *was carried out in Daderi CFUG of Bangesal VDC of Pyuthan District, with the main objectives of to assess the local understanding on climate change, adaptation practiced and impact of climate change in livelihoods and exploring the adaptation strategies adapted in the study area. 40 females and 40 male member of CFUG (out of 101 members) were interviewed to get answer of the major questions of the research. Various tools and techniques like focus group discussion, key informants survey, case study, seasonal calendar analysis, timeline and trend analysis, resource map were also used to collect primary data and the collected data were triangulated from various sources where as different published and unpublished literatures were reviewed as source of secondary data.*

The study had shown that most of the respondents were aware of the CC and they knew what climate change was. They had perceived the effects of climate change in agriculture and food security, water resource and energy, forest and bio-diversity, and public health. The visible impacts of the climate change that respondents had observed were decrease in quality and productively of agricultural crops decrease in water resource, loss in biodiversity and increased health hazards.

The people there were found to be less aware of the causes and future possible impacts of climate change. The adaptive measures developed by knowing the climate change issues were not implemented in the study area. The study discovered that the poor people were more vulnerable to climate change due to their limited assets of livelihood. They were also dependent upon the environment and the direct use of natural resources and therefore were affected when their access to natural resource were denied.

Therefore, there is necessitating of wide awareness on the topic to better cope with the situation. Adaptation measures on the basis of their requirement like agriculture, water resources, forest and biodiversity alternative options etc should be implemented.

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ABBREVIATIONS / ACRONYMS

CC	Climate Change
CFUG	Community Forest User's Group
COP	Conferences of the Parties
DDC	District Development Committee
DFO	District Forest Office
DFID	Department for International Development
DSCO	District Soil Conservation Office
FIRDO	Fulvari integrated rural development organization
FGD	Focus Group Discussion
GHGs	Green House Gases
INGOs	International Non - Governmental Organizations
IPCC	Intergovernmental panel on climate change
LFP	Livelihoods & Forestry Program
NGOs	Non- Governmental Organizations
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal
SPSS	Statistical Package for the Social Sciences
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee
WMO	World Meteorological Organization

CHAPTER ONE
INTRODUCTION

1.1 Background

Climate change refers to the variation of earth's global or regional climate over a long period of time, especially more than 30 year. Climate change has now become a global issue for the inhabitants of the earth. Climate Change first came to attention when the Intergovernmental Panel on Climate Change (IPCC) published its first assessment report in 1990. The fourth assessment report of IPCC clearly describes the evidence of a changing climate. There is now a clear consensus that the Earths atmosphere is warming due to emission of greenhouse gases, most of which are originated by human activities. According to the latest IPCC report, warming by 2100 is projected to be in the range of 1.1-6.4 degree Celsius above the average in the 1980-99 periods. Current increasing trends in emissions can be expected to raise Earth's temperature by 4-6 degrees Celsius above today's levels.

Nepal's temperature is getting warmer at an average rate of 0.06 ºC per year, which comes to 6 ºC in 100 years (LFP, 2008). High mountains are warming faster (0.09 ºC per year) than lower hills and the plains (0.04 ºC per year). This change has brought about major new challenges; its severe impact is seen on local natural resources, biodiversity and environment, leads to changes in geophysical, biological and socio-economic systems (Burton et.al, 2002). In particular, glaciers in the Himalayan region are retreating rapidly. Similarly, changes in forestry and vegetation systems have also been reported. Various studies have shown that the impacts of climate change are evident on forests, water resources, agriculture and other sectors in Nepal. The livelihood of more than 80 percent local people of mountain region is heavily depended on climate sensitive sectors such as agriculture, forest, and livestock and on the other natural resources such as water and biodiversity. They get food, fodder, fiber, medicine, water and income from forests, grasslands, and agriculture land for their livelihoods. For these reason, Nepal is identified as highly vulnerable country to Climate change.

Located in geologically young and unstable rugged terrain in the Himalayas, Nepal's natural environment and ecosystems are diverse and vulnerable. These ecosystems are increasingly threatened by a rapidly growing population that is putting pressure on its fragile natural resource base including land, water, and forest resources. With resource-dependent human settlements relying heavily on these ecosystems for their livelihood, the deterioration of their environmental and natural resource base has contributed to chronic rural poverty and migration to urban areas, and heavy out migration to India and other countries. Uncontrolled urbanization and spreading infrastructure has contributed to reduced agriculture land, increasing congestion, and environmental degradation associated with the poorly managed disposal of solid and industrial wastes and other forms of pollution. Add to this an increased intensity and frequency of extreme weather events attributed to anthropogenic climate change, making the prospects for environmental sustainability and human security disconcerting (ADB, 2009).

Response to climate change in Nepal is growing gradually. Action to reduce human contribution to the changing climate are slowly happening but they so far seem too few and too limited to make difference to climate change (Lemos, et. al, 2007). Nepal signed the United Nations Framework Convention on Climate Change (UNFCCC) on June 12, 1992, and ratified it on May 2, 1994, and made effective since July 31, 1994. But UNFCCC focused more on mitigation rather than adaptation.

Although Nepal has a negligible share in global emissions of greenhouse gases, it is particularly vulnerable to climate change due to its fragile mountain ecosystem. Nepal's major natural resources, biodiversity and water are at the forefront of climate vulnerability. Research has confirmed that mitigation – reducing emissions of Green house Gas of sequestering emissions – is critical to slowing the Climate Change. However, because of the long lifetime of the GHG already present in the atmosphere at least some amount of climate change will be inevitable, and so adaptation, or coping with climate change impacts is increasingly being recognized as critical (IPCC 2007). This is why Nepal needs to focus on adaptation measures rather than those of mitigation.

The literature on impacts of climate change has grown enormously over the past few years but very few can be found on the adaptation measures. Vulnerability assessment should be

carried out at an appropriate level, firstly by raising awareness of vulnerability in the sectors of agriculture, environment, forestry, and health. While a vulnerability assessment is important for responding to future climate risks, the assessment process may also help to improve the management of current climate change.

1.2 Statement of the Problem

Climate change refers to average change in weather and precipitation during the 20 years. Vulnerability to climate change depends not only on natural factors, but also on economic, social and cultural factors which impact on people's status, behavior, relationships and power.

Effects of global warming include all the vital systems supporting world population, agriculture, water resources, human health, forests and biodiversity. Some of the greatest increases in temperature and rainfall have already been recorded in Nepal. There are some observed impacts likely to occur in the future in different sectors like, Water resources, Agriculture sector, Forest and Fauna, GLOF, Health sector, and Livelihood. There is a scarcity of information and studies. While awareness and capacity are the basic barriers, lack of research and realistic facts on the impacts of climate change is the next major challenge.

The climate change and its impact is being genuine problem in current and future all over the world. In Nepal some of the greatest increases in temperature and fluctuation in rainfall pattern have been recorded and various adverse impacts have been seen in many sectors like agriculture, forestry, fresh water and biodiversity, glaciers. Although several agencies are concerned with climate change, they mainly focus on high altitude and the glacial retreat and only a few studies have been conducted in the mid hills.

Therefore this study focused on the perception of climate change and its impacts on local level and identified the adapted adaptation strategies to cope with these effects by the local community.

1.3 Research Questions

The research was carried out to answer the following queries:

1. What is the perception level of people’s awareness towards Climate change and it ’s impact ?

2. What are the major areas that climate change impact and what are the adaptation strategies adopted by the community?

1.4 Objectives

1.4.1 General Objective

To assess the impact of Climate Change upon livelihood of local people and adaptation Practices.

1.4.2 Specific Objectives

- To assess the level of perception/understanding of climate change and its impact.
- To assess the adopted and potential adaptation practices from impact of climate change.

1.5 Limitation of the Study

Some of the limitations of this study are given below:'

- Focuses only one a very small area of Nepal
- Most of the local people were unaware about it so it was time consuming to make them understand.
- The data are completely based on people's remembering power.

1.6 Significance of the Study

Some of the significance of this study are given below.

- Know current status of the Climate Change perception and impact on the research area.
- Know interlink between socio-economic and natural resources
- Knowledge of the locals on Climate Change vulnerabilities and impact and adaptation practices.

1.7 Organization of the Study

The study has been organized into six Chapters. The first chapter deals with introduction, the second chapter deals with theoretical literature and previous literature review on the issue of climate change its impacts and forest role for sink of the carbon dioxide, adaptation and mitigation measures to climate change impact. The third chapter deals with Research Methodology. The fourth describes the study area. The fifth chapter has discussion on the

result and discussion on socio economic characteristics of the respondents of their education, occupation, land types where they occupied, and house type, perception and awareness on climate change vulnerabilities, and impact on water resources, agriculture, health, biodiversity. The Chapter Six is related to the summary, major findings and recommendations drawn from the study.

CHAPTER TWO
LITERATURE REVIEW

2.1 Theoretical Literature Review

2.1.1 Climate Change

Climate change is a reality now and will continue for decades and potentially centuries to come. It is clear that burning of fossil fuels and deforestation are responsible for emission of GHG that ultimately change the climate (Smith 2006). Direct observation of climate change is seen as increase in global average air, ocean temperature, widespread of snow and ice, unpredictable rainfall pattern and rising average sea level. Addressing the threat of climate change is a current global priority. There is broad consensus that climate change is best addressed in the contexts of sustainable development. Unless it is effectively dealt with, climate change will have a dramatic impact on the environment and on economic and social development. Climate change is also likely to exacerbate both natural disasters and potentially conflicts over natural resources. The United Nations climate Change Conference in Bali in December 2007 clearly singled Member States commitment to addressing climate change and delivered the A Bali Action Plan- the crucial manmade to launch negotiations for the achievement of a comprehensive global agreement by the end of 2009.

The Bali Action Plan confirmed that effectively addressing climate change requires mitigation and adaptation action as well as technology and financing. Mitigation involves a process of curbing greenhouse gas emissions from human activities, for example, emissions from fossil fuels as well as deforestation, with a view to stabilizing greenhouse gas concentration at a safe level. Adaptation involves a range of activities to reduce vulnerability and build resilience, for instance in key sectors such as water, agriculture and human settlements .New and improved technologies and financing initiatives at all levels, are also receiving attention as part of the collective efforts to address climate change. It is now widely acknowledged that "the impacts of climate change will be felt more acutely by those with least adaptive capacity poor countries and the poor in developing countries" (Lambrou and Piana 2006). It is also recognized that "the vulnerability or susceptibility of a population group to the effects of climate change depends on the resilience of the surrounding natural landscape unit and society's capacity to adapt" (Ibid).

For the global average temperature, warming in the last century has occurred in two phases, from the 1910s to 1940s (0.35° C) and more strongly from 1970s to present (0.55° C). An increasing rate of warming has taken place over the last 25 years, and Eleven of the last twelve years (1906-2006) rank among the twelve warmest years in the instrumental record of global surface temperature (since 1850) (IPCC 2007). IPPC has also reported that the overall observed surface air temperature in Asia has increased by approximately 1-3° C over the last century from 1906 to 2005. Similarly, the mean annual temperature of Nepal is estimated to have increased by 0.06° C from 1977 and 1994; and is projected to increase by another 1.2° C by 2030, 1.7° C by 2050, and 3.0° C by 2100 (ADB 2009).

The amount, intensity, and frequency of precipitation have changed in recent years. Pronounced long term trends from 1900 to 2005 have been observed in precipitation amount in many large regions. Over this period, precipitation increased significantly in eastern parts of North and South America, northern Europe and central Asia whereas precipitation declined in the Sahel, the Mediterranean, southern Africa and parts of southern Asia (IPCC 2007). However there is no significant change in annual as well as monsoon precipitation in Nepal (Baidya et al. 2007, Shrestha et al 2000). Though no definite trends could be found in the annual precipitation records, clearly decreasing trends was seen in the annual number of rainy days during the last four decades (Baidya et al. 2007).

2.1.2 Anthropogenic Global Warming

The first theory of climate change contends that human emissions of green house gases, principally carbon dioxide (CO2), Methane and Nitrous Oxide, are causing a catastrophic rise in global temperatures the mechanism whereby this happens is called the enhanced greenhouse effect. We call this theory "anthropogenic global warming" or AGW for short.

