

**IMPACT OF CLIMATE CHANGE ON LIVELIHOODS OF RURAL COMMUNITIES
A Case Study of Shankar Pokhari VDC, Parbat District**

**A Thesis Submitted to
Central Department of Rural Development
Tribhuvan University,
in partial fulfillment of the requirements for the
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in
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DECLARATION

I hereby declare that the thesis entitled “**Impact of Climate Change on Livelihoods of Rural Communities: A Case Study of Shankar Pokhari VDC, Parbat District**” submitted to the 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 ideas and information borrowed from different sources in the course of preparing this thesis. The results of this thesis have not been presented or submitted anywhere else for the award of any degree or for any other purposes. I assure that no part of the content of this thesis has been published in any form before.

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RECOMMENDATION LETTER

This is to certify that the thesis entitled “**Impact of Climate Change on Livelihoods of Rural Communities: A Case Study of Shankar Pokhari VDC, Parbat District**” has been prepared by **Miss. Shanti Devi Regmi** under my supervision in partial of the requirements for the degree of Master of Arts in Rural Development
Therefore, I recommend this for the approval.

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APPROVAL LETTER

This is to certify that the thesis entitled “**Impact of Climate Change on Livelihoods of Rural Communities: A Case Study of Shankar Pokhari VDC, Parbat District**” has been submitted by **Shanti Devi Regmi** in the prescribed format of the Faculty of Humanities and Social Sciences has been accepted in the partial fulfillment of the requirements for the degree of master of Arts in Rural Development.

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ABSTRACT

Climate change is contemporary global threat to the animal world. Green house gases are resulting global warming which is reacting different impact in the world. Because of human activities green house glasses are increasing. Nepal's temperature is increasing at an alarming rate. Increasing temperature is creating different impacts on biodiversity health the environment and other aspects of life of the animal world. Nepal is also facing the threat of climate change. This study was conducted on Shankar Pokhari VDC of Parbat district during the period of October 18 to 27

The main objective of the study was to assess the impact of climate change on agriculture, people's health, and on biodiversity. Questionnaire survey, key informant interview focus group discussion were conducted in collecting primary information. In total 60 households were selected (20 houses from each of wards 3, 4 and 8). The data were analyzed using SPSS computer software.

It was found that some special signs of climate change are experienced by rural communities of the study area. Local communities experienced increasing warm days and shortening cold/winter days. The pattern, intensity and amount of rainfall also changed resulting in the scarcity of water. Moreover, people started feelings of scarcity of water for irrigation drinking climate change was affecting agriculture, production of main crops and cash crops has decreased. Different invasive species, pests and insects were increasing in farm. Many species of main crops such rice, wheat, mustard and endemic species water corn for instance are in threat. Livestock are also affected from climate change because of less germination of fodder. Number of livestock had decreased, resulting in declining incomes from livestock and related activities. Community members had experienced different new diseases including mosquitoes. Different health problems were increasing especially women and children have been affected from itching problem, skin diseases, and eye infection problem. On the other hand the time of flowering different species including Rhododendron was changed and so were the germination harvesting and maturing times of different crops has changed. Income level from agriculture and livestock had decreased. So, people are separating from their traditional occupation, why of life and they are seeking alternative professions.

It is concluded that climate change is creating multidimensional impacts on the life of rural communities. Adaptation practices must be developed and awareness level of the people on climate change must be increased.

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ABBREVIATIONS/ACRONYMS

CH ₄	methane
CO ₂	Carbo dioxide
DCs	Developed Countries
GHG	Green House Gases
HFCS	Hydrofloro carbon
IPCC	Intergovernmental Panel for Climate Change
LDC	Least Developed Counties
NO ₂	Nitrous Oxide
PFCs	Perfloro Carbon
SF ₆	Sulpher Hexa fluoride
SN	Symbol Number
UNFCCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee
DDC	District Development Committee
UNDP	United Nations Development Project

CHAPTER I

INTRODUCTION

This chapter begins with the introduction of the study including general information on the title, statement of problem, ideas for the study, objective of the study, scope of limitation of the study, and organization of the study.

1.1 Background of the Study

Climate change is a global issue that is linked with the day to day activities of people, plants and biosphere. It is a result of air pollution from Green House Gases (GHGs), water vapour, carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O) and Chlorofluorocarbons (CFCs). It has basically affected the common people living any corner of the globe. Similarly, IPCC reports that among these CO₂, CH₄ and N₂O are the three major gases which contribute about 88 per cent role in global warming. World Climate news reports that concentration of the CH₄ gas in the atmosphere is presently increasing at the rate of 3 per cent per annum (qtd. by Kelkar and Suruchi Bhawal, 2007).

Vandana Shiva (2008: 9-12) states that climate change is impacting us every day and everywhere. Many people do not contribute to climate change, yet they are the victims of the global threats. Green house gases have made this world the most vulnerable land and resulted in extreme draught, flood, loss of productivity in soil which are the parts of destabilization of climate change. Due to the population growth people are facing the troubles of drinking water and destroying the forest area for energy.

Climate change is a global problem and the Intergovernmental Panel on Climate Change (IPCC) predicts that by 2100, average global temperature will increase by 1.4⁰ C to 5.8⁰ C and affects the livelihood of the common people. Nepal's average temperature has been rising at the rate of 0.03⁰ C to 0.06⁰ C per annum between 1977 and 1994 with a higher rate in the mountains than in the low lands. Nepal is warming at a remarkably higher rate compared to the global average of 0.074⁰ C, recorded in the 20th century (Gurung and Bhandari, 2009). Similarly in Malla's observation

shows the rise in temperature in plain and Himalayan region is 0.04°C and 0.08°C per year respectively (Malla, 64).

Nepal is a beautiful Himalayan country geographically locked by India and China. India locks this country in the east, west and south; and China connects this country in the north. Its total area is 147,181 sq km. Nepal covers the 0.03 per cent land of the world and 0.3 per cent of Asia. Topographically Nepal is divided into three ecological regions covering Mountains 15 per cent, Hills 68 per cent and Terai 17 per cent of total area. The climate change mostly affects the people of Himalayan region like Nepal and Bhutan. Malla's study shows that in 2006 the crops production decreased by 12.5 per cent by draught in eastern Nepal whereas 30 per cent yields was declined by heavy rain fall in western Nepal (Malla, 4).

Geographical location of Nepal is $26^{\circ} 22'$ to $30^{\circ} 27'$ latitude and $80^{\circ} 4'$ to $88^{\circ} 12'$ longitude (Dol, 2061). It is laid from east to west with the average length of 885 KM and from north to south its average breadth is 193 KM. Economically Nepal is a least developed country. World Bank Report of 2011 ranked it in 157 position out of 187 countries. The economic survey of 2011-2012, total growth rate of domestic production is 4.6 per cent and the coverage of industrial sector is 1.3 per cent. One third population of the country is below the poverty line (The Kathmandu Post, 2011). The population of country by 2012 was recorded 26.4 million and the growth rate of population is 1.35 per cent. At present 50.27 per cent people dwell in Terai region; and 43 and 6.73 per cent people respectively live in hilly and mountainous regions. More than 76 per cent people depend agriculture; and remittances have become one of the foremost sources of income in Nepal. Almost 56 per cent of households receiving some sort of remittance (District and VDC Profile of Nepal, 2013).

Parbat District is located in the in hilly region of Dhulagiri Zone of the Western Development Region of Nepal. There are 55 VDCs with 11 *Illkas* and 2 constituencies. The area is stretched over mid hill and terrain ranges from 520 m to 3300 m above average mean seal level covering 494 sq. km. It has annual average rainfall of 2500 mm and temperature in between 32.3 and 7.5 degrees Celsius. The district falls in the subtropical to cold temperate climatic zone. The district consists of numerous ridges and rivers. About 51 % of people have been adopting subsistence agriculture and rest 49% of people have been adopting in other occupations. The

study area –Shankar Pokhari VDC- of this study lies in the southern part of Kusma – the district headquarter of Parbat. Its total population is 5,743 and 94 2 households live in this VDC. Location of Shankar Pokhari VDC is in 28.18° N 83.69° E. Out of 50,199 Ha. 15,371 Ha land is good for agricultural perspective. 26,189 Ha. land covers with forest area. Similarly, 7,756 Ha. land is covered with shrub, and 141 Ha. is in water bed. 735 Ha land is useless or barren and 7 Ha. is above the Iceland. The male and female population of Parbat is 65,301 and 81,289 respectively out of 146,590 of total population of the district. Its literacy rate is 73.8 (6 years and above) and economically it ranks in the 17th position of Nepal (District and VDC Profile of Nepal, 2013).

Climate is an important factor for agricultural production. However, in recent years consistent warming and rise in global temperature has resulted in visible impacts on the agriculture across the world. The rising temperature in Nepal has already affected the country's agricultural production. However, Nepal still lack strong scientific data about the cases of climate change and due to varied geographical setting, sufficient meteorological data cannot be easily obtained from remote parts of the country. This review tries to explore the current status of vulnerability to the climate change in Nepal. In Nepal, more than 80% of the people heavily rely on agriculture for their subsistence and thus, climate change will bring expectedly negative response to the agricultural sector in the country (Karki and Gurung, 2012).

1.2 Statement of the Problem

Atmospheric temperature is increasing at the high rate around the world. Warming seems to be consistent and continuous after the mid 1970. Between 1977 and 1994, average warming is annual temperature was 0.06° per year. Warming was much in the Himalayan region of Nepal such as the middle Mountain and high Himalayan, while warming at the winter was higher as compared to another season. Nepal's temperature is rising by about 0.41° C per decay.

The climate of Nepal varies greatly from South to North due to the vast altitudinal variation as the country ranges from 60 meters to 8,848 meters above mean sea level makes the country an abundant storehouse of biodiversity and ecological niches with diverse agro-climatic zones ranging from the subtropical to the alpine and tundra.

Weather related events such as irregular rainfall, longer drought periods, landslides and floods are increasing across the country. Climate change has negative impact on people's livelihood that hampers the developmental process and the day to day activities of the people. The climate change affects in the agricultural yields and increases pressure on limited fertile land. In the dry season it leads to water scarcity, drought, soil moisture, firing in the forest which cause the potential outbreak in our life. The impact of climate change is unpredictable.

In the course of global climate change South Asia is considered one of the most vulnerable regions. The change in temperature in mountainous region affects the activities of the people. The analysis of climate change is made with the help of a national climate model. The study area lies near Kali Gandaki river and Modi and Malyangdi streams. Increasing flood, landslide, scarcity of drinking water in local area and changing pattern of rainfall and seasonal changes have been observed by locals. The change in vegetation, loss of biodiversity, changing pattern of agriculture and people's livelihood will be observed.

1.3 Objectives of the Study

The objectives of this study are related with the impact of climate change on livelihood of vulnerable people. The detailed objectives are categorized as the following:

-) To find out the impact of climate change on agriculture
-) To examine its impact on health sector
-) To assess its impact on bio-diversity

1.4 Significance of the Study

Climate change is emerging issue at present. It is one of the greatest threats to environmental conservation. Increasing emission to the green house gases into atmosphere, and human intervention have been the potential threats of this field. In fact the least developed countries have less contribution in producing harmful gases but they are facing the serious effects. The contribution of Nepal to global green house emission is only 0.025 per cent. However, Nepal's atmospheric temperature is increasing every year by 0.04⁰ C in plain land and 0.08⁰ C in the Himalayan region.

The change in temperature is creating natural obstacles in people's livelihood. The changing pattern of rainfall will increase global temperature and gradually the tropical diseases will affect the hilly and mountainous people. The melting of ice-blocks causes the avalanches, flood and loss of environmental properties including fertile land, villages and people. Finally, it will affect in the agricultural production as most of the mountainous people depend on rainfall for cultivating the land and yielding crops. In this condition, it has severe effect in our lives. This study will assess the problem of the people of study area. The issue of climate change and its impacts to livelihood is the main target area of this study.

1.5 Scope and Limitation of the Study

Both climate change and its impact on livelihood are vague and vast subject. The study was conducted in limited time with limited resources and concentrated in a specific area. The study was conducted on one season. So, its result may not be applicable for other areas, context and other seasons.

The limitations of the study were:

- i. Concentrated on one ecological zone. It may not be applicable to other ecological zones.
- ii. Focus on the impact of the people on livelihood. It did not research the overall impact on environment and impact on flora, fauna and biodiversity.
- iii. In small scale and may not be replicable to the other location of the country.
- iv. Limited in three wards (3, 4 and 8) of Shankar Pokhari VDC. So, result may not be applicable for other areas.
- v. Limited time and budget.

