

**SOCIO-ECONOMIC IMPACT OF CLIMATE CHANGE IN
RURAL LIVELIHOOD: A CASE STUDY OF
JANAKINAGAR VDC, KAILALI, NEPAL**

**A Thesis
Submitted to
The Central Department of Rural Development
Tribhuvan University
In Partial Fulfillment of the Requirements for
The Degree of Masters of Arts
in
Rural Development**

**Submitted by
BHARAT BAHADUR SINGH
Central Department of Rural Development
Tribhuvan University, Kathmandu
TU Registration No. 6-2-4132-2008
Exam Roll No. 280954
August 2016**

DECLARATION

I hereby declare that the thesis entitled **Socio-Economic Impact of Climate Change in Rural Livelihood** submitted to Central Department of Rural Development, Tribhuvan University, is entirely my original work prepared under the guidance and supervision of my supervisor. I have made due acknowledgements to all the ideas and information borrowed from different source in the course of preparing the thesis. The results of this thesis have not been presented or submitted anywhere else for the award of any degree of for any other purposes. I assure that no part of the content of this thesis has been published in any from before.

Bharat Bahadur Singh

TU Regd No.

Date :



TRIBHUVAN UNIVERSITY
त्रिभुवन विश्वविद्यालय
CENTRAL DEPARTMENT OF RURAL DEVELOPMENT
ग्रामीण विकास केन्द्रीय विभाग

Ref. No.

विभागीय प्रमुखको कार्यालय
कीर्तिपुर, काठमाडौं, नेपाल ।
Office of the Head of Department
Kirtipur, Kathmandu, Nepal.
Ph. 4-331383
E-mail: rdtuc@wlink.com.np

Date:

LETTER OF RECOMMENDATION

The thesis entitled **Socio-Economic Impact of Climate Change in Rural Livelihood** has been prepared by Bharat Bahadur Singh under my guidance and supervision. I hereby forward this thesis to the evaluation committee for final evaluation committee for final evaluation and approval.

Ramesh Neupane
Lecturer

Date :



TRIBHUVAN UNIVERSITY
त्रिभुवन विश्वविद्यालय
CENTRAL DEPARTMENT OF RURAL DEVELOPMENT
ग्रामीण विकास केन्द्रीय विभाग

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Office of the Head of Department
Kirtipur, Kathmandu, Nepal.
Ph. 4-331383
E-mail: rdtuc@wlink.com.np

Date:

APPROVAL LETTER

The thesis entitled **Socio-Economic Impact of Climate Change in Rural Livelihood** submitted by Bharat Bahadur Singh in partial fulfillment of the requirements for the Master's Degree (M.A.) in Rural Development has been approved by the evaluation committee.

Prof. Dr. Prem Sharma

Head

(Central Department of Rural Development)

.....
External Examiner

(Central Department of Rural Development)

Ramesh Neupane

Supervisor

(Central Department of Rural Development)

Date :

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ABSTRACT

Climate change is in the center of contemporary environmental discussions. The negative consequences of climate change have already been realized in many places around the world and it is predicted that the consequences would be more severe in the future. The issue of climate change is particularly related to resource dependent communities because they are considered to be most susceptible to the impacts of biophysical changes. The impact of climate change in natural resources on rural livelihood. Climate change is the global issues. It is directly or indirectly affection livelihood. So, we want to know awareness level of community people on climate change and its impact. The main objective of their study was to examine the situation of climate change in the study area in last 30 years and analyze the impact of climate change in natural resource on rural livelihood with the coping mechanism of people against climate change impact.

The study is based on descriptive research design. The universe of the study was 195 households out of 50 sample household have been selected in sampling procedure with random sampling for interview survey. Nature of data were qualitative form and it showed in percentage, bar-diagram and pie-chart to analyze from survey from primary data were collected by household survey, key informant interview, focus group discussion, field observation research article, case studies, papers, journals etc.

More than 80 percent households responded that they have perceived increase temperature and unpredictable rainfall pattern. People have observed unexpected changes in their weather, water and environment. More then 60% respondents experienced increasing warm days and shortening cold winter days. 70% of the respondent reported that the rainfall pattern is changing in the area since last 3 decades. Climate change has affected agriculture production and human health, water resource is decreasing. Only 24 percent were found to have enough production of food grains and 16 percent, 28 percent, 32 percent were found to have food sufficient for 0-3 months, 0-6 months, 0-9 months respectively. So, people are separating from their traditional occupation, way of life and they are seeking alternative professions.

Local adaptive capacity was poor knowingly or unknowingly some coping strategies like use of boarding to irrigation land an loose check dam to flood control or ripening Nurcut were adopted within the community. There is an urgent need to formulate adaptive strategies for food security. Climate change induced disasters in the area with dissemination of information about climate change.

It is concluded that climate change is creating multidimensional impacts of the life of rural communities. Adaptation practices must be development and awareness level of the people on climate change. The systematic collection of such information would allow scientist, researchers and policy makers to be design and implement appropriate adaptation strategies for climate change in the area that are especially vulnerable.

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ABBREVIATIONS/ACRONYMS

ADB	:	Asian Development Bank
CDM	:	Clean Development Mechanisms
COP	:	Conferences of the Parties
DANIDA	:	Danish International Development Agency
DCs	:	Developed Countries
DFID	:	Department for International Development
DHM	:	Department of Hydrology and Meteorology
EU	:	European Union
FGD	:	Focus Group Discussion
GDP	:	Gross Development Product
GEF	:	Global Environment Facility
GHG	:	Green House Gas
GLOF	:	Glacial Lake Outburst Flood
ICIMOD	:	International Center for Integrated Mountain Development
INGOS	:	International Non-Government Organization
IPCC	:	Intergovernmental Panel on Climate Change
ISSET	:	International Symposium on Endovascular Therapy
LAPA	:	Local Adaptation Plans for Action
LDCs	:	Least Developed Countries
MOSTE	:	Ministry of Science, Technology and Environment
NAMS	:	Nationally Appropriate Mitigation Action
NAPA	:	National Adaptation Plan of Action
NARC	:	Nepal Agriculture Research Council
NCVST	:	Nepal Climate Vulnerability Study Teams
NGOS	:	Non-Government Organization
NTFPs	:	Non-timber Forest Production
RED	:	Reducing Emission from Deforestation and Forest Degradation
REDD	:	Reducing Emission from Deforestation and Foreign Degradation
UN	:	United Nation
UNCED	:	United Nations Conference on Environment and Development

UNDP	:	United Nations Development Program
UNEP	:	United Nation Environment Program
UNFCCC	:	United Nations Framework Convention on Climate Change
US	:	United States
USCSP	:	United States Country Studies Program
VDC	:	Village Development Committee
WFP	:	World Food Program
WWF	:	Wolf Wildlife Fund

CHAPTER I

INTRODUCTION

1.1 Background of the Study

Before climate change, we know about weather. Weather is prevailing in the atmosphere over a short period in specific location. It changes daily and seasonally. According to Academic's dictionary of Geography, "climatic condition of a specific location prevailing in the atmosphere over a short period of time especially near the ground and as affecting human beings." climate means average of weather in specific location. When we study about temperature, humidity, wind, rainfall above 30 years then we find about climate change neither we find only climatic fluctuation to study about mentioned things below 30 years.

Climate change refers to a change of climate that is attributed directly or indirectly to human activities that alters the composition of the global atmosphere and that is in addition to natural climatic variability observed over comparable time period (UNFCCC) climate change refers to any change in climate over time whether due to natural variability or as a result of human activity (IPCC) climate change has now been matter of concern to both developed and developing world, which first came to wider attention when intergovernmental panel on climate change (IPCC) published its first assessment report in 1990, several studies have shown that impact of climate change have already been observed on water resources, food security, human health, social and economic losses.

Climate change is a great challenge of human being. We have two reasons of climate changes through the human being. One is natural and other is human behavior. Natural climate change take the volcano, dust, radiation and human behavior set up global warming through various factors like as industries and smoke. As much as increased green house effect concentration in atmosphere is widely accepted as the single source of global warming and climate change for which human are mainly responsible (IPCC 2007). Green house gases (GHGs) are mainly produced from the burning of fossil fuels, agriculture, forestry and land uses change. Averaged over all land and ocean surface temperature warmed roughly 1.5°C from 1880 to 2012.

According to intergovernmental panel Oil climate change because oceans tend to more warm and cool slowly than land areas continents have warmed the most in the northern hemisphere, where most of earth is land mass is located the three decades from 1983 to 2012 were likely the warmest 30 years period of the last 1400 years according to the IPCC. The list of Countries by total GHGS emission in 2010. Nepal GHGH mission is 0.1 %. (37.3 7 Mt CO₂e) by <http://en.m.wikipedia.org>wlink>list>.

Nepal's GHGS emission is negligible in the global scenario but it has affected seriously. Kalapathar Cabinet meeting is held on 4 Dec 2009, Everest base camp at Kalapathar at 8n altitude of 5250 meters. The 23 cabinet member also wearing purple sashes reading "Save the Hirnalays". The Everest declaration was a message to minimize the negative impact of CC on Mount Everest and other Himalayan Mountains said Madhav Kum.ar Nepal the prime minister of Nepal. Dipak bohara, the forest minister, said that the event was designed "To get the world's attention on the impact global warming is having on underdeveloped countries" before the climate change conference is Copenhagen. He said that Nepal would urge wealthy countries to commit 1.5% of their earning to help poorer nation to protect environment. The 10-point Everest declaration the cabinet adopted includes increasing the protected areas of Nepal's land from 20% to 25%,developing communities capacity to cope with climate change and working together with other countries to mitigate the impact of global warming .The declaration also supported developed countries plans to contribute 1.5% of GDP to a climate fund and bring down green house Gases to pre industrialization levels .The countries is also sending some of its most famous Everest climber on the leadership of Wongchu Sherpa president of Everest summiteers association to highlight the challenges facing Nepal, such as floods from glacier melting, erratic rains, longer dry spells and unprecedented forest fires (WWW.Everestsumrnitte) likewise 20 Oct 2009 the Maldivian cabinet held a meeting under water to highlight the need for action of climate change.

Kailali district is located in fare western part of Nepal. It is one of the district of Seti zone in madhes plain. It's headquarter is Dhangadhi. It coursers an area of 3.235 krn2. There lives 7,75,709 people by 2011. It's density 240 km². There main language is Tharu 72%, Nepali 12%, Urdu 6% and others 10% (WW.kailali.com). My study area is Janakinagai VDC, which is one VDC among Kailali district).

1.2 Statement of Problem

Climate change has already been happening across the country with varying degree of impacts. Evidence of its impact is visible in agriculture production, infrastructure, health, sanitation etc. Rural people are the front live to bear the brunt of these changes. Their mainstay of livelihood is agriculture which depends largely on climate change's sensitive factors like forest and water resources. Land and land productivity is loss by climate change.

Rural livelihood is directly affected by climate change and it is affected the water, land, social, economic and health sector. Human activities deforestation, land use pattern and other activities disturb the natural balance so many problem (flood, landslide, heavy rain, acid rain etc.) are being seen to human environment, most of rural people face these problem because rural people's activities like skill, production, infrastructure, settlement system are damaged by calamite change and they compelled to live lack food, low health facilities, low house infrastructure. Therefore they are being weak; Dieses affect and worry about many problems.