Energy from the sun travels through space and reaches Earth. Earth's atmosphere is mostly transparent to the incoming sunlight, allowing it to reach the planet's surface where some of the incoming sunlight, allowing it to reach the planet's surface where some of it is absorbed and some is reflected back as heat out into the atmosphere. Certain gases in the atmosphere, called "'green house gases", absorb the outgoing reflected or internal thermal radiation, resulting in Earth's atmosphere becoming warmer than it otherwise might be.

Water vapor is the major greenhouse gas, responsible for about 36 to 90 percent of the greenhouse effect, followed by CO2 (1 to 26 %), methane (4 to 9 %) and ozone (3 to 7 %). These estimates are the subject of much dispute, hence their wide ranges.) During the past century, human activities such as burning wood and fossil fuels and cutting down or burning forests are thought to have increased the concentration of CO2 in the atmosphere by approximately 50 percent, Continued burning of fossil fuels and deforestation could double the amount of CO2 in the atmosphere during the next 100 years, assuming natural "sinks" don't grow in pace with emissions.

Earth's climate also responds to several other types of external influences, such as variation in solar radiation and in the planet's orbit, but these "forcing", proponents of AGW, cannot explain the rise in Earth's according to the, rise in Earth's temperature over the past three decades. The pressure caused directly by man-made greenhouse gases is also small, but he AGW theory posits that positive feedbacks increase the effects of these gases between two and four fold. A small increase in temperature causes more evaporation, which places more water vapor in the atmosphere, which causes more warming. Global warming may also lead to less ice and snow cover, which would lead to more exposed ground and open water, which on average are less reflective than snow and ice and thus absorb more solar radiation, which would cause more warming. Warming also might trigger the release of methane from frozen peat bogs and CO2 from the oceans.

Proponents of the AGW theory believe man-made CO2 is responsible for floods, droughts, severe weather, crop failures, species extinctions spread of diseases, ocean coral bleaching, famines, and literally hundreds of other catastrophes. All these disasters will become more frequent and more severe and temperatures will continue to rise, they say. Nothing less than large and rapid reductions in human emissions will save the planet from these catastrophic events (Gore, 2006).

2.1.3 Carbon Sequestration

Increased carbon sequestration by plants is perhaps the best- known consequence of the rise in atmospheric CO2. The productivity of most plants is enhanced because CO2 is the primary raw material utilized by plants to construct their tissues. The more CO2 there is in the air, the better plants grow and the more CO2 they remove from the air and store in their leaves,

branches, trunks, and roots, as well as in the soil beneath the plants- a suite of processes called "sequestration." Higher temperatures also tend to increase carbon sequestration rates.

Sequestration offsets some of the temperature-increasing power of higher levels of CO2. How powerful is this negative feedback? The answer depends on the size, growth rate, and duration of the "sinks" in which carbon is stored. These variables in turn depend on constraints to plant growth (such as lack of water or nutrients in soil), the rate at which plant material decomposes, and even how higher CO2 levels affect earthworms.

The latest research, by Wolfgang Knorr of the Department of Earth Sciences at Bristol University in England, indicates that sinks are growing in pace with man-made emission,, "having risen from about 2 billion tons a year in 1850 to 35 billion tons a year now," contradicting the assumptions made by the computer models used by advocates of the AGW theory. In addition, all carbon sinks have yet to be identified and new ones are being discovered every few years (Knorr, 2009).

2.2 Review of Previous Literature

Climate change is a reality now and will continue for decades and potentially centuries to come. The evidence is clear: emission of Green House gases because of fossil fuel burning and deforestation are responsible for climate change (Smith, 2006). It is… clear that climate change will, in many parts of the world, adversely affect socio-economic sectors, including water resources, agriculture, forestry, fisheries and human settlements, ecological systems, and human health, with developing countries being the most vulnerable (IPCC, 2000).

Although Nepal has negligible share in the global Green House Gas emission; Nepal has already encountered some negative effects of global climate change. The snow melting and increase in the size of glacier lakes in the Himalayan region is one of the major concerns. Himalayas in Nepal are geologically young and fragile and are vulnerable to even insignificant changes in the climatic system. This system is threatened through anthropogenic activities such as farming practices and natural resource consumption patterns. According to the National Communication Report, net emission of CO2 was about 9.747 tones and the net emission of methane was estimated to be 0.948 tones in 1994 (Regmi and Adhikari 2007).

In Nepal, 82.5 percent of the populations living below the poverty line are forest dweller,

largely comprising indigenous communities (MFSC, 2008). Poor, Marginalized and disadvantaged people in rural areas of Nepal, whose livelihoods primarily depend on natural resources and climate sensitive sectors such as agriculture, forestry and fisheries, are vulnerable to climate change (Raut 2005, Dahal 2006, Regmi and Adhikari 2007). Majority of farmers depend on monsoon rain for crop cultivation. Changes in rainfall pattern can be devastating for their crops; extreme rainfall can also cause injuries and loss of life (Regmi and Adhikari 2007). Climate change has impacted on rural livelihood factors in several ways like decrease in agriculture production, loss in biodiversity, decrease in water resource, and increase in health hazards (Baral, 2009). They have few options for diversifying livelihoods away from these sensitive sectors and reducing vulnerability. Poor people often do not have enough assets to sustain or rebuild livelihoods after the impact of hazards, because of low financial resources, lack of clean water and sanitation, weak physical infrastructure, remoteness from government services and poor health. Lack of access and ability to use technology reduces their speed of recovery and options for livelihood strategies (ADB 2009).

2.2.1 Climate Change in Global and National Context

Climate Change in Global Context

Climate change is now a scientifically established fact. The average temperature of the earth's surface has risen by 0.74 degrees Centigrade since the late 1800s (IPCC 2007). The climate has always been changing, throughout the history of the Earth. Between 2500 B.C. and 2300 B.C., for example, the climate in the present Sahara changed rapidly from a situation in which wheat, barley, millet and guinea corn could be cultivated into a situation in which only livestock could be kept (Curtin, 1978). Under a business as usual scenario, greenhouse gas emissions could rise by 25 – 90 per cent by 2030 relative to 2000 and the Earth could warm by 3°C this century. Even with a temperature rise of 1– 2.5°C the IPCC predict serious effects including reduced crop yields in tropical areas leading to increased risk of hunger, spread of climate sensitive diseases such as malaria, and an increased risk of extinction of 20 – 30 per cent of all plant and animal species. By 2020, up to 250 million people in Africa could be exposed to greater risk of water stress.(UNFCCC, 2007) Natural changes in climatic conditions have resulted in Ice Ages and relatively warm periods in temperate regions while wet periods have intermitted with dry periods in Africa (Kemp, 1994). Evidences of our rapid warming trend is found throughout the world: glaciers are in the widespread retreat; sea-ice is thinner and covers less area; snow cover has decreased;

plants are blooming earlier; plant, insect, and animal species are shifting ranges; and sea level has risen by 10- 20cm, caused by both the expansion of warmer ocean water and the addition of water from melting ice sheets (IPCC 2001a, Parmesan and Galbraith 2004, IPCC 2007a). Sea level rise will lead to inundation of coasts worldwide with some small island States possibly facing complete inundation and people living with the constant threat of tropical cyclones now face increased severity and possibly increased frequency of these events with all associated risks to life and livelihoods (UNFCCC, 2007). Since 1750 at the time of industrial revolution, CO_2 has increased by 31 percent, methane by 151 percent and nitrous oxide by 17 percent (Regmi and Adhikari, 2007).

Over a decade ago, most countries joined an international treaty – the United Nations Framework Convention on Climate Change- to begin to consider what can be done to reduce global warming and to cope with whatever temperature increases are inevitable. Recently a number of nations have approved an addition to the treaty, called the Kyoto protocol, which has more powerful measures emission reduction targets for industrialized countries.

National Context

Nepal is a landlocked country with rich natural and cultural diversity and is situated in the southern Himalayan flank, with a total area of 147,181 km^2. The country is about 850 kilometers (km) long (east-west) and experiences a wide range of climates varying from the subtropical to the Alpine type as the elevation varies from 64 m above sea level to 8,850 m (world's highest mountain peak, Mt. Everest) within a span of less than 200 km (ADB, 2009). Geographically, Nepal represents a transitional mountain area with over three quarters of the land covered by rugged hills and mountains. The geological formations correspond to the physiographic zones and most parts of the country are geologically weak and fragile. The Siwaliks and Middle Mountains are ecologically threatened by a rapidly growing population that is putting pressure on its fragile natural resource base including land, water, and forest resources and are geologically vulnerable. According to the Thematic Assessment Report on Climate Change (2008) prepared under the National Capacity Self Assessment (NCSA) project, ongoing records of national temperatures since 1962 and recent analyses of these records show high inter-annual variability, and that maximum temperatures in Nepal are progressively increasing in line with global and regional records. From 1977 and 1994, the mean annual temperature is estimated to have increased by 0.06°C, and is projected to increase by another 1.2°C by 2030, 1.7°C by 2050, and 3.0°C by 2100 (ADB, 2009). The temperature in the Himalayas, however, is increasing at a faster rate, and this has serious impacts on the country's glacial lakes (Raut, 2004). These findings are supported by observations by Liu and Chen (2000) on the other side of the Himalayas, on the Tibetan Plateau. Significant glacier retreat as well as significant horizontal expansion of several glacial lakes has also been documented in recent decades, with an extremely high likelihood that such impacts are linked to rising temperatures (ICIMOD and UNEP, 2002). Rainfall is increasing by 13mm per year, while the number of rainy days is decreasing by 0.8 days per year. Consequently, river flow is increasing at 1.48m3/s per year, which is about 1.5 times higher than increased precipitation. High increases in summer river flow provide further evidence that high summer temperatures are leading to fast glacial melt/retreat (Dahal, 2006). Weather-related extreme events like excessive rainfall, longer drought periods, landslides and floods are increasing both in terms of magnitude and frequency. More floods and glacial lake outbursts are expected to destroy irrigation and water supply systems, roads, bridges, settlements and productive land. Land degradation will reduce crop productivity and put more pressure on remaining fertile land. In the dry season, increased evaporation will lead to

water scarcity. Soil moisture deficits, droughts, fire and possible pest outbreaks will decrease crop yields. It is perceived that climate change will have major impacts on ecosystems, land and water resources, health, and major economic sectors such as agriculture in days to come

2.2.2 Impact of Climate Change on Human System and Natural

This is clear that the climate change will adversely affect socio economic sectors, including water resources, agriculture, forestry, fisheries and human settlements, ecological systems and human health and the countries being the most vulnerable (IPCC 2001) It is widely accepted that poor, natural resources dependent communities in the developing world are especially vulnerable to climate change, especially those living in high risk areas such as small islands or low lying coastal areas (IPCC 2007). Similarly, the current climatic changes are likely to have impacts on different sectors of Nepal. The several sections that observed impacts that are likely to occur in the future in different areas may be Agriculture, water resources, Biodiversity, health and livelihood sectors.

Agriculture

Agriculture is the main occupation of the Nepalese and backbone of the economy providing a livelihood for over 80 percent of the population and about 80 percent of the total population depends on the forests for daily fuel wood supply. Poor, Marginalized and disadvantaged people in rural areas of Nepal, whose livelihoods primarily depend on natural resources and climate sensitive sectors such as agriculture, forestry and fisheries, are vulnerable to climate change (Raut 2006, Dahal 2006, Regmi and Adhikari 2007). Majority of farmers depend on monsoon rain for crop cultivation. Changes in rainfall pattern can be devastating for their crops; extreme rainfall can also cause injuries and loss of life (Regmi and Adhkari 2007).

