CHAPTER –I

INTRODUCTION

1.1 Background of Study

Nepal is a multi-lingual, multi-ethnic, multi religious and multi-cultural Asian Landlocked democratic country, where as multi-geographical structure, Socio-cultural diversity and natural beauty. It has expanded in 147,181 sq. kilometers area, which is 0.03% of the world and 0.3% part of Asia. It is situated between two larger countries India and China. Geographically Nepal has divided in three parts Himal (Mountain) -15%, Pahad (Hill) 68% and Teral 17% regions. According to out of total covering area mountain covers 35%, the hill coer 42% and the Terai cover 23% of the land area. According to administrative view it has divided in fifth development regions, 14 zones and 75 Districts. In present constitution Nepal has divided into 7 federal states remaining implementation.

Most parts of area have situated in rural or villages in Nepal and 83% people are in the rural area. Economically, Nepal in developing and agricultural country. Agriculture is main occupation of Neplese people. Most of the Nepalese people involved in agricultural sector. They depend on agriculture. The development of agriculture is development of Nation. But it is effected by climate change. Climate change has become the main subject in the world nowadays. Climate change has become the challengious effect for the human civilization. The condition of atmosphere which is for a long period in the earth it is called climate. So climate is changing every period which can't be same ratio, it is called climate change. As a result, air condition, water condition and temperature condition is changing in the earth. By human activities green

house gasses are increasing now. As a result the temperature of the atmosphere is unbalance. For energy more use of coal and deforestation is increasing the carbon dioxide.

Climate change is the changing after a long time the average condition of the monsoon. Climate change is the changing for the ancient time. But it's more effects is applying in human well being. Nepal has already encountered same of the negative effects of global climate change. According to the national communication report prepared by the government of Nepal, net emission of Co_2 was about 9,747 tones and the net emission of methane was estimated to be 0948 tons in 1997. Studies done by Department of Hydrology and metrology show that average temperature in Nepal is increasing at a rate of approximately 0.06 degrees Celsius per year.

Climate is commonly defined as the average weather for a long period of time for the given region. Climate encompasses different components like temparature, precipitation, wind etc. Climate change is a statistically significant change in measurement of either theme an state. or variability or as a result of human interventions. (Provention consortium; 2007)

This is resulting in increase in the emission of green house gases reflecting variation in the climate statistics like temperature, precipitation and wind. (Orindi and Eriksen, 2005,28).

Greenhouse gases are present naturally in the atmosphere, where as few green house gases a consequence of human activity. The green hiuse gases that are present in the atmosphere naturally include water vapor, carbon dioxide, nitrus oxide, methane and ozone. There are few human activities and massive industrialization which increase the levels of most of these naturally occurring gases. Since the middle of 19^{th} century, human agriculture and industrialization, have dispensed an enermous

quantity of these green house gases into the atmosphere, where these have trapped enough heat to begin climate change. The effects of climate changes are comprehensive. Past and Current emissions mean that an increase in temperature of 1^0c to 1.5^0c is nevitable. Yet the increase of 0.6^0c that has already occurred is having a severe impact on global ecosystems and especially on poor people. To avoid the most serious impact of global warming and climate change, the global mean temperature should be limited to a 2^0c increase above pre-industrial levels. (*www.ciwf.org.**uk/climate-change***).

Temperature rises beyond 2^0c are likely to result in reduced crop yields in most tropical, subtropical and mid latitudes regions and some ecosystems will be irreversibly damaged or lost. It will contribute to result in much more flooding in low-lying areas with decline in food production, an increase in disease, and the extinction of plants, animals and entire ecosystems (*www.**ipcc**.ch/*).

Further, as a result of human activities, atmospheric concentrations of greenhouse gases are rising with them, global temperatures. In addition to increases in temperature, global Warming results in more extreme weather patterns; more rain, longer dry spells, stronger and more violent storms, more fires and the spread of tropical diseases. As climate change pushes the world toward more extreme weather, more and more people will be exposed to recurrent disasters during their lives. Ipcc (2007) predicted that there will be a widespread increase in the risk of flooding for many human settlements. Flooding and landslides, the unavoidable results of climate change, pose the most widespread direct risk to human settlements. It's estimated that by 2025 over half of all people living in developing countries will be highly vulnerable to floods and cyclones. Food, health, water and energy, the building blocks of livelihoods may

face many of the threats from and responses to global warming in the days to come. Without stopping the effects of global warming, it is clear that the viability of millions of people's lives and livelihoods will be undermined without significant new resources, millions of others won't be able to adapt to changes that are already happening. The information is more scant for countries like Nepal as underdeveloped countries are Vulnerable to climate because of the factors like persistent poverty, illiteracy and ignorance. World Bank (2003) also mentioned that all countries are Vulnerable to climate change but the poorest countries and the poorest people within them are most Vulnerable. The scarcity of adequate information flow on climate. Change trends slow down the task of effective policy formulation regarding adaptation and mitigation, (Aryal and Choudhary, 2009).

Making the poor countries and poor people more Vulnerable, Particularly, the poor and most Vulnerable people and the ecosystems in which they live on which they depend will bear the brunt of the impacts of climate change. In both developing and developed countries, the impact of climate change can be much greater for indigenous and dalits communities who rely most directly on their immediate environments for subsistence and livelihood often living in the more remote and ecologically delicate zone (*https://en.wikipedia.org,.*).

To propose the impact of climate change in Agriculture of Chhatedhunga VDC in Terhathum is alike to be possible in several perspectives. This might be taken as a model of climate change's impact. Terhathum is a one of the naturally beautiful district. In kirant peridd it was divides thirteen states (thirteen thum). Chhatedhunga is one of them. In chhatedhunga it is available that rice, maize, wheat, potato farm etc. The landscape of this area is diverse including terraces, slops and flat

lands covered by different types of vegetation. Most of the land is occupied by cash crops i.e. Tea, Broom grass, Big cardamom. This area is well forested with pine, utish, katush etc. But nowadays climate change is complex phenomena. So the impact is over many sector such as livelihood of people, forest, animal, plants, flora and fauna, agriculture etc. Here in this thesis, the researcher try to study of impact of climate change in agriculture of chhatedhunga VDC of Terhathum district. Therefore, the study is helpful for those people who take interest about climate change and its impact in agriculture and to gain about knowledge of climate change for struggling from it. Also we can divide the impacts of climate change among various sectors; water resources, health, forestry, agriculture, biodiversity, economy, tourism and so on. Here in this Study describes about impact of climate change in agriculture Sector.

1.2 Statement of The Problems

The historical and present condition between has been studying and analysis prove that climate change is changing before long time. Climate change has become common problematic subject in the world. Particularly, Urbanization and industrial society are main factors of climate change but it's effect has faced rural society and agriculture society. The lass of tap fertile soil due to soil erosion, landslide and folds coupled with negative effects of climate change way adversely reduce agricultural production in country. Nepal being agrarian country, in the absence of systematic irrigative facility, has to heavily depend upon natural rainfall (monsoon). So disturbances in natural rainfall pattern caused by climate change will responsible for enhanced food security and threat for Nepalese economy which is basically agriculture dependent.

Global warming may cause forest damage through migration towards the polar region, Changes in their composition, extinction of species. This would affect net only vast biodiversity of Nepal but also the livelihoods of majority of people who derive fuel, food, fodder, timber and medicines form forest. The growing risk of malaris, kalazar and Japanese encephalitis in commanded as the potential impacts of climate change on human health as warmer temperature may create favorable condition for more. Vectors and germs spread such mesquites particulary subtropical and warm temperature regions of Nepal would be more Vulnerable to malaria, Japanese encephalitis and kalazar. That's why the main cause of the research are given on the points;

(a) Less productivity became crisis livelihood because of the climate change.

(b) Agriculture sector and economic sector is becoming less day by day.

Global warming due to climate change has kept Nepal rich and diverse bio-diversity, ecology and infrastructure in the threat of destruction. An increased emission of greenhouse gases into the atmosphere is further aggravating these problems though Nepal with the carbon emission of less than 0.023% in one of the worst suffers of climate change in the world and most vulnerable to climate due to its geophysical and socio economic conditions. According to a recent study Nepal's atmospheric temperature is increasing at an alarming rate of about 0.410c per decade (Dahal and Kansakar, 2005).

Poor people, women and marginalized communities are highly Vulnerable to climate change impacts. Thus, in order to secure their livelihoods, it is imperative that climate change issues be mainstreamed as a key development concern. Nepal being a largely agarian economy is highly sensitive to changes in climate and natural resource availability.

Climate change threatens to reduce the effectiveness of development initiatives across Nepal. For example drying-added to a trend of warming will reduce food security and affect the availability of water resources. Further increases in the intensity of rains in other parts of Nepal particularly those where the topography is broken and soils eroded will experience increased flooding and landslide risks threatening human security, water supplies, urban infrastructure etc threatening all forms of livelihood of the poor people.

Nepal Agricultural Research council (NARC) has warned that the effect of a rise in temperature due to global warming will be greater on winter crops like wheat and millet. The vegetative state of those crops would be shorter with higher temperatures, thus lowering productivity (Upreti; 2003). All these scenarios are showing that cropping systems could change with climate change.

While the effects of climate change on glacial retreat and its associated hazards have been well assessed, there is paucity of information on its effects on Himalayan vegetation, as well as plant succession on recently deglaciated soils. Mountain communities are highly dependent on natural resources for the ecosystem services that they perform; Provisioning services (genetic resources, food, fiber, fresh water etc); regulating services (regulation of climate, water and human diseases); supporting services (Productivity; soil fertility and nutrient cycling); and cultural services (spiritual enrichment, recreation, aesthetics etc) (*https://en.wikipedia.org/*). Therefore, understanding the effects of climate change on Himalayan soil and vegetation dynamics is important for assessing impacts on mountain livelihoods, as well as for implementing effective conservation strategies.

There are very few studies regarding the impact of climate change in agriculture of particular place. This study helps to know the major thing about climate change and its impact as a phenomena. This study will help the scientists who interested about climate change and its impact. The main purpose of this study is to find out the impacts in agriculture from climate change of the study area and give some recommendations to develop the agricultural crops as a model farm in future.

1.3 Objectives of the Study

The general objective of this study is to know the impact of climate change in agriculture in Chhatedhunga VDC of Terhathum.

The specific objectives are;

(i) To assess the impact of climate change on agriculture production.