1.6 Organization of the Study

The thesis is divided into seven chapters and each chapter includes sub-sections. Chapter I deals with the background of the study, statement of the problem, objectives of the study, significance of the study, and scope and limitation of the study. Chapter II deals with the review of literature covering the concept of climate change and its

impacts in different sectors. Similarly, it covers the theoretical aspects of the climate change, its impact on food production and health sector which are the threats for vulnerable people. Possible mitigating measures to reduce the problems of climate change, and the role of the government and other institutions to cope the problems are its essential parts. Chapter III describes the methods, tools and techniques used for the collection of data and their analysis. In this chapter, research design selection of the study area, sampling procedure and sample size, nature and source of data and time frame of the study are included. Chapter IV is the most crucial part of the study which is about the study area. Chapter V will be split down into many sections to fulfill the objectives of the study presenting and analyzing the data..Chapter VI is about the impact of climate on study area. Finally, conclusions and recommendations for future considerations are provided in chapter VII.

CHAPTER II

REVIEW OF LITERATURE

Many researchers have done a number of studies in the field of climate change. Most of them are related to the impact of climate change on agriculture, ecology, water resources. Some studies focus on the situation of food security in Nepal. The main objective of this chapter is to highlight the issues of climate change on rational basis. Among them some related literature are reviewed in this chapter. It mainly focuses on introduction of climate change, causes of climate change and its impacts in Nepal.

Nepal is a LDC in south Asia, as reflected by a number of different criteria we discuss below a few general indicators that are useful in understanding and providing at least a basic picture of the socioeconomic constraints that the country faces in ultimately dealing with the comprehensive effect of climate change. World Bank Data report 2004 states over 30% of the population lives below the national poverty lines of US \$ 1.25/day and gross national income (GNI) per capita is only US\$ 1,100 purchasing power parity (PPP) World Bank 2010). Unemployment is as high as 46% ranking it 190 out of 200 countries, and the inflation rate is around 13% (208 out of 222 countries) (CIA 2010). Nearly 70% or the population depends on agriculture for livelihoods.

2.1 Cause of Climate Change

Climate change occurs from due to physical as well as human influences on nature. Global Warming brings change in climate factors, ecosystem (ecological process and functions) and biophysical systems.

Global average temperature has warmed the entire part of the world in the twentieth century, and is likely to rise constantly in the future due to increased concentration of green Gas (GHG) in the atmosphere. The earth surface temperature was raised by 0.74° and 0.18° (1.33_{\pm} of) in the 20th century and scientists estimated that it could increase as much as 6.4° c average in the 21st century (UBNFCC, 2007)

GHGS comprise carbon dioxide (CO₂), methane (CH₄), Nitrous oxide (NO₂) hydrofluoric carbon (HFCS) perfloro carbon (PFCS), Sulphur 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). The main cause of increasing GHGS is human intervention on environment and excessive use of resources from nature. Anthropogenic gases of GHGS are cause of increasing global temperature (IPCC, 2007).

2.2 Impacts of Climate Change

UN climate change impact report states about 20 to 39 percent of plant and animal species assessed so far are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5 to 2.5 degree (2.7 to 4.5 degrees f.). The mountainous areas of Europe will face much greater species losses. By 2020, between 75 and 250 million people in Africa are likely to be exposed to an increase of water stress due to climate change. By mid-century of this century annual average river runoff and water availability are projected to increase by 10-40 percent at high latitudes and in some wet tropical areas, and decrease by 10-30 percent over some dry regions at mid-latitudes and in the dry tropics.

By the 2080 millions of people are projected to be flooded every year due to sea level rise. The effected numbers will be largest in the mega deltas of Asia and Africa while small islands are especially vulnerable. Glacier welt in the Himalayas is projected to increase flooding and avalanches and affect water resources within the next two or three decades. This will be followed by decreased river flows as the glaciers recede.

Poor countries will suffer most and they have to spend money to respond and people should also be aware that even the ricer countries risk enormous damage. As a low lying delta, much of the land in Bangladesh is barely above sea level and is intersected by 230 rivers. Half of its 140 million people live below the poverty line. Seas level are raising and monsoon down pours are heavier, leading to more flooding. As a result, the poorest people in Bangladesh are suffering most; their homes will be destroyed and their land the very land that probes their family with food will be washed away.

2.3 Geography, Climate Change and Production

F. Malla (2008) examines that Nepal's economy depends on agriculture. Total area of Nepal is 147,187 km² divided in mountains (35%), hills (42%) and terai (23%). A total of 3091000 ha area is cultivated for agriculture, and it accounts for 38.15 percent

of the gross domestic product. The country is susceptible to disasters, including flash flood, GLOF and melting snow in the mountains and droughts and inundation in the terai.

Climate change is a burning issue in the world. Different scholars and organizations have defined climate change differently. 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 in specific region, or across the whole earth.

The term climate change is often used interchangeably with the term global warming but according to the national academy of sciences the phrase. ‘Climate change’ is growing in preferred use to global warming’ because it helps to convey warming of other terms related to climate change in addition to rising temperatures. Climate change refers to any significant change in measure of climate (such as temperature, precipitation or wind) lasting for an extended period, decade or longer (SPAN, 2008). Sudden and unexpected change in weather or season is known as climate change (Sapkota, 2011)

Annual economic survey of fiscal year 2069/70 shows the very low contribution of the agriculture sector for the economic growth of the country. The growth rate of agriculture production is limited and it is only 1.3 percentages. The fiscal survey declares the main cause of low production of crops is the irregularly of monsoon. Because of the climate change the pattern of monsoon is irregular. In Nepal about 31 percent of the agricultural land is irrigated but not all irrigated areas have access to year round irrigation. The use of improved seeds is low. Each of the three main ecological zones has its own unique resources endowment, cropping patterns and farming system leading to differences in commodities produced. Production levels and productivity (Jarvis et al., 2008) states that Nepalese small holder farmers are largely poor with limited access to external resources and are likely to be particularly vulnerable to climate change. The farming in Nepal is characterized by mixed farming and livestock production systems which have rich diversity. Forest, home gardens,

agro forestry and productive fields all embedded diversity rich maintenance and use practices that increase adaptability and reduce vulnerability.

The rising temperature and emission of CO₂ to some extent is helpful in production of major crops. For example, increase in agricultural production by enhancing photosynthesis processes, water use efficiency shortening physiological period and soil microbial activities. Decrease in grain filling period due to increase in respiration process, fertilizer use efficiencies, shift in agricultural zone, increase in insect pest population, desertification, increase in soil erosion, evaporation and cause malnutrition in a world overflowing with food due to reducing protein and decrease in mineral nutrients content in different crops are negative effects.

Weather is an atmosphere condition at the surface timescale from minutes to week and has an important impact on agriculture (ICIMOD/UNEP 2007). In Nepal, more than 80 percent of precipitation occurs in the monsoon during June to September. Increase in temperature and vents of erratic rainfall directly affect the agriculture food supply and food security through their effects on crops. The production varies due to rain brought by monsoon. Agriculture is sensitive to short term changes in weather that affect the production of crops. Insufficient rain and increasing temperature cause drought, whereas intense rain in short period reduces ground water recharge by accelerating run off and cause floods. Both the situations induce negative effects in the agriculture. The climate change also causes disruption in normal weather pattern changing intensity and duration of monsoon.

Wagley(2064) analyzes Nepal has various types of agricultural zones like plains, hills, and hills, high hills and mountains. Changes in agro-zones lead to the change in cropping pattern of the zone. Climate parameters have potential impact to change the ecological distribution of agricultural crops. If shifting of climatic zones occurred rapidly due to climate change, extinction of biodiversity might be sever. Effects are mainly on crops production, cold water fish, herbs, pasture land, tree lives and livestock (Chauri). Increase in temperature cause more damage on agricultural sectors in Terai region and will be more favorable to agriculture in the hills and mountains. As temperature increases, cropping pattern as well as vector born disease of human and livestock can be expected to shift in higher eco-zones too. Some lands, which are presently undesirable due to different weather factors, may be desirable inner future.

For example, maize, chilly, tomato and cucumber are now being adopted in Mustang district of the country.

2.4 Climate Change and Nepal

Average temperature in Nepal is increasing at a rate of approximately 0.060c per year between the years 1977 and 1994. Nepal's total GHGS production is only share is 0.025% of total production, net production of CO₂ was about 9.747 tons and the net production of methane was estimated to be 0.948 tons in 1994, (Sapkota, Keshab Raj 2011, 199).

Nepal's contribution for causing climate change is very small. Today Nepali population comprises less than 0.4 percent of the world population and are responsible for only about 0.025 percent of annual greenhouse emission. Temperature is likely to increase in high mountain is higher than areas than other parts of the country. Glaciers and snow fields will reduce and may even disappear, reducing Nepal's dry season river water sources. This will impact irrigation and drinking water supply and as well as the reliability of hydroelectricity. Global climate change will likely shift monsoon rainfall pattern that threaten Nepal's current agricultural practices. Changing temperature and moisture pattern will threaten biodiversity especially in mountain areas where migration of species is physically restricted (GON, 2003).

Metrological Department of Nepal states increasing phenomenon of melting of glacier and Glacier Lakes may cause outburst and increase flooding. The report says 0.12⁰c in Himalayan, 0.030c in Hill and 0.060c in Terai temperature is increasing annually (Sapkota, 2064). Increase in temperature causes the spread of tropical insects mosquitoes, flies and other diseases in upper part that will cause epidemics. The pasture land of Himalayas will be covered by bushes and will lead to scarcity of pasture land and bring negative impacts on livestock rearing. Periodic monsoon pattern has been changing and monsoon period shortened. Thousands hector of land is being barren due to lack of irrigation, which are depending upon rainfall. Epidemics and tropical disease out burst is taking place due to lack of monsoon is season (Kantipur, 2066).

2.4.1 Impact of Climate Change on Agriculture

The impact of climate change on agriculture is the decrease of productive land in some region and increase in other region. So, it is a complex problem to the world (Pathak, et al. 2003a). Climate change will have far-reaching consequences for agriculture that will disproportionately affect. The poor people will have the greatest risks and their crops and livestock death are already imposing economic losses. Climate change will definitely threat to and due to the complex interactions and feedback process in the ecosystem. Major five factors will affect agricultural productivity due to change in temperature, rainfall, carbon dioxide, fertilization, and surface water runoff.

With less rain, water lands drop in reservoirs or rivers and people have less water to use. The quality of the water deteriorates as sewage and industrial effluent becomes more concentrated; as a result waterborne disease is rife with a lack of water, vegetation doesn't grow so livestock have less to graze on. There is also less wood for cooking. So, women have to spend more time searching for fuel to cook for the family.

Our greatest concern about change is causing to our agriculture. It makes our economy extremely vulnerable to any slight changes in the weather. According to IPCC the following are some important factors directly connected to climate change and agricultural productivity. Increase in average temperature can lengthen the growing season in regions with a relatively cool spring and fall; adversely affect crops in regions where summer heat already limits production; increase soil loss rates, and increase the chances of severe droughts. Change in rainfall patterns can affect soil erosion rates and soil moisture, both of which are important for crop yields. The IPCC predicts that precipitation will increase in high latitudes and decrease in most subtropical land regions. Rising atmospheric concentrations of CO₂: Increasing atmospheric CO₂ levels, driven by emissions from human activities, can act as a fertilizer and enhance the growth of some crops such as wheat, rice and soybeans. CO₂ can be one of a number of limiting factors that, when increased, can enhance crop growth other limiting factors include water and nutrient availability. While it is expected that CO₂ fertilization will have a positive impact on some crops, other

aspects of climate change (eg. Temperature and precipitation changes) may temper and beneficial CO₂ fertilization effect (IPCC, 2011)

A higher level of pollution in troposphere ozone limits the growth of crops. Since ozone levels in the lower atmosphere are shaped by both emissions and temperature, climate change will most likely increase ozone concentrations. Such changes may offset any beneficial yield effects that results from elevated CO₂ levels.

Change in climate variability and extreme events brings drought, floods and hurricanes, remain a key uncertainty in future climate changes. Farmers are in the trap of decreasing production and productivity of crops. Rainfall pattern is opposite in comparisons with previous years automatically bring loss in agriculture productivity and widely affects in livestock and biodiversity.

Over two-thirds of Nepal's population depends on agriculture for their livelihood. Farmers follow traditional agricultural patterns, relying on rainwater and seasons. Change in local and regional temperature, rainfall patterns, sunshine and cloudiness will threaten to traditional agriculture in Nepal. Moreover, climate change will increase the occurrence of extreme events like floods, droughts and hailstones, which can also have an extreme effect on agriculture and loss of human property. Rising temperatures and increased rainfall may also lead to more pests and weeds, while will reduce agricultural productivity.

Agricultural production comprises 32% of Nepal's gross domestic product (GDP) (World Bank 2009b), but only 13% of that production is traded in markets (World Bank 2009 a.). Rice is the primary crop in the lower elevation regions of the country, wheat is grown in the terai and the valleys of the Himalayas, and corn is the principle crop of the hilly regions (Stads and Shrestha 2008). Out of 147,187 km² Nepal's land is divided in mountains (35%), hills (42%) and terai (23%). Only 3091000 ha area of total land is cultivated for agriculture.