Water Resources

Nepal has more than 6000 rivers which provide a dense network of rivers with steep topographic conditions. River basins in Nepal are spread over a diverse and extreme geographical and climatic condition that the potential benefits of water are accompanied by risks. Rising temperatures have caused glaciers to melt and retreat faster. Receding glaciers mean an increased risk of the sudden flooding following flacial lake outbursts. Glaciers are excellent indicators of climate change and global warming (Ageta and Kadota 1992, Oerlernans 1994). Warming led glacier retreat in the Nepalese Himalayas is widespread and alarming. According to a study carried pit by the International Commission for Snow and Ice, snow in the Himalayas will disappear by 2035 if no proper initiative is taken to reduce warming. Due to snow and glacial melting, several glacial lakes are under tremendous risk of flooding in Nepal (Oerlernans 1994, Bajracharya et al 2007). Lakes either overflow or seep and dams are sometimes broken, sweeping lands, forests and houses, and damaging valuable property downstream. Moreover, there are still at least 20 glaciers in Nepal that are likely to outburst in next 5-10 years (UNEP 2002).

Human Health

The impacts of rise in temperature on human health have not been well studied yet in Nepal. Diarrhea, Kalaazar dysentery malaria, and Japanese encephalitis are on the top five diseases in the country. Climate change may upset the achievement of last decade in bringing down the burden of diseases (WHO 2008). Subtropical and warm temperate regions of Nepal, in particular, would be more vulnerable to ka-laazar and malaria. Increase in temperature would make the subtropical region of Nepal more vulnerable to Japanese encephalitis as well. Adaptation options in this sector could be considered and drawn out from historical perspective and experiences. Chemical control of the potential outbreak of disease may not be appropriate because of the growing chemical resistant mosquitoes and associated ecological effects. More research and development of alternative approaches are required to control possible disease outbreak (INC, Nepal 2004).

Biodiversity

Biodiversity is the part of climate system both the storage of carbon and nitrogen compounds in vegetation, plankton biomass, soils and river sediments and their release through respiration and decomposition are influenced by the composition of plant, animal and microorganism communities. Nepal supports a disproportionately high number of globally important wild animal and plant species and contributes to majority of people's livelihood. Climate is one of the main factors that influence the distribution and population density of species of flora and fauna on Earth. Many observations suggest that recent climate change as already influenced animal and plant populations in a number of ways. The influence can be seen in the timing of seasonal events (flowering, migration), in rates of growth and reproduction, and in the distribution of species. Because species react differently to climate change, climate change is also influencing species interaction e.g., predation, parasitism, competition, symbiosis). Lengthening of growing season in colder region and shortening of the same in warmer part of the earth are some examples. This has resulted in the expansion and reduction of species habitat (ADB 2009).

Livelihood

The livelihoods of most poor people, especially in rural areas, depend on natural resources and climate sensitive sectors such as agriculture, forestry and fisheries. They have few options for diversifying livelihoods away from these sensitive sectors and reducing vulnerability. Poor people often do not have enough assets to sustain or rebuild livelihoods after the impact of hazards, because of low financial resources, poor health, lack of clean water and sanitation, weak physical infrastructure and remoteness from government services. Lack of access and ability to use technology reduces their speed of recovery and options for livelihood strategies.

Data on impacts of climate change on livelihood in Nepal is limited as there are no analytical means to assess such impacts. It is indeed a challenging task to ascertain the impacts of climate change on livelihoods given the diverse topography and different habitats with varied climates even within a small distance. Nepal is basically an agricultural country. About 80 percent of the people are dependent on agriculture for their income and employment. Agriculture and livestock farming is the most common livelihood for the majority of people living in rural areas. Their livelihood may well be threatened due to impacts of climate change on crops production and livestock rising. Indeed, climate change will weaken the livelihoods of poor people by eroding their livelihood assets. Poor people are vulnerable to

loss of physical capital because of the damage to shelter and infrastructure, human capital because of malnutrition and diseases, social capital because of displacement of communities, natural capital because of loss of productivity in agriculture and fisheries and financial capital because of more disasters and lower income. Degradation of livelihoods by climate change will thus leave poor people with less of the assets they need to withstand shocks and stresses (ADB 2009).

It is likely that when the weather gets warmer, microorganisms become more active and act more quickly on the foods we eat. Since people in developing countries often have poor sanitation and lack of refrigeration, and thus have no choice but to eat leftover foods, they are likely to be affected by such pathogens very easily. Floods following ice melting and lake outburst or river overflow also kill several people by adversely affecting water quality from debris carried along with the flood. Between 2000 and 2005, more than 1300 people mostly poor, were killed by floods and landslide related disasters (CBS, 2006). Impact of climate change take place in different assets of livelihood therefore different adaptation option should be taken for strengthening livelihood assets to build resilience to climate change and support poverty reduction.

2.2.3 Adaptation and Mitigation Measure to Climate Change Impact

The major impacts and threats of global warming are widespread. As a result of global warming, the type, frequency and intensity of extreme events, such as tropical cyclones (including hurricanes and typhoons), floods, droughts and heavy precipitation events, are expected to rise even with relatively small average temperature increases (Meehl et al. 2007). Climate change will have wide-ranging effects on the environment, and on socio-economic and related sectors, including water resources, agriculture and food security, human health, terrestrial ecosystems and biodiversity and coastal zones. Changes in rainfall pattern are likely to lead to severe water shortages and/or flooding. Melting of glaciers can cause flooding and soil erosion. Rising temperatures will cause shifts in crop growing seasons, which affects food security, and changes in the distribution of disease vectors putting more people at risk from diseases such as malaria and dengue fever. Temperature increase will potentially severely increase rate of extinction for many habitats and species (up to 30 per cent with a 2° C rise in temperature) (UNFCCC, 2007).

Nepal signed the UNFCCC on June 12 1992, as steps towards controlling greenhouse gas emissions or mitigating the impacts of climate change. Since then Nepal has been regularly participating in Conference of Parties (COPs) and other subsidiary meeting. Nepal also

became party member of Kyoto Protocol by submitting its instrument of accession on September 16, 2005. To take advantage of the clean development Mechanism (CDM) as a source of new investment and technology, Nepal is trying to develop various CDM projects which promote clean energy and sustainable development in the country. Nepal has recently set up the National Designated Authority under the Ministry of Environment, Science and Technology to approve CDM projects. National Climate change policy and National Adaptation program of Action (NAPA) are being formulated. The purpose of the NAPA Project is to develop a strategic framework of action on climate change that identifies immediate priorities for climate resilient low carbon development behind which the government, the civil societies and the donors can align their actions in amore synergistic manner. Furthermore, the project will deliver a NAPA document that outlines Nepal's immediate and urgent priorities in climate change adaptation and will guide the provision of follow-up funding, including financing from the Least Developed Country Fund (LDCF) to implement climate change adaptation and climate risk management activities in Nepal.

This can be achieved not just by preventing forests from being cut down, but through a forestation (new plantings) and reforestation (replanting) of deforested areas) of non-forested lands. Particularly in the tropics, where vegetation grows rapidly and therefore removes carbon from the atmosphere more quickly, planting trees can remove large amounts of carbon from the air within a relatively short time. Here, forests can store as much 15 tons of carbon per hectare per year in their biomass and wood (FAO March 2006).

In the adaptation process, both coping and adaptation strategies constitute short term activities as well as long term activities. At the first step, communities try to modify their existing practice to better respond to the impact of climate change. At the second step, they seek alternative livelihoods. In order to address the community needs for adaptation, program and activities also need to be designed accordingly. The following is a list of major activities for coping and adaptation program agriculture and livestock development, Water resource management, forest, land and soil conservation, income and livelihood diversification, local infrastructure reconstruction, awareness and education and institutional development (Gurung and Bhandari, 2009). There are many reports and case studies focusing on the various aspects of climate change in Nepal, these studies mainly focused in high altitude and glacier retreat. Impact of Climate change and its adaption measure applied by the locals are rare in the context of mid hill. Available literature has been reviewed before carrying the study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Research Design

Main approach used for data collection for this study is exploratory where the gathering data is through observing people, actions and situations and exploring the individuals, attitudes, and preference of behaviors in informational issues of this research. The research follows qualitative as well as quantitative methods of information collection and analysis.

3.2 Rational of Selection of Study Area

The research was carried out in the Daderi Village of Bangesal VDC - 7 and 8 of Pyuthan District. This site was selected according to the following criteria as follows:

- The research on climate change has not been conducted before.
- Accessible and near from highway.
- Vulnerable from Climate Change impact
- Regularity of climate and weather related disaster

3.3 Universes, Sample and Sampling Design

The total numbers and the list of the households were taken from the CFUG records. There were 101 households as a Universe. Out of them 81 households were randomly selected and conducted surveys with the household head. According to the sample table determine the required sample size based on a 5 percent confidence level (Krejeie and Morgan, 1970).

3.4 Data Collection Tools and Techniques

Data are both qualitative and quantitative in nature. Primary and Secondary data were collected from the study area. The source of primary data were household questionnaire, key informant interviews, group discussion, official discussion field observation and secondary data were collected from the record of CFUG, VDC, DDC, DFO, DSCO and other organization's reports, published and unpublished booklets and research, relative journals on different aspects of the study obtain from different source and offices.

3.4.1 Primary Data Collection

Both qualitative and quantitative social research techniques were applied in this research. Household interviews/questionnaire direct observation and additional Participatory rural appraisal (PRA) tools were also applied to collect the nature of household's livelihood strategies and their relationship with ongoing climate change impact and the adaptive measures followed. Checklists/Interview guide and questionnaire are prepared for collection of primary data.

3.4.1 Interviews/Discussion

3.4.1.1 Household Interviews

Using a structured questionnaire, surveys were conducted in the selected households. The questionnaire was particularly designed to collect information on how households perceived the impacts of climate change, their vulnerability and how they coped with them. In addition, their demographic and socioeconomic attributes, particularly related to different forms of capital assets they owned, were also recorded in order to infer relationship between households' capital stocks and their vulnerability to climate change. The questionnaire included both qualitative and quantitative parameters.

3.4.1.2 Key Informant Interviews

Elderly individuals who lived in that area throughout their lives were supposed to be key informants for realizing the change. They were encouraged to recall past disasters and their coping strategies over time. Local school teachers were also interviewed to obtain information on the weather related disasters occurring in the community and their impacts to households in relation to capital assets.

3.4.1.3 Group Interviews/Discussion

Usually, group discussion is considered as a means to elicit information through a consensus building in a group. In this research, group interviews/discussions were conducted to supplement and triangulate information gathered from the household interviews and other sources. One general group discussion was conducted, in which an average of 11 participants took part belonging to rich/medium and poor categories to capture their perceptions and coping strategies.

3.4.1.4 Field Observation

A field observation was carried out to cross check the information gathered during group discussion, interview and questionnaire survey.

3.4.2 Secondary Data Collection

The secondary information regarding background, information of the study area was collected from the available data in Pyuthan DSCO, DDC and LFP. A record of well being ranking was collected from the respective CFUG's of the study area for the information on economic status of the people. Similarly, articles of different journal workshop/seminar proceeding, dissertations and scientific papers were reviewed. Various articles were downloaded from internet too.

3.4.3 Data Analysis

The collected data were categorized and variables were formulated. The data were logically interpreted along with simple tables, charts and graphs. Mainly Microsoft Excel work sheets and statically package for social science (SPSS) were used to analyze the information.