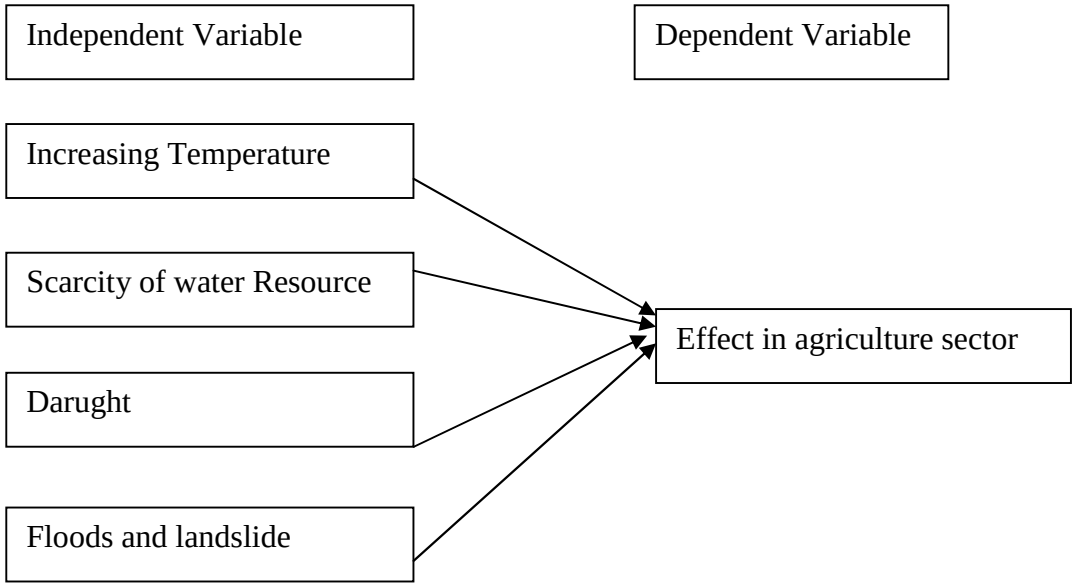
(ii) To analysis the impact of climate changes in rural livelihood.

1.4 Importance of the Study

The importance of studying the impact of climate change is increasing day by day. Because of climate change the crops are affected by climate and people have to know about climate and its effects. it is necessary to inform the effects of climate change for making dood environment for the coming generation. Today's necessity is to know the impact of climate change for making good environment. It has seen population growth and food scarcity present context. So, scientific study and analysis is necessary to know impact of climate change. What types of climate change effects on agriculture? Which place is effected by climate change? Which place is affected by climate change? It must be find out compulsory such kind of problems. We can know actual problem by the study and evaluation impact of climate change. So, to live being

happily human community must be conscious about impact of climate change. That's why conceptual frame work is shown given below.

Impact of Climate Change in Agriculture Sector.



Therefore, research work in this topic is more concerned with the subject matter of rural development.

1.5 Limitations of the Study

Any kinds of Research works have been done with in certain area of limitation. But it determines its nature, situation and area of study. This study has some limitations which are as follows;

- The research was conducted in chhatedhunga VDC of Terhathum district.
- The result was applicable only for the study area.
- The resarch was based on sample data collection in chhatedhunga VDC.
- The research was related with agriculture sector where included maize farm, paddy farm and other type of farming.
- There was used primary data and secondary data for the research work.
- The research was conducted within 25 households in study area.

- The conclusion/result derived from the research depends on the reliability primary and secondary data collected by different data collection instruments.
- This study was mainly based on the data of field survey and secondary information was also used as and where needed.
- The research highlights the present condition of impacts of climate change in agriculture of chhatedhunga VDC.
- The research was concerned only about the subject watter of climate change.

1.6 Organization of the study

This thesis is divided in to five chapters as follows:

- Chapter one - presents introduction of the study, statement of the problems, objective of the study, justification of the study and limitation of the study.
- Chapter two - discusses the relevant literature of different issues related to the climate change and its effects on agriculture from the different perspectives.
- Chapter three - presents the methodology adopted for the study to collect data from the field and the method of analysis.
- Chapter four - presents the introduction of the study area and research data analysis and presentation, the agricultural trends in chhatedhung VDC, impact of climate change in agriculture and biodiversity in Chhatedhunga VDC, problems faced by people of Chhatedhunga VDC of impacts of climate change.
- Chapter five - Presents summary, conclusion and Recommendations.

CHAPTER - II

REVEW OF LITERATURE

Climate change is the greatest issue in the world. Different scholars and organizations have defined climate change self style. In this regard, 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 water. The effects of green house gases on both drought and flooding events have been found. Including several winter drought and excessive monsoon flooding. Climate change has been alarming in the world by global warming which caused by increasing concentration of green house gases (GHG_so) physical impacts of climate change and deforestation. In Nepal 95% of (GHG_so) emissions from forestry sector only. The consequences of global warming have seemed globally to specifically in developing and in to mountainous countries like Nepal has high Extensity rainfall during raing season. It resulted heavy floods, landslides and soil erosion. It also common to find drought in many parts of Nepal that comes out the impacts of climate change are evidences on sectors like forest, water resources, agriculture, human health and biodiversity in Nepal. Likewise, altogether 14 glacial lake outburst floods (GLoFs) have happened between 1935 and 1991 in Nepal. In total 21 GLF_s have been identified as being potentially dangerous at present. In this way, climate change and livelihoods integral part and have voice versa relationship. The low income and subsistence users are about 38% of total population of Nepal lies below the poverty line have hard time to afford for their livelihoods in Nepal. That is a great challenge to cape with climate change induced hazard and extreme events. The livelihoods

of more than 80% local people of hilly area such as agriculture forest and livestock and on other natural resources such as water and irrigation.

Some of the literature related to study have been discussed as follows;

Nepal has felt the adverse impact of climate change even though its contribution to global green house gases (GHGs) is negligible. Many scientists have expressed concern that the general rise in temperatures at high altitudes poses a serious environmental and humanitarian threat in Nepal as many glaciers and glacial lakes are located in the high Himalayas. For this study, I have observed rising temperatures in the Langtong catchment are decreasing. Given these findings, Nepal may be facing increasing water scarcity while also keeping more serious watch on glacial melt. (N.P. Gautam;2008).

Climate can be defined as the average weather. scientifically, climate is the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. (www.en.pumpash.com,2008).

Climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. (www.en.pumpash.com, *2008*).

Climate change may be due to anthropogenic causes or natural processes. The united Nations Framework convention on climate change (UNFCC) also defines climate change in Article 1 as follows; "A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable times periods."(www.en.pumpash.com, *2008*).

Anthropogenic climate change refers to climate change resulting from human activity. Human activity that could possibly change the climate include emission of gases into the atmosphere, industrial activities, development of extensive cities, pollution of water ways and cities, diversion of water, creation of thousands of dams and lakes, conversion of grassland or forest to cropland and agricultural activities. (Piechota and Garbrecht, 2006).

Global warming is considered as one of the major factors causing climate change. Even a conservative estimate of 1^0c increase could have dramatic effects for all aspects of human life. For example, during the medieval warming period (1200-1500A.D.), and during the little ice age (1600-1700A.D.) The average temperatures were 0.5^0chigher and 0.5^0c lower respectively than they are today (*https://www.jstor.org,*1997).

Scientific studies have shown that due to a higher concentration of GHGsi the atmosphere, global warming has intensified. The higher carbon dioxide concentration has resulted from burning of fossil fuels (coal, oil and natural gas) and deforestation. The global carbon dioxide (co2) concentration increased from 316 parts per million (ppm) in 1959 to 389 ppm in 2008. (Gantam; 2010).

Nepal is a mountainous and landlocked country having an area of 147,181 square. kilometers. The country is located between $26^0$22' to $30^0$27' north latitudes and $80^0$04' to $88^0$12' east longitudes. It occupies about 0.03 percent of the total land of the earth and about two-thirds of its land is hills and mountains. It extends approximately 885km east to west and about 193km north to south. Elevation of the country starts from 61 m to 8848 m within a span less than 200km. The world wildlife Fund (2005) reports that the Nepal Himalaya contains 3,252 glaciers and 2,323 lakes above 3,500m above mean sea level (amsl). Glaciers cover an area

of 5,323km_2 with an estimated ice reserve of 481km_3. By basin, the koshi River contains 779 glaciers and 1062 lakes; Gandaki River basin consists of 1025 glaciers and 338 lakes; the karnali River basin consists of 1,361 glaciers and 907 lakes; and the Mahakali basin (within Nepal), consists of 87 glaciers and 16 lakes. Glaciers are an important means of freshwater storage in Nepal as they accumulate water in monsoon and winter seasons at higher altitudes and provid melt-water at lower elevations during the dry seasons. The importance of glaciers extends beyond Nepal; the Ganges Basin draws up to 80% of its water flow from Nepal rivers. (*www.**worldbank**.org,*2012).

Impacts of climate change can be categorized both positively and negatively. In a positive sense, winters will be less cold and more vegetation can be produced in high altitudinal areas. However the rise in mean temperatures, currently projected to be as high as 5.8^0c. over the next century, may produce several of the negative consequences listed in table. (www.en.pumpash.com*, 2008*).

In global context, 2009, ranked as the fifth warmest year on record since the beginning of instrumental climate records around 1859. On the decadal scale, the 2000_s (2000-2009) were warmer than the 1990s, which in turn were warmer than the 1980s and earlier decades. (WMO; 2009). n

Water distribution is uneven in Asia and it has a large and dense population with a fast growth rate. In this setting, it is expected that climate change will intensify water scarcity in Asia, adding to already present socio-economic stresses. (www.en.pumpash.com*, 2008*).

The Himalayan regions are located in the northern part of Indian sub-continent. The Himalayan region contains many rivers and the abundance of water in the area influences meteorological and hydrological conditions in the Indian sub-continent. It is assumed that

even a minor change in the climate of the Himalayas could cause disastrous consequences on the socio-economic condition of millions of peoples living downstream of the river systems. (Bhutiyani:2007).

Climate change may be intensifying the spread of mosquito-related diseases such as malaria, dengue fever, Ross River Virus and west Nile Virus. (*www.**climateinstitute**.org.au,*2013).

Gaire (2005) studies dynamics of Abiesspectabilisin relation to climate change at the tree line eco tone in langtang National Park. They collected tree core sampling and found that upward advancement of tree line should be expected in the coming decades. They further included that the general increase of winter minimum temperatures might be responsible for the upward advancement of the tree line and early melting of snow.