2.4.2 Impact of Climate Change on People's Health

Health statistics paint a similar picture of lacking development life expectancy is one of the lowest in Asia at 63. Almost 50,000 children die from curable diseases every year. 69 percent of those dead die from due malnutrition alone. 39 percent of children between 0 and 5 years have stunted growth and are under weight; and 75 percent of

pregnant women and anemic (World Bank 2010), IRIN 2008). Only 27 percent of Nepal's population has access to improved situation (World Bank 2010). The result of the combination of these socio-economic and health statistics, Nepal is ranked low in UNDP's Human Development Index (HDI), and is 142 out of 177 measured countries (Watkins 2008). One major contributor to such a low ranking is the weakened and underdeveloped state of the country's agricultural production and water resource infrastructure.

Climate change is expected to have many consequences of human health. Diseases such as malaria and Japanese encephalitis have spread to new area. Temperature 22-23⁰c favors development of misquotes and completion of its cycle, increasing average temperature making favorable environment for different kinds of diseases. (ARE, 2009).

Health hazards from climate change are diverse, global and difficult to reverse over human time scales. They range from increased risks of extreme weather events, to effects on infections disease dynamics and sea level rise leading to Stalination of land and water sources. The report of WHO estimates that around 150,000 deaths occur in low-income countries each year due to climate change from four climate-sensitive health-outcomes crop failure and malnutrition, diarrheal disease, malaria and flooding. Almost 85% of these excess deaths are in young children. The climate change exposures are likely to affect the health status of millions of people through increased in malnutrition, heat waves, floods, storm, fires, and droughts. Increased frequency of cardio-respiratory diseases due to higher concentrations of ground level ozone related to climate change, and the migration of some infectious disease. The effect of new disease will bring problem in human health and the increasing medical facilities and services invite tropical diseases like *Kalajar* and *Japanese Encephalitis* that are seen widely (Gurung, 2009).

The poor populations is considered to be at greatest risk who are living in small island, developing countries, mountainous regions, water stressed areas, megacities and coastal areas of in developing countries. The climate change will affect first the children, women, old people as they are lacking access to health services.

Climate change may directly affect human health through increase in average temperature. Rising average temperature is predicted to increase the incidence of health waves and hot extremes. In Chicago of the United States 25 percent people have frequent heat waves and in Los Angeles a four-to-eight-fold increase in health wave days by the end of the century. It basically causes particular segments of the population such those with heart problems, asthma, the elderly, the very young and the homeless can be especially vulnerable to extreme heat (IPCC, 2007).

2.4.3 Impact of Climate Change on Biodiversity

About 20 to 30 percent of plant and animal species are likely to be at increased risk of extinction if increases in global average temperature exceed 1.5 to 2.5 degrees (UN, 2008). A recent study projected that doubling of atmospheric carbon dioxide (CO₂) concentration will reduce Nepal's forest from 15-12 percent, and habitats and ecosystem will be destroyed. Climate change will affect the productivity of natural eco-systems, particularly provision of environmental services such as clean air, water, food and aesthetic values. Communities of various parts of Nepal have already experienced loss of native plants and species.

Climate change will affect the world's habitats and ecosystems. It will alter the fragile ecosystems of the Himalayas. As it warms up, vegetation and wildlife will be in higher risk at higher altitudes. This change will upset the ecosystem balance and seriously endanger the survival of many plant and animal species. Rapid climate change will not give plants and animals enough time to adapt to the new situation. Loss of biodiversity along with the immediate impact on species will affect the health, well being and livelihood of the people who rely on such resources (www.epa.gov/climatechange).

CHAPTER III

RESEARCH METHODOLOGY

Research methodology is the most important aspect of research work and it systematically solves research problem. This chapter includes research design, rationale of the selection of study area, sampling procedure and sample size. Data collection and techniques of analyzing the data will be the part of this chapter.

3.1 Research Design

The study is carried out in exploratory research design as it focuses to investigate the impacts of climate change at Shankar Pokhari VDC of Parbat district. The objectives of the study in general are to find out the effects change on agricultural production, health sector, bio-diversity and the society of the study area. It describes the effects of climate change on agriculture, livestock at the local level of study area. The research has been carried out on the basis of local people's perception and it has explored the possible causes of climate change and its possible remedies. Thus, this is both descriptive and explanatory.

3.2 Nature and Sources of Data Collection

The primary data have been collected from questionnaire, survey, and interview. Secondary data have also acquired from different reports, periodicals, articles, books, newspaper and previous research on the topic have been used for making this project success.

3.3 Selection of the Study Area

Nepal lies in the Himalayan range and the country is being affected by climate change. The particular area is easily assessable to reach there. It is diverse in terms of geography, culture, and caste. The people living in this study area depend on farming. It is rich in biodiversity, water resources. Thus the area is selected to assess livelihood impacts, health impact, impact on biodiversity.

3.4 Sampling Procedure and Sample Size

The universe of the study has the total households of wards 3, 4 and 8 of at Shankar Pokhari VDC of Parbat is focusing point of study area. Out of the total 200 households 60 HHS (20HHS each from three wards) with random sampling for questionnaire survey. Farmers, wage labors, business man, teachers and students from Shankar Pokhari multiple college were the respondents of the study.

3.5 Data Collection Tools and Techniques

The study has used questionnaire, interview and observation methods. Primary information have been acquired through filling questionnaires. Interview to key informants is another method adopted for the study. Secondary data have been acquired from different reports, documents and websites.

3.5.1 Questionnaire Survey

Structured questionnaires were prepared to generate primary data from the study area. The researcher requested to fill the questionnaire to the respective respondents. The respondents who were unable to fill up questionnaire . the questions were asked to the respondents and answer were filled up to collected the required data by the researcher.

3.5.2 Key Information Interview

The primary data have been also collected from key informant using the direct or indirect interview method. The interview is taken as across reference (checking) for the data obtained from the questionnaire . The informant were interviewed on the impact of climate change, impact on the biodiversity, impact on human health, impact on agriculture respondents were also chosen by the help of key informant.

3.5.3 Field Visit and Observation

The data has been generated from field visit and observation method observing the household environment, agriculture field and sites.

3.5.4 Focus Group Discussion

To get information necessary group discussion was made. Group discussion was carried out with farmers, business man teachers and students of Shankar Pokhari multiple college. It has been collected the information through group interaction on topic determine by the researcher each wards FGD were conducted consisting 4-8 persons were carried out to find out the impact of climate change on livelihood of rural people and what they need for the improvement to better life.

3.6 Data Analysis and Presentation

The collected data have been tabulated with the help of SPSS method. All the necessary statistical tools like tables, graphs, means and medium have been calculated for drawing the result.

CHAPTER IV

THE STUDY AREA

This chapter includes the introduction of study area like geographical, demographical and political introduction of Shankar Pokhari VDC and Parbat district

4.1 Background

Parbat district is located in Dhawaligiri zone of western development region of Nepal. Geographical location of Parbat district is 28⁰19" to 28⁰23' 58" northern latitude and 83⁰33' to 40" to 49029" eastern longitude. It is bordered with Kaski and Syangja in east, Baglung and some parts of Myagdi in west, Myagdy in north, Syangja and some parts of Gulmi in south. There are 55 VDCs with 11 *Illakas* and two constituencies.

The area is stretched over mid hill and terrain ranges from 520 mt. to 3300 mt. above average mean sea level covering 494 sq. km. It has annual average rainfall of 2500 mm and temperature in between 32.3 and 7.5 degree Celsius. The district falls in the subtropical to cold temperature climatic zone. The district consists of numerous ridges and rivers. Setibeni and Modibeni are the famous sacred religious places; and Panchase is one of the most famous mountain tourist view points.

Major occupation in the district was agrarian and now people are slowly shifting from agriculture to other occupations. According to the national population census (2068 B.S.) the total population of the district is 146,590 comprising of 81,289 female (55%) and 65301 male (45%) residing in 35,719 households. Parbat district has an average population density of around 297 Population per square km. The average family size is 4.1; life expectancy of the people living in Parbat is 58 years. The average literacy rate is about 68.15 (61.99%) female and 75 (82% male). The district has multi ethnic compassions; and Brahmin, Chhetri, Thakuri, Sanyasi, Gurung, Magar, Newar, Kami, Damai, and Sarki dwell in the different location of this district. Parbat district is full of diversity in biodiversity, culture and vast as well as difficult geographical situate.

The study site Shankar Pokhari is situated in the southern part of this district. This is bordered with Thapaathana VDC in east, Khanigaun and Mudikuwa in west, Katuwachaupari and Pipaltari in north; Thanamaula and Llimithana VDCs in southern part. The area of Shankar Pokhari VDC is 12.059 sq km consisting of 942 households. The population of the VDC is 5743 comprising of 2834 (49.35%) male and 2909 (50.65%) female (District and VDC Profile of Nepal- 2013). The climate is characterized by monsoon i.e. heavy rainfall during June to September and very occasional light rainfall during rest of the months. It has both cultivated and non-cultivated lands. The cultivated lands are irrigated lands for growing paddy and non-irrigated land mostly for growing maize and millet whereas the non-cultivated land includes forest land and non-forest barren land.

4.2 Agriculture

More than 80 percent people depend on agriculture and livestock in the study area. Rice, maize, millet are major cash crops in Shankar Pokhari VDC whereas potato, zinger, sugarcane, mustard, coffee are the prominent cash crops of the study area. Traditional system of cultivation, mono crops, cultivation and subsistence farming are the features of traditional agricultural system. Therefore, even at present agriculture is the main backbone of the people dwelling in the study area. However, a very small part of people are trying to change their occupation in order to make their survival easier- as the traditional agricultural system is not supporting them to spend comfortable life.

4.3 Natural Resources

Among the natural resources forest, water and minerals are major natural resources of Parbat. Diverse timber species and non-timber forest product (NTFPS) can be found in different geographical region up to 1200 m altitude subtropical forest. Similarly between 1200 to 2100 m deciduous plant can be found, and at the altitude of 300 meter ever green forest grow. Different kinds of herbs are found in this district water resources is precious resource of this district level of precipitation is high in low and plain land area of Parbat. Kaligandaki River Modikhola Khola, Lamaya Khola, Malayangdi Khola, Seti Khola, Rati Khola, Lasti Khola, Damuwa Khola, Armadi Khola, Lungdi Khola flow from its different parts. High potential of hydro and

irrigation are available in different part of Parbat. This district is rich in hydroelectricity projects and different irrigation projects are available in Parbat district. Likewise, Lamaya Khola, Malayanfngi Khola are main water sources of Shankhar Pokhari VDC; and some small rivulets are the sources of drinking water in the study area.

4.4 Demographic Scenario

Although, the majority of Bharman, Chhetri, Ghatri and Dalit people are residing in the study area and there is a heterogeneous society. According to census 2011, 5743 people were residing in Shankar Pokhari VDC. Some data on demographic scenario is given in Table 4.1:

Table 4.1: Demographic Statistics of Shankarpokhari VDC

Facts	2011 Census
Total population	5743
Male	2909
Female	2834
Sex ratio (Male/female)	942
Total household	
Literacy rate	81.5
HH size	6.1
Population density	476.25
Growth Rate	1.3

Source: District and VDC Profile 2013

CHAPTER V

DATA PRESENTATION AND ANALYSIS

Climate change is a global problem at present. Of all environmental issues, the destruction of forest, agricultural production, rising temperature, drying out the sources of water, health condition have received the attention of the scientists, the governments, administrators, social workers and common people who live in the problematic area. This chapter includes data analysis including local people's perception on climate change, its impact on climate on agriculture, effect of unseasonal rainfall on agricultural production Similarly, effect of rising temperature on agricultural system e, impact of climate change on people's health, biodiversity and livestock. This chapter also includes effects on different activities by change in livestock pattern impact on income due to change in livestock pattern.

As described in research methodology, primary data is collected from one of the high undulating village, Shankar Pokhari of Parbat district. All questionnaires and group discussions are focused on climate change and its impact in the day to day life of the people. Change in climate and its effects to the daily life are experienced differently by the people in different ways. The impact of climate change is seen through the study of rainfall, appearance and disappearance of various species of vegetation and insecticides the nature of weather, humidity and temperature.

Table 5.1 shows the composition of respondents among them 35 males and 25 females. Six male were less than 15 years, 10 were 15 – 25 years, 10 were 25 - 60 years and 9 were more than 60 in the age group. Likewise, 5 female were less than 15 years, 8 were 15 – 25 years, 8 were 25 – 60 years and 4 were above 60 years old.