CHAPTER FOUR

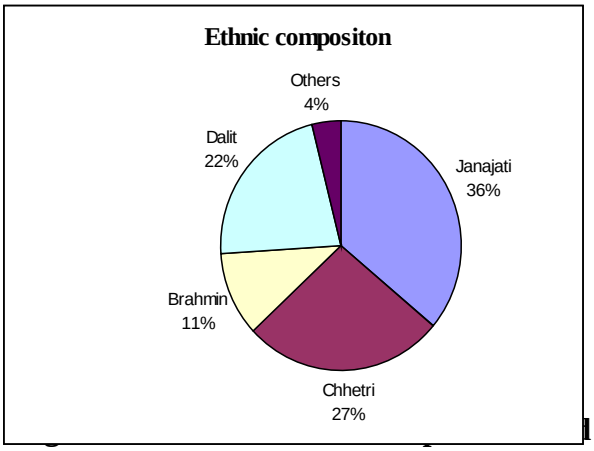
STUDY AREA

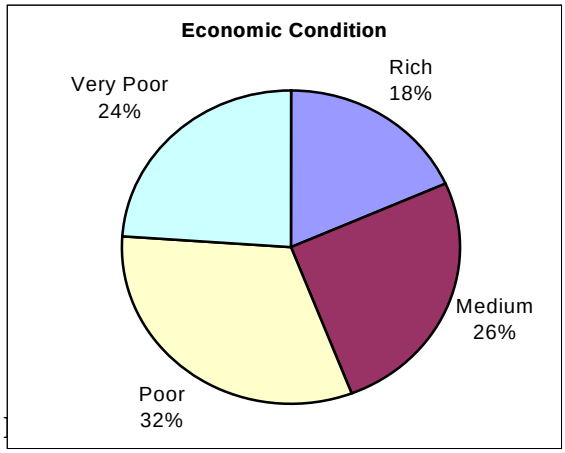
4.1 The Study Area

Pyuthan district is located in the Midwest region of Nepal. The district lies between 27° 52' – 28° 22' N latitude and 82° 36' – 8° 6' E longitude. Eastern part of the district joins with Gulmi and Argakhanchi where as Dang in western part of the district. Similarly Rolpa and Baglung district lies in the northern part of the district and Argakhanchi falls in the southern part of the district. Khalanga is head-quarter of the district. Altitudinal variation of the district ranges from 305 m. to 3659 m. According to its' altitudinal variation, it also has climatic variation from tropical, sub-tropical, temperate, to sub-alpine across the district.

Total land area of the district is 1, 32,890 hac. Out of the total land area, it has 42766 hac. (32.18%) Agricultural land, 72694 hac. (54.7%) forest land, 12899 hac. (9.70%) Grazing land, 4531 ha (3.40%) river and other land.

Total 40183 households having the total population of 212,484 reside in the district. Out of total population 98, 390 (46%) are male and 114,094 (54%) are female. Similarly, average household of the district is 5.29. If we compare based on ethnicity, out of the total population 36 percent, 27 percent, 22 percent, 11 percent and remaining 4 percent composed of Janajati, Chhetri, Dalit, Brahamin and others ethnic community respectively (DDC Pyuthan, 2006).





4.2 Core Study Area

4.2.1 Bangesal VDC

Bangesal VDC lies in 27° 52' – 27° 57' N latitude and 87°55' longitude, the Northern part of the district head quarter (Khalanga) of Pyuthan district. This VDC extends from 380 to 800 meters in altitude. Land is plain and hilly type. Soil is black and Sandy soil**,** somewhere found red soil.

A total type of household of this VDC was 1138 HH and the population was 7672 including 3772 female and 3900 male. The average population size per household is about six and main ethnic groups/castes were Janajati-Magar, Kumal and Raut, Dalit-BK, sunar, badi, Others-Brahmin, Chhetri and Religious minority- Muslim. The dalit consist 24 percent, Janajati 4 percent, Brahmin Chhetri 27 percent and Religious minority 3 percent. Major religion is found hindu and Buddha, Christian and Muslim respectively. The Land use system covers 80.63 percent forest land in the VDC. The total area of the VDC covers 4328.58 hector out of them 3490.29 hector area of land consists forest are in the Bangesal VDC.

4.2.2 Daderi Community Forest

Daderi Community Forest User Group lies in Bangesal VDC-7 and 8, Pyuthan district. There are 101 household in total to conserve, manage and utilize the community forest. It was handed over in 2050 BS. Khayer, Sal and Saj are the major tree species found in the forest. The total area of Community Forest is 205.11 hector and found mix type of species. The Community Forest User committee is formed of 11 members. The compositions of members were 9.1 percent from Dalit, (Magar, Kumal and Raut, Dalit-BK, Sunar, Badi), 18.2 percent were from Janjati (Magar, Kumal and Raut), and 63.6 percent from other (Brahamin, Chhetri) ethnic. The forest user Committee have managed various types of activities within the community like forest management, good governance, social inclusion, and pro poor activities lime revolving fund mobilization, income generation etc.

Community Forest Users Committee Member list

Table 4.1

CFUG Committee Member List

	Rich	Medium	Poor	Pro poor	Total	Percentage
Dalit	0	0	0	1	1	9.1
Janjati	1	0	0	1	2	18.18
Other	1	4	2	1	8	72.72
Total	2	4	2	3	11	
Percent	18.18	36.36	18.19	27.27		

Beneficiaries of Community Forest Users

Table 4.2

Community Forest Users Beneficiaries List

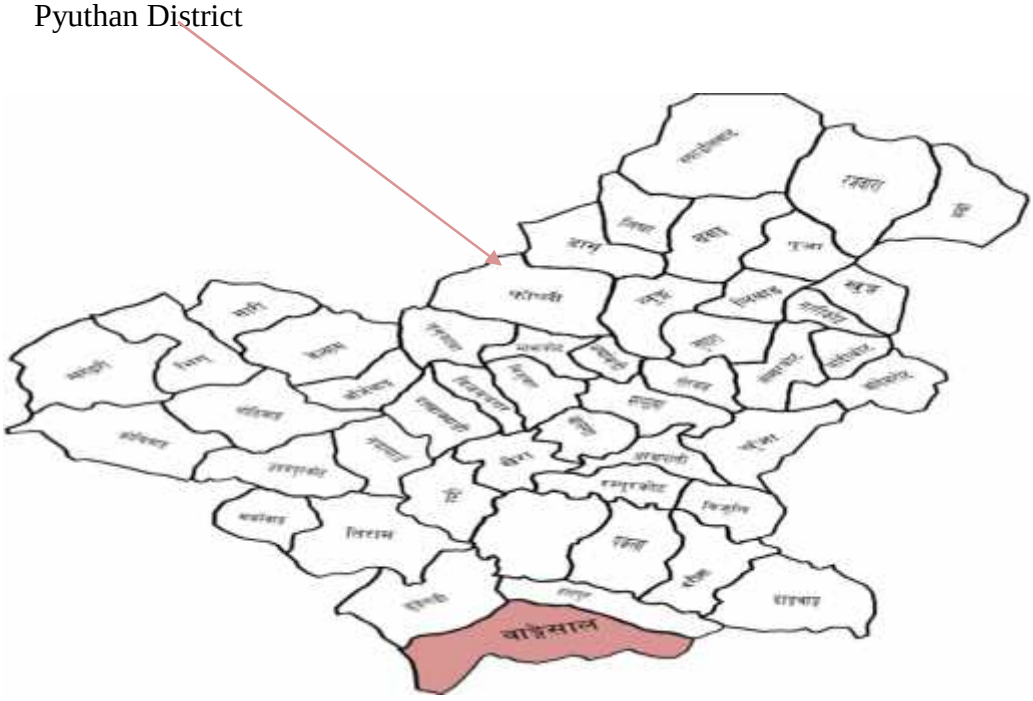
Cast	Rich	Medium	Poor	Pro poor	Total	Percent
Dalit	1	0	5	3	9	8.91
Janajati	2	7	32	5	46	45.54
Others	9	16	19	2	46	45.54
Total	12	23	56	10	101	
Percent	11.88	22.77	55.45	9.90		100

Source: Daderi Community Forest Users Constitution B.S. 2067.

4.3 Map of Study Area

Figure 4.2: Map Showing the Study Area.

Pyuthan District



CHAPTER FIVE
RESULTS AND DISCUSSION

5.1 Socio-economic Characteristics of the Respondents

Socio-economic features such as Sex, age structure, occupation, family size, etc of the respondents give quick understanding of the setting of socio-economic condition of the users in the study area. Thus, different socio economic aspects are presented and analyze below this heading in a graphical form

5.1.1 Social Characteristics of Respondents

Female and Male constitutes fifty-nine (59%) and forty one (41%) percent of the total respondents respectively. Although, the survey was targeted to the household heads, who were supposed to be adults youth and elderly. The youth (below 35 years) share 37.49 percent of the respondents, with 34.57 percent by adults (36-55) years and 28.39 percent by Elderly (Over 55) years respectively. In terms of Occupation 59.87 percent of the respondents were Farmers, 31.5 percent of the respondents were foreign workers, 5.3 percent respondents were Service holder and the rest of Business holders were 3.33 percent 36 percent of the responds were Illiterate, 34 percent were Literate, 18 percent of the responds were under SLC and 12 percent of them have college degrees. General characteristics of the respondents are given bellow.

Table: 5.1

Social Characteristics of Respondents.

Social Characteristics of the Respondents			
Gender			
Male	40.74%		
Female	59.26%		
Ethnic composition of respondents			
Brahmin/Chhetri	44.45%		
Janajati	44.44%		
Dalit	11.11%		
Caste and Sex Composition of respondents			
Brahmin /Chhetri-Male	44.44.%	Brahmin /Chhetri-Female	55.56%
Janjati- Male	33.33%	Janjati- Female	66.67%
Dalit-Male	55.56%	Dalit Female	44.44%
Age group			
Youths (‹35 Years)	37.04%%		
Adults (35-55 Years)	34.57%		
Elders (›55 Years)	28.39%		
Education			
Illiterate	36%		
Literate	34%		
Under SLC	18%		
Above SLC/Collage	12%		
Occupation			
Agriculture	59.87%		
Foreign work	31.5%		
Service	5.30%		
Business	3.33%		

Source: Field Survey, 2066.

5.1.2 Economic Status of the Respondent

Major indicators used by the CFUG to classify them into four well-being categories are presented in table below.

Economic status of people was recorded, already done by the CFUGs named Daderi CFUG. Major indicators used by the CFUG to classify them into four well-being categories are presented in table below.

Table 5.2

Indicators for Well Being Ranking of the Users

S.N.	Category	Major indicators
1	Rich	Food sufficiency for 12 months with surplus for sale; 15-30 ropanis of land (all good quality of Khet, Bari and Kharbari).
2	Medium	Food sufficiency for 6-12 months; 10-15 Ropanis land (Khet, Bari and Kharbari).
3	Poor	Food sufficiency for 3-6 months; 5-10 ropanis usually poor quality land
4	Pro poor	Food sufficiency for, less than 3 months ; landless or usually less than 5 ropanis of land (mostly of poor quality Bari land)

Source: Daderi CFUG's Work plan and Constitution 2067.

Respondent's social status was linked with economic status using crosstab shown in figure 5.1.4. A total of 44.45 percent of the respondent belonged to others (Bahun/Chhetri caste), 44.44 percent of them were Janajatis and 11.11 percent were Dalits. Now comparing them with the economic status, 13.90 percent of Brahminn/ Chhettri were from rich family followed by 19.44 percent to medium, 30.55 percent poor and 36.11 percent pro poor. In case of 8.33 percent Janajatis, link missing was from rich family followed by 13.89 percent to medium, 36.11 percent poor and 41.67 percent belonged to pro poor family. And in case of Dalits 11.11 percent were from medium family, 33.33 were from poor family and 55.56 percent were from pro poor, whereas the CFUG categorized in main two rank like as Poor which combine poor and pro poor and next is non poor which combine rich and medium where as poor family were 74.07 percent and non poor family were 25.93 percent. In this way

a majority of 74.04 percent belonged to pro poor family. A study shows that the overall economic status of household and diversity of livelihood sources decides the ability to withstand the impacts of shocks and trends and changes that disrupt lives and livelihoods (IISD, 2003).

Well-being Status of the Respondents

Table 5.3

Well-being Status of the Respondents

Caste/Ethnic	Rich %	Medium %	Poor %	Pro poor %
Dalit	0	11.11	33.33	55.56
Janajati	8.33	13.89	36.11	41.67
Others (Brahmin/Chhetri)	13.90	19.44	30.55	36.11

Source: Field Survey, 2067.

5.1.3 Education Status of the Respondents

Education, being a key part to people's knowledge also develops the power of understanding to subject matter so it was broadly classified into 4 categories such as illiterate, Literate, under SLC and College degree. A total of 32.0% of respondents were illiterate, followed by 35 percent, were literate, 18 percent under SLC level and only 15 percent with college degree. This shows that majority of the respondents are literate and illiterate.