Jankinagar VDC is situated in side of Kulariya river. Flood comes every year in this area. It destroyed the farmers production like paddy, vegetable etc. and road, school, houses. At that time people were suffered by many disease reason of flood. This is 14.75 km². There have been only few studies, which exmine the socio-economic impact of climate change in rural livelihood. The study aims to find the answer of the following research questions. The problem of this study is the following unanswered questions.

-) What is the situation of climate change in the study area ?
-) What is the impact of climate change in rural livelihood ?
-) What is the copping mechanism of rural people to flood ?

1.3 Objective of the Study

The general objective of this study is to assess the socio-economic impact of climate change and the specific objectives of the study are the following:

- i. To examine the situation of climate change in the study area in last 30 years.

- ii. To analyze the impact of climate change in rural livelihood.
- iii. To analyze the coping mechanism of people against climate change impact.

1.4 Significance of the Study

Change in climate have a major impact in Nepal. The majority of people are directly dependent on natural resources that are affected by the climatic response. Both periodic variation and long term trends in climate have to be mark to understand the interaction between social ecological and climate system.

Additionally the natural hazards such as land slides, earthquakes and forest fires, serious drought, temperature increase and flash flooding are causing serious determinantal impacts on community livelihoods causing food insecurity, lack of access to fresh water for irrigation and householdness, soil erosion, damage to infrastructure (including irrigation system, land, property and roads), increase in pests and diseases and change to ecosystems (including NTEPs). These hazards are in part as a result of non-climate drivers (such as land use pattern change unsustainable use of natural resources, governance and tourism) but exacerbating by climatic variability (WWF 2010, p. 10).

It would take a long time for climate change impacts to become evidence in this area but definitely people perceptions are very much useful to establish the fact that the region facing indirect problems in agricultural production and in other livelihood options. This work also tries to quantify the people's perception and relate them to temperature, rainfall and agricultural production records to measure the accuracy of these perceptions. There are seems to be a similarity between perceptions held by the people and different climatologically and agricultural data. There are slight variations in the temperature and weather patterns are changing and shifting ahead. Winters are shorter, rainfall has become more unpredictable, agricultural production is declining in the last 10 to 15 years. Nepal is affected from climate change and besides this area is mostly affected. The particular area had chosen for the study because it is easily accessible and heterogeneous is socio-economic cultural and geographical structure. Most of the people in this area are engaged in agriculture and livestock farming. Which are widely affected area from climate change. It is rich fertile land and water resources. Thus the area is selected to assess impacts on

various livelihood options of the rural community. So, affecting their livelihood and the adaptive measure practiced by community to cope up from impact of climate change

1.5 Limitation of the Study

The study has been conducted in Janakinagar VDC of Kailali district with in a limited time frame, so the generalization of this study may or may not be applicable to other parts of the areas. This research has point focus on the local people perception on impact on climate change on livelihood, it did not cover all the aspects of livelihood assets.

1.6 Organizational of the Study

The study has been divided in to five chapters. The first chapter deals with introduction of the study, statement of the problem, objectives of the study, significance of the study and the limitation of the study. The second chapter deals with the review of the literature related to the topic in various document, study reports and various document, study reports and various other records in order to explore the issues regarding the topic. The chapter three states research methodology. The chapter four consists of data analysis. Finally, the chapter five summarizes the major findings with conclusion and recommendation.

CHAPTER II

LITERATURE REVIEW

2.1 Conceptual Review

Climate change refers to change in climate conduction over a time period either due to natural variability or due to anthropogenic factors. Climate change is a burning issue in the world. Different scholars and organizations have given different definition for climate change. According to wikipedia the free encyclopedia "Climate change is any long-term change in the statistics of weather over periods of the time that range from decades to millions of years." It can express itself as a change in the mean weather conditions, or in any other part of the statistical distribution of weather. Climate change may occur inspecific region, or across the whole earth.

Climate change would have an impact upon all of services through its impacts upon the hydrological cycle. So hydrological changes could be the dominant effect of climate change, as snowmelt increases, as evaporation rates increases and as droughts, storms and flood intensity. United Nation Framework convention on climate change (UNFCCC) has defined climate change as a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods (UNFCCC, 2007).

Intergovernmental panel on climate change (IPCC), defines climate change as "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decdes or longer." The fourth assessment report (2007) of IPCC, which provides comprehensive information through assessment report (2007) of IPCC, which provides comprehensive information through assessment of literatures available globally on climate change, mentions "warming of the climate system is unequivocal s is now evident from observation of increases in global average sea level." This statement has been endorsed by joint statement of 16 National Academies of science (Union of Concerned Scientists, 2009). Oveskes (2004) after analyzing 928 abstracts published in referred scientific papers between

1993 and 2003 concluded that 75 percent of the papers conceded that climate change is happening and human activities are major contributors for such unprecedented change.

Agriculture is the most common livelihood for the majority of people living. There livelihood may be threatened due to impacts of climate change on crops production.

Ellis (2000) has developed his own definition and starts from the perception that "a livelihood comprises the assets (natural, physical, human, financial and social capital), the activities, and the access to these (mediated by institutions and social relations) that together determine the living gained by the individual or household" (p. 10). According to Ellis (2000), the likelihood definition identifies five assets which are "... owned controlled, climate or in some other means accessed by the household" (p. 31). The approach looks more positively on what people have rather than what they do not have.

A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for means of living : a livelihood is sustainable in that it can cope with and recover from stress and shocks can maintain or enhance its capacities and assets, can provide opportunities for the next generation and can provide net benefits to other livelihoods at the local and global levels in the long and short term (Chambers and Conway, 1992).

Livelihoods assets refers to the means of production available to a given individual, household or group that can be used in their livelihood activities. The assets are the basis on which livelihoods are built and, in general, the greater and more varied the assets base the higher and more durable the level of social security. Carney (1998) suggests that there are five dominant forms of livelihood assets arranged in a pentagon:

-) National Capital : The natural resource stock from which resource flows useful to livelihoods are derived.
-) Social Political Capital : The horizontal and vertical social resources (networks, membership of groups, relationships of trust, access to wider institutions of society) upon which people draw in pursuit of their livelihood.

-) Human Capital : The skills, knowledge, ability to labor and good health important to the ability to pursue livelihood strategies.
-) Physical Capital : The basic infrastructure (transport, shelter, water, energy, and communications) and production equipment and means which enable people to pursue their livelihoods.
-) Financial Capital : The financial resources which are available to people (whether saving, supplies of credit, or regular remittances or pensions) and which provide them with different livelihood options.

The debate over climate change has now reached a stage where all but the most extreme contrarians accept that, whatever happens to future green house gas emissions, we are now locked into inevitable changes to climate patterns. Studies show that Himalayan glaciers have been melting at unprecedented rates in recent decades. Most of the glacial lakes in the Himalaya have appeared within the last five decades, and the region has faced devastating consequences as a result of such flood (Bajracharya et. al. 2006). In recent decades, a spectamlare degradation has been observed on most of the natural resources. It climate change continues unchecked there will be huge implication or our way of life, especially on livelihoods.

Over two-third of Nepal's population depends on the agriculture for a livelihood. Farmers follow a traditional slattern, relying on rain water and seasons. No wold shythms are upset by unpredicable rains or prolonged droughts. Likely change in the local and regional temperature, precipitation, rainfall pattern, soil moisture, sunshine and cloudiness threatens the traditional agricultural practices in Nepal (WWF, 2006).

So, climate change is analogous to temporal change in livelihoods, which can increase or decrease total factor resiliency and can increase or decrease the viability of one likelihood option relative to another.

The United Nations framework convention on climate change (UNFCCC) is an international environmental treaty negotiated at the Earth summit in Riode Jancirofrans to 14 June 1992, then entered into force on 21 March 1994. The UNFCCC objective is to stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous on traopgenic interference with the climate

system. The framework set non-binding limits on green house gas emissions for individual countries and contains no enforcement mechanism. Instead, the framework outlines how specific international treaties (called "Protocols" or "Agreements") may be negotiated to set binding limits on green house gases.

Initially an intergovernmental negotiation committee produced the text of the framework convention during its meeting in New York from 30 April to 9 May 1992. The UNFCCC was adopted on 9 May 1992 and opened for signature on 21 June 1992. UNFCCC has 197 parties as of December 2015. The convention enjoys broad legitimacy, largely due to its nearly universal membership.

The parties to the convention have met annually from 1995 in conferences of the parties (COP) to assess progress in dealing with climate change. In 1997, the Kyoto protocol was concluded and established legally binding obligations for developed countries to reduce their green house gas emissions in the period 2008-2012. The 2010 Copenhagen agreements state that future global warming should be limited to below 2.0°C (3.6°F) relative to the pre industrial level. The protocol was amended in 2012 to encompass the period 2013 - 2013 in the Doha Amendment, which as of December 2015 not entered into force. In 2015 the Paris agreement was adopted, governing emission reductions from 2020 on through commitments of countries in nationally determined contributions.

One of the first tasks set by UNFCCC was for signatory nations to establish national greenhouse gas inventories of green house gas (GHS) emissions and removals which were used to create the 1990 benchmark levels for accession of Annex I countries to the Kyoto protocol and for the commitment of those countries of GHS reductions. Update inventories must be regularly submitted by Annex I countries.

The UNFCCC is also the name of the United Nations secretariat charged with supporting the operation of the convention, with offices in Hans carstanjen, and UN campus (Known as : langer Eugen) Bonn, Germany. From 2006 to 2010 the head of the secretariat was yro de Beer. On 17 May 2010, Christiana Figueres from costa Rica succeeded de Boer. The secretariat augmented through the parallel efforts of the inter governmental panel on climate change (IPCC), aims to gain consensus through meetings and the discussion of various strategies.

The United Nations framework convention on climate change UNFCCC was opened for signature at the 1990 United Nations conference on Environment and Development (UNCED) in Rio de Janeiro (known by its popular title, the earth summit). On 12 June 1992, 154 nations signed the UNFCCC, that upon ratification committee signatories' governments to reduce atmospheric concentrations of green house gases with the goal of "preventing dangerous anthropogenic interference with earth's climate system." This commitment would require substantial reductions in green house gas emissions.

Article 3(1) of the convention states that parties should act to protect the climate system on the basis of "common but differentiated responsibilities" and that developed country parties of their commitments under the convention related to financial resources and transfer of technology and will take fully into account that economic and social development and poverty eradication are the first and overriding priorities of the developing country parties.

The framework convention specifies the aim of developed (Annex I) parties stabilizing their green house gas emissions (Carbon dioxide and other anthropogenic green house gases not regulated under the montreal protocol) at 1990 levels, by the year 2000.

1. Kyoto Protocol
2. Paris Agreement
3. Bali Action Plan
4. Copenhagen Accord and Cancun Agreements

2.2 Empirical Review

Climate change impact takes important role in rural livelihood. So many people and institution are said about many things of climate change. Here an attempt has been made to briefly with some studies and findings. NFCCC (2001) defines climate change as a change of climate which is attributed directly or individually to human activity that alters the composition of the global atmosphere. "The term climate change is often used interchangeably with the term global warming but according to the National Academy of Science the phrase." "Climate change" is

growing in preferred use to "global warming" because it helps to convey meaning of other terms related to climate change in addition to rising temperature. Climate change refers to any significant change in measures of climate. Such as temperature, precipitation or rainfall lasting for an extended period, decade or longer. Climate change occurs from different causes physical as well as human influences on nature. Global warming causes change in climate factors and affects eco-system/eco-logical processes and functions and biophysical system.