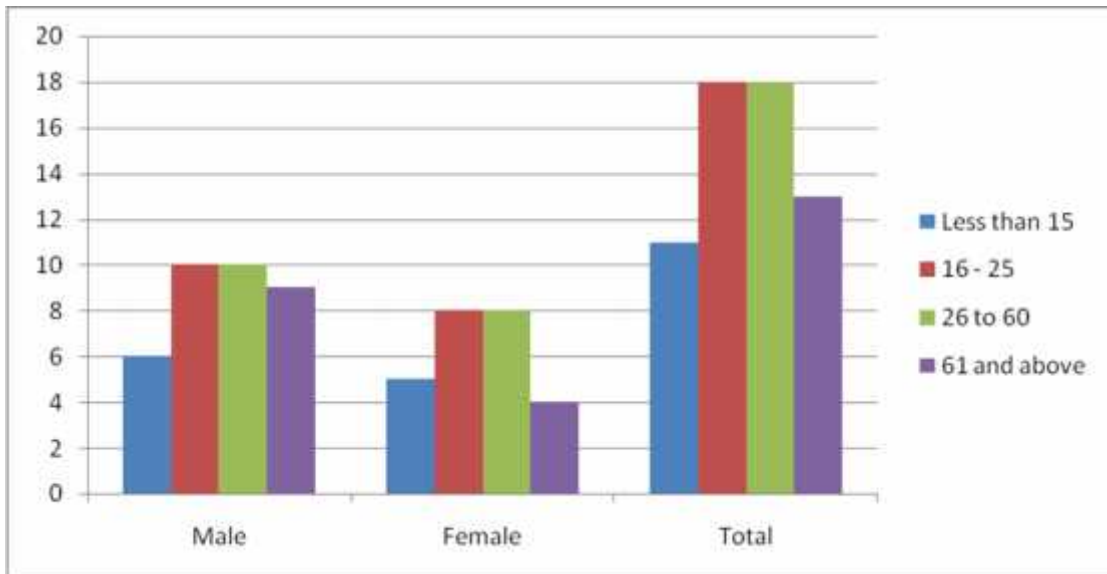
Table 5.1: Age wise distribution of Respondents

Age groups	Male	Female	Total
Less than 15	6	5	11
16 - 25	10	8	18
26 to 60	10	8	18
61 and above	9	4	13

Source: Field Survey, 2013

The above information can be presented differently in figure no. 5.1.

Figure 5.1: Age wise distribution of Respondents



Source: Field Survey, 2013.

The questionnaires are designed to get information about rainfall pattern, environment and temperature change. The collected data is useful to study the pattern of biodiversity in the study area. This study intends to find out the impact of climate change in the daily life of the rural people and their engagement in livelihood including agriculture and livestock. It helps the current trend of problems faced by them due to the problem of climate change. Acquired information and their interpretation are presented below, dividing into different sectors, which reveals the situational pressure of climate change. The presented data shows that the climate

change is affecting the traditional ways of living and the effort for livelihood has been harder each year.

5.1 Local People’s Perception of Climate Change

Group discussion and key informants interview indicate that the communities experienced water stress and increased temperature in recent years. Rainfall and duration of rainy season is in decreasing trend in comparison to previous years. People’s sensation of temperature is beyond their understanding. Though they feel increase in temperature, most of the people who are busy in agricultural sectors are still unaware on the causes of increasing temperature. However, some of the students and most of the teachers were familiar with the causes of increasing temperature and impact of climate change.

Table 5.2: Responses of the interviewees on changing pattern of Rainfall and Temperature from Gender Perspective in Comparison to Previous Years

S.N.	Respondents (Gender)	No of Respondents on rainfall pattern			No of respondents on temperature pattern		
		Less	More	Same	Increased	Decreased	Same
1	Male	31	1	3	30	1	4
2	Female	19	2	4	18	2	5

Source: Field Study, 2013.

Table 5.2 shows the responses from males and females on the issue of changing pattern of rainfall and increasing temperature. More than 80 per cent of males and female felt decreasing trend of rainfall and increasing pattern of temperature in the recent year comparing it with previous years.

Table 5.3: Perception on Change in Rainfall and Temperature Pattern in Comparison with Previous Year (Age wise)

S.N.	Respondents' age groups	No of Respondents on rainfall pattern			No of respondents on temperature pattern		
		Less	More	Same	Increased	Decreased	Same
1	Less than 15	7	1	3	7	2	2
2	15-25	18	0	0	16	0	2
3	26-60	15	1	2	15	0	3
4	61 and above	10	1	2	10	1	2

Source: Field Study, 2013.

Table 5.3 shows the age wise perception of respondents on rainfall pattern and temperature increasing pattern. All the people of different age group felt the increasing temperature, and decreasing pattern of rainfall. More than 80 percent of the people felt increased in temperature.

Table 5.4: Perception on Change in Rainfall and Temperature Pattern by Occupation

S.N.	Respondents Occupation	No of Respondents			No of respondents		
		Less	More	Same	Increased	Decreased	Same
1	Agriculture/ Livestock	20	2	3	20	1	4
2	Business	4	0	1	4	0	1
3	Social service	5	0	0	4	0	1
4	Student	11	1	3	10	2	3
5	Teaching	10	0	0	10	0	0

Source: Field Study, 2013.

Table 5.4 shows the respondents of all occupation who experienced increased in temperature as well as decreasing pattern of rainfall. All the people from all occupation experienced the life has been severe due to climatic change.

The above mentioned tables 5.2, 5.3 and 5.4 show most of the respondents realize that rainfall pattern and temperature is changed diversely. Unseasonal rainfall, massive rainfall in some period, short period rainfall, irregular and erratic rainfall and drought are hampering agricultural production and people's lives. Most of the respondents e.g. 80% said temperature is increasing every year. Similarly, 5 percent and other 15 percent respondents have felt the decreased and constant temperature respectively. Likewise 83.3 percent respondents said rainfall is decreasing every year. While other 5 percent other 11.66 respond increasing pattern and constant pattern of rainfall. They indicated deforestation and growing population are the main cause of less rainfall and temperature increase as well as overall change in the climate. Natural calamities like drought, hailstone and widened spread diseases have been extended. Due to climatic change wind pattern is getting changing and it has been warmer and stronger.

5.2 Impact of Climate Change on Agriculture

Among the respondents 41.66 percent depend on agriculture and livestock agriculture. Basically the traditional pattern of agriculture and livestock heavily depend on seasonal rainfall. Due to less and irregular rainfall its adverse effect on agriculture and livelihood has been noticed. Unseasonal rainfall, irregular and erratic rainfall has resulted in flood and drought. This has adverse impact on crops production (food and crops), which is threatening for food security of the common people. People have to work harder to meet their necessities. The impact of climatic change is observed on the decrease of productive agricultural land. Its affects on the traditional pattern of agriculture and unseasonal rainfall has shifted from Ashar to Shrawan which might have a severe impact on people's lives.

Due to less rainfall and increasing temperature, water resources are drying up slowly. Wet land is decreasing and the feeling of respondents on changing of environment in terms of impact of less rainfall on water resources are presented below:

Table 5.5: Impact of Less Rainfall on Water Resources

S.N.	Effects on water resources	Respondents	
		Number	Percentage
1	Drying water resources	12	20.0
2	Reduction in water level in ponds	5	8.33
3	Loss of wetland	3	5.0
4	Drying water resources reduction in water level in ponds	2	3.33
5	Reduction in water level in ponds, loss of wet lands	3	5.0
6	Drying water resources loss of wet land	15	25.0
7	Drying water resources reduction in water level in ponds, difficult to find drinking water	18	30.0
8	Not answered	2	3.33

Source: Field Survey, 2013.

The above table 5.5 shows that the scarcity of water in various sectors has basically impacted agriculture; and the resources of water are decreasing that causes the decrease of wetlands in the study area. Among the respondents 96.66 percent responded that the water resources are drying out, wetlands are disappearing and level of water on ponds and rivers is decreasing every year. Many of the respondents noticed that the less rainfall or short period of rainfall is the main cause of decreasing flow of water in the rivers. As a result people are getting the problem of drinking water (See photo in Appendix 2).

Decrease of wetland has resulted to water scarcity for household use like drinking and irrigation area turning to arid region. Delays in the monsoon in the past few years have changed cropping patterns and crops maturity period. But this year monsoon remained for a long time. Planting and harvesting of key crops has been pushed back by a month and rational cropping systems have been consequently affected. The change in rainfall has affected the agriculture system.

Table 5.6: Effects of Rainfall on Agricultural System

S.N.	Effect on production	Respondents	
		Number	Percentage
1	Rise in production	5	8.33
2	Decrease in production of crops	18	30
3	No change of production	6	10
4	Difficult to cultivate	20	33.33
5	Others	7	11.67
6	Not answered	4	6.67

Source: Field Survey, 2013.

Note: Others include less production, threatening food security and causing farming, xerophytes species (species available in and places) is being cultivated no irrigation facilities.

The above table 5.6 shows the effect of erratic and unpredictable rainfall in production of crops and its effects to cultivating process. Scarcity of water resources is creating virus problems in agriculture sectors, both cash crops and food crops have been affected.

Many respondents share their experiences about the effect of less rainfall on agriculture. It is difficult to harvest paddy, maize and other food crops in regular time. Growth of crops is also affected and ultimately their source of income is decreasing. The pattern of production and productivity of crops has been changing day by day. 30 percent of respondents believed unseasonal rainfall decreases in production of crops, while 33.33 percent replied that it is difficult to cultivate the land in time.

5.2.1 Effect of Unseasonal Rainfall on Agriculture

Irregular and unseasonal rainfall is in the increasing trend comparing it with the past few years. The respondents state that it has affected the cultivation of crops. Among the total respondents 13.33 percent replied that they are facing problem on cultivation of crops while 20 percent of respondents replied irregularities on production of crops.

Table 5.7: Effect of Irregular Rainfall on Agriculture

S.N.	Effects on irregular rainfall	Respondents	
		Number	Percentage
1	Effect on cultivation	8	13.33
2	Drawn of crops	0	0
3	Flooding	5	8.33
4	Irregularities on production of crops	12	20.0
5	Others	10	16.67
6	Effect on cultivation, irregularities on production of crops	12	20.0
7	Effect on cultivation, flooding and irregularities on production of crops	10	16.67
8	Not answered	3	5.0

Source: Field Survey, 2013.

Others in the table include decreasing production due to unseasonal rainfall. Growth of crops is limited and the cultivation of crops has been nearly impossible due to irregular rainfall, and from more input they get low output.

5.2.2 Effect of Rise of Temperature on Agriculture

According to respondents, new types of insects have recently appeared and the disease has spread on crops and other vegetations. The farmers are using different pesticides to get rid of those insects/diseases. The respondents realized rise in temperature is the main cause of early flowering of different species of fruits and corps. Crops species and fruits which are known as suitable for summer season are also being ripened in winter season. Crops species which are found on tropical region are also found on subtropical region including in the study area. The rate of spread and growth of these species is very high in comparison to endemic species. Increasing temperature is crating many consequences, decreasing the period of maturing of corps decreasing the time period of breeding of seed and wide spread of insects and disease etc.

Table 5.8: Effect of Increasing Temperature on Crops

S.N.	Effect of Increasing Temperature on Crops	Respondents	
		Number	Percentage
1	Decreasing the maturation period of crops	8	13.33
2	Decreasing the time period of germinating seed	2	3.33
3	Wide spread of insect/diseases	12	20.0
4	Others	5	8.33
5	Decreasing the maturation period of crops, decreasing the time period of germinating seed	5	8.33
6	Decreasing the maturation period of crops, wide spread of insect/diseases	4	6.66
7	Decreasing the time period of germinating seed, wide spread of insect/diseases	3	5.0
8	Wide spread of insect/disease other	6	10.0
9	Decreasing the maturation period of crops, decreasing the time period of germinating seed and wide spread of insect/disease	12	20.0
10	Not answered	3	5.0

Source: Field Survey, 2013.

Note: Others includes, irregularities in flowering of plants species, shedding time of plant is changed change in harvesting time of crops and increasing different pests and insects.

Slightly more than 20 percent of the respondents of the study sites indicated wide spread diseases/insects due to increase in temperature and less rainfall, while the others 13.33 percent felt decreased the maturation period of crops and 3.33 percent of the respondents felt shortening the time of germinating seed.

5.3 Impact of Climate Change on People's Health

The impact of climate change on human health is widely felt. Respondents at study sites experienced various kinds of disease, allergies and itching problem as well as skin disease. Many respondents pointed out the need for using mosquito nets these days. But the elder people say there were not any mosquitoes in past, so that there was no need of using mosquito nets. Some other unknown diseases also have appeared on the study site Shankar Pokhari VDC. Tropical and vital diseases have been frequent in all seasons.