Education	Percent
Illiterate	32
Literate	35
Under SLC	18
College	15

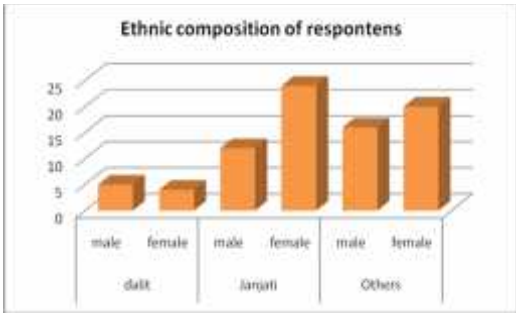


Figure 5.1: Education Status and Ethnic Composition of Respondent.

5.1.4 Occupation of the Respondent

Occupations refer to all the activities of earning by people for their livelihood and daily requirement fulfillment. People of study area were found involved in a various occupations like agriculture, foreign work, business, service etc. Members of some household were also involved in foreign employment and some people worked on the basis of daily wage for their livelihood. The figure below shows that the greater part of the people i.e. 60 percent of the household are engaged in agriculture as their main occupation, 32 percent were engaged in foreign work like India, gulf country, 5 percent worked under Service and only 3 percent worked under business. Although these are the main occupation of the family, supportive occupations are seasonable foreign employment for their livelihood. The impact of climate change on any household varies widely with their occupation. It also helps in determining their vulnerability as well as their adaptive capacity.

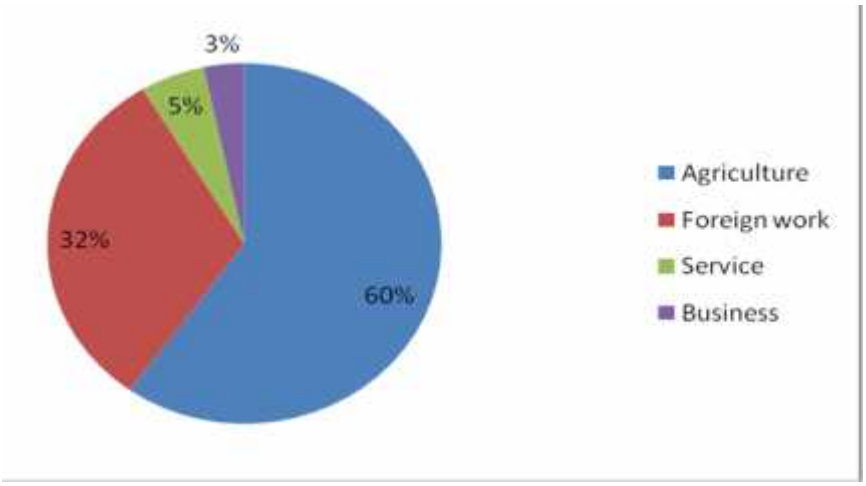


Figure 5.2: Occupation of Respondent.

5.1.5 Land Types of the Respondent

There were various types of land. The productivity of any land depends on its type. Therefore the type of landholding of people also helps in deciding the vulnerable situation. The types of land categorized for this particular study are as Khet, Bari and Kharbari. The pie chart below clearly shows that 16 percent of the respondents possess all three types of land i.e Khet, Bari and Kharbari. 20 percent of them has Khet and Bari, 44 percent has only Bari and 11 percent

has only Khet. Whereas 9 percent of them were landless and earned their living on others land or daily wage.

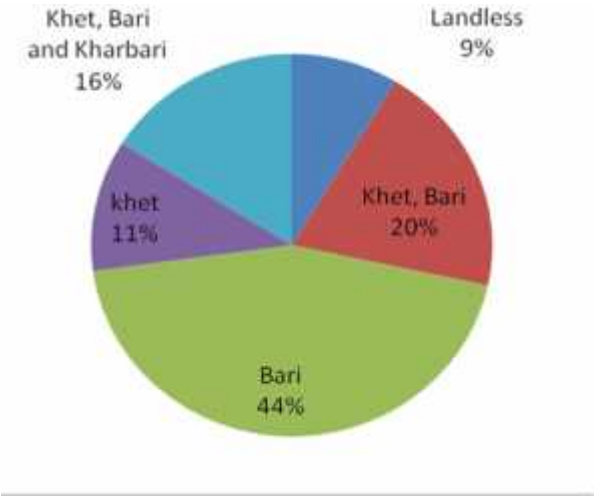


Figure 5.3: Land Types of the Respondent.

5.1.6 Livestock Raised by the Respondent

Livestock were categorized as cattle, buffalo, goat, sheep and others. A sudden decline in the number of livestock was found after the forest was handed over to community. Since they had no other option to feed their livestock, it was difficult for the people to raise them. It was seen that people mainly use stall feeding system and few dependent on Community forest to manage their livestock at present.

5.1.7 House Type of the Respondent

The type of house was categorized on the basis of roofing system. The types of house categorized for this study were thatched roof type, those of 'Khar' and "Thakkal", semi-permanent type, those of tin and stone roof and permanent type, those of concrete house, strongly built with cement. 58 percent of the respondent had thatched roof house and 36 percent had semi-permanent house, whereas 6 percent of the respondent had a permanent house. Type of house can also be a basis for learning about the economic status of people. Communities of different parts of Nepal have already been experiencing increase in water leakage in traditional houses, which people feel is due to new precipitation patterns. Roof leakage and wall erosion problems are a major concern for low-income families who cannot afford to regularly repair their houses (Dahal, 2005).

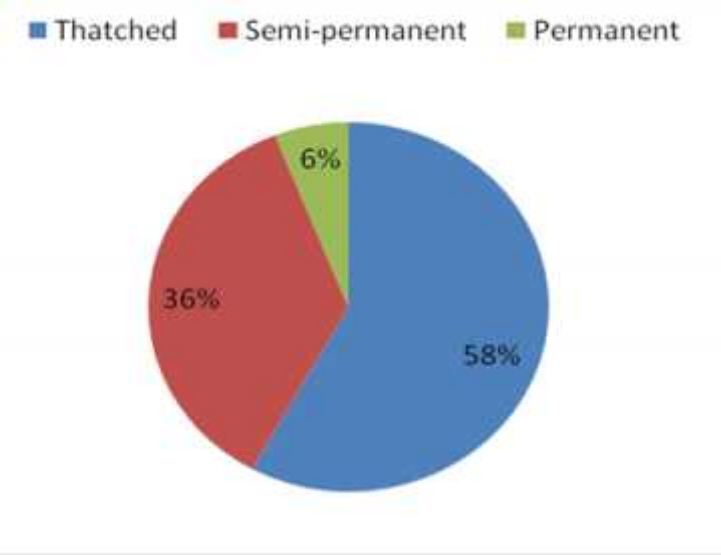


Figure 5.4: Type of House.

5.2 Awareness and Vulnerabilities to Climate Change

A general thought on people's understanding on climate change was necessary to analyze their vulnerability and adaptation measures. On the basis of their economic status, education, knowledge, and experience of natural disaster of the respondents, vulnerability was analyzed. The table 5.2.1 demonstrates that few people were unaware of the Climate Change issue.

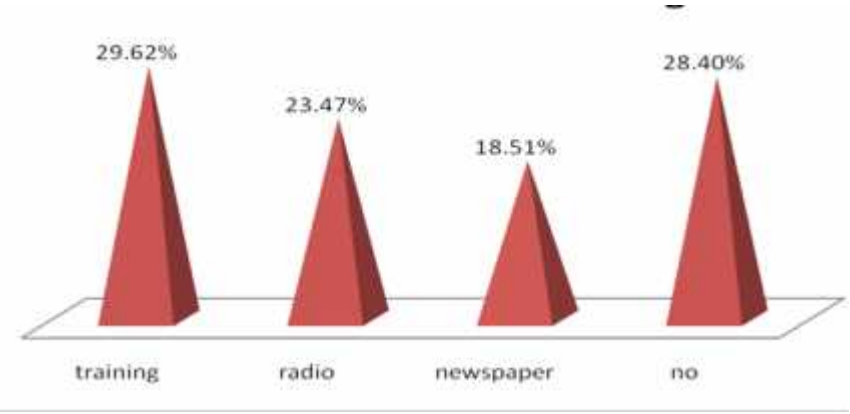


Figure 5.5: Heard about Climate Change.

Above figure 5.5 shows that 71.58 percent of the respondent said that they have heard about the climate change through climate change orientation held by LFP, Radio, Television and Newspaper. And 28.40 percent of the respondents have not heard about the climate change. Out of 29.6 percent heard it through Training, 23.47 percent through radio, television and 18.51 percent through newspaper. Although they were unfamiliar with the topic climate

change a general idea was gained by explaining them about the climate change. According to the respondents, increase of population, deforestation, encroachment, unmanaged urbanization, used of recreational materials, use of chemical fertilizers and old & UN serviced transport vehicles are the main cause of the climate change.

5.2.1 Understanding of People on Climate Change

This section deals with analyzing what people have understood or perceived about the ongoing climate change in the surrounding area. In this heading understanding of people regarding change in climatic factors, water resource is tried to analyze.

5.2.2 Understanding on Change in Climatic Factors

On figure 5.2.4 shows that the climate of the area has changed and locals have perceived it too. Most of the respondents have felt difference in precipitation pattern occurrence of rainfall, temperature, warm, cold, and drought and dew formation. While discussion on precipitation pattern, respondents exposed that the amount of rain, and intensity of rain, warm in summer and cold in winter has changed then before. The figure shows that regarding change in climatic factors before and now.

Changing in following phenomena, (During 30 Years)

Table 5.4

Changing Pattern of the CC Phenomena

Description		Apr		May		Jun		Jul		Aug		Sept		Oct		Nov		Dec		Jan		Feb			Mar
Rainfall	Before																								
	Now																								
Cold	Before																								
	Now																								
Warm (temp. raised)	Before																								
	Now																								

Source: According to Group discussion and Seasonal Calendar of CFUG.

All the respondents generally opinioned that time of rainy season has changed. In general, the rainy season starts from 2nd week of April and June to August in summer season and 1st week of December and January in winter season. But in recent year the rain occurred mostly from the 2nd week of June to 2nd week of August in summer but now a day the respondents have not felt the winter rainfall. However, responses regarding the year of changing rainfall time

are different. Most of the respondents said that time of rainfall have changed since ten years. Cent percent respondents have perceived that intensity and amount of rainfall has changed. According to respondents recent rainfall occurs with high intensity for the short duration when asked about the numbers of years that they learnt about change in amount and intensity of rain most of the respondents accepted that it has changed from last 10 years/or since 2002 AD.

Regarding the response on change in rainfall pattern in winter, all the respondents agreed that it has changed too. As said by respondents, in past winter rainfall used to occur in the month of December and January. However, in recent years they have not seen any such rain during the month of December and January but the responses regarding the number of years of change in rainfall pattern in winter differs. At an average the rainfall pattern in winter has changed since last five years.

All the respondents in single voiced said that temperature has changed. The temperature in the summer season has gone up and the winter has become less cold. This shows that temperature has increased in recent years.

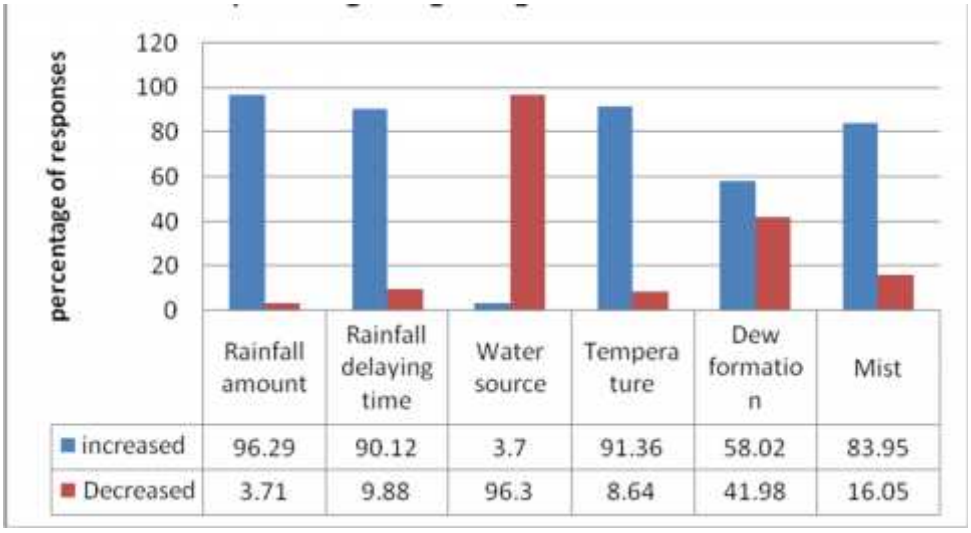


Figure 5.6: Response Regarding Climatic Factors.