The greenhouse gases that help in global warming are carbon dioxide (CO₂), Methane (CH₄), Nitrous oxide (NO₂), Hydrofluorocarbon (HFCs), Perfluorocarbon (PFCs), Sulfur hexafluoride (SF₆). These gases are emitted naturally but human induced activities are accelerating the rate of emission of these gases from different activities (Dahal, 2007).

Blaikie, P. and Cannon, T. (1994) makes a study on the vulnerability of poor people because of natural hazards such as flood, land-slide and drought in south Asia. Even though the study has covered different ecological regions of south Asia, it does not discuss the impacts.

Chaudhary, P. and Aryal, K.P. (2009) has tried to identify the causes and consequences of climate change in Nepal. It highlights the temperature rise and glacier-like outburst as the consequence that ultimately result in occurrences of health hazards such as diarrhea, malnutrition. It does not analyze whether the incidence of impacts is equally distributed among all classes of people or vice versa.

Ghaire, D. Subedi, M. and Amatya, J. (2008) is also worth mentioning an article that gave an idea to look at a specific region while making an impact assessment of climate change. This article takes one of the districts of the inner Terai region of Nepal. It covers the entire district without focus on the lower class of community that is supposed to be more vulnerable to climate change. Some systems are less vulnerable to short-term climate effects (e.g. some irrigated farming systems). Others (e.g. those relying on rain-fed agriculture) have always been exposed to truncation and extreme climate but may now face variability beyond the current coping range (Tiwari, 2010). In vulnerable systems, climate change threatens food security, livelihood and economic prosperity (UNDP, 2007). The expected increases in temperature and shifts in precipitation

region are predicted to cause significant changes in crop productivity across the globe through direct abiotic influence or through associated change in pests and disease pressure. A cold wave in Nepal in 1997/98 had negative impact on agricultural productivity and showed reduction in the production of crops by 27.8, 36.5, 11.2, 30, 37.6 and 30 percent in potato, tori, rso, rayo, lentil and chickpea respectively (NARC, 1999, Cited in Malla, 2008) and it was also known the early maturity of the crops due to increase in temperature may help to have more crops in the same crop cycle (Malla, 2008).

Out of 2.64 million ha of cultivated land in Nepal, only 43 percent has access to irrigation facilities, of which only 70 percent, 20 percent and 10 percent irrigation water in monsoon, winter and spring seasons respectively (ADB, 2004) and remaining depend on natural precipitation. The crop yield is sensitive to the amount of precipitations and these may fall in western region where a larger population of the poor live and this could threaten overall food security (DFID, 2009 cited in NAPA, 2010). Assessment shows that climate change is posing a threat to food security due to loss of some local and land races and crops (Regmi and Adhikari, 2007).

A livelihood comprises the capabilities assets and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (DFID, 2000).

DFID's biggest aim is the elimination of poverty in poorer countries. DFID, however, stresses, that there are many ways of applying livelihood approaches. Although the application of the livelihood approach is flexible and adaptable to specific local settings and to objectives defined in participatory manner.

"... The framework depicts stakeholders as operating in a context of vulnerability, within which they have access to certain assets. Assets gain weight and value through the prevailing social, institutional and organizational environment (policies, institutions and processes). This context decisively shapes the livelihood strategies that are open to people in pursuit of their self-defined beneficial livelihood outcomes" (Killmaire et. al., 2002).

2.3 Climate Change in its Cause

UNFCCC (2001) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere." The term climate change is often used interchangeably with the term global warming but according to the national academy of science the phrase "climate change" is growing in preferred use to "global warming" because it helps to convey meaning of other terms related to climate change in addition to rising temperatures, precipitation or wind, lasting for an extended period, decade or longer. Climate change occurs from different causes physical as well as human influences on nature. Global warming causes change in climatic factor and affects ecosystem (ecological processes and functions) and biophysical system.

On Earth, human activities are changing the natural green house. Over the last century the burning of fossil fuels like coal and oil has increased the concentration of atmospheric carbon dioxide (CO₂). To a lesser extent, the clearing of land for agriculture, industry and other human activities have increased concentrations of green house gases.

The green house gases that help in global warming are carbon dioxide (CO₂), Methane (CH₄), Nitrous Oxide (NO₂), Hydrofluor carbon (HFCs), Chlorofluoro carbon (CFCs). These gases are emitted naturally but human induced activities are accelerating the rate of these gases from different activities (Dahal, 2007).

2.4 Climate Change in Nepal

Nepal's contribution for causing climate change is negligibly small. Nepali citizens comprise less than 0.4 percent of world population and are responsible for only about 0.02 percent of annual green house emission. Nepal's vulnerability to damage from climate change is however large. Temperature is likely to increase more in high mountain area than elsewhere. Glaciers and snow fields will reduce, even may disappear and drinking water supply as well as on the reliability of hydroelectricity. Global climate change will also shift monsoon patterns in the way that threatens Nepal's current agricultural practices. United States country studies program (USCSP) has also contributed some climate change related activities in Nepal. Under this

program preliminary GHG inventory was constructed that identified mitigation option of GHG emission in energy sector. Vulnerability adaptation assessment for water resources and agriculture were carried.

Nepal has ratified the UNFCCC 2nd May 1994 and came into force on 31st July 1994. Under UNFCCC commitments, Nepal is supposed to prepare and periodically update the national green house gas inventory and submit National communication" to UNFCCC. Global environment facility (GEF) is the financial operating entity of the convention with the help of UNEP and UNDP supporting non-Annexed countries under its enabling activities. Nepal has received US \$ 0.31 million (n full cost basis) from GEF through UNEP to carry out stage I activities related to climate change. Ministry of science, technology and environment (MOSTE) is the principle focal point for climate related activities.

The interim plan prepared as guideline for development during interim period does not pay any special attention to climate change but simply identifies potentiality of forestry sector to benefit from carbon trading. The government of Nepal in cooperation with world wide fund has prepared a draft on climate change policy, 2009. The policy highlights over seeking opportunities from clean development Mechanism (CDM), Reducing Emission from deforestation and foreign degradation (REDD) and least developed country fund. This strategy designed to deal with climate change includes institutional capacity building, management of natural resources, disaster management and risk minimization and adaptation (MOSTE, 2009).

As least developed country, Nepal has prepared the National Plan Action (NAPA), which was endorsed by the government in September 2010. The government of Nepal has started the implementation of the climate change policy 2011 which has the goals of improving livelihood by mitigating and adopting to the adverse impacts of climate change, adopting a low-carbon emissions socio-economic development path and supporting and collaborating in the spirit of the country's commitments to national and international agreements related to climate change. During the NAPA inception workshop in May 2009, participants suggested to formulate local adaptation plans for action (LAPA) for the effective implementation of NAPA. The national framework for LAPA has been formulated in order to translate the suggestions into action and to assist identification of local adaptation

actions with people's participation as prescribed in NAPA, development and implementation of action plans, including support for the integration of climate change adoption into sectoral and area specific plans. The LAPA framework was designed and piloted in 10 districts namely Ilam, Udaypur, Nawalparasi, Kapivastu, Kaski, and Dadeldhura, Pyuthan, Rukum, Achham and Kalikot in 2010. This LAPA framework will help to integrate climate adaptation and resilience aspects in local and national plans.

2.5 Impacts of Climate Change

The programs of today, such as drought, forest fires and flooding will only be magnified by climate change. In Nepal changes in monsoon patterns will greatly exacerbate the situation of unacceptable presence of poverty and inequalities of opportunities in the country. While many Nepalese people are coping autonomously to current stresses, the state must design and implement effective strategies to adopt to climate change impact to achieve economic and social progress. Adapting to long and short term climate related problems need creative engagement among government, market actors and the civic movement.

Climate change has been labeled a "wicked problem", one that is characterized by many underlying strata of nested, intractable and unforeseen predicaments. As the inter linkages among these many predicaments are non linear and complex, the solution to this problems falls outside the comfort zone of our conventional knowledge systems. We need interdisciplinary understanding of the challenges faced and the solutions sought, mediated through plural institutional approaches.

Nowhere is the challenge of responding to the varied impacts of climate change more daunting than in the Hindukush - Himalaya region. IPCC's 2007 fourth assessment report designated this region a "white spot" because of the limited number of scientific studies conducted in this region, including Nepal. This paper discusses the physical climatic and social variability of Nepal. It summarizes climate change scenario results from a recent modeling exercise. While temperature is likely to go up in the region, precipitation will be more erratic in the future implying increasing uncertainty. The paper suggests that increasing uncertainty does not imply no vulnerability and non adoption. It then goes on to discuss two types of disasters rapid

and slow on set. Floods and landslides are considered rapid on set disasters while drought, forest fires, snow melt and regional sedimentation fall within the latter category. The risks climate change imposes on both types are highlighted while drawing implications for decision making for adoption. In conclusion, it is suggested that responses to climate change impacts require plural institutions and that approaches must pursue incremental solutions at local, regional and national scales.

2.5.1 Rapid on Set Disaster

Climate dependent hazards that arise suddenly or whose occurrence cannot be predicted far in advance, trigger rapid on set disasters. They include cyclones and other windstorms, landslides, avalanches and floods. The warning time before these hazards strike ranges from a few seconds or minutes (in the case of landslides), to a few days (in the case of storms and floods).

a) Flooding

Flooding during the monsoon are a natural phenomenon in Nepal. The country's more than 6,000 rivers and rivulets, with a total of 45,000 km in length, support irrigated agriculture and other livelihoods, but also wreak havoc in valleys and in the tarai when they overflow. The river drainage density of 0.3 km/km² are (Shankar, 1985) and, in consequence, how susceptible they are to floods. Flooding damages crops and property and often results in epidemics. The poor are the most vulnerable to its effects. The scale of the impact of any given flood depends on both natural conditions and the characteristics of the population. Certainly climate change has a bearing on flooding but it is not possible to scientifically attribute floods to climate change.

Along with regular monsoon floods, the country also has two special types of floods. The glacial lake outburst flood (GLOF) and the bishyari. In the Himalayan region, glacial lakes are formed between the end of a glacier and its moraine. According to a study by Mool et. al. (2001) there are 22,323 glacial lakes in Nepal covering 75 sq. km. Glaciers have retreated rapidly in the second half of the 20th century, forming, in many cases, ice-core moraine flanked lakes of melted water. Occasionally, a moraine dam is breached and a lake empties in a very short time,

creating a GL, OF, Causing localized damage to assets and local infrastructure and taking lives.

A bishyari is a flood that occurs when a landslide which dams a river is breached by the reservoir of water which forms upstream of it. They commonly occur in the mid-hills after a cloud burst, Bishyari occurs randomly and cannot be predicted precisely.