Table 5.9: Problem Occurred from Increasing Temperature

S. N	Problems Occurred	Respondents	
		Number	Percentage
1	Increasing flies, mosquitoes and other insects	18	30.0
2	Increasing flies, mosquitoes and other insects, appear new diseases on human beings	21	35.0
3	Appearance of disease in crops and livestock	9	15.0
4	Others	7	11.66
5	Not answered	5	8.33

Source: Field Survey, 2013.

Note: Others include, increasing death of sheep, increasing in injection of diseases, increasing death rate of old people.

Increasing temperature is creating problematic condition on the day to day life of the people. Among the respondents 30.0 percent noticed increased in flies, mosquitoes and other insects; and similarly 35.0 interviewees are aware on the appearance of different diseases. They have seen the people being affected by new disease. They

answered due to the problem of new disease aging people have been victims. 15.0 percent interviewees have seen the effects of climatic change and occurrence of new diseases on crops and livestock including poultry farming. Increasing diseases are making local life harder and exclusive. Expenditure for cure of diseases on medicine and health services is increasing unbearably. The following table shows the increment in medicine and health service costs.

Table 5.10: Increment in Medicine and Health Service Cost

S.N.	Level of expenditure	Expenditure increment over the previous year	Annual expenditure on medicine and health services
1	Maximum	25%	5000.0
2	Minimum	5%	500.0
3	Average	11%	9421.0

Source: Field Survey, 2013.

Because of new appearance of disease people are suffering and they are investing more in order to cure disease and the amount is in rising up for the people annually. Though primary health service has been made free by the government, annual expenditure on medicine is gradually increasing. Among the respondents 77 percent responded this question and half of them said their annual expenditure is increasing by 11 percent on an average and expenditure in medicine is more than nine thousand.

5.4 Impact of Climate Change on Biodiversity

Natural ecosystem and biodiversities are also affected from changing climate. Community (respondents) of study site has already experienced loss of some native plants and species. The key informants reported that forests, lakes, grass land, wetland and agricultural ecosystems are continuously degrading. Grazing land, wetland and forest area is decreasing due to less rain fall and increasing temperature.

Most respondents reported that the loss of forest species such as *Sal*, *Kafal*, *Myrica* (esculeuta), *Kaulo* (maesa chisia), *Lapsi* (choer ospondia axillaris) *Bimiro* (Citrus medica), *Rani Sallo* (Cupressus torulosa) *Pipal* (ficus religious a bar), *Swami*, Timber (zanthoxylum allatum), *Pakhuri*, *Ambak* (Psidium guaa), *Dar*, *Khayar* (chimal) and many other species in the last one decade.

They also mentioned that medicinal plants and non-timber forest products (NTFPs) including *Pipla* (piper longum), *Gurjo* (Tinospora), *Aasuro*, have also disappeared. Respondents revealed that different plant species had been flowering irregularly. Rhododendrons were flowering early from January/February. Orange was matured in September/October; *Kapro* (ficus locor) was shooting in September, which is not seen as normal time.

Many key crops species were lost in recent years. Many species of paddy like *Ananadi*, *Aaga*, *Kalo dhan*, *Akle dhan*, *Sudhara*, *Kalo Marshi* and other crops like *Mas* (black pulse), *Body* (seeds of bird eye), and *Hiude Simi* (winter bean) have been disappearing rapidly. Many respondents strongly showed their concern about the risks of different crops in the study area.

5.4.1 Spread of Invasive Species

Change in temperature, rainfall pattern is creating favorable environment for pests, diseases and invasive species to emerge, spread and encroach in agriculture and forest lands. Respondents have already experienced the emergence of species that they have never seen in their field area. Invasive species like *Ban Mara* (Lantana Lamara) *Ghode Jhar* (Ageratum Conyzoides) and *Kande Jhan* and *Titepati* (Local Weed) are evident in the study area.

Respondents perceive that invasive species are spreading very fast and damaging agriculture, pasture and forest lands. They were worried on production of staple food crops and cash crops. Sugarcane and mustard are also affected from these invasive species.

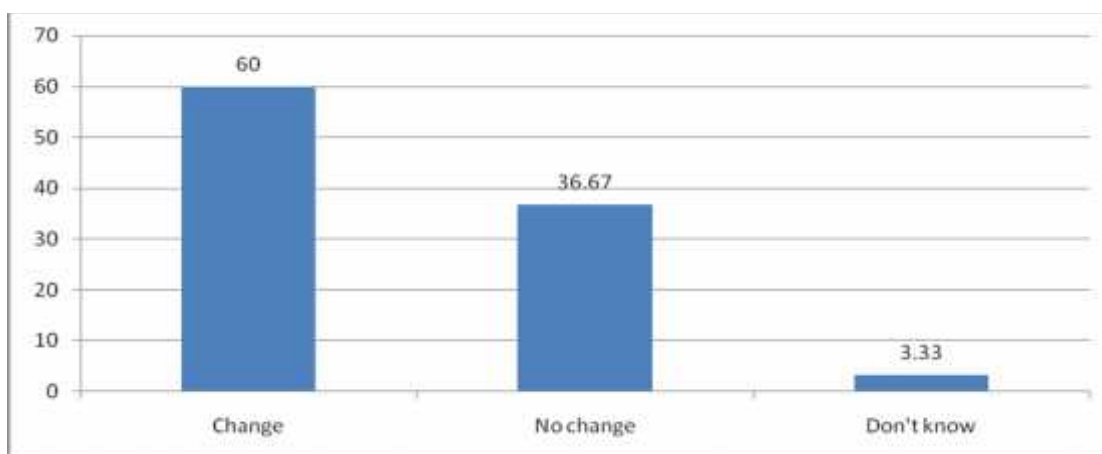
5.5 Impact of Climate Change on Livestock

Due to extreme drought, there were direct impacts on the growth of Pala table grass species. Regeneration of fodder species in pasture and forest fodder is also decreasing due to the less rainfall. As a result, there is a shortage in diversity and quality of livestock fodder. This has affected livestock which has further agreed on production of milk, milk products and meat. Livestock population is also decreasing and the drought has affected the livestock fodder by drying wetlands, pasture land and water resources. The loss of water in streams and decreasing availability of drinking water

to livestock, increasing temperature are the common problems in the study area and livestock are being affected by different new born diseases.

The scarcity of fodder and loss of grazing space for livestock due to the growth of unwanted weeds and disappearance of wetland number of livestock is decreasing. As a result, people are either compelled to go to foreign land or the farmers are forced to change their livestock pattern. Most of the people who have changed their livestock which needed less fodder, the study shows that majority of the people (60%) have changed their livestock whereas 36.67 percent said that they have not changed their livestock pattern. Figure 5.2 shows the status of livestock changing pattern.

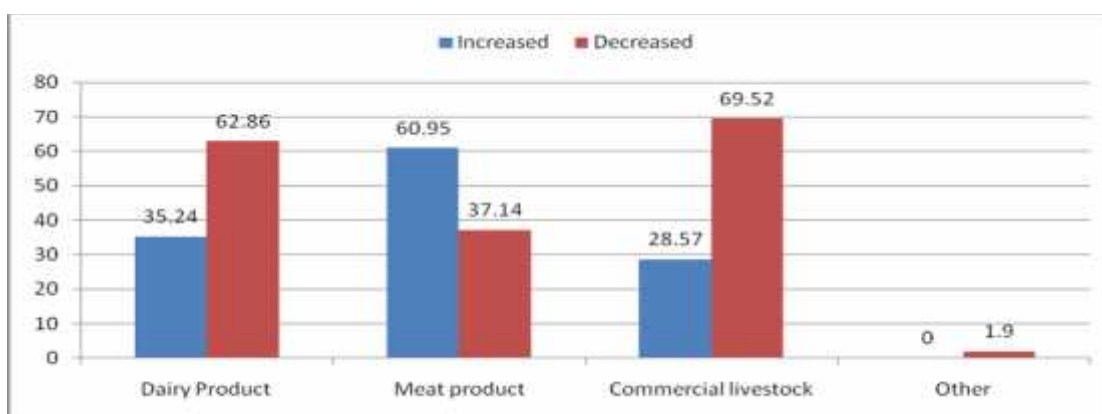
Figure 5.2: Change in Livestock Pattern



Source: Field Study, 2013.

5.5.1 Effect on Different Activities by Changing in Livestock Pattern

Figure 5.3: Effect on Different Activities by Changing livestock pattern

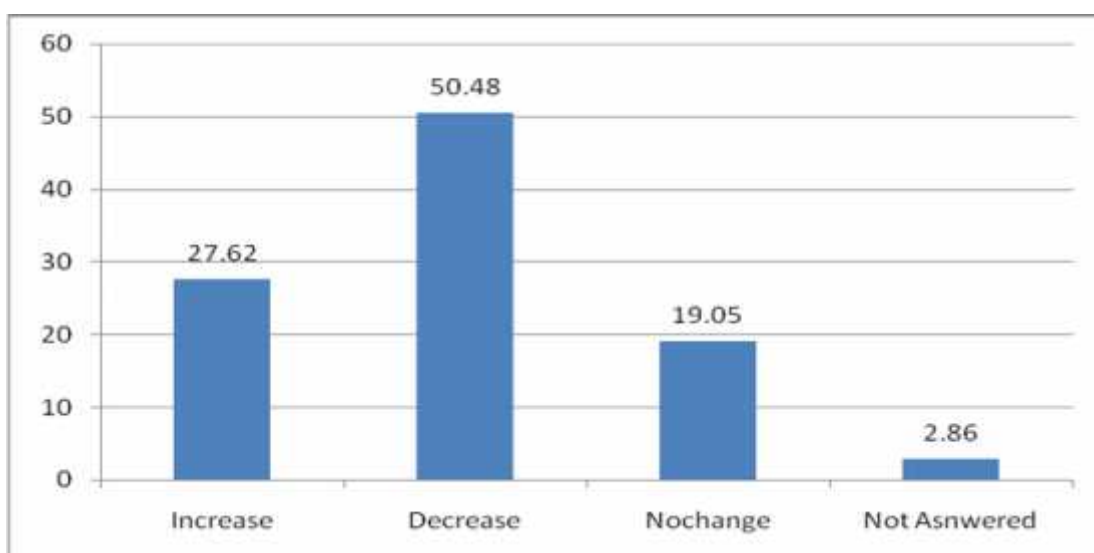


Source: Field Survey, 2013.

Due to scarcity of resources for livestock, change in livestock pattern has been observed. According to respondents dairy products have decreased significantly whereas the meat product is increased due to the increasing trend of poultry farming. Figure 3 shows the effects of changing pattern. 62 percent of the respondents noticed direct impact on dairy product, 60.95 percent noticed increase in meat products and 69.52 percent of the respondents notice decreased in livestock. Nearly 2 percent of respondents have noticed change in occupation, migration etc.

5.5.2 Impact of Income Due to Change in Livestock Pattern

Figure 5.4: Changing Income due to Livestock Pattern



Source: Field Survey, 2013.

Slightly over 50 percent of the respondents said that their income level is decreasing due to change in livestock pattern while 27.62 percent of the respondents said that their income level was increasing. On the other hand, 19.05 percent of the respondents said that their income level was constant. Figure 5.4 shows change in the income brought by livestock pattern change.

CHAPTER VI

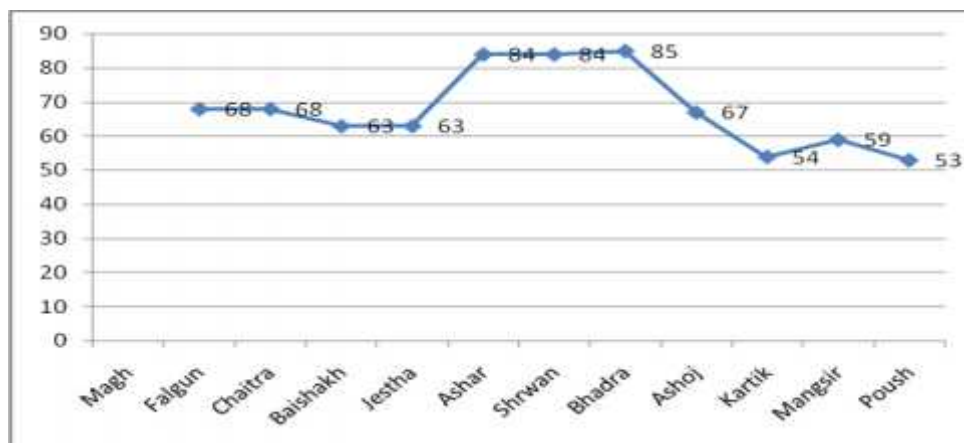
IMPACT OF CLIMATE CHANGE

This chapter includes discussion between the data analysis literature reviews, which compares the respondents' perception with scientific studies, previous studies and literature.

Respondents' perception and observations of climate change and its related impact are found differently. Although many of their observations, experiences, feelings and perceptions are inconsistent or even contradictory, apparently most of them are valid even from scientific perspective. However, they may not have full explanation for all the observation and experiences; they can help advance understanding of climate changes and their diverse impacts on communities.