Above figure 5.6 shows that 96.29 percent respondents were response on rainfall amount has increased by 3.71 percent response decreased, 90.12 percent respondents said that rainfall delaying time was increased, 9.88 percent respondents said decreased. Like as temperature rise high, dew and mist formation were high.

5.2.3 Perception of People towards Change in Natural Disaster

According to the Respondents, natural disasters like forest fire, dry landslide, drought, lightening and storm have increased and flooding and hail have decreased in recent year due to climate change, detail information is given bellow.

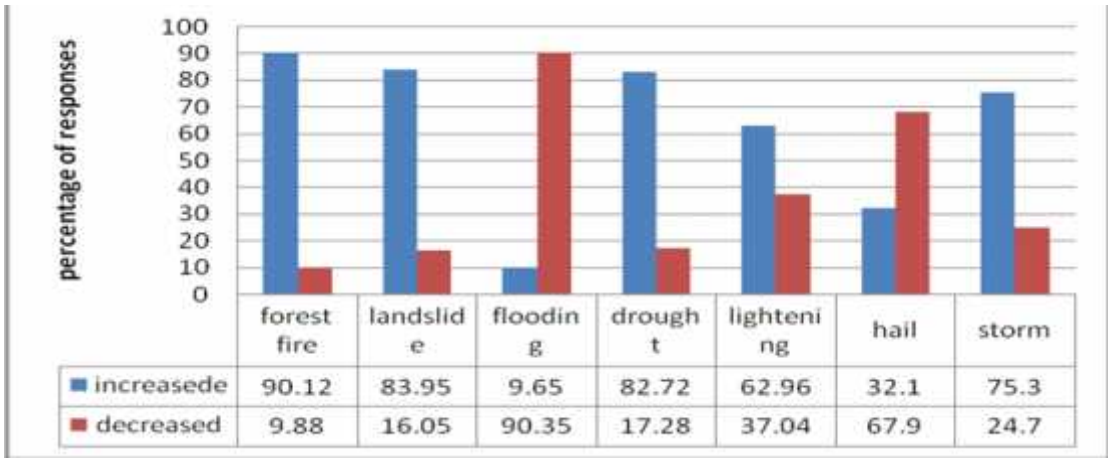


Figure 5.7: Response Regarding Change in Natural Disaster.

Most of the respondent's responses upon change in natural disaster like forest fire, landslide, drought, lightening, and storm has increased and flooding and hail have decreased.

5.2.4 Understanding of Change in Water Resource

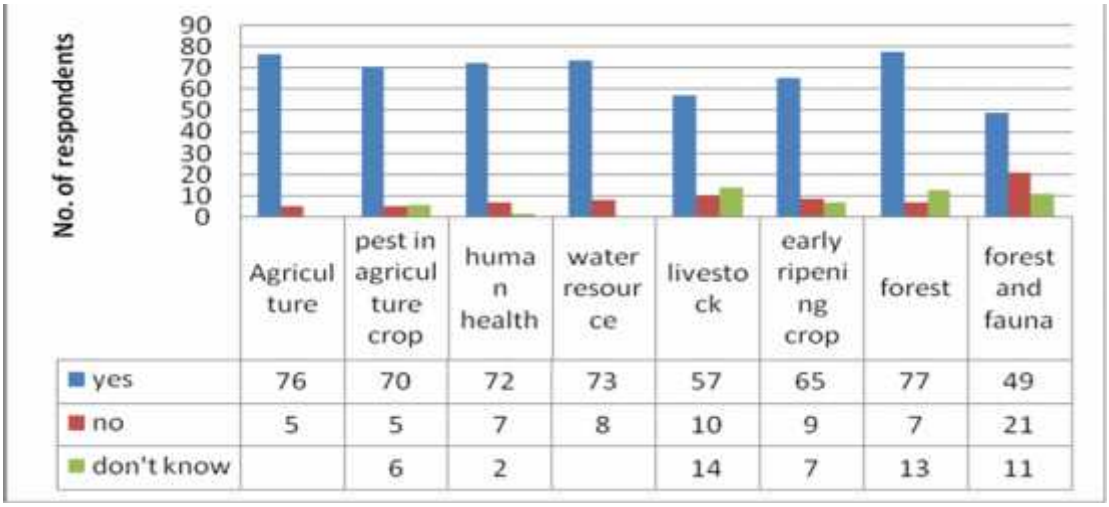
In the questionnaire, survey explains that all the respondents have noticed decrease in water resource. According to the respondents, water springs have dried up and they have to go further away to get drinking water. They have realized, water level in nearby rivers, wells, ponds were decreased. Most of the respondents (96.3%) have agreed that water resource has been decrease in these five years.

5.2.5 Understanding of Change in Weather Related Disasters

According to the respondents most common weather related disasters in the area are droughts, fires landslides floods, and hail. Most of the respondents confirmed that frequency of weather related disasters have increased.

5.3 Impact of Climate Change

Respondents have been observed change in their environment due to climate change. According to their views, the major changes have seen in terms of water resources, agriculture, forest and forest fauna human health, livestock, and early ripening of fruits. Impacts on various sectors have been illustrated in following.



	Agriculture	pest in agriculture crop	human health	water resource	livestock	early ripening crop	forest	forest and fauna
yes	76	70	72	73	57	65	77	49
no	5	5	7	8	10	9	7	21
don't know		6	2		14	7	13	11

Figure 5.8: Response Regarding Change in Various Sectors.

5.3.1 Water Resources

Water resource in the research area has highly decreased. About 70.37 percent of the respondents responded that water resource highly decreased followed by slightly decrease (25.93%) and only 3.70 percent said that water resource has not changed and is as same as before (figure 10). As already discussed about streams, ponds and sprigs have dried. Thus decrease in water has significantly affected irrigation of the local area. Apart from that now a days locals have to travel further away from previous source to get water for household purpose.

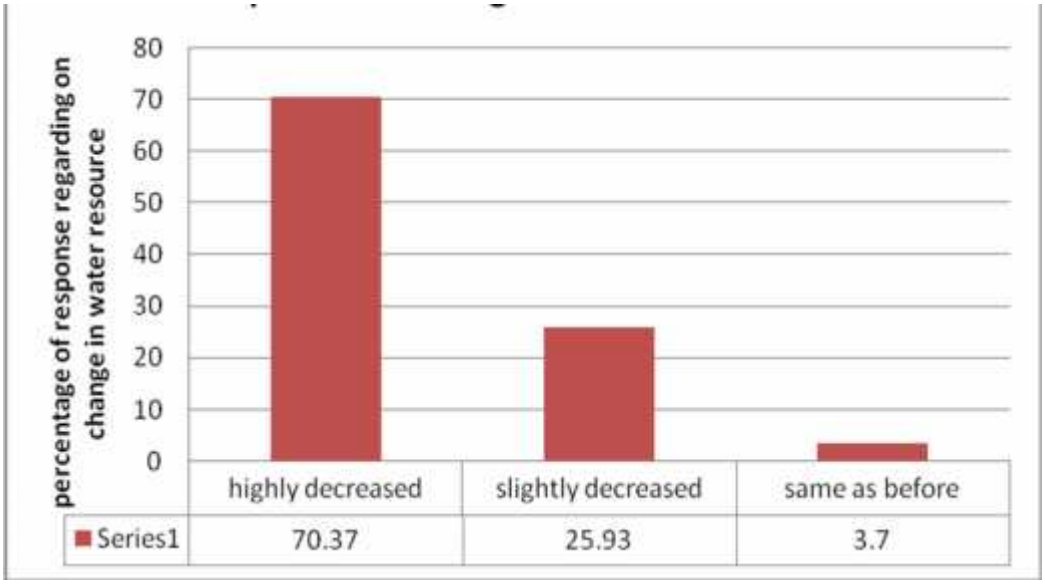


Figure 5.9: Response Regarding Change in Natural Disaster.

5.3.2 Agriculture

Respondents have noticed decrease in agricultural production in recent years in comparison to last 30 years. The 94 percent respondents said that agricultural production has been reduced and that crop production has reduced with these facts in hand could be declared that climate change has impacted in the agriculture production. Main reasons for this decrease in production are ill-timed rain fall and increased drought period. According to respondents, the time of rainfall changed because of which they couldn't plant rice in the month of June with the delays in rice plantation time, the season of planting of other agricultural crops also delayed. Because of this they could only plant crops only twice, which used to be thrice before. The respondents said that the local rice like Hansaraj and Jadan had disappeared and the local maize named Mankamana has also disappeared.

(Agriculture productivity loss- Mrs. Beli Devi Kandel, 56 Farmer, and a resident of Bangesal, agriculture is the main occupation of the area, said that 10 years ago we produced 4 Muri of rice in a one Kadtha land but now a days rarely the produced 2-3 muri of rice. Agriculture of the area is totally dependent on good weather conditions. The biggest problem we face is food insecurity due to decrease in the productivity of the land. If there were good weather, timely rain and good security, we would never search for alternate occupation. Most of the men of the area have gone to foreign countries to solve their problem and women are in stress due to low productivity of crops and household activities.

Similarly, in case of fruits, the time and productivity has changed, according. For example early ripening of fruits like, mango, Chiuri has been observed by respondents similarly, banana, has started falling before ripening. The fruits production was low and quality of fruits also degraded and also increases in the pest in fruit trees.

Effect of Climate Changes

Table 5.5

Effect of Climate Changes

Area	Effects in recent years	Percentage of respondents	Remarks
Agriculture production	Decreasing	94	
Agriculture quality	Decreasing	89	
Production of local crops	Decreasing	94	
Hybrid species	Increasing	95	
Invasive species in Agriculture field	Increasing	91	
Pest in Agriculture	Increasing	87	

Source: Field Survey, 2067.

5.3.2.1 Change in Agricultural Cropping Patterns

Seasonal calendar has changed in recent years. Calendar presented in table 6 shows the cropping season of locals. However, the changes in cropping pattern are not significant in seasonal calendar generally respondents cultivated three crops like rice, wheat/Mustard, and maize along with vegetables. But Disaster like drought, forest fire, flood, storm, occurred in the study area. Drought and forest fire took place in falgun to jesth, flood came about in Asad to Bhadra, storm occurred in Falgun to Baishak.

Seasonal calendar and disaster

Table 5.6

Seasonal Calendar and Disaster

Calendar	Activities		Disaster
	Before 5 years	Now	
Asar	Rice cultivation	Srawan/Bhadra	Drought, forest fire
Baishakh	Maize cultivation and weeding	Jestha	Flood
Kartik	Wheat cultivation	Mansir	
Asoj	Mustard /peas cultivation,	Last of Asoj	
Poush/Magh	Forest management		
Falgun/chaitra	Wheat harvesting		Forest fire, drought

Source: CFUG's Seasonal Calendar (Climate Change Adaptation plan of Action CAPA report).

5.3.3 Health

Response from the household survey lets us know that health hazards have increased. According of disease to them frequency of disease like fever, jaundice, eye infection, common cold, etc have increased and incidents of new disease was also observed.

One of the main reasons for the increase in health hazard is due to the increase of mosquito and flies in number in the study area. The respondents of 89 percent said that number of mosquitoes and flies have significantly increased in the area. Remaining respondents quoted that mosquitoes have increased but only slightly. According to the respondents, the main reason behind the increase in mosquito is rise in temperature of the local area. As already discussed above, the temperature has perceivably increased since last five years.