Chaudhary and Bawa (2011) conducted field surveys in Darjeeling and west Bengal of India and in the Ilam district of Nepal to analyze local perceptions of climate change. Respondents reported changes in bio diversity such as early budburst and flowering, new agricultural pests and weeds, and the appearance of mosquitoes. They also reported that temperature increases appeared to be more rapid at higher altitudes.

Nepal Agricultural Research council (NARC) has warned that the effect of a rise in temperature due to global warming will be greater on winter crops like wheat and millet. The vegetative state of those crops would be shorter with higher temperatures, thus lowering productivity. All these scenarios are showing that cropping systems could change with climate change (Upreti; 2013).

The average number of 'hot' nights per year in Nepal increased by 9 and the average number of 'cold' days per year has decreased by 19 of days between 1960 and 2003. 'Hot' day or 'hot' night is defined by the

temperature exceeded on 10% of days or nights in current climate of that region and season (*www.**undp**.org,*2008).

A general circulation model (GCM) projection has shown that mean annual temperatures are projected to increase by 1.3 to 3.8^0c by the 2060s and 1.8 to 5.8^0c by 2090s. (*www.**undp**.org,*2008).

Several temperature analyses in Nepal have shown that warming is occurring at much higher rates in the high altitudinal regions than in the low altitudinal regions. (Aryal: 2013).

Chaulagain (2009) studies glaciers in langtang Himalayas and found that they may disappear within two centuries at current temperature rates. Seventy-five percent of langtang glaciers will disappear within 3-4 decades and only 24% of the basin may remain by 2100 AD even without any further warming.

While the effects of climate change on global retreat and its associated hazards (e.g GLOFs) have been well assessed, there is paucity of information on its effects on Himalayan vegetation, as well as plant succession on recently deglaciated soils. Mountain communities are highly dependent on natural resources for the ecosystem services that they perform; provisioning services (genetic resources, food, fiber, fresh water etc); regulating services (regulation of climate, water and human diseases); supporting services (productivity, soil, fertility and nutrient cycling); and cultural services (spiritual enrichment, recreation, aesthetics etc) (ICIMOD; 2009). Therefore, understanding the effects of climate change on Himalayan soil and vegetation dynamics is important for assessing impacts on mountain livelihoods, as well as for implementing effective conservation strategies. (Gurung, Janita; 2012).

There is a worldwide consensus that global warming is a real, rapidly advancing and widespread threat facing humanity this century. Scientists have presented evidence and tested models to substantiate this truly alarming facts. The evidence confirms that man-made factors such as deforestation, agriculture, industries, automobiles, and the burning of fossil fuels, are contributing to Greenhouse Gas (GHG) emission, a major cause of global warming (www.en.pumpash.com).

The warming has manifold impacts on ecosystems and biological behaviors. Some widely discussed impacts include snow melting and glacier retreat, drought and deforestation, flooding, frequent fire, sea level rise, species shifts, and heightened diseases incidence. These ecological and biological responses can consequently lead to serious consequences for human wellbeing. (Mehl and Karl, 2000).

Temparature and precipitation are two important climate factors affected by climate change in general and global warming in particular. Although global average temperature was warmed and cooled many times in the past, it has been constantly rising since the mid-twentieth century and is likely to rise constantly in the future mainly due to an increased concentration of GHGs in the atmosphere without GHGs, the earth's surface temperature would be 60^0c cooler than it is today (Groom ; 2007).

Global warming is not only affecting climate and ecosystem, but it is also impacting human wellbeing. Warming affects various man-dominated ecosystems and biophysical systems that support human wellbeing. Agriculture is affected most when drought adversely impacts rain-fed agriculture, largely in developing countries where the majority of farmers practice subsistence agriculture. (Pimeatal and Pimeatal; 2006).

Ecosystem degradation often follows the floods, GLOF and droughts caused by snow melting and heavy rain. Floods carry debris downstream, affecting soil properties, hydrology, hydrochemistry, evapo-transpiration and microbial activities. Water upsurge and debris flows triggered by GLOF have damaged forests, agricultural lands, walking trails, bridges and rivers as for as hundred of meters downstream (www.**unep**.org, *2002*).

As in other regions of the world, climate and ecological changes caused by global warming have resulted in several negative consequences for people's health, the economy and livelihoods in Nepal. Every year, diseases and natural calamities caused by such changes claim the lives of several people, the majority being poor women and children who lack the capacity to adopt to change. For instance, Diarrhea kills 28,000 people annually in Nepal and most of the affected are children below age 5. (http://www.pnas.org/content/109/40/16089).

It is likely that when the weather gets warmer, microorganisms become more active and act more quickly on the foods we eat. Since people in developing countries often have poor sanitation and lack refrigeration, and thus have no choice but to eat leftover foods, they are likely to be affected by such pathogens very easily. Foods following ice melting and lake outburst or river overflow also kill several people by adversely affecting water quality from debris carried by adversely affecting water quality form debris carried along with the flood. Between 2000 and 2005, more than 1300 people, mostly poor, were killed by floods and landslide related disasters. (CBS, 2006).

Agriculture the mainstay of rural food and economy that accounts for about 96% of the total water use in the country-suffers a lot from erratic weather patterns such as heat stress, longer dry seasons and

uncertain rainfall, since 64% of the cultivated area fully depends on monsoon rainfall. (CBS, 2006).

The earth has warmed and cooled several times as a natural process and will do so in the future. What concerns the global community is the alarming constant, yet unprecedented, increase of temperature exercised in some regions. Scientists are now in agreement that human activities releasing GHGs into the atmosphere are responsible for the already observed global warming causing climatic changes. (*https://www.**ipcc**.ch/*).

It is important to reduce the effects of climate change by restraining activities that produce carbon and other green house gases. Certain mitigation measures can be followed to reduce carbon emission and enhance carbon sinks, as suggested by the international community and agreed upon in conventions. Forests provide a carbon reservoir as they contain about 60% of all carbon stored in terrestrial ecosystems and they serve as important adaptation buffers. Since deforestation contributes about one-fourth of global carbon emissions, the first and most important task is to curb deforestation and invest in reforestation activities. This can be achieved by providing rural people with alternative energy sources, such as biogas, solar power and hydroelectricity and by adopting better land use management to improve carbon sinks. If we preserve forests, they can store large amounts of carbon and reduce warming substantially. Non-agriculture employment and other alternative income source can also reduce the dependence of people on forest resources. In forming, better agricultural technologies, including introduction of drought-tolerant (water-stess) crops that perform well with low external imputs (e.g. chemical fertilizers, pesticides), can also offset crop losses that might be caused by drought. These measures all require strong and vibrant policies and commitment to international

treaties such as facilitation of the clean Development Mechanism (CDM) and carbon markets that facilitate payment for important environmental services. (Chaudhary and Arayal, 2009).

The greater Himalayan region, sometimes called the 'Roof of the world', is noticeably impacted by climate change. The most widely reported impact is the rapid reduction in glaciers, which has profound future implications for downstream water resources. The impacts of climate change are superimposed on a variety of other environmental and social stresses, many already recognized as severe. (Ives and Messeri, 1989).

The 'roof of the world' is the source of ten of the largest rivers in asia. The basins of these rivers are inhabited by 3.1 billion people and contain seven megacities. Natural resources in these basins provide the basis for a substantial part of the region's total GDP and important environmental services, which are also of importance beyond the region. (Penland and Kulp, 2005).

Continuing climate change is predicted to lead to major changes in the strength and timing of the Asia monsoon, inner Asian high pressure systems, and winter westerlies the main systems affecting the climate of the Himalayan region. The impacts on river flows, ground water recharge, natural hazards, and the ecosystem, as well as on people and their livelihoods, could be dramatic, although not the same in terms of rate, intensity, or direction in all parts of the region. Given the current state of knowledge about climate change, determining the diversity of impacts is a challenge for researchers, and risk assessment is needed to guide future action. (Shrestha, Baidhya and Nepal 2006).

The Himalayas display great climate variability. The mountains act as a barrier to atmospheric circulation for both the summer monsoon and

the winter waster lies. The summer monsoon dominates the climate, lasting eight months (March-October) in the eastern Himalayas, four months (June-september) in the central Himalayas, and two months (July-August) in the western Himalayas. (Chalise and Khanal, 2001).

The east-west Variation is based on the dominance of different weather systems, which in turn cause the monsoon to weaken from east of west. The monsoon penetrates north wards along the Brahamaputra River into the southest Tibetan Plateau, but rarely as far as the karakoram. (Hofer and Messeril, Ress and Collins, 2006).

The monsoon rainfall is mainly of an orographic nature, resulting in district Variations in rainfall with elevation between the southern slops of the Himalayas and the rain shadow areas ont the Tibetan Plateau. On the meso-scale, the impacts of climate are mainly due to local topographic characteristics. (Chalise and khanal, 2001).

Climate change is curreutly taking place at an unprecedented rate and is projected to compound the pressures on natural resources and the environment associated with rapid urbanization, industrialization, and economic development. It will potentially have profound and widespread effects on the availability of, and access to, water resources. By the 2050s, access to fresh water in Asia, particularly in large basins, is projected to decrease. (Shrestha, 2004).

The location and area of natural vegetation zones on the Tibetan platean will change substantially under projected climate change scenarios. Areas of temperate grassland and cold temperate coniferous forest could expand, while temperate and cold deserts may shrink. The vertical distribution of vegetation zones could move to higher altitude climate change may also result in a shift of the boundary of the farming-pastoral transition region to the south in Northeast china, which may

increase grassland areas and provide more favorable conditions for livestock production. However, the transition area of the forming. Pastoral region is also an area of potential desertification, and of protection measures are not taken in new transition areas, desertification may occur. (Li and Zhou, 2001).

Mountain ecosystems contain a series of climatically very different zones within shert distances and elevations. They display a range of micro-habitats with great biodiversity. Mountain ecosystems are sensitive to global warming and show signs of fragmentation and degradation. (xu and wikes, 2004).

The impacts of climate change on forest ecosystems include shifts in the latitude of forest boundaries and the upward movement of free lines to higher elevations; Changes in species composition and in vegetation types; and an increase in net primary productivity. In the eastern Himalayas, forest vegetation will expand significantly; forest productivity will increase from 1 to 10%; and it is expected that forest fires and pests such as the North American pinewood nematode will increase as dryness and warmth increase. (Rebetez and Dobbertion, 2004).