The respondents or community observation tells interesting stories about climate change and its impact of the diverse aspects of natural phenomenon. Climatic variation is prominent among them. According to their observation the summer is getting hotter, longer whereas the winter is getting shorter and warmer. The intensity of rainfall has been increased but the length of the rainfall particularly during winter has decreased. The observation also supports the scientific studies in general (IPCC 2007). Similarly, the observations also corresponds with the estimates of temperature rise of 0.410 Celsius per decade in Nepal based on long term metrological data on climate change and its impact is visible in the study area.

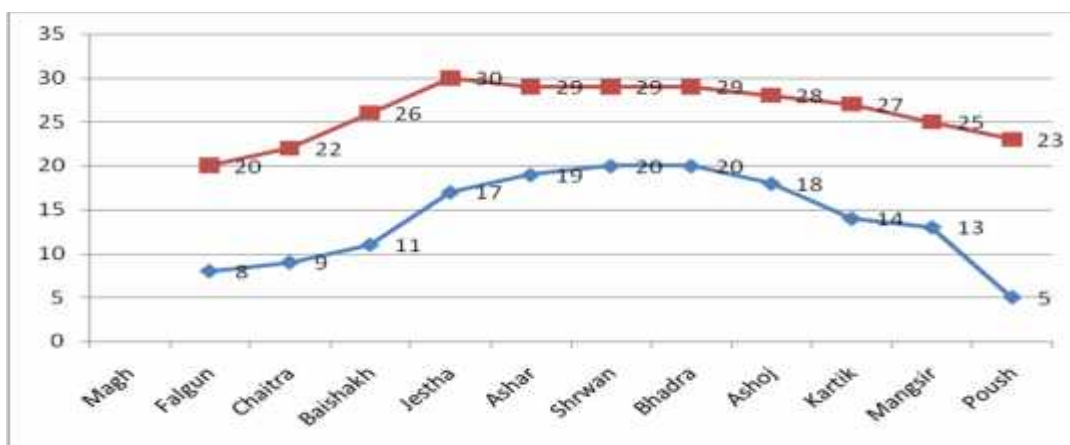
Figure 6.1: Average Humidity in the Altitude of 1403 m



Source: Meteorological Center Shankar Pokhari (See photo in Appendix 2)

Figure 6.1 shows the change in trend of change in temperature in Parbat which is at the study area Shankar Pokhari. It was established by Li-Bird. The center is in the compound of Shree Tribhuwan Higher Secondary School where the students take daily records of minimum and maximum temperature rainfall and relative humidity.

Figure 6.2: Average monthly temperature of 2069 in Shankarpokhari VDC.



Source: Meteorological Center Shankar Pokhari (see appendix 2)

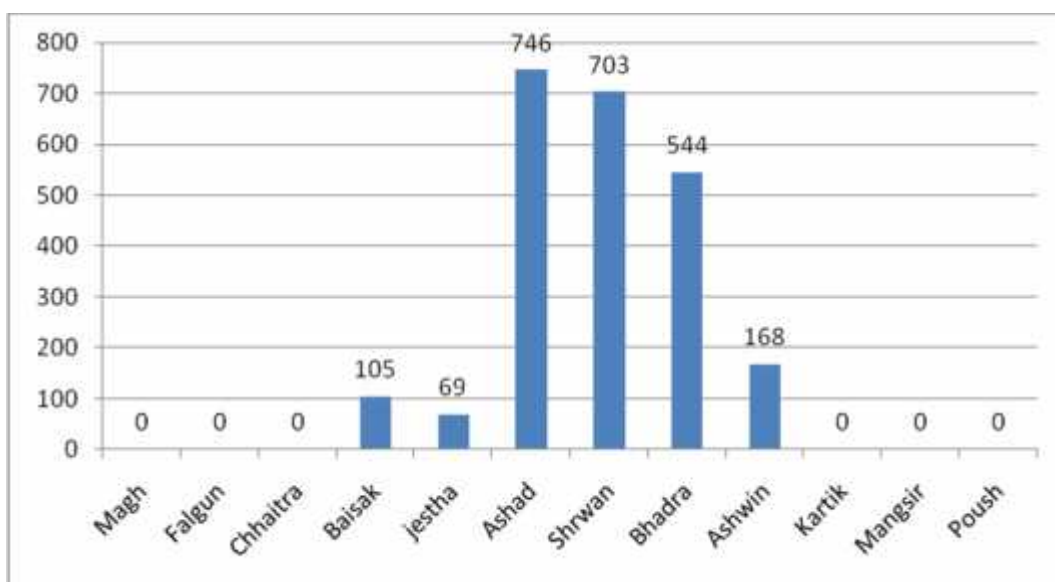
Figure 6.2 shows the average monthly temperature of 2069 in the study area. The normal condition of weather is changing year by year converting into extreme. The Temperature in Baisak, Jestha and Asar is as high as nearly 35⁰ Celsius. In Magh and Poush the trend of minimum temperature is increasing every year. This record also supports the respondents' response.

Similarly, the overall average trend of climatic conditions in Nepal indicates that the perception is decreasing at the rate of 9.8 millimeter (mm) per decade on annual basis. But there are variations in perception level in different parts of country which matches with the respondents' experiences and perceptions on rainfall and its variation. The local communities have experienced shortened moon soon which is also correlated with scientific observations shows that monsoon has onset is faster by 70% of day per annum and with drawl is delayed by 15% of day per annum (Chapagain 2009). Respondents of study site have experience of new plants which were found in temperate region. According to study many of the tropical region plants now also grow in the temperate zone, which is a clear indication of the rising temperature. The local people have also observed new weeds and other plants invading their farms and

forests. Similarly trees are shedding their leaves much earlier than usual. The temperature fluctuation (change) may have changed the distribution of plants.

Most of the respondents in the study area have experienced decreasing rainfall pattern and increasing temperature. According to them, the unpredictability on monsoon has been increasing every year. They can't predict the monsoon which is creating difficulty to harvest. Above figure 8 supports the respondents' experiences. The average, rainfall pattern in the raining season is increasing and average rainfall in day season is decreasing.

Figure 6.3: Monthly rainfall pattern of 2069 in Shankarpokhari (Study site)



Source: Meteorological Center: Shree Tribhuwan Higher Secondary School.

Above figure 6.3 shows that there is no rainfall in dry season. Even in monsoon, there is not sufficient rainfall in 2069. The figure indicates there is no rainfall in six months which hampers the winter crops like mustard, potato and other vegetables. Due to the absent and low rainfall in dry season there is severe scarcity of drinking water in the upper part of study area. People are compelled to collect water in rainy season for drinking water. Different kinds of cash and food crops are badly affected by drought. Maize, potatoes, wheat, mustard and vegetables have been affected. Change in rainfall pattern had drastically decreased yield and production of staple crops such as rice, maize, wheat and the cash crops were also found affected from change in rainfall pattern.

The erratic rainfall pattern has affected regular paddy cultivation. Farmers are looking for alternative crops that would be produced under erratic rainfall conditions. Some farmers have replaced rice with millet and some have replaced by mustard, turmeric, ginger because these crops may be the best alternatives. The main reason for such replacement was not for the value of millet but to protect farm land.

It was found that most of the respondents are facing difficulties on cultivation of crops. Irregularities on rainfall and its changing pattern are affecting overall life style of the people. Drought has been increasing every year. Drought has multiple effects because it affects not only water resources, but also agriculture and subsequent food security. Shankarpokhari is now facing challenges of drought and insufficient water. They are forced to reuse water and storing of water for the fulfillment of household and faming activities. It is found the water level and flow of less water in rivers and river tributaries has been lowered resulting in water scarcity for irrigation and the farm land terrace and wet land causes multiple problems to the farmers.

The cash crops like mustard and potato have also been found affected from different unidentified diseases. The productivity of soil is gradually decreasing. The existence of new pests which were found in low land or warm climate is also found on the upper part of study site. Many insects and weeds have been identified in crops and agricultural field. Striped border (*chilozonellus swin*) pink border (*seamia informs walk*) arm warm (*mythym separate*) *pseduelastia unipuaeta*, grass hoper (*chrotogonoushp*) have increased on the study site. According to respondents paddy cultivation has been affected from different pests such as rice wilt (*stiphilus orgzac*). *Angowhios grawin mota* (*sito traga cerealella*) Khapru Reetle, (*Traogodermn/granasium*) bovrer rice bug and leaf roller. Traditional species of rice and disappearing and productivity is decreasing. Traditional and enteric species of rice have been lost.

It was found that farmers were using large swamps and farmers at wet land area used to cultivate local rice named *Gauriya* which is being affected. As a result *Gauriya* rice was no longer grown and was replaced by modern varieties such as *Radha* and *Mansuli* in the study area. At present it is difficult to find seed of local types of food and cash crops as people are facing difficulties with production and expenses of growing modern varieties.

Climate change parameters, temperature, rainfall pattern and humidity have an impact on the development and distribution of pests and diseases in the study area. Increase in temperature leads to an increase in population of pests and severity of diseases presence of host plant. Climate change increases the rate of reproductive cycle of insect and pests. In the study site, the increase in insect population leads to demand for more use of pesticide, which affects ecosystem as well as brings problems in human society.

Over the past fifteen years, the delay in monsoon season experienced in study site has changed the cropping pattern and crops maturity period. It has delayed the planting and harvesting season by a month, which has in turn affected rotation practices. The delay in monsoon season has also made farm land fallow and reduced production due to lack of water. Farming communities of Shankarpokhari have related to loss of local landraces to climate change. They state that local landraces require a longer rainy season and that in the past 15 years the duration of rainfall has decreased except in 2070 B.S. These local landraces have been replaced by short duration modern varieties.

Farmers in study site have also described the effects of beekeeping due to the increase in insect and pest numbers. The increased unpredictability and intensity of weather events and hazards have been described by farmers as causing significant distribution to rain fed agriculture. Climate change contribute to the loss of local landraces of crops changing in timing of fruit, trees and coffee lowering a decline in some local grass species and reduced size of some fodder trees.

It is found that respondents are also facing difficulties in livestock. It is being difficult to find fodder from jungle and pasture land is also decreasing because of less rainfall, grazing area is decreasing because of encroachment of forest and cultivation of mustard, turmeric and ginger. Livestock are also being affected due to different new diseases which were not seen before.

Livestock numbers have declined in study area and this has negatively affected the diet of the population milk production is decreasing. Some villagers have replaced their livestock which requires less fodder and grass. Some of the respondents were replacing livestock by poultry farming which is easy to handle and manage.

6.1 Impact on Health of People

It is found that community at study site has experienced intense heat for the last few years that resulted in development of different kinds of diseases and insects affecting human health. Allergies and itching problem are increasing particularly women and children. It is found that different temperature diseases have been increasing. There were no mosquitoes five years ago but now villagers are using mosquito net at even in October. Mosquitoes, flies, moths and other insects are increasing which are resulting increasing in frequency of illness among children. Fever, malaria, chickenpox, diarrhea and water born diseases are increasing every year. It is found that the village communities reported of increasing in number of mosquitoes and flies, which is resulting in frequent illness among children.

It is found that expenditure over medicine and curing diseases has been increasing every year. Increasing expenditure is creating pressure on households to search for alternatives. Moreover, youth population is migrating toward urban and semi-urban areas for employment to cover the increasing expenses.

6.2 Impact on Biodiversity

It was found that biodiversity is also affected from climate change especially by increase in temperature. Change in temperate and rainfall pattern is creating unfavorable environment for livestock and biodiversity. Attack of new diseases and invasive species spread and that encroach the agricultural land, forest lands and other pasture land. The respondents experience that invasive species is spreading very fast and damaging both agriculture and forest lands. They were worried that production of cash crops like mustard, grass for cattle has declined to some extent due to invasive species *Banmara* (Lantana Camara). It is found that some behaviors of plants have been changed.

It was found that plant species which did not exist in that location in the past were also found in study areas. Traditional species of crops like paddy have been lost and disappeared. New species which are restricted in warm temperature were gradually growing up. Moreover, those plant species and crops species which were only found in warm temperature and only in summer season were cultivated in winter season. Respondents have developed many ways of managing risks which are created by

climate variability. Swiveling and exchanging drought resistant seeds and others a biotic stress. Tolerant crop varieties and adopting and practicing specific soil and water management practices are the core activities of the farming communities of study site. Seeding of the plant has been changed. Flowering time of different plants is changed due to the change of climatic pattern.

CHAPTER VII

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter includes summary, conclusion and recommendations of the study.