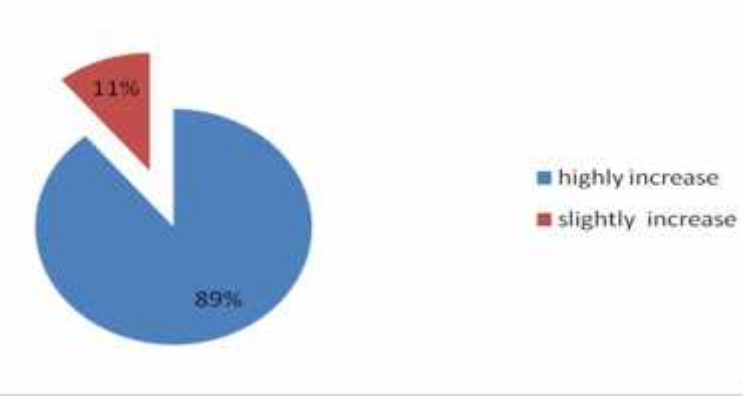


Figure 5.10: Response Regarding Increase in Mosquitoes and Flies.

5.3.4 Biodiversity

The respondents of 69 percent have said that the wildlife populations have decreased. Similarly, 25 percent of the respondents responded that wildlife population has not changed and 6 percent respondent's opinion was that the animal population has gone up. As per the general observation of local respondents, number of Chitaha, Bear and rate has disappeared and rabbits have appeared. According to the locals with the changing climate drought incidents and drying up of the water sources increase. With increase in such incident, the habitat of the wildlife population decreased thus decreased the wildlife population of the area.

People recognized that Thakkal, Sadan and Bhorla have decreased these days due to rise in the temperature. Two types of a Banmara, and Yejerru (local name) have increased significantly.

One of the other impacts of the climate change includes forest fire 89 percent of the respondents agreed that forest fire have highly increased and 11 percent said that it has increased slightly due to increased drought period. This had led to increase in incidences of fire and finally decreasing the number of wildlife population in the Jungle.

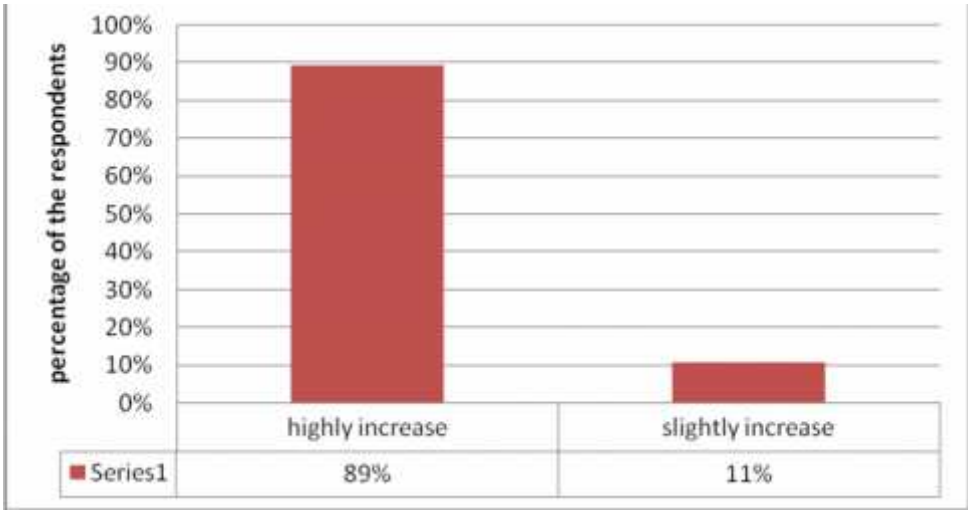


Figure 5.11: Response Regarding on Increased Forest Fire.

5.4 Adaptation Strategy on Climate Change Impact

5.4.1 Local People Point of View

People of the study area have shifted from traditional culture to new one to adopt impact of climate change. Some of the key climate change adaptations related to culture is change in type of crop, crop planting time, plantations of mix cropping use, improved cooking stove, collection of rain water, protection of forest, soil conservation and so on. Percentage of respondents adapting various adaptation strategies is presented in table 7.

Table 5.7

Perception on Adaptation Strategies

Adaptation strategy	Percentage of response of respondents	
	Yes	No
Agriculture Crop Variety	78	22
Change in crop Sowing and Plantation time	65	35
Irrigation System	89	11
Dropped irrigation	19	81
Pipeline irrigation	46	54
Lift irrigation	7	93
Rain water	24	76
Roofing System	24	76
Collection of water in rainy season	45	55
Water resource conservation	98	2
Uses of new source of water	36	64
Uses of purified drinking water	74	26
Forest protection	96	4
Soil conservation	47	53
Terrace improvement	21	79
Work schedule shift in morning	23	77
Uses of ICS	37	63
Use of mosquito net	85	15
Uses of umbrella	95	5
Uses of thin/loose cloth	80	20
Cash crop	16	84
Planting tree at their home garden	57	43

In case of crop variety, out of 78 percent, 50 percent have started using hybrid variety instead of local and 28 percent use pesticides and insecticides, which they did not have to do before.

In case of change in crop sowing and plantation time, out of 65 percent, 18 percent had sown their seeds twice in the same season and 47 percent had their plantation time delayed.

In case of roofing system, 24 percent changed their roof from Khar, to tin. But the clear reason behind it was scarcity and expensiveness of Khar, and Thakkal in the study area.

As information by the respondents, seed sowing, planting, and harvesting time of rice, wheat and maize have been shifted 20 to 25 days than 15 years ago. The main reasons for changing cropping pattern time are delay in rainfall and increase in drought. However, in 2009 production of wheat and maize was poor and rice-planting time was delayed around a month due to long drought of five months Before 15 years, the local varieties of crops were planted. These crops are slowly being displaced by hybrid and improved varieties of crops. Most of the respondents seeming that the decreasing productivity of local varieties was due to long drought season change in rainfall pattern and maximum use of fertilizers. Thus, Hansaraj and Jadan (local name) rice are not now cultivated. Instead of local varieties, hybrid and improved varieties like bikase are planted these days.

The respondents have adopted of irrigation system, out of 89 percent, 39 percent completely depend on rain water and 24 percent have supplies of irrigation water through pipelines, 19 percent used dropped irrigation and 7 percent used lift to collect water which was accessible from streams and rivers.

16 percent of respondents have planted cash crops like vegetables fruits etc in place of traditional crops because the productivity of traditional crops has decreased in recent years due to climate change. The working time of the local farmers has been changed from daytime to morning and evening time. Some of the respondents (45%) have started collecting rainwater for agriculture and household purpose for the future. They collect water in tanks and reserve ponds. 74 percent the respondents have used purified (filtered and boiled) water due to loss of quality of water. 85 percent of the respondents have used mosquito net, 95 percent of the respondents umbrella and 80 percent of the respondents thin and loose cloth.

5.4.2 Stake Holder's Point of View

Adaptation practices to cope with the climatic event such as natural disaster were implemented. Organization such as LFP with its SEEP program with FIRDO and collaboration with DFO for technical support have commenced program for natural disaster impact. For this study, LFP, FIRDO, DSCO and DFO were considered as stakeholders.

LFP provides financial support to launch improved cooking stoves, revolving fund mobilization and check dam construction to control the landslide and climate change awareness program and support to preparing the Climate change adaptation plan of CFUG. It has promoted the use of improved cooking stove, conservation of water resources, beekeeping and setting up pipe lines for drinking as well as irrigation water, with an SEEP program with FIRDO. Although these were not a direct adaptation measures for climate change, it is related to the change. Improved stove helps in reduction of carbon into air as well as less use of fuel wood. Revolving fund for income generation activities will be enhancing the poor people's economy. Beekeeping could be an alternative source of income for the people with no agricultural land.

DSCO plays a vital role in dealing with natural disaster. It promoted land use change to deal with drought, crop diversification, surface water collection, plastic ponds setup for solving the water problem.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATION

6.1 Summary

About the responses on knowledge of climate change, more than two third of the respondents have knowledge on the impacts of climate change. Those who were familiar with climate change got knowledge about it from training, radio, and newspapers. 72 percent of the respondent said that they have heard about the climate change through climate change orientation/training held by LFP, Radio, Television and Newspaper. Even though remaining 28 percent said that they had not heard or learnt about climate change but they understood that their local climate is changing in some or other way. According to the people, increasing in population deforestation, industrialization, unmanaged urbanization, use of chemical fertilizers and fires are the main causes of climate change. Locals have perceived change in their local environment due to climate change. Most importantly the impacts have been seen in agriculture, water resource, health and biodiversity.

According to Responses views, the major changes have been seen in terms of water resources, forest, agriculture, human health, and livestock. Respondents have noticed decrease in agricultural production, crop production has reduced due to ill- timed rainfall and increased drought period. According to respondents, the time of rainfall changed because of which they could not plant rice in the month of June with the delay in rice plantation time the season of planting of other agricultural crops also delayed. Because of this they could only plant crops twice, which used to be three times in the earlier years. Water resource in the research area has highly decreased. About 70 percent of the respondents responded that water resource highly decreased followed by slightly decrease (26%) and only 4 percent said that water resource has not changed.

The health hazard has increase. According to them frequency of disease like fever, jaundice, common cold, etc have increased and incidents of new disease was also observed. One of the main reasons for the increase in health hazard is increase in mosquitoes and flies number in the study area. Most of the respondents disclosed that seasonal calendar has changed in recent years. The calendar is shifted 20 to 25 days.

Most of the respondents have felt difference in precipitation pattern, occurrence of drought, temperature and fog and dew formation. Forest fire is another major impact of climate change as 84 percent of the respondents agreed that forest fire highly increased and remaining that it has increased but slightly. Locals have supposed that increase in drought has resulted in increasing number of fire incidents.

Some of the important strategies adopted by locals are change in crop planting time, types of crop, plantations of various plants in home garden using improved cooking stove, collection of rain water, protection of forest, and soil conservation. In current years, the respondents have started protection of forest as the mitigation measures against the changing climate. They have started the protection and plantation of forest with the concept that forest would increase rainfall, reduce drought and maintain the rainfall time. Community forest have also supported in their attempt to protect and conserve forest.

6.2 Major Findings

- Social characteristics of respondents were 40.74 percent from male and 59.26 percent from female. Caste/Ethnic composition of respondents was 44.45 percent Brahmin/Chhetri, 44.44 percent and 11.11 percent Dalit.
- Occupation of the respondents were 59.87 percent Agriculture, 31.5 percent Foreign work like India, gulf country, 5.30 percent Service and 3.33 percent Business.
- About the responses on knowledge of climate change, more than two third of the respondents have knowledge on the climate change and impacts through training, radio, and newspapers. 71.58 percent of the respondents have heard about the climate change through climate change orientation/training, Radio, Television and Newspaper. 28.42 percent had not heard or learnt about climate change but they understood that their local climate is changing.
- Summer and winter rainfall time is different.
- 96.29 percent respondents were response on rainfall amount was increased 3.71 percent response decreased, 90.12 percent respondents said that rainfall delaying time was increased, 9.88 percent respondents said decreased.
- Most of the respondents' responses upon change in natural disaster like forest fire, landslide, drought, lightening, and storm increased and flooding and hail have decreased.

- The major changes have been seen in terms of water resources, forest, agriculture, human health, and livestock. 94 percent respondent said that crop production has reduced due to ill- timed rainfall and increased drought period.
- With the time of rainfall changed, farmers could not plant rice in the month of June with the delay in rice plantation time the season of planting of other agricultural crops also delayed.
- Water resource in the research area has highly decreased. About 70 percent of the respondents responded that water resource highly decreased followed by slightly decrease (26%) and only 4 percent said that water resource has not changed.
- The seasonal calendar has changed in recent years. The calendar is shifted 20 to 25 days.
- Frequency of disease like fever, jaundice, common cold, etc have increased and incidents of new disease was also observed. Due to the temperature rise and increase of mosquitoes and flies in the study area. 89 percent of the respondents said that number of mosquitoes and flies have significantly increased.
- 89 percent of the respondents agreed that forest fire highly increased and 11 percent said that it has increased slightly. Locals have supposed that increase in drought has resulted in increasing number of fire incidents.
- Some of the important strategies adopted by locals are change in crop planting time, types of crop, plantations of various plants in home garden using improved cooking stove, collection of rain water, protection of forest, and soil conservation. They have started the protection and plantation of forest with the concept that forest would increase rainfall, reduce drought and maintain the rainfall time. If it happens agricultural product will grow, improve the economic status and upgrade social, financial assets of the respondents.