Flooding has major implications, not just for livelihoods and food security, but also for overall strategies for adapting to climate change. The impacts of past flood events suggest what future impacts are likely to be if extreme floods become more frequent. They also give indications of how we have failed to respond and suggest how we may do so. The 2008 Kosi embankment breach flood in Nepal, India and the 2010 flood in Pakistan are cases in point. The Kosi embankment breach flood caused by institutional dysfunction (Dixit, 2009; Shrestha et. al, 2010) affected 3.5 million people in Nepal and India while the 2010 Indus flood in Pakistan will have major social, economic and political implications for the country's well being. Subsequent analysis needs to examine linkages among rainfall variability, topography, rivers geomorphology, drainage congestion and use changes.

Both events reflect the fundamental challenges that all aspects of life in south Asia may face in the event of a future disaster of such scale. If the monsoon pattern alters due to climate change, much of the Gange, basin in India and Nepal would face consequences such as those that Pakistan is currently facing. As in the case of Pakistan, the rural livelihood, urban food supply, transport, communications, energy, health, water management and institutional systems on which local populations depend will fail. This failure will severely impact poor and marginal populations. As has happened in Pakistan, humanitarian needs of the affected, non-state actors, some of them militant, may fill the void.

Through out most of recent history, the government's strategies for flood mitigation have emphasized structural control measures, primarily embankments. Such measures, as recent flood events demonstrate, have proved inadequate and in many cases, detrimental. The limitation will be further exacerbated as the climate continues to further exacerbate as the climate continues to change. Alteration in the

dynamics of hydrology, geomorphology and social contexts will render structural measures such as embankments increasingly ineffective because the science according to which such measures are designed will become inapplicable. The probabilistic approach they employ uses historic data collected in a stationary hydrological system, obviously, when climate change renders the system non-stationary this approach will fail. Alternatives to structural measures which can help us to adopt include measures to improve drainage, provide points of refuge during periods of floods and improved early warning systems. Livelihood systems that have a high level of resilience to the disruptions caused by floods also support adaptive strategies.

2.5.2 Slow Onset Disaster

Most discussions of slow onset disasters have focused on drought, whose results, in the form of water and food shortages and livelihoods lost, can take months or sometimes years to become evident. Rising temperatures, forest fires, regional sedimentation and accelerated melting of snow and glaciers can also result in slow-onset disasters whose cumulative impact may not be felt for decades although they may contribute to an increase in rapid-onset events such as flash floods.

a) Aridity and Drought

While the impact of flooding are dramatic, immediate and widespread, aridity and drought can be considered a slow onset widespread disaster. Climate dynamics, particularly the projected increase in the variability of rainfall regimes, suggest that agriculture in Nepal will face immense challenges as seasonal drought increases. The impact of the 2008-2009 winter droughts on farming and on local food security was severe. In that period, most monitoring stations received less than 50 percent of normal rainfall, 30 percent recorded no precipitation at all and temperatures were 1-20 above average. At the national level, wheat and barley production decreased by 14.5 percent and 17.3 percent respectively and the 2009 maize production was also seriously affected. Communities which forest products also found that the drought had severely reduced what they could harvest. At present, 40 districts, mostly in the west, face major food deficits and the world food program (WFP) anticipates having to provide Nepal with almost four times the food aid it did in the past.

The obvious impacts of climate change on food production and food security at the local level are likely to be compounded by other on going processes. Hill agriculture has been in decline over the past one and a half decades despite significant effort and resources invested by both the government and the donor community, primarily because of the effects of Nepal's recently concluded armed conflict. As production has declined, local populations have become increasingly dependent on imported food and thus on the conditions of global markets. Climate change, there by, makes them more vulnerable to fluctuations in global production and global market prices. An even more serious implication of erratic rainfall is on functioning of drinking water supply systems. These systems use spring and other systems. These systems use springs and other local water sources which could be seriously affected by changes in rainfall patterns.

b) Forest Fires

It is not only agriculture and regional grain markets which impact food security. Forestry and other production systems, which are themselves impacted by climate change, also are a key influence. Community forestry in Nepal is a major success story, one linked to success in promoting livestock rearing and increasing milk production, livelihoods which have specially benefited women in households with seasonal male migrants. Increasing forest cover-effective carbon banking which mitigates green house gas emissions, while providing local populations with an array of products that help them adapt to climate change. If, however, the mid-hills become drier, as is predicted, the unintended consequences of promoting community forestry may be devastating. An increase in the frequency and intensity of droughts, if coupled with extended forest cover, will greatly increase the risk of forest fires. Already in the spring of 2009, smoke from fires blanketed much of the Himalaya, from Kashmir in the west to Meghalaya in the east.

These fires not only had a negative impact locally but also had potentially major implications for glacial and snow melt rates at higher elevations. In addition, in comparison with areas with extensive vegetative cover, areas affected by fire and drought generate far higher sediment loads because they are more vulnerable to landslides, erosion and debris flow after intense precipitation and because they exhibit "flashy" run off patterns. The problem of sediment transfer has long-term

implications. The rivers of Nepal already transfer huge amounts of sediment derived from natural and geological processes such as landslides and other mass movements and the erosion of riverbeds and banks. Rainfall events, particularly cloudbursts, accentuate these processes there by increasing regional sedimentation. Coarse sediment deposition is particularly intense at the base of hills, where river gradients decline dramatically as they enter the plains. In this zone, rivers shift their channels frequently.

These dynamics will clearly have an impact on sedimentation processes, but the extent of that impact is not easy to quantify. The challenge is particularly complex because it has never been possible to measure sediment base-loads, which are mobilized during intense flooding events. This lack of precise information is significant as water and sediment fluxes determine the design, operation and functioning of structural control measures such as embankments.

Forest fires have other indirect long term impacts, too. The difficulty in establishing seedlings after a fire will prolong the time before villagers can gather non-timber forest products (NTEPs). The loss of forest implies loss of local livelihoods. It may also affect integrity of local water sources, as increased instances of local landslides may damage them while changes in pattern of local rainfall may affect ground water sub-processes in the mountains. On the other hand, if, higher intensity rainfall become more frequent it means that landslide events in the mountains will become more common.

2.6 Climate Change Vulnerability

The discussion above demonstrates that climate change is a complex problem in Nepal and raises more questions than provides answers. Uncertainty is high and models do not tell us specifically what is likely to happen. However, uncertainty about what the impact will be does not mean that we should do nothing people will be more vulnerable and the need for adaptation will be crucial. What are the possibilities for adaptation? Who decides how to adapt and how is that decision made? How are the perspectives of the affected and those who are already making of the affected and those who are already making autonomous decisions included? What can the government do in terms of planned adaptation? Answers are not easy because every

group in every community right across Nepal has its own set of vulnerabilities. In addition, since vulnerability is dynamic, those sets of vulnerabilities. In addition, since vulnerability is dynamic, those sets of vulnerabilities will alter as climate change begins to impact the inter-linkages among livelihood systems, water management, disaster risk reduction, agriculture and forestry and financial instruments.

Financial opportunities that help reduce risk include access to credit, the formation of self-help groups that disburse loans and micro-used it, crop insurance and access to local markets. These mechanisms can provide individuals with a safety net, should crops or assets be damaged by floods, drought or forest fires and provide incentives for behavioral change. For instance, micro-credit and loans can help farmers cultivate drought or flood resistant species and increase crop variety. They also enable them to access seeds and equipment more rapidly in the aftermath of a flood event. Non-financial options for improving resilience include the expansion of communication networks. The use of local radio stations and cell phone networks increases the potential of information flow and the livelihood that communities will be more culture of key issues related to climate and weather. Such systems can also foster the functioning of early warning systems. Improved awareness gives individuals more time to move assets, such as livestock and food, to safer places prior to a flood event. The feasibility and long term implications of such policies for adaptation need to be explored further.

We began this paper by arguing that climate change is a "wicked" problem. The above discussion demonstrates that this indeed is the case in Nepal, where development, meteorology, social context and responses to climate change adaptation intermesh in a complex way. The problem has no simple answer or silver bullet solution. Clearly, approaches to respond to the challenges need to be conceived in terms of plural institutions (Verwij and Thompson, 2006) and incremental solutions (NCVST, 2009) designed to overcome key constraints and enable Nepali households to adopt to new conditions as and when they emerge. The approach must strive to remain flexible particularly because of the tendency of government agencies to move towards unitary or rigid paths, away from those that are plural and reflexive.

2.8 Adaptation of Climate Change

Recent research has helped bring about a better understanding of adaptation. It is increasingly seen as adjustments in ecological, social and economic system in response to actual or expected climate stimuli and their effects or impacts. Adaptation it is now recognized, is much more than coping. In well adapted systems, people actually "do well" despite changing conditions, including those attributable to climate change (ISET, 2008). They thrive either because they shift strategies or because the underlying systems on which their livelihoods are based are sufficiently resiliently and flexible to absorb the impact of those changes. Field studies in south Asia, that aimed to document the factors that increase people's vulnerability to flooding and drought, have identified factors that help people achieve well being by building their resilience or adaptive capacity. Drawing upon a series of shared learning dialogues with affected communities, non-government organizations and local government officials, researchers have come up with a number of soft and hard resilience measures which reduce vulnerability to natural hazards. These measures take into account the unique interplay among physical, social, economic and political relationships. The ability to reduce vulnerability to disasters is related to the robustness of the systems (Moench and Dixit, 2004) summarized in Table 1.

Table 2.1
Factors Enabling Adaptations

System	Details
Communications	The presence of diversified media and accessibility of information about weather in general and hazards in particular.
Transportation	A system which functions even during extreme events.
Finance	Access to banking, credit and insurance products which spread risk before, during and after extreme events.
Economic diversification	Access to a range of economic and livelihood options.
Education	Basic language and other skills necessary to understand risks and shift livelihood strategies as necessary.
Organization and representation	Right to organize and to have access to and voice concerns through diverse public, private and civil society organizations.
Knowledge generation, planning and learning	The social and scientific basic required to learn from experience, proactively identify hazards, analyze risk and develop response strategies that are tailored to local conditions.

Source: By Ajaya Dixit, Institution for Social and Environmental Transition Nepal (Year : ND).

The robustness of such system serve as the requisite physical institutional infrastructure that in turn enables health, education, finances, social networks and markets to exist. Both are foundations for pursuing adaptive strategies. Climate "adapted" systems will help build social resilience. Where such systems are weak or tail, they constrain adaptive behaviors such as livelihood diversification, disaster response and recovery.

CHAPTER III

RESEARCH METHODOLOGY

This chapter deals with the procedural and technical part of the study. It consists of the research design, selection of study area. The source of data, method of data collection, sampling design, data processing, analysis of data, time period as follows.

3.1 Research Design

This study had carried out using descriptive research design as it takes raw data and summarizes it in a useable form. The design is qualitative as well as quantitative in nature as the sample size was small and data were collected from questionnaire, interviews or observation.

3.2 Rationale for the Selection of the Study Area

Kailali district is situated in far western part of Nepal in terai region. It covers an area of 3235 km² with a population of 775, 709 in 2011 A.D. Janakinagar is village development committee in Kailali district in the Seti zone. The total population of VDC is 14,139 and the number of household is 992 (District Profile, Kailali, 2072).

Table 3.1
Demography of Janakinagar VDC

Details	Number
Total population	14,139
Female	7,257
Male	6,872
No. of household	992
Ethnic group	Percent
Janajati	66.81
Dalit	5.47
Others	27.72

Source: District Profile, Kailali, 2072.