7.1 Summary

Climate change is a burning issue of the contemporary world. Most of the people have been affected from the global phenomenon of climatic change. Everywhere, climate change is the matter of debate. From grass root to national, international, regional and global levels it is a matter of discussion. It is subjected to the balanced growth and sustainable development and concerning the prop serious future of the earth. All nations of the world have been affected from this issue. Because of low capacity to cope with and to avoid, under development countries are being affected more than developed countries. Most of the under development countries are dependent on agriculture and agrarian activities. Traditional agriculture is connected with their day to day living style is severely hampered by climate change in the poor and developing countries.

Many people have been affected from climate change in the third world, like Nepal. Nepal is at the forefront of the climate change impacts. It is found that at present the rate of increase in average annual mean temperature is higher than the past and event the increasing trend of the temperature will be growing in the future as well. The variation in climate is due to variation in altitude increasing from south to north resulting into different climatic vegetation and verities of ecosystems. With being the same watershed for such different climate zones, the vulnerability to each change spreads thereby leading to more serene associated impacts in other regions in the down stream throughout the whole watershed. Right now Nepal being a developing country lacks the capacity to cope with a single flood stress is at the forefront of climate change induced disasters. The anthropogenic-factor like deforestation, faculty agricultural practices and insufficient strategies to cope with climate change impacts have adversely affected the livelihood of the communities.

Until this time the researchers are not concentrating to find out its entire effects in various sectors relating to livelihood, their immediate remedies to mitigate the

impacts from which the common people like living in Shankar Pokhari VDC of Parbat can feel hope of future life. Very few studies have been conducted in this issue on national level and the knowledge or the result reached from one study has not been linked with the problem of different local areas. Now it is a time to show the link among different problems in order to find out the immediate and long term solution of climate change. Effect of climate change has not been assessed minutely in the local level yet. Understanding of this crucial matter is different in national and local levels. No effort can be found for understanding and minimizing its effect in the grass root level. Thus the people of study area are unaware on the remedy aspect.

This study tries to assess and evaluate the impacts of climate change on livelihood of rural communities of Shankar Pokhari VDC of Parbat district. The purpose of this study is to find out the generally seen or felt effects of climate change and to complete the course of Masters Degree of Rural Development under Tribhuvan University. For this purpose primary data were collected by questionnaire survey key informants interview and observation method. Secondary information was collected from various relevant publications newspaper reporting and other national and international journals published recently. In this process, I have tried to present local peoples' perceptions in the same way as they had expressed in course of my visit of that place. Collected information were accumulated, tabulated and analyzed by the established research techniques and in this process, recently developed computer software is used to measure the data consistency.

The analysis indicates continuously rising temperature, low volume of rainfall and inconsistency in livelihood of the local people. They have also interpreted these events as a result of climate change or especially less rainfall or untimely rainfall. Local common people or farmers, teachers, students etc are aware on the issue of rainfall and temperature and their impacts on their day to day lives.

In recent year rainfall pattern is shows the fluctuated pattern, altered and delayed monsoon period, erratic and abnormal draught of rain fall etc. The record of rainfall pattern in Shankar pokhari study area clearly indicates rainy and dry season –as Baisakh to Ashbin as a rainy season whereas Kartik to Chaitra as a dry season. The absence of rainfall in winter season makes the life harsh and leads to uncertainty of agricultural production. On the other hand natural calamities like hailstone and

hurricane are occurring unpredictably and seem to have increased in recent days. Temperature rising pattern is also an unpredictable and a strange matter. The plants lifecycle behavior regarding flowering shedding and germination of seed are shortening maturation time of fruits and crops also indicates the pattern of increasing temperature.

The production and productivity of agricultural products is decreasing due to the effects of less rainfall; and scarcity of water for irrigation and for drinking purpose has been experienced by the common populace. Therefore the local farmers who make their livelihood from agricultural sector are unable to cultivate the land in the damp and swampy areas and farming land are disappearing day by day. The availability of grass for feeding their livestock and forest field is also in decreasing pattern. The scarcity of grass and fodder is increasing pattern and existence of such field is destroyed by the growth of unwanted weed or plant like *Banmara* etc.

Traditional pasture land has been converted to arid desert or the land without good grass for livestock. Due to the scarcity of water and fodder it has resulting in decreasing number of livestock –as the farmers are forced to decrease their animals. The lack of adequate fodder and difficulty to manage water for animals, livestock pattern has been changed and it is believed that definitely it will bring a change in ecosystem. People are replacing those animals which used to consume large amount of grass with the animals that consume less fodder. In other words local farmers are compelled to make other alternative decision on taming the livestock from which they gain comparative more benefit than keeping the traditional animals in their farm houses.

The changing pattern of taming animals will invite different diseases in the farm houses and the spread of new disease will have the severe impacts livestock and local people. The benefit from livestock is decreasing and the agrarian livelihood is harrowing down to the subsistence level.

Many species of the area and biodiversity are found affected from changing climate. Most of the plants and animals and traditional species of staple crops are difficult to find and some of the species are completely lost. Different invasive species, weeds and pests are in increasing pattern.

Diseases and insects which were found on temperature climate are also found in cold climate and hot climate –upper part and lower part of Shankar Pokhari VDC. Mosquitoes, flies and other insects are being spread out in the high altitude of study area –the old people never had observed the existence of mosquitoes in the past when they were children or youths. As a result, human health is affected from changing climate especially women and children have been affected from different diseases. Indices, diarrhea, cholera and other water born diseases, itching problem have been increased. The cost of living is increasing because of the spread of diseases and increasing medical expenses.

Climate change increases problems in rural life -even local people are using different local adaptation mechanism as it not sufficient. Rural communities are experiencing difficulties on their traditional occupation and on which they are depending on. People are changing their profession from agriculture and livestock to easy profession like business, construction-work and foreign employment.

People are compelled to change their traditional occupation due to the low productivity from higher cost in traditional occupation like agriculture. The availability of less amount of fodder and loss of grazing land and pasture land due to climate change people look absent in taming traditional livestock pattern. Many people are migrating towards urban and semi-urban areas searching alternatives professions and young people are going to foreign counties for employment.

The changing pattern of life in local area or the desire of youth of making money from foreign employment has left the local land barren or uncultivated. In one side, due to climate change people have been victims of changing ecosystem and in the next side new pattern of living style among the youth has hampered on the traditional living style of aging people. Migration of youths is creating vacuum and creating scarcity of human resources to cultivate the local farming land.

7.2 Conclusion

Climate change is a natural process as human activities are accelerating the speed of change. At present climate change is in increasing trend due to growing number of people and decreasing number of trees. The collision between people and nature has

invited ultimate problem in the existence of animal kingdoms, bio-diversity and future of mankind.

Increasing temperature is the main cause of climate change. Increasing temperature has different consequences in physical world as well as biological species. Change in rainfall pattern, melting ice from Himalayas, increasing sea level affecting coastal area, drought have been increasing in the global level. Due to the scarcity of water for irrigation agricultural production and productivity is decreasing. The problem of global environmental problem is seen in the local levels of poor and developing countries. Even the people of Shankar Pokhari VDC are being affected by the climate change.

Threat to biodiversity and human health has been experienced on different geographical regions or small area like the study area of this research. The less adaptation and mitigation capacity of LDCs have been affected more in comparison with DCs from climate change. Despite the fact that Nepal's contribution of global warming and increasing GHGs is negligible, yet Nepal is the most vulnerable country. Being in the Himalayan range, Nepal and Nepali people will have the severe problem –so the people of Shankar Pokhari will have.

Annual temperature rise is higher in Himalayan ranges in comparison to other non-Himalayan countries. The effects of this global problem are seen very soon in Nepal as the increase trend of temperature invites many problems here. The melting of ice from Himalayan ranges either creates floods in the bank of rivers or creates scarcity of water resources in the areas like Shankar Pokhari VDC. Right now, increase in temperature in Himalayan region is clearly noticeable in the context of Nepal. Rural communities are experiencing increased temperature and changing pattern of rainfall and their impacts in their day to day lives. Though they are experiencing effects of climate change, they do not seem to have been aware on causes of climate change and its long term consequences. Rural committees are experiencing changing pattern of rainfall, strange climate change, changing time of cultivation of crops, changing behavior of animals only.

The production of productivity of the food grain as well as cash crops has been decreasing every year. Due to the low productivity threat of food security is using as

a big issue. Income level is decreasing because of reduction on production of cash crops. Cultivation of crops is being difficult because of scarcity of water for irrigation. Livestock also has been affected from climate change. Area for livestock rearing, getting grass and fodder is reduced because of drought. Due to less availability of fodder livestock pattern has been changed, resulting reduction on milk and milk production. On the other hand, changing pattern of livestock, commercial poultry farming is increasing. So that availability of meat is increasing.

Biodiversity also has been affected from the changing climate. Different crop species have disappeared and lost behavior of plant and animal is changing. Germination, flowering maturation and shedding time of plants species have been changing. Different species of herbs and weeds have been spreading on farm land and jungle. Although, the density and of jungle is increasing the number of wild animals have been decreasing. On the study site the unique species of maize is in extinction phase. Different species of rice, millet and barley have disappeared already.

With increasing temperature, threat to human and livestock is growing too. Especially problem of skin diseases, itching, eye disease, water born diseases have increased. Temperature disease, insects, pests have increased in cold climate zone including study area. It is found that number of mosquitoes, flies and other insects are increased; as a result fever, typhoid, and other communicable disease are increasing. It is found that medicinal expenditure and expenditure on rehabilitation of patients is increasing every year.

Lack of labor forces in traditional agricultural system and taming livestock are decreasing. Number of livestock has been decreased because of scarcity of fodder, water resources and grazing land. As a result, the income from livestock is decreasing. Natural hazard and uncertainty is increasing everywhere. Cash crops such as mustard, zinger, coffee, turmeric and medicinal herbs are threatened either by extreme drought or spread of pests. In addition, increasing temperature is creating health problem in human life as well as livestock. They are putting pressure on monetary burden on households. To maintain these expenditure youth members of household are migrating either to semi-urban, urban and going to abroad for getting better opportunity. Overall economic status of the people of the study area is seemed to be satisfactory. People in study area are facing problem of scarcity of farm labor and

other agricultural problems due to the migration of youth from homeland to other places. Moreover, the cause of migrated people from village is found very less so the financial capital is playing away from village.

In nutshell, climate is threatening the life of people in rural areas and opportunities for livelihood have been narrowing down. Traditional sources of income are being inconvenient for survival. Poor, marginalized, women and children are affected more from climate change.

7.3 Recommendations

Different impacts of climate change have been observed in study site. To combat against the impacts of climate change some of the recommendations are made as follows:

7.3.1 Recommendations for Planning and Program Implementation

-) Awareness on climate change and its impact must be raised on rural communities. People are experiencing the problems of climate change. The reality is they do not know the exact cause and consequences of climate change.
-) The capacity for coping with the impacts of climate change must be strengthened. Local adaptation practices must be presented and promoted mitigation of climate change seems to be impossible for our country and from our effort so adaptation practices must be increased.
-) In order to reduce uncertainty on production of main crops and cash crops, insurance of crops must be done in local level. To pressure seeds of main crops and endemic crops gene bank should be established.
-) To reduce uncertainty on livestock farming, livestock insurance policy be implemented. To increase availability of water for irrigation and for the use of livestock reservoir and ponds/wells should be established. Rain water collection center and rainwater harvest system should be promoted improved for irrigation facilities that can improve the productivity of crops.

-) Crop diversification and crops intensification should be promoted; subsistence farming should be changed and commercialized. Cash crops should be promoted as the alternative to key crops, cash crops such as tea, mustard, turmeric, zinger, coffee can play vital role in improving livelihood of local people. For the commercialization purpose organic crop farming must be promoted.
-) To reduce damage of agricultural production from natural calamities like hail stone, water hazard (flood, flash flood, drawn, droughts) and weather forecast center should be developed; and the farmers getting loss from such problem should get immediate compensation from the government level.
-) To reduce encroachment on forest intensive farming should be done so that wild animals could also be protected and their habitat can be preserved too.
-) Awareness level for curing diseases and improving deteriorating health condition should be improved using traditional, indigenous techniques of preserving and utilizing medicinal herb and aromatic plants.
-) Indigenous knowledge on agriculture, taming livestock, handicrafts making and coping problem of climate change must be preserved and prompted.
-) To preserve biodiversity on local areas, awareness on the preservation of biodiversity at local level of rural communities must be increased.
-) To improve economic conditions of rural communities, local resources must be utilized to increase agricultural production.

7.3.2 Recommendations for Action Research

-) More studies need to be conducted on cultivation of cash crops and food security.
-) Depth study is needed to determine which species of main crops and other plants are lost and why and what implication has on livelihood strategies for local community implementing to preserve them.

-) More studies need to be conducted on climate change and in livestock pattern.
-) Research is also required on changing life style of the people in relation to climate change production and productivity of crops and income generating activities and direct impact on health.
-) Research is required on spectral impact of climate change such as water resources, agriculture production mainly cash crops and livestock management.
-) Loss of biodiversity and its implications on lives of the people should be studied.
-) Research is also required what should be the impact of youth migration to urban area in village and what should be the relation to climate change.
-) Increasing invasive species spread of diseases and use of pests and its implication of health.