6.3 Recommendation

- Local cropping calendars should be updated to go with the changing weather pattern and disseminated to the community.
- New agriculture technology and suitable crops/plants need to be identified. New technologies based on traditional systems should be upgraded to mitigate the increasing

effects of climate change like bio-fuel, improved cooking stoves and rain water harvesting system in a reserve ponds or tanks for future use

- Policy plays the Vitol role to reduce the adverse climate change in both local, district and national levels. Avoided deforestation promote afforestation and reforestation, climate friendly energy, capacity building
- There are very few research activities in Nepal concerning climate change. Action research should be promoted and conduced in the future.
- Hazard mapping, research and documentation, vulnerability assessment, situation analysis and sharing meetings and mobilization for awareness among community people should be focused
- Awareness on the climate change causes, impact and adaptation must be build through the training/workshop/orientation/interaction programs, TV, Radio

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Annex - I

घरधुरी सर्वेक्षण प्रश्नावली

Questionnaire Survey

A. Socio-economic Information (सामाजिक आर्थिक जानकारी)

1. जवाफकर्ताको नाम (Respondent's Name):
2. लिङ्ग (Sex):
3. उमेर (Age):
4. शिक्षा (Education):
5. गाविसको नामः (Name of VDC):
6. वार्ड नं. (Ward no.):
7. घरमुलीको नामः (Household head):
8. पेशाा (Occupation): i) कृषि (Agriculture) ii) व्यापार (Business)
   iii) नोकरी (Service) iv) अन्य (Others Specify)

9. वैवाहिक अवस्था (Marital Status): i) विवाहित (Married-M)
   ii) अविवाहित (Unmarried-U)
   iii) विधवा (widow-W)
10. जनसंख्यीक विवरण (Household size and demographic information)

परिवार संख्या (family size)	लिङ्ग (Sex)		शैक्षिक स्तर (Education status)		
	पुरुष (Male)	महिला (Female)	अशिक्षित (Illiterat)-I	एस एल सि (Under SLC)-II	क्याम्पस स्तर (College)-III

11. जग्गाको स्वामित्व (Land holding):

तपाईको जग्गाको किसिम तथा परिमाण बारेमा भन्नुहोस् ? (What are the types and land in your family holds?)

जग्गाको किसिम (Land Types)	जग्गाको उपयोगीता (Land use pattern)		कैफियत (Remarks)
	पहिले (Before 10 years)	अहिले (Now)	
खेत (Khet)			
बारी (Bari)			
खरवारी (Kharbari)			
अन्य (Others)			
जम्मा (Total)			

12. तपाईको परिवारलाई आफ्नो खेतवारीमा उत्पादन भएको अन्नले कति महिना सम्म खान पुग्छ ? (Food Sufficiency)

(a) Less than 3 month (३ महिना भन्दा कम)

(b) 3-6 month (३ देखि ६ महिना)

(c) 6-9 month (६ देखि ९ महिना)

(d) 9-12 month (९ देखि १२ महिना)

13. पशुपालन (Livestock)

(a) गाई गोरु (Cattle)

(b) भैसी रागा (Buffalo)

(c) बाखा (Goat)

(d) भेडा (Sheep)

(e) अन्य (Others)

14. पशुपालन व्यवस्थापन तरीका (Livestock Management)

जनावरको किसिम (Animal Types)	जनावरको संख्या (No. of Animals)		चरिचरण विधि				कैफियत (Remarks)
	पहिले (Before)	अहिले (Now)	सामुदायिक वन (CF)	राष्ट्रिय वन (NF)	निजी वन (PF)	बाँधेर पाल्ने (stall feeding)	

15. घरको किसिम (Types of house)

a. खरले छाएको घर (Thatched roof type)

b. अर्ध पक्की घर (Semi permanent type)

c. पक्की घर (Permanent type)

B. जलवायु परिवर्तन र यसबाट परेको प्रभाव बारेमा जानकारी (Understanding of Climate Change and its impacts)

1. तपाइले जलवायु परिवर्तनको बारेमा सुन्नु भएको छ, छ भने कसरी सुन्नु भयो यस वारेमा बताउन सक्नु हुन्छ ? (Have you heared the climate change and if yes, how did you know and what it is ?)

a) छ, Yes

b) छैन, No

2. तपाईले निम्नानुसार दिइएको कुराहरुमा परिवर्तन भएको महशुश गनु भएको छ विगत ३० वर्षदेखि ।

(Have you realized the change in following bellow last 30 years?)

महिना	बैशाख	जेष्ठ	असार	साउन	भाद्र	असोज	कार्तिक	मंसिर	पौष	माघ	फाल्गुन	चैत्र
तापक्रम Temperature)												
पहिला (Before)												
अहिले (Now)												
वर्षात (Rainfall)												
पहिला (Before)												
अहिले (Now)]												
जाडो (Cold)												
पहिला(Before)												
अहिले (Now)												
गर्मी(warm)												
पहिला (Before)												
अहिले (now)												

3. माथि बताइएको कुराहरुमा आएको परिवर्तनले तपाईको परिवारमा कस्तो प्रभाव परको छ ? जस्तै कृषि, स्वास्थ्य, जलश्रोत, वन तथा जैविक विविधता, उर्जा, भौतिक पुर्वाधार (Have you realized what the impacts of above mentioned changing phenomena are?)

4 . तपाईको विचारमा जलवायु परिवर्तनको कारणले तल दिइएको क्षेत्र मध्ये सबैभन्दा बढी प्रभावित कुन क्षेत्र होला (In your opinion which sector is the most effective from the climate change?)

a. कृषि (Agriculture)
b. जलश्रोत (water Resource)
c. स्वास्थ्य (Health)
d. जैविक विविधता (Biodiversity)
e. पर्यावरण (Ecosystem)

5. विगत ३० वर्ष देखि अहिले सम्ममा प्राकृतिक विपत्तिहरु जस्तै खडेरी, पहिरो, आगोलागि, बाढी, अन्य विपत्तिहरु महशुश गर्नु भएको छ । (Do you memorize any disasters like drought, fire, flood, landslide etc before 30 years to date?)

6. माथि बताइएका जलवायु परिवर्तनले पारेको विपत्तिहरु/असरहरुसंग जुध्नको लागि के उपायहरु अपनाउनु भएको छ ? (What are the adaptation practice adopted to cope from the climate change disasters?)

7. उपरोक्त प्राकृतिक विपत्तिहरुले तपाईको जिविकोपार्जनको कुन पक्षमा असर पारिरहेको छ ? (In what aspects of your livelihood are being affected by these climatic hazards ?

a. कृषि (Agricultur)

b. नोकरी (Service)

c. व्यापार (Business)

d. अन्य (Others)

8. तपाई आफनो परिवारलाई अरुको परिवार भन्दा बढी जोखिममा भएको ठान्नुहुन्छ ? (Do you think, your family is the most vulnerable than other family?)

छु (Yes) छैन (No)

यदि छ भने कुन कारणले गर्दा (If yes, by which is the causes you are most vulnerable than other ?)

a. मेरो जिविकोपार्जन पुर्णरुपमा कृषिमा निर्भर भएकोले गर्दा

b. मेरो जिविकोपार्जन पुर्णरुपले प्राकृतिक श्रोत माथको निर्भरताले गर्दा

c. मेरो दयनिय आर्थिक अवस्थाले गर्दा

d. अन्य भए उल्लेख गर्नुहोस्

1. के उपरोक्त उपायहरु समस्या समाधानको लागि सहयोगी छन/(Are these measures are helpful to solving the problem ?)

a. छन् (Yes) b. थाहा भएन (unknown) c. छैनन् (No)

2. जलवायु परिवर्तन वारेमा कुनै तालिम/गोष्ठी कार्यक्रमहरु संचालन भएको छ (Had there been any training/workshop program conducted on CC issue ?)

a. छ (Yes) b. थाहा भएन (unknown) c. छैन (No)

a. लाग्छ (Yes) b. थाहा भएन (unknown) c. लाग्दैन (No)

3. आवश्यक सहयोग उपलब्ध गराएको खण्डमा तपाईले जलवायु परिवर्तनको अनुकुलन/समायोजनका थप उपायहरु के के गर्न सक्नुहुन्छ (What do you think can be done more as adaptation option, if given opportunity ?)

A. Climate Change and It's impacts.

Have you realized any changes in climatic factors comparing before 30 years ?

SN	Description	Change			if changes		change year---since	Remarks
		Yes	No	Don't know	Increasing	Decreasing		
	Rainfall starting time							
	Rainfall amount							
	Winter rainfall							
	unpredictable rain							
	Drought							
	Cloudy days							
	Water resource							
	Temperature fluctuation							
	Mist							
	Dew formation							
	Landslides							
	Flooding							
	Forest Fire							
	Lightening							
	Storm							

B. In your opinion, what are the reasons behind these changes?

C. Mark the impact of climate changes in your area?

Impacts areas		Impact			If yes what sector is most effected
		Increased	decreased	same	
Agriculture	production				
	quality				
	traditional crop				
	hybrid crop				
	invasive species				
	disease				
Water/Natural resource	water availability				
	water quality				
	availability forest fuel wood & forage				
Human health	mosquitoes				
	flies				
	diarrhea				
	increase hot days				

D. What are the impacts of climate change in our community?

E. What adaptation technique is applying to cope with climate change?

For temperature increased

For changing rainfall time

For water resource scarcity

F. Awareness on Adaptation measures (अनुकुलन उपायहरुको बारेमा ज्ञान)

1. के तपाईले कुनै अनुकुलन/ समायोजनका उपायहरु अपनाउनुभएको छ ।

(Have you practiced any adaptation actions like?)

परिवर्तन गरेका कार्यहरु (Change in)	छ (Yes)/ छैन (No)	यदि छ भने (If yes)		कैफियत (Remarks)
		पहिले (Past)	अहिले (Present)	
कृषिबाली प्रजाती (Agricultural Crop variety)				
विउ रोप्ने तथा छर्ने समय (Sowing & plantation time)				
घरको वनावट, छाना, झ्याल, ढोका (Roofing/ window/door)				

2. In overall what is the adaptation technique you used ?

Impacts areas	Adaptation technique	Participation		
		Male	Female	Both
Agriculture	change in crop planting time			
	change in crop type			
	drop irrigation			
	Rotational irrigation			
	pipe irrigation			
	terrace improvement			
	lift irrigation			
Water/Natural resource	Collection of rain water			
	collection of flood water			
	water source conservation			
Human health	use of mosquito net			
	use of umbrella			
	use of loose clothe			
	use of purified drinking water			

धन्यवाद, तपाईको अमुल्य जानकारीको लागि । तपाई यसबारेमा केहि थप्न चाहानुहुन्छ ?

(Thank you for the invaluable information. Would you like to add anything else?

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Check List for Group Discussion

1. Have this community experienced any changes in temperature in last 30 years? What type of change in temperature?

2. How temperature is changing (promote by following points)?
   Extreme hot summer days, Extreme cold winter, winter are less cold and frosty, days are becoming hotter, other)

3. Then what do you think are the impacts (in agriculture disease spreading, water resources)

4. What you think, are the consequences of warmer days and seasons?

5. Then to except from such changes, what did your community use to do?

6. Have you experienced any changes in rainfall within last 30 years? If yes, then what type of change? Increasing/Decreasing

7. What you think are the consequences of changed rainfall pattern in agriculture?> (In agriculture yield increased /decreased)

8. What are the consequences of changed rainfall pattern in water resources? (Water availability increased /decreased, flood frequency increased/decreased etc.)

9. What are you doing to cope with these changes in rainfall?

10. Is there any long drought in this area in past years, how long was it, what are the impacts and how you mitigate?

11. What are the impacts of these changes and how you are mitigating them?

ANNEX - II :

PHOTOS

FGD-Daderi key informants

Daderi community Forest

Person to person interview with Belidevi Kandel

Women group discussion

Check dam construction by CFUG Members

Complete check dam construction.