3.3 Nature and Source of Data

The nature of data is both qualitative and quantitative. The study was based on primary and secondary data. The primary data were collected in field study with the help of household's survey, questionnaires and interviews. On the other hand, secondary data were also studied, acquired from different reports, published and unpublished documents presentations, from individuals, experts and organizations related to environment and elated website.

3.4 Sample Size

The Jankinagar VDC was selected for the purpose of study. The ward No. 8, 9 was selected purposively because the area is more vulnerable to flood. The ward No. 8 and 9 has altogether around 235 households which is the universe of the study. Each ward has almost equal No. of households. 25 households from each ward was selected by using judgmental sampling. Due to consideration was given to select there respondents who are basically affected by climate change.

3.5 Techniques and Tools for Data Collection

3.5.1 Household Survey

Household interviews were the most crucial component of the data collection process in this research, and were conducted in all the sample households using a semi-structured and structured questionnaire. The questionnaires mainly focus on socio-economic information impact and adaptation measure and vulnerability of climate change. Households were interviewed with eldest of the available family members and most experienced about household affairs. The respondents were asked to compare the condition of their agriculture land, source of water, ambient temperature and rainfall of past with current years. The format of households survey questionnaire in annex I.

3.5.2 Key Informant Interview

Key information interview was next important method for this study. Member of civil society teacher of primary school, landlord, VDC's Mukhiya, ward member of

Nepali congress party were key information for realizing the change. The were encouraged to recall past disaster and coping strategies. Five persons were interviewed in the study area with the consultation of local people and with minimum age of 50 years. They were interviewed by using a checklist. From this discussion vulnerability and coping strategies were found. Key informant method was also used to memories the condition of the past. Key informant interview questions in annex II.

3.5.3 Focus Group Discussion

Groups were considered as a means to elicit information through a consensus building in group. The focus group discussions (FGD) were conducted with farmers group and mother group. These were conducted to supplement and triangulate information gathered from the household interviews and other sources. During FGD open ended questionnaire were used to capture their perception and coping strategies. Focus group discussion in annex III.

3.5.5 Field Observation

Observation is on of the technical to collect the information data. I was observed road, agriculture land coping technique during field work. It is helpful to know more about the impact of climate change in rural livelihood. Things to observe for field observation in annex V.

3.5.6 Secondary Data Collection

Secondary data were also the major source of information for the study. During the preparation of final report, documents related to the objectives such as research articles, case studies, papers, journals, published and unpublished reports were reviewed. Libraries of ICI, MOD, central library of TU and different organization working on climate change and its implementation were also used to carry out literature survey. Further more, essential information was downloaded from the related websites.

Climatic data published from Department of Hydrology and Meteorology (DHM) was used to analyze climatic pattern.

3.6 Methods of Data Analysis

All the data available were tabulated in an orderly manner. The information obtained from the analysis was listed in the result and discussion chapter. The data collected so far were properly edited and coded for further processing. After proper editing and coding, the data were subjected to various applicable simple statistical tools. Calculation has been done by using Microsoft Excel. The quantitative data collected so far was analyzed via-charts, percentage, average etc. were also used for processing, analyzing and interpretation of the collected data. After proper interpretation, the data and findings were properly agglomerated in the report form.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF FIELD DATA

The data collected were edited, coded, tabulated presented in tabulator form for the purpose of data analysis and interpretation. This chapter has been organized as:

- 4.1 Socio- Economic Profile of the Respondents
- 4.2 Situation of Climate Change
- 4.3 Impact of Climate Change in Rural Livelihood
- 4.4 Copping Mechanisms

4.1 Socio- Economic Finding (Livelihood Assets)

4.1.1 Sample Population by Cast and Ethnicity

Table 4.1 : Sample Population by Cast and Ethnicity

Ethnicity	Population	Percentage
Bahram/chhetri	24	48.00
Ethnic people(Mager/Tharu)	20	40.00
Dait	6	12.00
Total	50	100.00

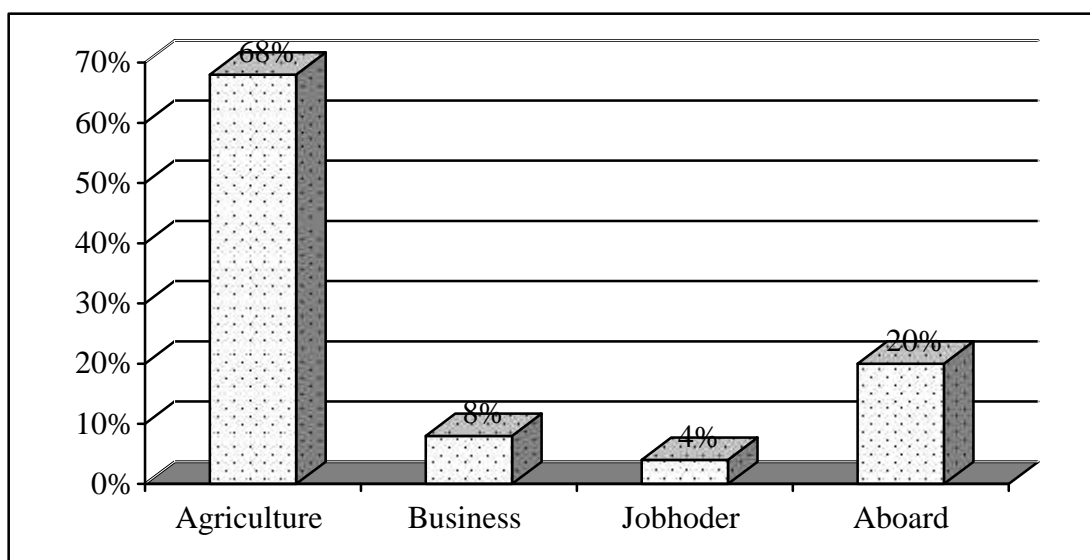
Source : Field Survey, 2016

As revealed by the survey, the total population of sample household is 50. The distribution of Bahun Chhetri to the total sample population was found to be 48%, ethnic population was found to be 40% and Dalit population was found to be 12%.

4.1.2 Distribution of Occupational Structure

Agriculture was the main occupation of the sample households, paddy, maize and wheat was cultivate crops include mustard, potato and lentils (Masuro, Kerau, Mas) and the vegetables (Gobi, Mula, tamato, jajar) were cultivated; only for subsistence purpose.

Figure 1 : Distribution of Sample HHS by Occupation



Source: Field survey 2016

For the study of occupational status of the sample population were agriculture, Business, job holder and go for aboard for job. The study had found agriculture population was 68%, business population was 4% and or aboard for job was 20% agriculture was the main occupation of my study area.

4.1.3 Food Sufficiency

It was purposively categorized into 4 different levels such as sufficient for 9-12 moths, 6-9 month, 3-6 months and less than 3 months. As revealed by the study of sample population in my study area only 16% were found to have enough production of food grains and who how sufficient land 24%, 28%, 20% were found to have sufficient food respectively 6-9 months, 3-6 months and less than 3 months and surplus 12%.

Table 4.2 : Distribution of Household by the Food Sufficiency

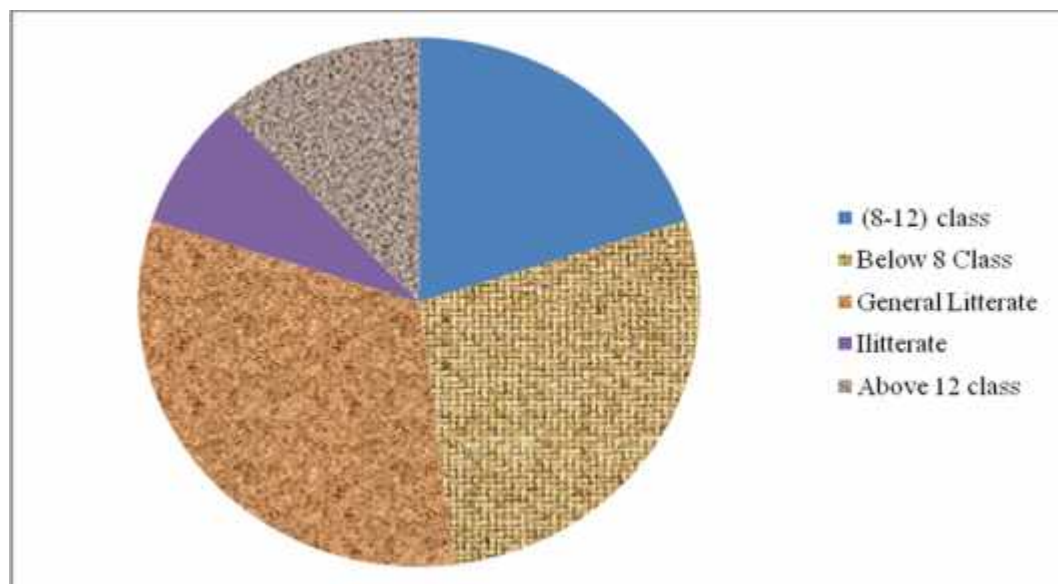
Food Sufficiency (In month)	No. of Respondents	Percentage
0-3	8	16.00
3-6	12	24.00
6-9	14	28.00
9-12 (Sufficient)	10	20.00
Surplus	6	12.00
Total	50	100.00

Source : Field survey 2016

4.1.4 Educational Status of Sample Household

Education being the key factor to people's knowledge, decide the power of understanding to the subject matter (Climate change). So, education was classified as illiterate, general literate, below 8 classes, (8-12) class and above 12 class. Respectively these people were 32%, 28%, 20%, 12% and 8% people were illiterate and genera certificate of study area.

Figure 2: Distribution of Household by Education Status



Source : Field Survey 2016

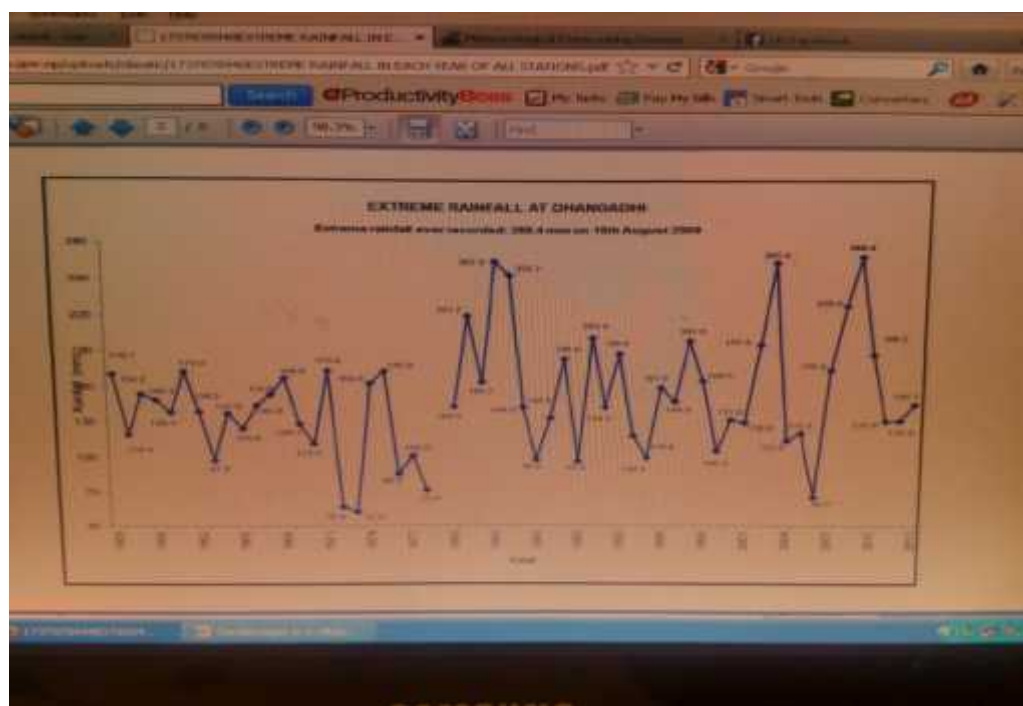
4.2 Climatic Condition

This section deals with the analysis of climatic data mainly, temperature and rain tall. The 30 years climatic data of the study area was taken from the Dhangadhi meteorology station for Janakinagar VDC.