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APPENDIX A
QUESTIONNAIRE

Dear

I am doing my research on “IMPACT OF CLIMATE CHANGE ON LIVELIHOODS OF RURAL COMMUNITIES: A Case Study of Shankarpokhari VDC, Parbat District”, and here are list of some questions. I am hopeful I will get full support from you regarding the queries that I want to get from you.

Name: (Optional/ if you want to keep secret)

Ward No..... Occupation..... Age.....

1. How many family members do you have in your family?

Age groups	Male	Female	Total
0-15 years			
16-25years			
26-60 years			
61 and above			

2. Please mention your sex.

a. Male b. Female c. Other

3. What is your main identity?

a. Student b. Teacher c. Farmer d. Business person e. Social worker

4. What is the main occupation of your family?

Agriculture/ livestock /employment / other.....

5. Please mention the literacy status in your family

a. Number of people who are unable to read/write.....

- b. Number of people who are able to read/write
6. Please mention the levels of education that they have completed.
- a. Up to class 5 b. Up to class 8
- c. Up to S. L. C /equivalent d. Up to +2 /Intermediate and above....
7. Do you have any idea on climate change?
- a. Yes b. No
8. If yes, what is its impact in our daily life?
-
9. What may be the cause in reduction of rain?
- a. Deforestation b. Over population
- c. Other.....
10. What kind of change have you have felt in raining pattern in comparison with previous years?
- a. Less b. More c. Same
11. What kind of change have you felt in monsoon season?
- a. Increase/Decrease in winter
- b. Increase/Decrease in monsoon season
- c. Increase/Decrease in both seasons
12. What kind of effects has been occurred due to excessive/less rainfall?
- a. Increase/Decrease in winter
- b. Increase/Decrease in monsoon season
- c. Increase/Decrease in both seasons
13. What is the effect of less rainfall?

- a. Rise on production b. Less production of crops
- c. No change d. Effects on cultivation/ no cultivation
- e. Others.....

14. What is the effect irregular rainfall pattern?

- a. Effects on cultivation b. Drown of harvested crops
- c. Waste harvested crops d. Irregularities in production
- e. Others.....

15. What kind of effects have been observing from excessive rainfall?

- a. Flood b. Land slide c. Drowned d. Other.....

16. Who are more affected from dry up of water resources?

Class/Effectuated	Male	Female	Child
Rich			
Medium class			
Poor			

17. How much extra time have you been spending due to dry up of water resources?

- a. Half an hour b. More than half hour c. More than one hour

18. What effects have been experiencing from increasing temperature?

- a. Increase in population of mosquitoes, files
- b. Diseases have been appeared in human being
- c. New disease is seen in livestock
- d. Others.....

19. What kind of change have you observed in temperature in comparison to last years?

- a. Increase in temperature b. Decrease in temperature
- c. Same as previous d. No idea

20. What sort of change/effect have you observed due to climate change on cash and food crops?

- a. Difficult b. Easy c. Same d. No idea
- e. Write any if you like to add.....

21. What kind of effects have you getting on rearing/keeping livestock after reduction of production of crops and grasses?

- a. Reduction on number of livestock b. Increase in livestock
- c. Same as previous

22. What kind of effects on crops have been observing due to increasing temperature?

- a. Shortening the time of reaping of crops
- b. Shortening the time of germination seeds
- c. Increase in the number of insects and diseases
- d. Other

23. What kind of species of crops have you abandoned cropping now days in comparison to previous years?

- a. b.
- c. d.

24. What sort of change have you been observing due to climate change on cash and food crops?

.....

25. Have you changed livestock profession due to change in availability of grass/fodder?

(Example cow instead of buffalo, pork instead of goat and poultry farming)

- a. Changed b. No changed

26. What type of livestock are you taming now?

- a..... b.....
c..... d.....

27. What types of animals are being decreased more this time?

- a. b. c.

28. What types of plants are being disappeared recently?

- a..... b.....
c..... d.....

29. Increase or decrease the number of wildlife?

- a. Decreased b. Increase c. No Idea

30. What kind of insects have been added which were not in existence in the past?

.....

31. What kind of insects have disappeared nowadays?

.....

32. What kind of diseases have appeared and increased by increasing temperature

- a. b.
c. d.

33. Can you suggest anything to get rid of environmental change? Please write/ mention.

34. Are you facing the scarcity of work force in your farm house? Can you add any points on it?

a.

b.

c.

35. Do you want to suggest anything on the issue of climate change? List out the suggestions categorically:

a.

b.

c.

❖ Thank You

Appendix B

Some useful Photos taken from Study Area

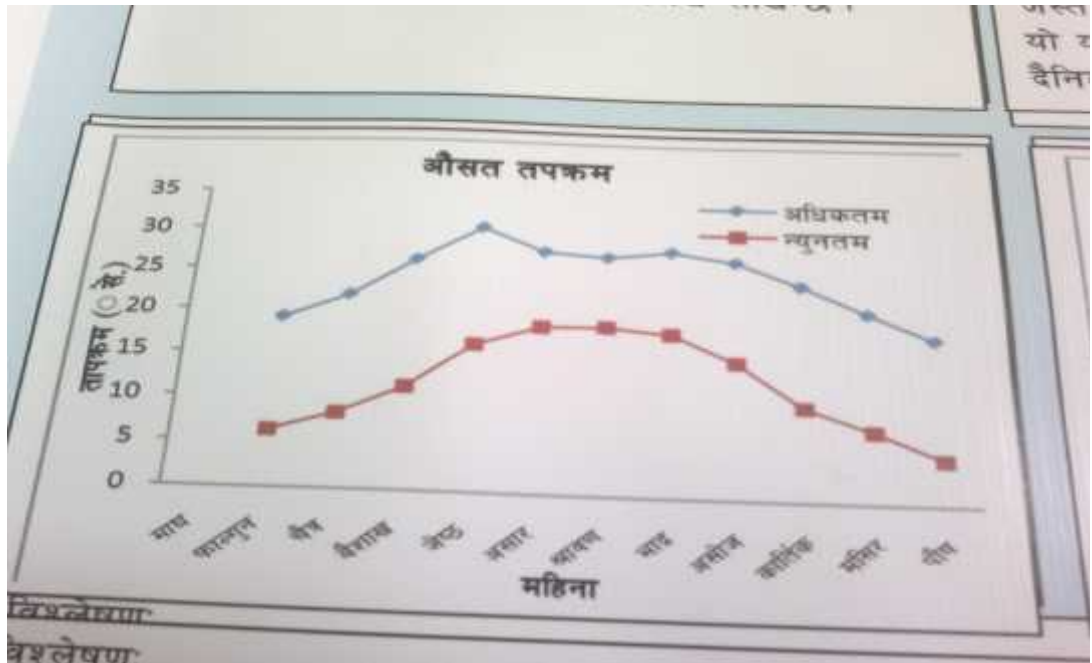


Plate 1 shows average annual temperature recorded in 2069 B. S.

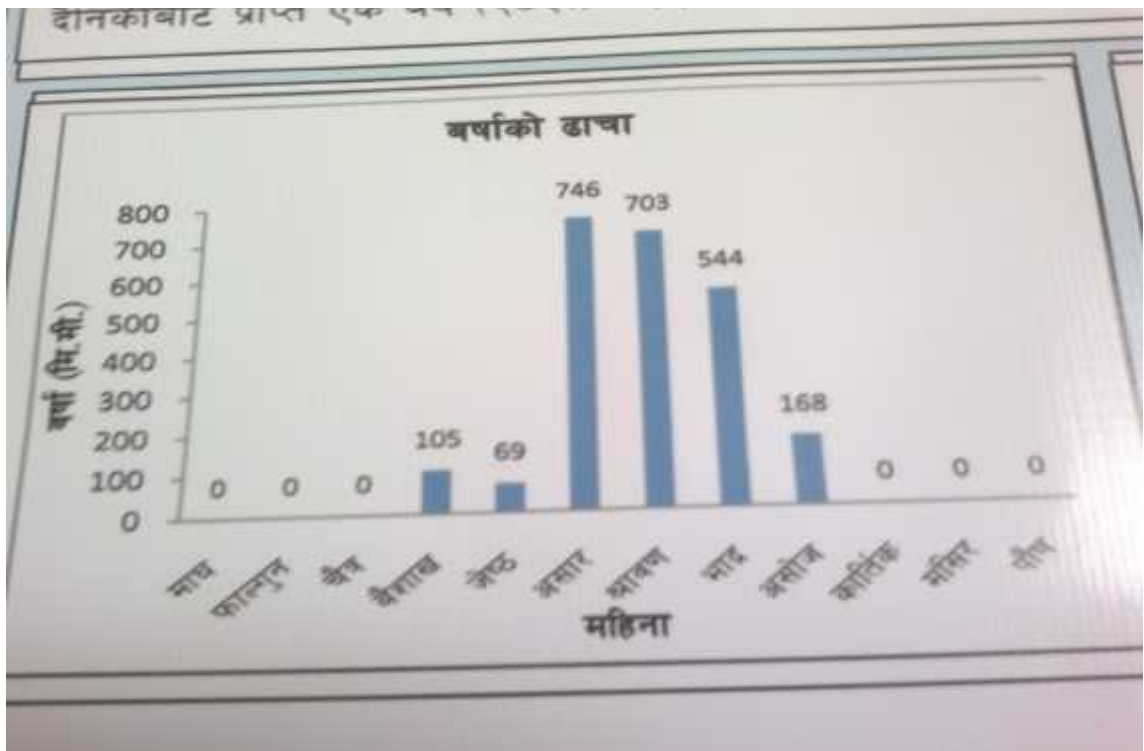


Plate 2 shows the annual pattern of rainfall recorded in 2069 B. S.

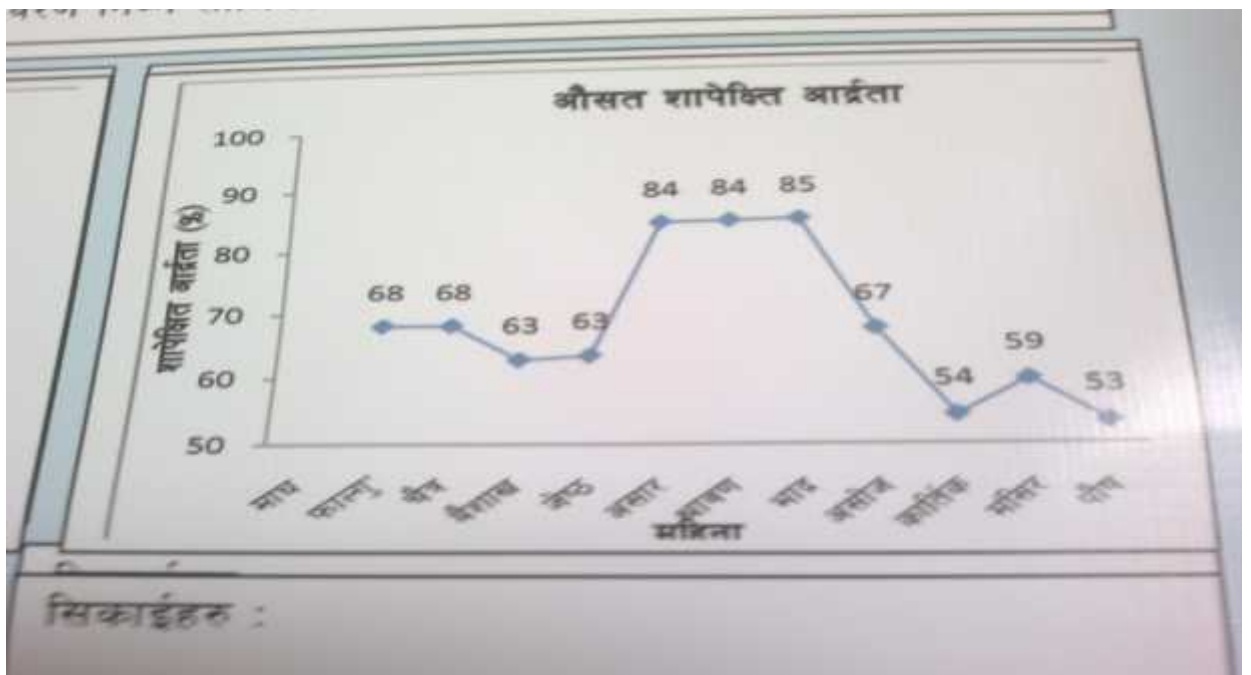


Plate 3 shows annual humidity recorded in Shankarpokhari VDC in 2069 B. S.



Plate 4 shows the place where environmental activities are recorded



Plate 5 shows the huge cemented pots used to collect water during monsoon period