The impact of climate change on health conditions can be broken into three main categories; (i) direct impacts of for example, drought, heat waves, and flash floods, (ii) indirect effects due to the spread and aggravated intensity of infectious diseases due to changing environmental conditions, (iii) indirect effects due to climate induced economic dislocation, decline, conflict, crop failure and associated malnutrition and hunger. The latter effect includes the expansion of vector-borne diseases such as diarrhea. Regions such as the Hindu Kush-Himalayas, located at eht fringe of the current geographic distribution of these and many other diseases, are particularity susceptible to the negative effect of rising

temperatures. It is projected that the spread of malaria, Bartonellosis, lick-borne diseases and infectious diseases linked to the rate of pathogen replication will be enhanced. Malaria mosquitoes have recently been observed at high altitudes in the region. (Eriksson, 2008).

However, there are also expected to be positive climate change induced effects on the health status of certain populations in the Himalayan region. High altitude areas will open up to new types of agricultural production and new types of agricultural production and new livelihood opportunities, people will find their homes and villages more comfortable due to less cold conditions, and the risks associated with cold and respiratory diseases will be reduced as the use of fuelwood for heating is reduced. (*https://books.google.com.np/books*).

The impact of climate change on the Himalayan cryosphere is not understood sufficiently to be able to estimate the full scale of the downstream impact of reduced snow and ice coverage. While in-depth studies of glaciers, snow and permafrost have been carried out in some areas, they are scattered widely in space and time. Few detailed are scattered widely in space and time. Few detailed investigations of the response of snow and ice to climate warming have taken place in the Himalayan and other high ranges. Baselines studies are lacking for most areas, particularly for areas higher than 4,000 most, and there has been little long-erm monitoring of climatic variables, perennial snow and ice, runoff and hydrology in the extra ordinary heterogeneity of mountain topography. (Lin and Chen 2000: Rees and Collins 2006; Messerl; 2004).

In addition, the one common feature that all mountain areas share with one another complexity caused by topography-causes temperature and precipitation to vary over very short distances, which in turn makes projection difficult. (Becker and Bugman1997).

Three levels of impact to climate change can be identified; (i) local effects; (ii) downstream effects; and (iii) global feedback effects. The development of adaptive strategies can be approached from the perspective of each of these three different levels. Firstly, adaptive strategies can be developed at the local level, looking at local effects within the Himalayas and giving priority to local adaption. Secondly, adoptive strategies can be developed from the perspective of the downstream level, evaluating the downstream effects of climate change and designing adaptive strategies around these effects. Thirdly, adaptive strategies can be on the global level, based on the potential feedback mechanism of the environmental changes in the Himalayas to global warming. Ass three levels are interlinked and inter related, but full of uncertainty. (Backer and Bugman, 1997).

Few model simulations have attempted to address issues related to future climatic change in mountain regions, primarily because the current spatial resolution of models is too crude to adequately represent the topographic and land use details. (Beniston, 2003).

Most climate models and predictions for high-altitude areas (above 4,000 masl) are dependent on extrapolation from hydro metrological stations at comparatively low altitudes and upon assumptions based on other, better studied, parts of the world. (Rees and Collins, 2004).

Environmental and ecological changes noted in the Nepal Himalaya indicate that global warming will have a serious impact on the lives and livelihoods of indigenous communities. Many mountain-living indigeneous peoples depend on agriculture for their livelihood and there is increasing concern that climate change will have a significant aderse impact on forming. The study into indigenous peoples views on climate change revealed that landslides, soil erosion and debris flow as a

consequence of melting glaciers, as well as changing rainfall patterns, are leading to low productivity and crop failures are affecting many Himalayan indigenous forming communities, who are increasingly facing food insecurity. (Rai, 2009).

However, the relationship between climate change and glacial retreat and the impact on indigenous communities is not yet sufficiently understood and studies to develop an appropriate response in the form of policies adaption and mitigation initiatives, let alone disaster management programmers. Understanding how climate change affects indigeneous communities in mountain areas is vital as governments and international organizations develop strategies to reverse current global warming trends, producing treaties such as the Kyoto protocol and United Nations Framework convention of comate change. (Rai, 2009).

The 'greater Himalayan region', sometimes called the 'Roof of the world', is noticeably impacted by climate change. The most widely reported impact is the rapid reduction in glaciers, with profound future implications for downstream water resources. The impacts of climate change are superimposed on a variety of other environmental and social stresses, many already recognized as server. (Ives and Messerli, 1989).

The impact of climate change on the Himalayan cry sphere is not understood well enough to support estimates of the full scale of the downstream impact of reduced snow and ice coverage. While in-depth studies of glaciers, snow and permafrost have been carried out in some areas, they are scattered widely in space and time. Few detailed investigations of the response of snow and ice to climate warming have taken place in the Himalayan and other high ranges. Baseline-studies are lacking for most areas, particularly for areas higher than 4,000 masl, and there has been little long-term monitoring of climatic Variables, perennial

snow and ice, runoff and hydrology in the extra ordinary heterogeneity of mountain topography. (*https://books.google.com.np/books?isbn=9400778171*u).

The impact of climate change on health conditions can be broken into three main categories; (i) direct impacts from phenomenon such as drought, heat, waves and flash floods, (ii) indirect effects due to climate induced economic dislocation, decline, conflict, crop failure and associated malnutrition and hunger, and (iii) indirect effects dut to the spread and aggravated intensity of infectious diseases due to changing environmental conditions. (*https://books.google.com.np/books?isbn=1317015851*).

However, there are also expected to be positive climate change induced effects on the health status of certain populations in HKH region. High altitude areas, formerly too cold, will open up to new types of agricultural production and new livelihood opportunities, people will find their homes and villages more comfortable due to warmer conditions, and the risks associated with cold and respiratory diseases will be reduced as the use of fuel wood for heating is reduced. Valuable infrastructure, such as hydropower plants, roads, bridges and communication systems, will be increasingly at risk from climate change. Entire hydropower generation systems established on many rivers will be in jeopardy if landslides and flash floods increase, and hydropower generation will be affected if there is decrease in the already low flows during the dry season. Engineers will have to consider how to respond to these challenges (*www.oecd.org › Environment Directorate*).

People centered approach is considered in livelihood framework. And for people's livelihood different assets are required. Climate change increases difficulty in the livelihoods of the people Vulnerability is the degree to which a system is susceptible to and unable to cope with adverse effect of climate hazard. (*https://books.google.com.np/books*).

Climate change increases the depth of Vulnerability. The transformation in the external environment changes the natural, social, economic, health condition which makes people/community unable to cope with the events. To change the level of vulnerability is the most challenging job. Influencing policies, institutions and process will help in reducing the vulnerability of the people regarding the climate change. Though people have poor knowledge on the technical matters of climate change but there are several evidences which demonstrates that they have perceived, felt and experienced about its effects more on their livelihood. Therefore, because of climate change and the rising temperatures. Nepal could face drier phases during dry seasons with water monsoon (as soon as three times the current level of rainfall) with chances of flooding and landslides during rainy seasons with subsequent impacts on agriculture and livelihoods. (Alam and Regmi, 2005).

There are many evidences that show that how climate change is affecting people's lives and livelihood. The rain pattern over the years is a live experience. People have been facing longer and frequent droughts, erratic rainfall, storms, thunderstorm and hailstone. (https://papers.ssrn.com).

As a result crop failures are common; the cases of landslide, flooding/inundation, river side erosion are other phenomenon and further these are in increasing order. The spread of new water and vector borne diseases are other impacts of climate change. The most vulnerable ecological and socio-economic systems are those with the greatest sensitivity to climate change and the least ability to adapt. The evidence of prominent increases in the intensity and frequency of many extreme weather events such as heat waves, tropical cyclones, prolonged dry spells, intense rain full, tornadoes, snow avalanches, thunderstorms and

sever dust storms in the region. The impacts of such extreme events range form hunger and susceptibility to disease to loss of income and livelihoods affecting human survival and well-being. (Cruz,2007).

Ganfam (2007) reveal that due to changing patterns of rain, people are water induced disasters. More cases of landslides, soil erosion are recorded in the hilly region where as the Terai is affected by the flooding, inundation, river side cutting/erosion, sedimentations etc. These events have resulted crisis for livelihoods of small holder farmers as the flood impact more on the live and livelihood of rural poor.

Adger (2003) explains that the communities are faced with many risks from climate change. The risks are apparent in agriculture, fisheries and many other components that constitute the livelihood of rural population in developing countries.

As mentioned by senbeta (2009) in his study in Ethiopia disclose the fact that drought and delay in the onset of rain led to poor grass regeneration/forage deficit, water shortage and heat stress on livestock and consequently increased the mortality of the livestock, vulnerability to diseases and physical deterioration due to long distance travel for water and pastures.

Climate change has increased different types of diseases which have affected human health, predicted adverse health risks will affect the poor in particular throughout the developing world. These risks are in particular those associated with water-borne (such as dysentery or cholera), vector borne (such as malaria) diseases as well as heat stress, cold waves, morbidity and mortality. These health impact pose a double jeopardy for poor people's livelihoods; the contribution of key productive members of the household is lost and cost of health care is expensive and time consuming. Such risks will be widespread but the death of medical

care systems in many more remote, poorer areas of Africa and Asia in particular mean that the poor in these areas are the most vulnerable to these risks. (https://books.google.com.np)

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 specify-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 meaning of other terms related to climate change in addition to rising temperatures. Climate change refers to any significant change in measures of climate (Such as temperature, precipitation or wind) lasting for an extended period, decade or longer. Sudden and unexpected change in weather or season is known as climate change (sapkota, 2064)

Chaudhary and Aryal (2009) reveals strong need of government, civil societies, involvement of Ngo's for the high quality of outcome in the field of climate change and environment management.

In my opinion climate change is the common problems of the world. So, we should be aware from today.

CHAPTER-III

RESEARCH METHODOLOGY

Research methodology is necessary for any research work it is appropriate to present short account of methodological aspect which has been used for this study. There are various methodology that applied to get related information and facts for their specific research however, there is not only one method to collect the information related to all aspects of human society and used of more techniques is also not be a practical in terms of cost, time and so on. Therefore appropriate data collection technique should be selected for any study. So that the researcher could get maximum information by utilizing this time cost and other available resources. For this study a combination of data collection techniques are used. Reliable and relevant study can be made possible only by applying scientific method, so, the primary purpose of this chapter is to discuss and design the framework for the research.