4.2.1 Rain Fall Pattern

Rain fall data of Dhangadhi meteorology station was collected and annals and monthly rend. Rain tall is the major factor to indicate climate change in any area. Annual rainfall of 30 years was taken for study. Rainfall rate was increased in every 10 years from 1980 to 2013 from 1980 to 1992 highest rainfall was 267.0m, 1992 to 2004 highest rainfall was 265.0 and 2004 to 2013 highest rainfall was 2.69.4mm let we see about the rainfall from this figure 4.2% by the figure 3.

Fig. 3: Extreme Rainfall of Dhangdahi



Source: Department of Hydrology and Methodology Babarmahal, Kathmandu.

Similarly mean monthly rainfall 1981 to 2010 years was also taken. The data revealed that June, July, august and September were highest average rainfall 301.5 (11.87) mm, 655.9 (25.833) mm 674.7 (26.563)) mm, 412.2 (16.228) mm

respectively. The low rainfall was in November and December which months were 4.0 (0.157) mm and 15.4 (0.606) mm. Let, see about rainfall following table 4.3.

Table 4.3 : Climate data for Dhangadhi (1981-2010)

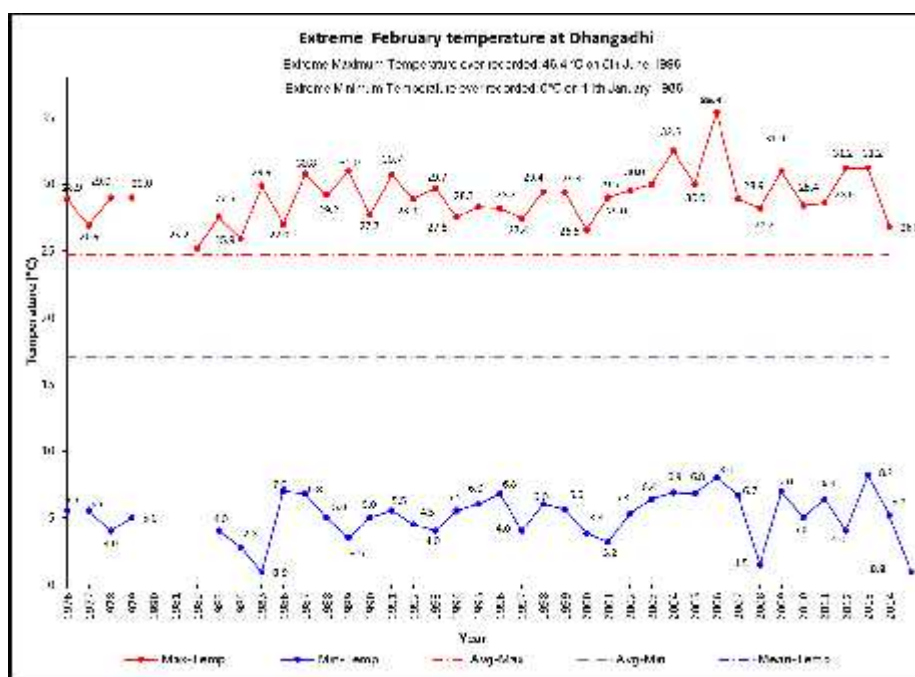
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	20.8 (69.4)	24.8 (76.6)	30.4 (86.7)	35.9 (96.6)	37.2 (99)	36.3 (97.3)	33.1 (91.6)	32.8 (91)	32.4 (90.3)	31.5 (88.7)	27.8 (82)	23.3 (73.9)	30.53 (86.93)
Average low °C (°F)	7.1 (44.8)	9.3 (48.7)	13.0 (55.4)	17.6 (63.7)	22.5 (72.5))	25.2 (77.4)	25.7 (78.3)	25.5 (77.9)	24.2 (75.6)	18.7 (65.7)	12.4 (54.3)	8.2 (46.8)	17.45 (63.43)
Average precipitation mm (inches)	30.6 (1.205)	39.1 (1.539)	22.7 (0.894)	21.3 (0.839)	70.1 (2.76)	301.5 (11.87)	655.9 (25.823)	674.7 (26.563)	412.2 (16.228)	55.4 (2.181)	4.0 (0.157)	15.4 (0.606)	2,302.9 (90.665)

Source: Department of Hydrology and Meteorology (Nepal)

4.2.2 Temperature

Temperature increase is the direct indicate of climate change for this study. I had taken 30 years temperature from 1981 to 2014. By Dhangadhi Hydrology and meteorology station extreme maximum temperature from 1980 to 1992 was 31.0⁰c, 1992 to 2004 was 32.5⁰c and 2004 to 2014 was 35.4⁰c. Similarly minimum temperature from 1980 to 1992 was 0.9⁰c, 1992 to 2004 was 3.2⁰c and 2004 to 2014 was 1.5⁰c. Let's see about temperature following figure 4.

Fig. 4 : Extreme Temperature of Dhagadhi



Source: Department of Hydrology and Methodology Babarmahal, Kathmandu.

Maximum temperature from 1981 to 2010 was in May and June of 37.2⁰c and 36.3⁰c and average minimum temperature was in Dec. and January of 8.2⁰c respectively. Let see about temperature following table 4.4.

Table 4.4 : Climate data for Dhangadhi (1981-2010)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C (°F)	20.8 (69.4)	24.8 (76.6)	30.4 (86.7)	35.9 (96.6)	37.2 (99)	36.3 (97.3)	33.1 (91.6)	32.8 (91)	32.4 (90.3)	31.5 (88.7)	27.8 (82)	23.3 (73.9)	30.53 (86.93)
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Source: Department of Hydrology and Meteorology (Nepal)

4.3 Impact of Climate Change

4.3.1 Agriculture

Despite the majority of the sample population were termers the nature of agriculture was subsistence and dependent on natural climate. Once the climate is

disturbed the whole agriculture system is affected. Above 80% of household surveys told that agriculture production were decreasing in the study area. The reason of decrease in production was increase temperature rainfall was not of time like ripening time rainfall was falling down and different types of disease also destroyed farmer's agriculture production. Their main production was paddy, wheat and mustard and this production was destroyed by khair, kalo-sindure and cold were respectively.

Flood regularly destroyed the crop in Janakinagar VDC of Kailali district in recent years. Farmers have alive in indebtness. So, people's motivation towards foreign employments, job and business.

4.3.2 Impact of Water Resources

Water resources were decreasing in the study area. Most of people of focus groups discussing said that water resource was decrease by deforestation in Kailali district. Forest was rapidly deforesting in last 20 years. Now we being on the water from ground to increase the pipe of nalka and boarding's 2 to 4 fit water resource was decreasing so many people had boarding to irrigated land 20% of farmers had boarding to irrigate their land.

Lack of water resource they had difficult to irrigate their land and land productivity is decreasing. Therefore, they had depend on electricity and diesel to irrigate land for farming. They were farming one by one in their village.

4.3.3 Human Health

Human beings are exposed to climate change through changing weather pattern (Temperature, precipitation, sea-level rise and frequent extreme events) and indirectly through changes in water, air and food quality with changes in ecosystem, agriculture industry, settlements and economy. Changes in climate and increase in temperature are creating favorable environment for pests and disease to develop and spared into human settlements. So this study wanted to know specific change in human health.

Table 4.5 : Frequency of Disease

Disease	Frequency	Percentage
----------------	------------------	-------------------

Fever	5	10.00
Eye effect	6	12.00
Typhoid	10	20.00
Pneumonia	6	12.00
Common cold	14	28.00
Hot/Cold Diaria	4	8.00
Malaria	6	12.00
Total	50	100.00

Source : Field survey, 2016

Typhoid and common cold were major problem and increasing currently. Most of people were suffered to tiddy in hot season. Similarly, common cold in cold season form the study it was revealed that high temperature and cold were. In the study area from 5 to 6 years and their main reason for rise in health hazard was due to increase in mosquito.

They became weak of these disease and lost money. Then, they have alive in poverty and they could not work properly so, they have left their domestic animal.

4.3.4 Impact on Human Assets

Human property like house, agriculture land, crop, livestock were mostly destructed by climate related disaster like flood, siltation etc. Many people's livelihood regularly destroyed flood in over study area. Therefore many people faced this disaster yearly.

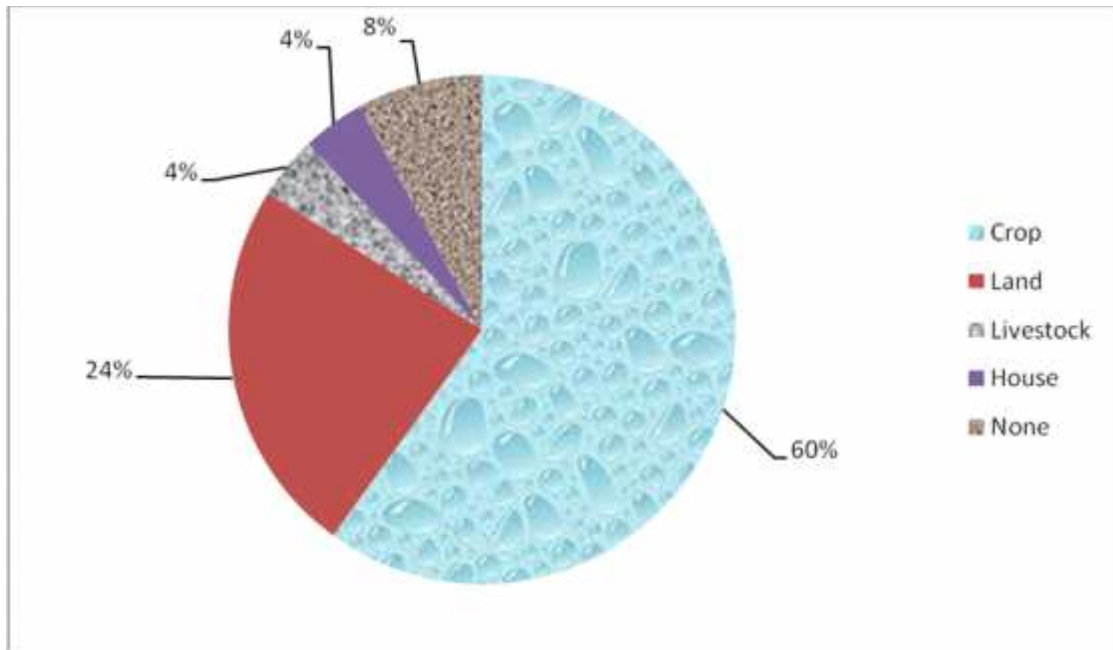
Table 4.6 : Distribution of Livelihood Assets

Assets	Frequency	Percentage
land	12	24.00
Crops	30	60.00
Livestock	4	8.00
Human Life	-	-
House	2	4.00
None	2	4.00

Total	50	100.00
--------------	-----------	---------------

Source : Field survey 2016

Fig. 5 : Distribution of Livelihood



They lived in sample system They sleep infloor. They had burnt wood for cooking and heating. They would not buy expensive material. They could not cropping properly reasons of flood in every year.