3.1 Rationale for the Selection of the Study Area

This study focused on the impact of climate change in agriculture. Peoples of Chatedhunga VDC of Terhathum district are selected as the project for the study. Terhatum District is one of the famous districts for the agriculture as tea, cardamom, maize, millet, rice cultivation etc. It is situated between $26^0$18 north's latitude and $87^0$25 East to $87^0$45 East longitudes Chateduhga VDC is one of Terhatum district. It is called Athrai Pokhari panchayat befor 2037 Bs. The elevation of the VDC is 1204 meter to 2500 meter from the sea level. In the 19^{th} century one of cast of limbu is kandangwa who made as umbrella stone which is big and stayed in Terhatum is called in Nepali.' Chhata Jasto Dhunga' The name of Chhatedhung VDC derived from it. In this Chhatedhunga VDC various

types of plants are available which creates vegetation situation round the year. The land scope of this area is drivers including terraces, slopes and flat lands covered by different types of vegetation. Most of the land is occupied by cash crops, i.e. Tea, Broom grass, cardamom. This area is well forested with pine, utish, chhap, katush etc. Because of climate change VDC, there is available for orange, mango, utish etc, Climate is a one of the determining factor for human settlement as well as agricultural cultivation. If climate is suitable, there will be the great possibility to develop the agriculture. In chhate dhunga VDC the climate is sub-tropical which has made an applying atmosphere round the year. water resources are going to be disappeared so the life is very congested and not proper managed.

Such Type of research has not done in the past, such research study was necessary to be done; therefore, the researcher chooses this area as a research site.

3.2 Research Design

The present study is based on filed survey in order to fulfil the specific objectives of the study. Exploratory research design is applied. This study is based on both primary and secondary data, but the analysis is mainly depended on primary data, which is collect by questionnaire method. The research is applied of impact of climate change in agriculture in Chhatedhunga VDC of Terhatum. To meet the objective of the study (research) descriptive and exploratory research design has been adopted. The study depends upon the response of respondents. Since, the research aims at findings out the impact of climate change in agriculture in Chhatedhunga VDC of Terhathum District.

3.3 Nature and Source of Data.

The present study has been completed mainly with the help of primary data and also supported by the secondary data. Primary data has been collected by survey through different data collection tools and techniques.

Similarly, secondary data has also been obtained from published relevant book, newspapers, reports, bulletins and previously done dissertations. Both primary and secondary data are used for this study to make study more effective and authentic. Both qualitative and quantitative data were taken from the field work.

3.3.1 Primary Data

Primary data were collected from the field work, with the help of field survey (Interview, questionnaire, observations).

3.3.2 Secondary Data

Secondary data were collected whenever it was required. It was collected from previous relevant studies, Published and unpublished documents. Related literatures, Journals, books and various governmental and non-governmental records.

3.4 Universe and Sample Size of the Study

Chhatedhunga VDC word no 7 of Terhathum District has been taken as the universe for the study but due to various constraints whole universe cannot be studied. So, only the selected area of VDC has included as this research area. The respondents were selected by purposive sampling method and simple random sampling procedure has been used for survey of local residents who was interested about climate change. The purposive sampling method used to reach the problems and

to know the actual condition of the selected area out of 40 households, the sample size was selected 25 households in Chhatedhunga VDC. In general, the researcher visited in the study area and determined the population of worker by anther, used to purposive sampling method to select the respondent.

3.5 Techniques and Tools of Data Collection

In order to collect the required and relevant primary data following techniques were used in this study.

A. **Household survey:** Questionnaire 25 households were surveyed with the help of questionnaire prepared Prior to the visit of filed.
B. **Interview:** to take the information about impact of climate change in agriculture formal as well as informal interview was also taken with active and educated people in the study area. Interview was also taken with local residents through already prepared questionnaire.
C. **Observation:** Observation plays great role to know the real situation of the study area. To complete this dissertation filed observation was also conducted. Condition of cash crops, food crops, water resources, lack of drinking water were directly observed during the field survey period through participant and semi participant observation methods an observation from developed and used in order to obtain qualitative information observation technique is also applied for qualitative data.

3.6 Tools of Primary Data Collection

A. Structure questionnaire: All the necessary information was collected through a structured questionnaire the structured questionnaire was prepared intending to gather the information about climate. Both

open and close-ended types of questionnaire were prepared to get information from local people. The structured questionnaire is given in appendix.

B. unstructured Schedule: the data was also collected from checklist or instructed interview. The respondent of such interview were especially renowned persons of Study area as well as Terhatum District.

C. Site observation checklist: Different condition of water resources, forests, crops, cattle's were directly observation by the help of site observation checklist during the study period. Prior to the visit of the filed a checklist was prepared not to be confused during filed study for what to be observed.

3.7 Data Presentation and Analysis

When the field survey and data collection were completed. The gathered data and information were processed manually. The data were analyzed both in qualitative and qualitative ways. Descriptive analytical tools such as percentage table and charts were also presented wherever felt necessary.

CHAPTER-IV

INTRODUCTION OF THE STUDY AREA

4.1 Geographical Location

The study area lies in Terthum district which is situated in the eastern development region of Nepal. In the present context it lies in the region no.1 of Nepal according to the constitution of 2072 of Nepal, the hilly region among three ecological zones.

Terhathum district extends between 26^0 03 to 27^0 18 northern attitude and $87^0$25 to $87^0$45 eastern longitude this district is famous for model agriculture farming. Chhatedhunga VDC is one of the village's development committee of this district. The total area of VDC is 19.8 square k.m. (Source VDC report 2070bs). This VDC Is about 30km from distirct headquarter- Manglung bazaar. The elevation of the VDC is 946 meter to 1936 meter from the sea level. The landscape of chhatedhunga occupies divers structure including terraces, slops and flat lands that are covered by different type of cash crops. Most of the lands are occupied by cash crops i.e tea, cardamom and Broom grass.

4.2 Climate

Climate is a one of the determining factor for tourism as well as human settlement and agricultural cultivation. If climate is suitable, there will be the great possibility to develop Tourism and other things, in chhatedhunga VDC the Climate is subtropical Which has made an appealing atmosphere round the year. But the kartik, Mangsir and Falgun to Basishkh are the best month to visit this chhatedhunga VDC. The area gets heavy monsoon rain totalling 4000 mm annually. The month of June to Agust will have the maximum precipitation. The winter is cold and pleasant. Temparatumre during winter lies between 15^0c to 20^0 as

maximum and $0^0$to 3^0c minimum. The summer Climate is between 20^0c to 30^0c maximum and 15^0 to 20^0c minimum.

4.3 Vegetation

Vegetation is the main source for tourist attraction. So in this locality various types of plants are available which creates vegetation situation round the year. The landscape of this area is diverse including terraces, slopes and flat lands covered by different types of vegetation most of land is occupied by cash crops, i.e. Tea, Broom grass, Big cardamom. This area is well forested with pine, Uthish, Chhap, Katush etc.

4.4 People

In this locality different types of people are living with their own identify. The inhabitants their own identify. The inhabitants of this VDC are form different tribes and culture. Limbu, Rai, Yakkha, Tamang, Chhetri, Branhmin, Majhi, Magar, Newar, Biswakarma are in majority Eighty percpat people are engaged in agricultural occupation. They work in farm for Dhan Kheti (rice farm) and in tea garden either of their own or others as a wage labour. So, the people of this VDC is found to be diligent and their behaviour toward the visitors is very co-operative and positive. The festival (mahathasv) period most of the people were actively participate in the seasonal agricultural activities.

4.5 Culture

Very ancient temples and other religious may not be found in this area. Moreover, other tribes such as Limbu, Rai, Dewan (Yakkha), Tamang, Chhetry, Brahmin, Majhi, Magar, Parctices. Dashain, Tihar, Buddha Jayanti, Shivaratry, sakela, Chandi Naach, Dhan Naach are the

main festivals celebrated by the various tribes in this locality chhatedhunga VDC is the only tourism places for people.

4.6 Economy

Economy is the main factor for any sector of development. The main source of income in Chhatedhunga VDC is agricultural activities especially tea farming, Broom grass, Cardamom, Farming so, in this Chhatedhunga VDC economy is totally dependent upon the agricultural activities. About 90% peoples are engaged in agricultural farming. Most of the people are self-employee and some are working as a wage labour in tea processing and chhurpi, cheese factories. Due to the recently starting tea processing and chhurpi, cheese factories. Due to the recently starting tea forming activities, the economic condition of people's in this chhatedhunga VDC is gradually progressing as the production increase.

4.7 Transportation Facilities

Transpiration is the key factor for the development of business, agriculture, tourism, education, communication etc. Only the transportation facilities make it possible to travel from one place to another if the transportation or road conation is good, there is linked by main two roads.

One is Phidim via Athrai via Chhatedhunga which is about 30km. The major part of this road has been constructed and a bridge over Hewa Khaw and Tamor khola has been also completed. Moreover, about 15 km of road from Athrai to Chhatedhunga has been recently gravelled. So, the means of transportations are nowadays every comfortable to reach Chhatedhunga VDC via Dhankuta Basantapur- Mangulun-Chhatedhunga.

All wards of Chhatedhunga VDC are linked with dust motor able road. However horses are popular means of local transpiration in this VDC. During the rainy season (June-Augest) these roads are more slippery. So, the ravel in this season is very difficult. At the dry season (October-June) Some Means of transportation (taxi) are available that makes easy for the visitors.

4.8 Services (Health, Electricity, Water Supply)

One health post with an auxiliary health worker at Chhatedhunga VDC. Besides this Governmental health Services other 3 private medicine Shops are located in chhatedhunga VDC. They Provide additional Primary health services to the people. About 90% of Chhatedhunga area are facilitated with electricity services. In Case of drinking water, Chhatedhunga Drinking water and sanitation project has been providing drinking water facilities in chhatedhunga VDC. In other area, Drinking water is available by locally sources (own piped water).

4.9 General Introduction of VDC

Chhatedhunga VDC of Terhathum is the present studies are of this thesis. So, the general introduction of this VDC is described in the following section.

4.9.1 Population Composition of VDC

Population is the main part of the society. Different categories of Population play the vital role for the development of any area. the following table Shows the population composition of chhatedhunga VDC.