4.3.5 Impact of Flood

Flood was the most vulnerable for my study area. Flood has affected livestock, land, crop and mobility of people. Flood has occurred in plain land. All household area near plain and irrigated land by karnali river. This river is flow near village. Heavy rainfall is responsible for this disaster. For this disaster most of people were found to be suffering from flood. In my study area 80% people were suffering by flooded and 20% were suffered by siltation.

4.3.6 Impact of Cold Wave and hot Wave

Cold wave and hot wave are directly related to temperature. Temperature was regularly increased in last 30 years. Similarly hot and cold days were increasing and minimum temperature also decreasing in last 20 years many people were suffering

from disease like fever, typhoid, eye-pain, Rughha-khoki etc. In my household survey 70% people were suffering by water induced disaster like flood and siltation 30% people were suffering by hot and cold waves.

4.4 Copping Mechanism

4.4.1 Distribution of Households by Food Deficiency Copping Mechanism

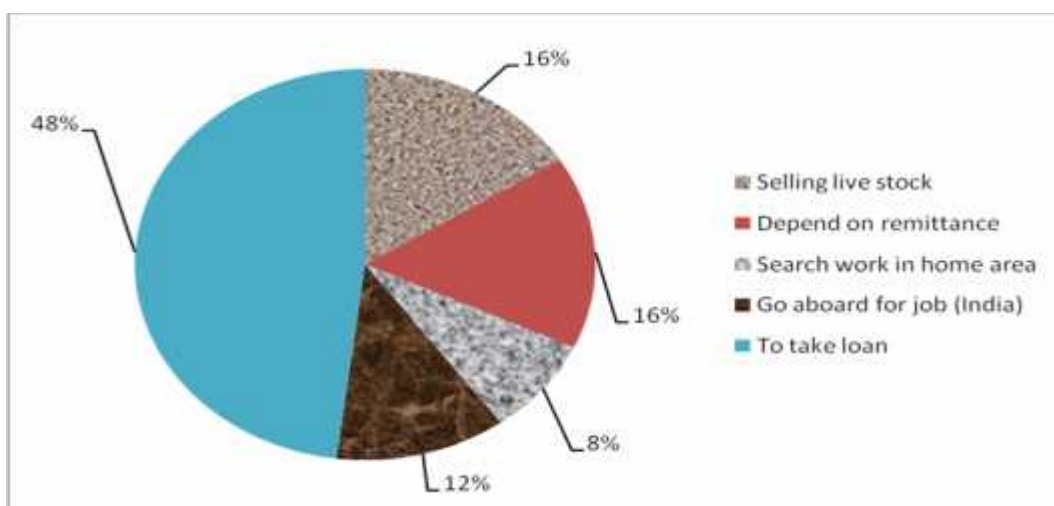
For coping the food deficit problems, the sample households were found to have adopted various alternative ways. The alternatives adopted by them are presented in table 4.7 and figure 6 livelihood options were used for coping food deficit months.

Table 4.7 : Distribution of households by food Deficiency coping mechanism

Copping Mechanism	No. of Respondents	Percentage
To take loan	24	48.00
Selling livestock	8	16.00
Dependent Remittance	8	16.00
Go aboard for job (India)	6	12.00
Search work in home Total	4	8.00
Total	50	100.00

Source: Field survey 2016

Figure 6 : Distribution of Households by Food Deficiency Copping Mechanism



Source: Field survey 2016

48% people were taken loan in food deficit months 16% people were selling livestock in food deficit months equally people were depend on Remittance 12% and 8% people were go aboard for job (India) and 8% people were search work in home area search work in home area in food deficit month.

4.4.2 Copping to Flood

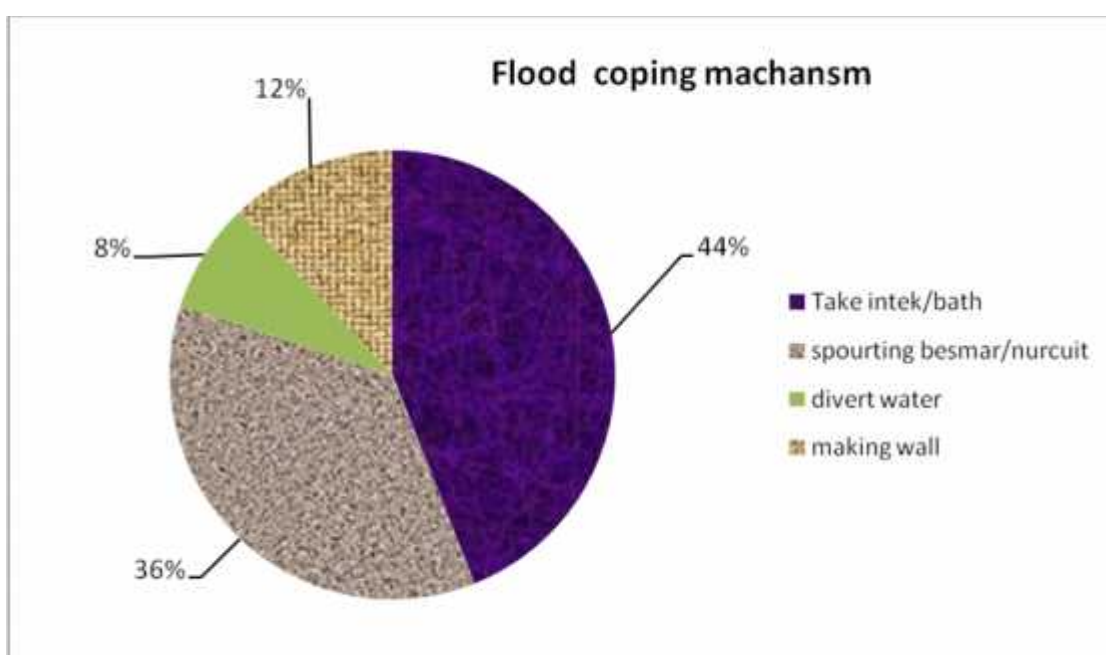
People cope many techniques for save them to flood. Kailali district is situated in terai region and teari region is most vulnerable by flood. Their livelihoods were destroyed by flood yearly. People cope their individually and government policy, Distribution of household techniques are presented table 4.8 and figure 7.

Table 4.8 : Distribution of Households and Copping Mechanisms to Flood

Copping Mechanism	No. of Respondents	Percentage
Take intek/Batha	22	44.00
Spourting Besmar/Nurcut	18	36.00
Making wall	6	12.00
Divert water	4	8.00
Total	50	100.00

Source: Field Survey, 2016

Figure 7 : Distribution of Households Copping Mechanisms



Source: Field survey 2016

44% people were affected by making batha/Intek which was most important for people. Government or villagers food action for it bio-engineering design like Nurcurit/ Besmar was people indogeneovs Tech. people divert water or making wall in their own idea.

4.4.3 Cope to Hot Wave and Cold Wave

In terai region summer and rainy season, people are difficult to live hot wave and winter season they are difficult to live cold wave. My study area is totally lies in terai region. In summer season people at terai, region in summer season people sat

near trees, used ventilation than ate ice cream and cold drinks people were wear heavy cloth ate Dhangadi burnt wood distribution of household's cope mechanism for hot ware and cold were in figure 8 and 9.

Figure 8 : Distribution of Households for Cope hot wave

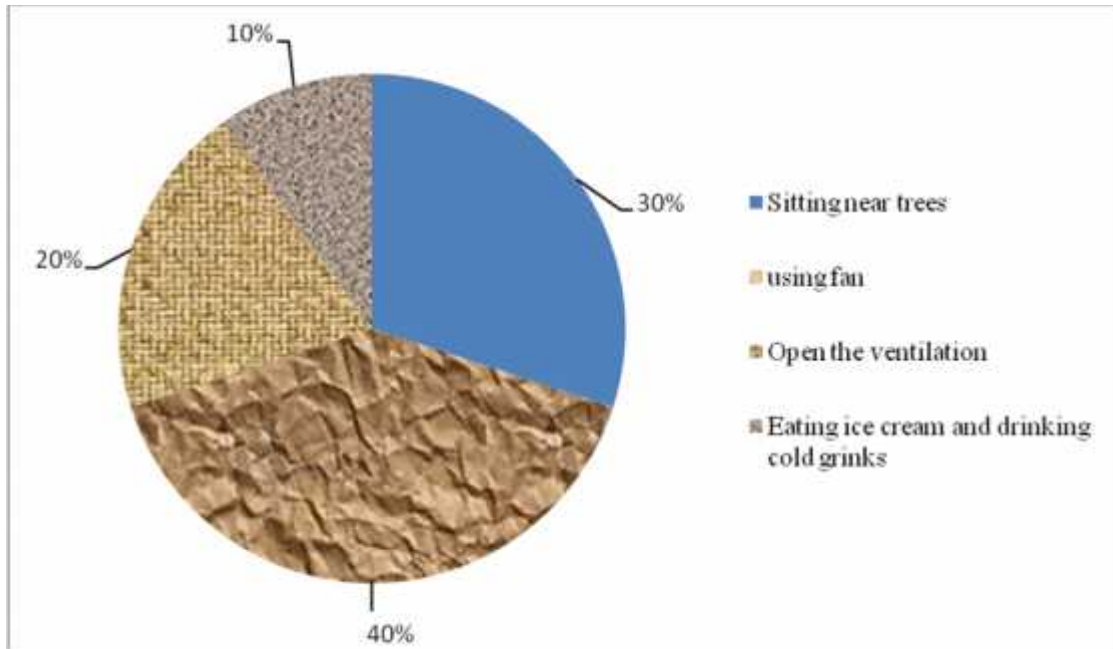
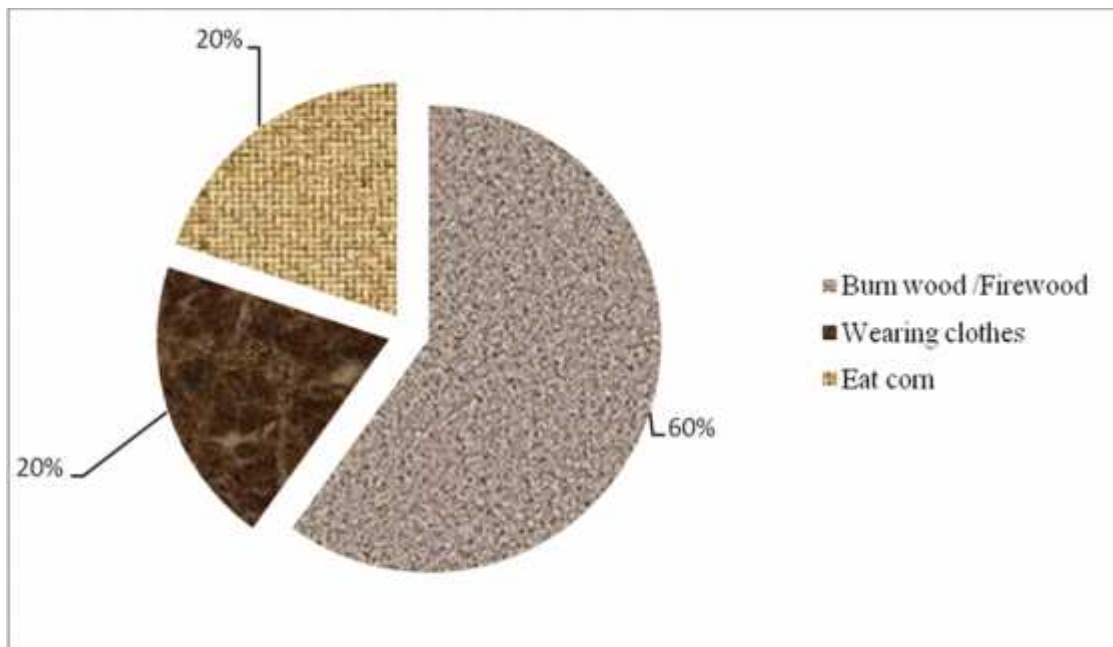


Figure 9 : Distribution of Households for Cope Cold Wave



Most of people use fan for save them by hot ware similarly most of people save them firewood by cold ware. These people didn't use A/C or heater hot ware and cold ware.