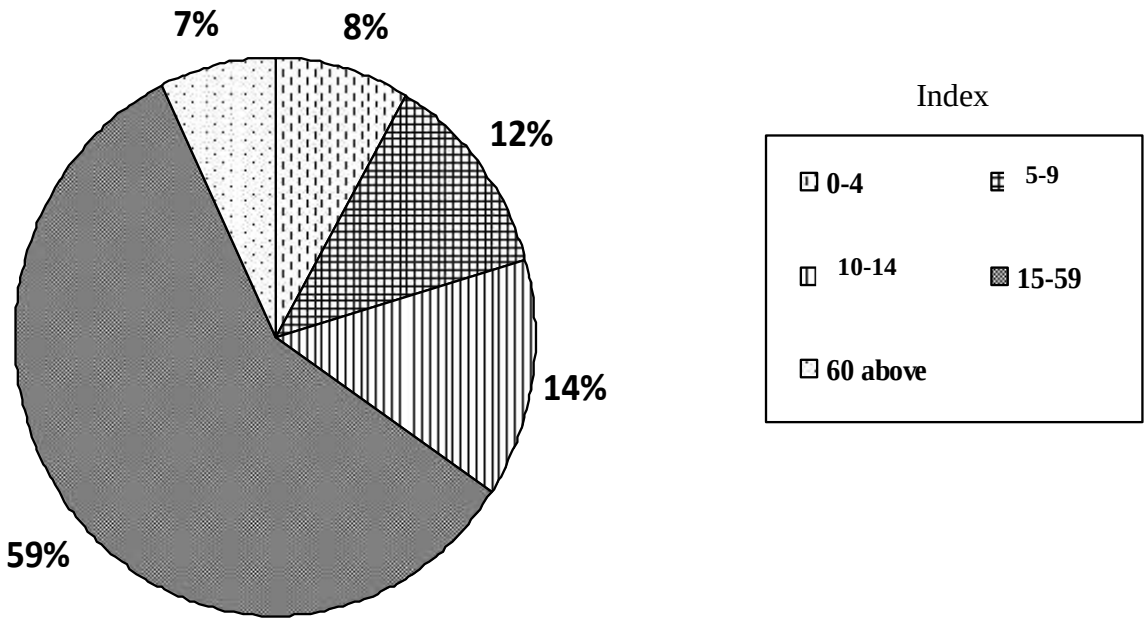
Table-4.1 Population Composition of VDC

Age group	Male	Female	Total	Percent
0-4	250	191	341	8.22
5-9	260	255	515	12.41
10-14	280	292	572	13.78
15-59	1150	1175	2425	58.46
60 abolve	170	125	295	7.11
Total	2110	2038	4148	100

Source: DDC Terhathum, 2072, BS

The table no 4.1 shows that in Chhatedhunga VDC total number of Population are 4148, among them the number of male population are 2110 and female are 2038. The highest number of population are 15-59 age group which is also called the active population and their number is 2425 both male and female.

Fig. 4.1 Population Composition of VDC



4.9.2 Literacy Level of VDC

Education is the best method to invest in human resource development. Educated people can read and write and they can obtain various information about the present changing world. Their behaviour is also affable to visitors.

The present total literacy percent is 73.68 in chhatedhunga VDC where male literacy percent is 83.15 and female literacy percent is 74.21 out of the total population of VDC. (Source: Village Profile, 2071)

4.9.3 Ethnic Composition of VDC

As we know Nepal has various ethnic groups, in the study area has also different cast and ethnic groups. There are 40 percent Limbu population in chhatedhunga VDC. Other ethnic groups like, Rai yakkha (dewan), Tamang, Chhetri, Brahman, Majhi, Magar, Newar, Kami etc are occupied less percent than limbu population. Limbu are living in chhatedhunga on 1659 out of total population 4148.

4.9.4 Occupation Structure of HSs Population in Chhatedhunga

Agriculture is the backbone of our country which Contributes 39 percent of national GDP. About 65 percent people are engaged in agricultural occupation. Some time our social hierarchy and deep-rooted social values set the occupation of people living set the occupation of people living in rural society. The following table shows the occupational structure of households' population in chhatedhunga VDC.

Tale-4.2 Occupation Structure of HHs Population

S.N.	Occupation	Total no of Population	Percent
1	Agriculture	3825	92.21
2	Teaching	45	1.08
3	Govt. Services	8	0.19
4	Police services	20	0.48
5	Army services	10	0.24
6	Medical services	20	0.48
7	Business	35	0.48
8	INGO services	60	0.84
9	Tailoring	10	0.24
10	Other	115	2.77
Total		4148	100.00

Source: VDC Profile, 2070, BS

The table no 4.2 clearly shows or presents that most of the people (92.21 percent) are engaged in agricultural occupation which is the main source of income. Similarly 2.77 percent are involving different occupation like some are carpenters, wage labour, driver, foreign employees etc. 1.44 percent are involving in local services, I/NGO services, 1.08 percent are engaged in teaching profession. Likewise 0.19 percent are in government services, 0.48 percent are in police job, 0.24 percent are in army job, 0.24 percent are involved in medical service, 0.84 percent are involved in business. So This data shows the main occupation in the study area is agriculture with comparison to other occupations.

4.9.5 Religious Structure of VDCs

Religion is the major parts of the Nepalese society. Different religious People are performing different behavior and activities and the religion also preserved the various cultural norms and values. The following table shows the religious structure of the study area.

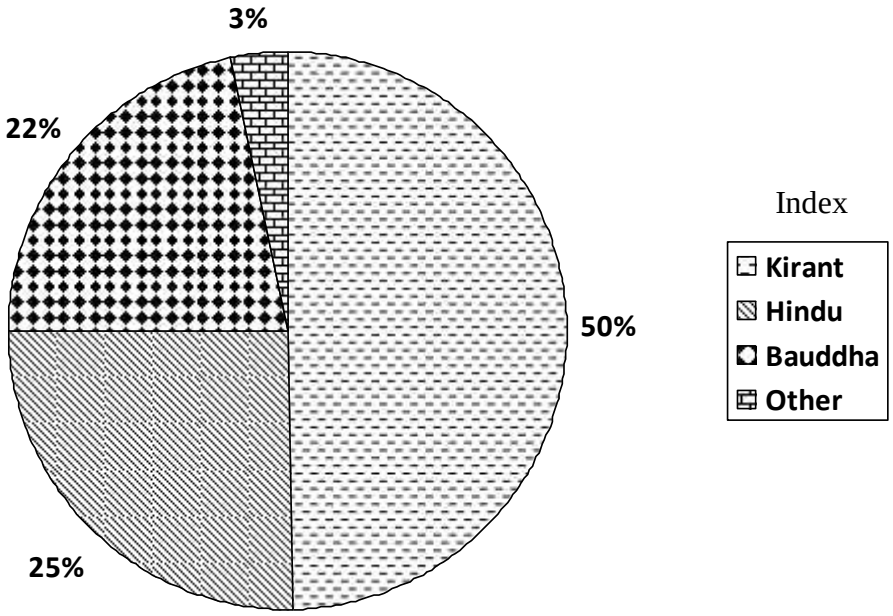
Table-4.3 Religious Structure of VDCs

Religion	No. of People	Percent
Kirant	2060	49.66
Hindu	1050	25.31
Buddhist	905	21.82
Others	133	3.21
Total	4148	100.00

Source: VDC Profile, 2070, BS

The table no 4.3clearly shows the religious structure of the study area. In Chhatedhunga VDC area there are 4148 population. Among the total population 49.66 Percent people are kirant. Which is the highest percent among other religions. Similarly, Hindu, religious people are 25.31 percent, Buddhist are 21.82 percent and besides other religious people are 3.21 percent.

Fig. 4.3 Religious Structure of VDCs



4.9.6 Land Holding Pattern of Households in Chhatedhunga VDC.

Land holding patterns of the households indicates the economic as well as social status of household in our traditional rural society. Generally it is believed that person who has possessed land will consider as of higher economic status and who have small size of land will consider as of poor status in the society. The land holding size of households in the study area is presented in the following table.

Table-4.4 Land holding pattern of Households in Chhatedhunga VDC

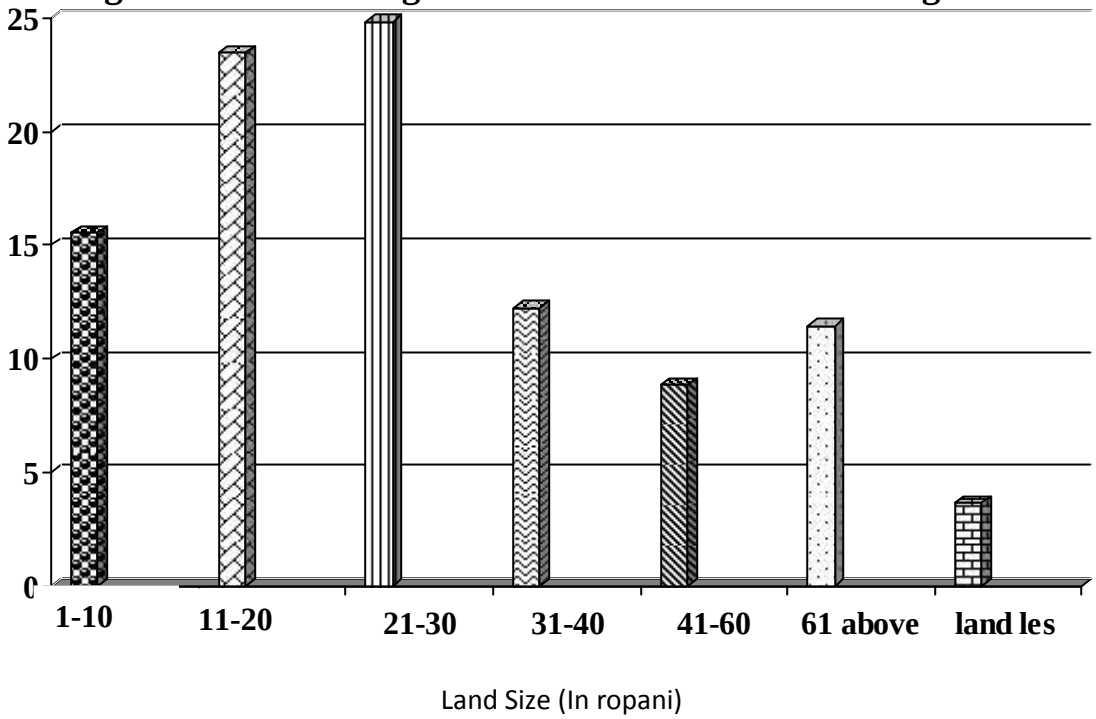
Land size (in ropani)	No. of HHs	Percent
1-10	137	15.53
11-20	207	23.47
21-30	219	24.83
31-40	108	12.25
41-60	78	8.85
61 above	101	11.45
landless	32	6.62
Total	882	100.00

Source: Village profile, 2070, BS

The above table no 4.4 clearly shows the landholding pattern of hose holds in the study area. In Chhatedhunga VDC, there are 24.83% households have 21-30 ropanies of land which is the highest percent out of total households. Similarly 32 households or 3.62 percent are landless.

The above data is shown in bar diagram as well

Fig. 4.4 Land Holding Pattern of HHs in Chhatedhunga VDC



4.10 Types of Paddy Production

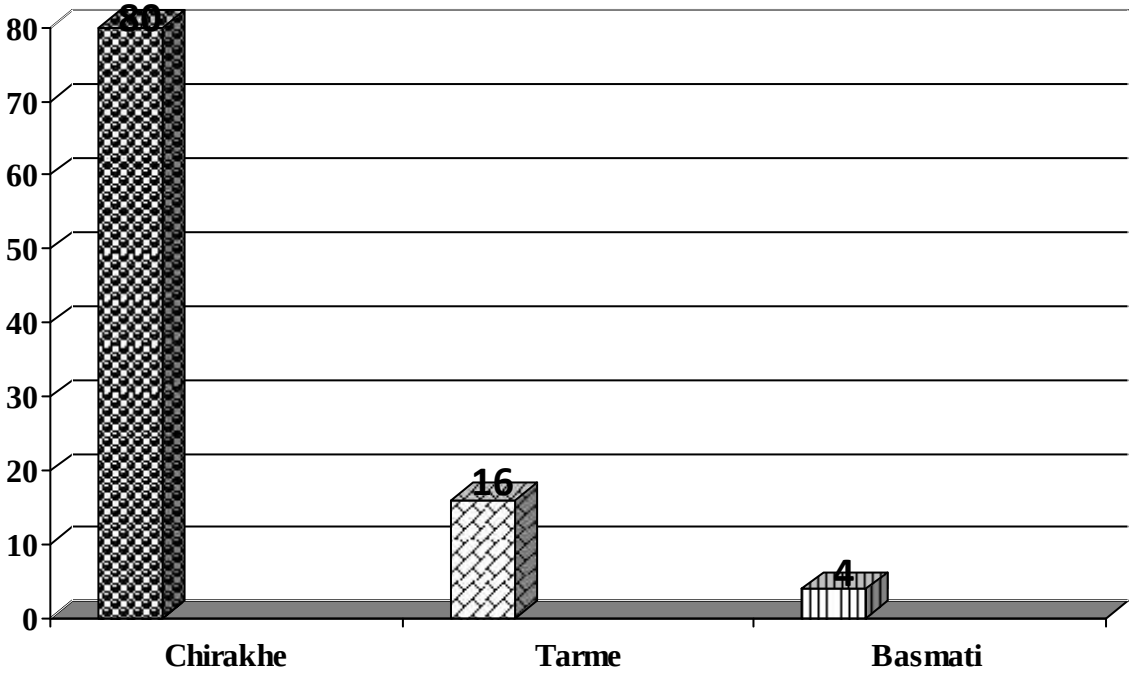
There are mainly three types of paddy production in Chhatedhunga VDC.

Table no.4.5 Types of Paddy Production

Name of paddy	No. of respondent	Percentage
Chirakhe	20	80.00
Tarme	4	16.00
Basmati	1	4.00
Total	25	100

Source: Field survey, 2016

Fig no 4.5 Types of paddy production



The table no. 4.5 (fig no. 4.5) shows that 80 Percent respondents say Chirakhe rice, 16 Percent respondents say Tarme rice and 4 percent respondents say Basmati rice is suitable for this land.

4.11 Scarcity of Water Resources

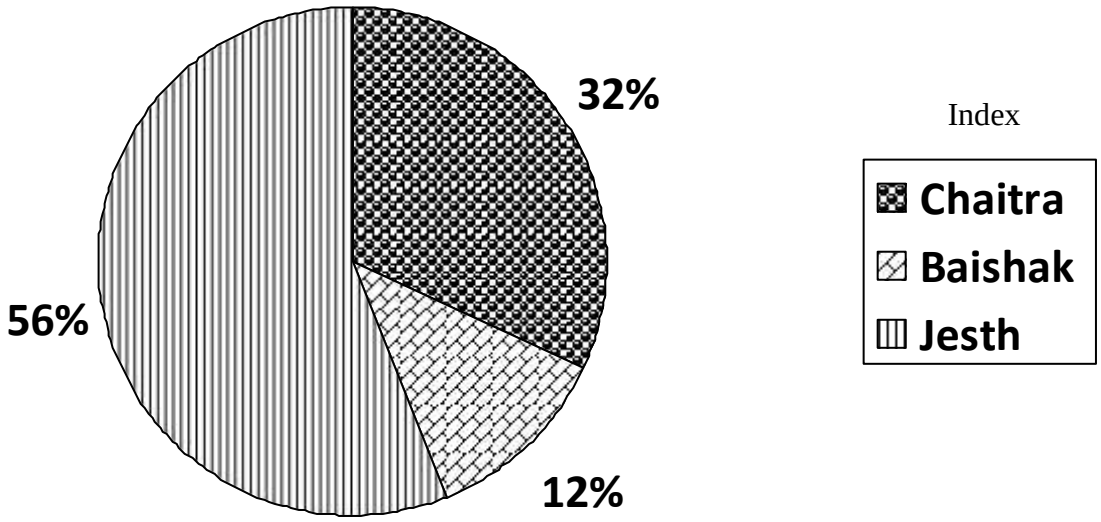
The most of the respondents reply that the water resources are going to be disappeared specially in Bishak and Jesth because of climate change or increasing temperature.

Table no. 4.6 feeling about water resources

Month of the year	No. respondents	percentage
Chaitra	8	32.00
Baishak	3	12.00
Jesth	14	56.00
Total	25	100.00

Sources: Field survey 2016

Fig no.4.6 Feeling About Water Resources



The table no. 4.6 (fig no.4.6) clarity that 32 percent respondent say water resources disappear in Chaitra, 12 percent respondent say water resources disappear in Baishak and 56 percent respondent say in Jesth.

4.12 Changing the Fruits Ripen Season

The most of the respondent feel about fruits ripe is in before time. They feel that many fruits are ripening quick or before time because of increasing temperature.

Table no. 4.7 Changing the Fruits Ripen Season

Saying Fruits are ripen	No. of respondent	Percentage
Ripen before time	20	80.00
Ripen in time	5	20.00
Total	25	100.00

Sources: field survey 2016

The table no. 4.7 shows that 80 percentage respondents reply that the fruits are ripen quick nowadays than three five years ago and 20 percent respondent reply that fruits are ripen in timely.

4.13 Land Ownership

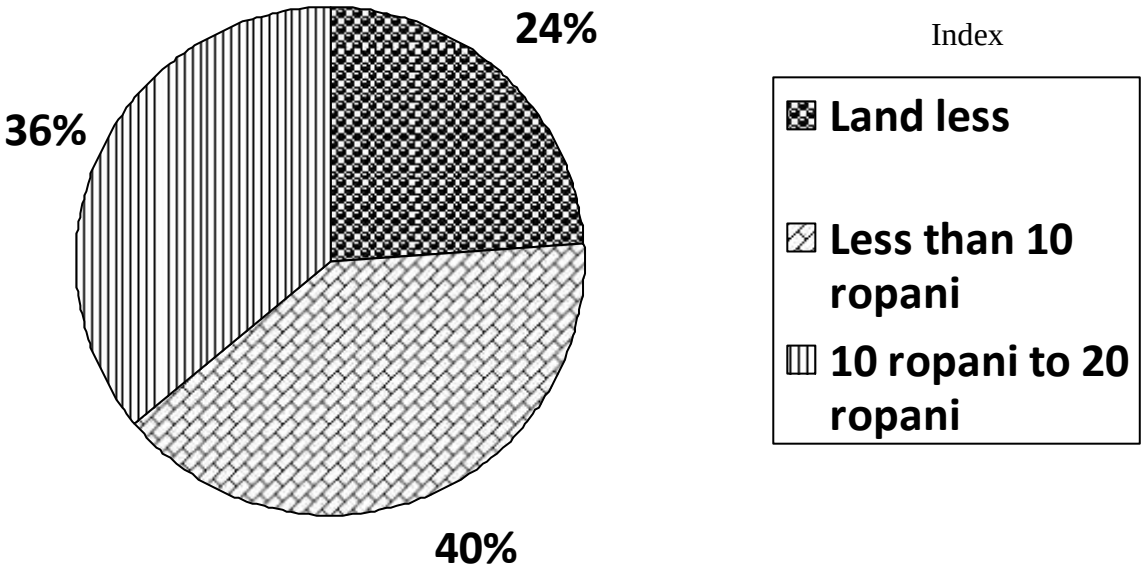
The land holding size of Respondents family is given below

Table no.4.8 Land Ownership

Land size in Ropani	No. of Respondents	Percentage
Land less	6	24.00
Less than 10 Ropani	10	40.00
10 Ropani to 20 Ropani	9	36.00
Total	25	100.00

Source: field Survey, 2016

Fig no.4.8 Land Ownership



The table no.4.8 (fig.no4.8) indicated that most of the land holders 40 percent are less than 10 ropani similarly 24 percentage land less and 32 percent respondent have 10 to 20 ropani land owner.