CHAPTER V

SUMMARY OF FINDINGS, CONCLUSION AND SUGGESTIONS

From the above results and discussions, different conclusions are made and some recommendations are listed on the changing climate change, their impacts on agriculture, water resource, human health and vulnerability as well as coping strategies of rural livelihood.

5.1 Summary of Findings

Climate change is a burning issue of contemporary world. Most of the people have been affected from the global phenomenon. All nation of the world have been affected from this issue. Because of low capacity to cope with and to adopt, least developed countries (LDCs) are being affected more than developed countries (DCs). As most of LDCs have dependency on traditional agriculture, living opportunities are connected with climate change in these countries.

The analysis indicates continuously rising temperature low volume of rainfall and inconsistency in livelihood of local people. In recent years, rainfall is recorded in decreasing trend with erratic pattern. Similarly, temperature is also rising in an unpredictable and strange way plant behavior regarding flowering, shedding and germination of seeds are also shortening that indicate the trend of increasing temperature.

Climate change is a natural process but human activities are accelerating the speed of change. Out of 50 sample household 70% of the respondent reported that the warming days are increasing thus causing temperature affect in study area. Increase in temperature has different consequences in physical world as well s biological. Out of 50 sample household 60 percent of the respondent reported that the rainfall pattern is changing in the area since last 30 years. Melting ice from Himalaya, increasing sea level affecting coastal areas and extended drought periods are the other key indicators of climate change that has been experienced by the local people in Nepal. Climate change is affecting the rural livelihood of study area. Out of 50 sample of household 20 percent of the respondent piped boarding for irrigation in land causing of scarcity of water. Out of 50 sample household 70 percent respondents reported that agriculture

production is decreasing by new pests and disease. Similarly, out of 50 sample households 80 percent respondents that they are affecting health hazards due to increase in mosquito and 80 percent respondent reported flood destroyed livelihood assets of rural people. Field studies in south Asia, that aimed to document the factors that increase people's vulnerability to flooding and drought.

Climate change increasing problem in rural life, even they are using different local adoption mechanism but they are not sufficient. Out of 50 sample households 48 percent take loan to cope food deficiency and other people would be one other ideas, like selling livestock, so on, search work in home area etc. 70 percent respondents cope to flood by intake and Nurcuit. Similarly most of the cope not wave by using fan and cold wave by burning wood. The emerging dynamics of climate change as they relate to flooding, aridity, drought and forest fires could significantly increase the impact on local-level livelihood systems. The implications of these dynamics for policy making for adoption are immense. Understanding the interactions among forest, agriculture, water management, disaster risk reduction and other livelihood systems on the one hand and climate scenarios on the other, has implications for the development of effective strategies for adopting to both short and long term impacts of climate change. Failure to explore these linkages will jeopardize the country's ability to adapt to climate change. The government of Nepal recently completed its national level adaptation plan (NAPA) with support from UNDP, GEF, DFID and DANIDA.

5.2 Conclusion

The situation of climate change in study area in last 30 years continuously increasing temperature. So, many diseases were affected of rural people's life. Rainfall pattern unflucted and lack of water resource, agriculture production were decreasing and food deficit rate is higher than last 5 years. They need to change their cropping pattern and have planted hybrid variety of crops.

Climate change impact of natural resource on rural livelihood, people's land structure is decreasing by flood. When flood comes then situation and soil erosion in rural areas. Land size would smaller than last 5 years flood disturb the people's financial and livestock structure. Out of 50 sample 70 percent respondent reported the

flood loss their land and livestock. So, people's purchasing power is decreasing regularly. They faced many disease and problem before flooding. Similarly road, house and fertile land is damaged by flood. They are diverted the farming to business, job and go aboard fore earn money.

Floods was identified as the most climate hazard in the study area. Most of the respondents were in higher degree of vulnerability to flood due to higher exposure and lesser adoptive capacity. Some people spurting nurcuit and besmar to reducing soil erosion and making intake to reducing salutation. Likewise, they need to raining to cope flood, hot wave and cold wave.

5.3 Recommendation

Based on this study, following recommendations have been made :

-) Improved agriculture technology, training and awareness to farmers, mixed cropping system, improved varieties and drought resistance varieties are recommended to combat climate change.
-) Water sources within the forest must be conserved and bioengineering methods should be introduced in flood affected area.
-) Local adoption plan must be prepared and excepted to mainstream the adaptation into practice in local level.
-) Conduct specific research about climate change impacts on agriculture, water resource, human health.

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Annexes

Annex - I

Questionnaire for the Household Survey

1. Household Information

No. of Person	Age	Education	Occupation
1	A, B, C	A, B, C, D, E	A, B, C, D
2	A, B, C	A, B, C, D, E	A, B, C, D
3	A, B, C	A, B, C, D, E	A, B, C, D
4	A, B, C	A, B, C, D, E	A, B, C, D
5	A, B, C	A, B, C, D, E	A, B, C, D
6	A, B, C	A, B, C, D, E	A, B, C, D
7	A, B, C	A, B, C, D, E	A, B, C, D
8	A, B, C	A, B, C, D, E	A, B, C, D
9	A, B, C	A, B, C, D, E	A, B, C, D
10	A, B, C	A, B, C, D, E	A, B, C, D
11	A, B, C	A, B, C, D, E	A, B, C, D
12	A, B, C	A, B, C, D, E	A, B, C, D

Note : Age : A = Below 15 years, B = (15 - 60) years, C = Above 60 years.

Education : A = Illiterate, B = General literate, C = Below 8 classes, D = (8-12) class,
E = Above 12 classes

Occupation : A = Agriculture, B = Job holder, C = Business, D = Service

2. Livelihood Assets :

Human

- 2.1 Does your children go to school regularly ?
a) Yes b) No
- 2.2 If no, why they couldn't go to school regularly ?
a) Flood b) Cold
c) Hot d) Other
- 2.3 In which season they couldn't go to school regularly ?
a) Hot season (summer) b) Rainy season
c) Cold season d) Autumn season

Financial

Type of Finance

Finance	Yes	No
Cash		
Gold		
Silver		
Livestock		
Vehicles		
Loan		
Indebtedness		

3. Impact of Flood

3.1 Have your family ever faced water induced disaster in last 5 years ?

- a) Yes b) No

3.2 If yes, what type of disaster that your family has faced ?

- a) Flood b) Landslide
c) Storm d) Soil erosion/siltation

3.3 What you loss in flood ?

- a) Land b) Live stock
c) Crop d) House
e) Life

About loss :

Loss	Quantity	Worth value
Land		
Cow		
Buffalo		
Hen		
Duck		
Bangur		
Goat/Sheep		
Crop		
House		
Life		

Vulnerability Context and Coping Strategies

Shocks

- 4.1 What factors affect your life ?
- a) Flood
 - b) Cold wave
 - c) Hot wave
 - d) Strome
 - e) Above all
- 4.2 In which season your life is affected ?
- a) Summer season (hot season)
 - b) Rainy season
 - c) Automs season
 - d) Winter season
- 4.3 What types of disease have your family faced by hot wave ?
- a) Fever
 - b) Diaren
 - c) Maleria
 - d) Typhied
 - e) Eye effect
 - f) If any
- 4.4 What types of disease have your family faced by cold waves ?
- a) Nomonia
 - b) Cold Diarea
 - c) Dam
 - d) Rugha/Khola
 - e) If any

Trends

- 4.4 What did you do after affecting by flood ?
- a) Search good shelter
 - b) Selling land
 - c) Divert water
 - d) If any
- 4.5 Have you product same quantity before and ever ?
- a) Yes
 - b) No
- 4.6 Do you feel your land productivity is decreasing ?
- a) Yes
 - b) No
- 4.7 If yes, what factors play role to decreasing land productivity ?
- a) Pesticides
 - b) Fertilizer
 - c) Lack of water
 - d) Intensive farming
 - e) If any
- 4.8 Have you seen some change on your land ?
- a) Decreasing wetness
 - b) Lack of fish
 - c) Fragmentation of land
 - d) Strong of land
 - e) Lack of worm
 - f) If any

Change in Assets Structure of Last 5 Years

1. Land structure

Size	Before 5 years	After 5 years
Below 5 Katha		
Below 10 Katha		
Upto 1 Bigha		
1-3 Bigha		
Above 3 Bigha		

2. Financial Structure

Size	Before 5 years	After 5 years
Cash		
Loan		
Gold		
Silver		
T.V.		
Cycle		
Bilk		
Tractor		
Powertriller		

3. Livestock Structure

Livestock	Before 5 years	After 5 years
Cow		
Buffalo		
Hen/Duck		
Goat/Sheep		
Bangure		

Annex - III
Checkliest for Focus Groups Discussion

FGD (Qualitative)

1. What are the impacts of climate change in your area ?

- Flood
- Increase hot
- Increase cold
- Decreasing of productivity
- Unfluctution of rain fall pattern
- Lack of water resources
- Increase of new disease
- Impact of public health
- Impact of food security
- Social impact

2. What are the major factor of climate change ?

- Deforestation
- Population growth
- Infrastructure
- Industry
- Vechicles

3. What do you do to cope climate change strategy ?

- Forest conservation
- Change of food habit
- Care in sanitation
- Micro finance
- Disaster resist building
- Conservation of watershed
- Dam/intake or jail
- Sporting nurcut and besmar
- Dieting

Annex - IV

Map Showing the Study Area



Janakinagar VDC of Kailali District

Annex - V
Thing to Observe



Photo 1 : Boarding for Irrigation



Photo 2 : Make Intake



Photo 3 : Spourting Nurcuit in Land Side



Photo 4 : Make Jali of River Side

Annex - VI
Photographs



Photo 1 : Focus Group Discussion



Photo 2 : Collection Data with Farmer



Photo 3 : Flood Destroyed the Road