4.14 Realizing Difficulty for Irrigation

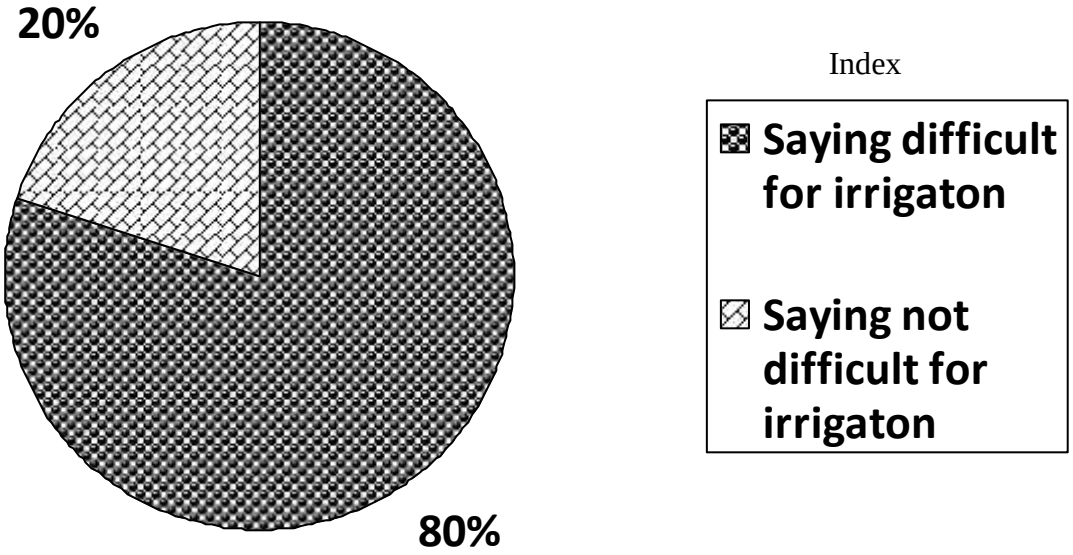
The most of respondents realize difficulty for irrigation in the agriculture sector day by day because of lack of rainy and increasing temperature.

Table no.4.9 Realizing Difficulty for Irrigation

Particulars	**No. of Respondents**	**Percentage**
Saying difficult for irrigation	20	80.00
Saying not difficult for irrigation	5	20.00
Total	25	100.00

Source: Field Survey, 2016

Fig no 4.9 Realizing Difficulty for Irrigation



The table no. 4.9 (fig no.4.9) clearly shows that 80 percent respondent realize that irrigation is difficult because of lack of rain and 20 percent respondent realize same as before.

4.15 Agricultural Trends in Chhatedhunga VDC.

Land use is important aspect of development of country. If we don't suitable use of land our development will be weak. Unsuitable and too much use of land, it affects negative results such as landslide, flood which decreases soil. We get land spoil by natural and human activates which is the world. Temperature of world is increasing day by day because of green house effect. The temperatures of world have increase from 14.18^0c to 14.33^0c in the period 1980-1999 AD. In this way temperature of world regularly increases day by day, the world have to face great disaster in future similarly people of chhatedhunga VDC realize that temperature of climate is increases to much so that nowadays many crops are suitable for in high altitude of land. Except for this people like to destroy forest to conduct the life for increasing population. In this chhatedhunga VDC people cannot use the modern system in agriculture. So the situation of productive is lies in problem. Chemical drawn and seeds are used by people in land it depreciate the quality of land. So that is arises a question for sustainable development.

4.16 Agricultural Development and Role of its in Development

Rural Development is often confused with agricultural development but it involves more where the majorities or rural men and women-and many of their children-earn areas are directly or indirectly related to the fortunes of the agricultural sector. The aim of Agricultural Development planning is to improve production and income earning opportunities in agriculture through improved information, institutions, techniques, technologies, information, institutions, techniques, technologies, infrastructures and marketing. Agricultural Devopment

planning can stress the depth of analysis and expansion for the fulfilment of this purpose.

Almost developed countries of the world have decreasing proportions of their economically active populations dependent on agriculture. Despite increased demand for food production, the percent of the population which makes a living directly from agriculture continues to fall in developing countries. Intensification of production through improved technology and increased in puts is responsible in most cases for increased production, rather than from increased numbers of producers high rural population growth rates and increased efficiency in agricultural production have led to increased and a consequent migratory drift (Some would say flood) to cities in search of work and better standards of living. National budgets tend to be directed to satisfying the need of urban centres at the cost of funding and services for rural areas. This urban bias and rural neglect has led to decreasing levels of real income in the rural areas.

Rural Development is more than agricultural Development. A continuing problem is designing Rural Development programs in the persistent notion that the best rural development strategy is a healthy production agricultural sector. But climate change is a complex phenomenon so that the effect of climate change is overview of all sectors. Climate change's effect lies on agricultural sector. Because of effect of climate change resource of water are disappeared day by day. It effects on crops. In chhatedhunga VDC a few years ago, there is a found water resource everywhere but nowadays it cannot be found such as. Because of climate change temperature of chhatedhunga in creased per year so that on high altitude of land, there is suitable for orange cultivation. Lack of water and too much hot the cardamom cultivation is

about going to be spoil VDC realize that a few year later many people migrate from here so that for suitable resident making other should be tamp on the Tamor River water resource have to be got on Chhatedhunga VDC.

4.17 Impact of Climate in Agriculture on Chhatedhung VDC

Agriculture is backbone of the rural livelihood. There is no medium to reduce rural poverty unless the development of agriculture. But problems in chhtedhunga VDC. Climate change is increasing day by day. There is no found environ mental protection from people. Frosts are destroying nowadays. So that effects of climate is directly seems here. Environmental and ecological changes noted in the chhatedhunga River, forest, flora and fauna indicate that global warming will have a serious impact on the lives and livelihoods of indigenous people of chhatedhunga depend on agricultures for their livelihood and there is increasing concern that climate change will have a significant adverse impact on farming. The study into indigenous peoples view on climate change revealed that landslides, soil erosion and debris flow as a consequence of melting glaciers, as well as changing rainfall patterns, are leading to low productivity and crop failures are affecting many Himalayan indigenous farming communities, who are increasingly facing food insecurity. The informants also reported absorbing adverse affects on the hill ecosystem likewise Chhatedhunga VDC, and hence on the natural resources on which their livelihood depends, due to changing rainfall patterns and other climate changes. People of Chhatedhunga VDC used to go to wetland sites to collect our traditional wild foods, vegetables, medicines etc. It is one of their ancient traditions to harvest the foods for our livelihood. At present, such foods, vegetables and medicinal herbs are

disappearing along with the wetlands. This could be an example of the impact of climate change on informant explained about climate change;

'My father established an apple garden a long time ago. The garden was a near a beautiful, sacred lake, with a view of the hill, which attracted tourists. And the garden became famous with tourists because at that time, all the apple trees bore very delicious fruits with a shiny, beautiful color. But for the last five years, different kinds of changes are appearing in this apple garden, for example early flowering, failure of fruit setting, early and tasteless apples and the trees and the apples often become rotten. The shiny and beautiful colors of the apples have almost disappeared and that may be impact of climate change'

Hill (Like Chhatedhunga VDC) indigenous peoples are cattle and sheep headers, and declining production of grass in the grasslands due to moisture deficiencies resulting from reduced snow deposits is therefore a serious concern, forcing people to seek grazing at higher altitudes. Stream flow and spring characteristics have also changed dramatically in recent years, making the management of water supplies a challenge.

4.18 Positive Impact of Climate Change

Although the impacts of climate change are considered mainly negative, some positive changes have also been noted. A study conducted in the chhatedhunga VDC of Terhathum district revealed that, surprisingly, many people in the region feel positive about climate changes and are hopeful about the future of the environment.

Most of the respondents, the impact is positive. Farmers are growing new vegetables such as cauliflower, cabbage, chilli, tomato and cucumber, which used to need green house to survive. Local fruits have better sizes and lasts. New plants that only used to grow at lower altitudes

can be found. Many note the fact that this chhtedhunga VDC is greener that it was a few decades ago local residents say this is because of changing climate rather than technological inputs or improved seed varieties. The study, however, stresses that most people are unaware of the real consequences of global warming and that communities who are most vulnerable the effects of climate change are generally unaware of the nature of possible impacts.

4.19 Cultural Impacts of Climate change

The pressure on land of chhatedhunga VDC Causing landslides, soil erosion and so on, not only has practical implications for indigenous communities in chhatedhunga. The Himalayan range and its snow, water, air and biological resources have secular, cultural religious and spiritual value for indigenous peoples in the region. Many believe that their ancestors souls live in the fall in the winter, increased rain and snowfall after the winter, unusually intense summer rainfall and increased frequency of avalanches, flash floods and hailstorms. Hill areas such as the Chhatedhunga VDC are therefore expected to be most affected by the adverse impacts of climate change.

4.20 Effects of Climate Change on biodiversity

Due to their shape and size, hill area supports a wide range of climatic conditions. It is said that climbing just 100 meters up a mountain slope can offer as much climatic variety as travelling 100 km across flat terrain. Each rise in altitude generates different conditions, with unique ecosystems that contain some of the world's greatest variety of plant and animal life.

With the rise in global temperatures, conditions in the different altitudes change. Detailed studies have shown evidence of an upward

movement on mountains of tree lines and alpine plants. Plants at the highest elevations are competing with and losing out to plants normally found at lower elevations. Such floral retreats and advances on mountains have also taken place in the past but current changes are taking place of an unprecedented speed. Consequently, the diverse Himalayan plant and animal species are being seriously affected. Many rare species are already disappearing or are at risk of extinction. It the current speed with which changes are occurring due to rising temperatures continues, trees are likely to cover the high mountains and indigenous peoples will be deprived of their traditional resources and biodiversity, the means with which they have traditionally been able to cope with variation and change.

Weather related extreme events like excessive weather related drought periods, landslides, floods are increasing both in the terms of magnitude and frequency. Mean annual precipitation is increasing, as is the occurrence of intense rainfall. This causes more erosion of soils and riverbeds and banks, as well as sedimentation on fertile land. More floods and glacial lake out bursts will destroy irrigation and water supply systems, roads, bridges, settlements and productive land. Flood-related deaths with increase land degradation will reduce on remaining fertile land. In the dry season, increased evaporation will lead to water sacristy. Soil moisture deficits, droughts, fire and possible pest out breaks will decrease crop yields-climate change will have major impacts on ecosystems, land and water resources and major economic sectors such as agriculture.

In the chhatedhunga VDC there is an increasing risk of infectious diseases as an indirect consequence of warmer diseases as n indirect consequence of warmer temperatures. warm up. Ticks are proliferating

northwards and at higher altitudes, causing disease, and insect pests are predicted to spread and cause damage to crops. Indigenous people in the chhatedhunga VDC are among poorest in the world and, with climate to show respect to these souls and pray for good health, a good harvests, healthy livestock and wealth. There is cultural, as well as religious and spiritual, dimensions of the hill landscape, along with the ancestral memories inscribed on it, are in danger of disappearing along with the glaciers.

4.21 Problems Faced by People of Chhatedhugna VDC of impact of climate change

Based on the field study with people of chhatedhunga opinion. Since their involvement in the agricultural sector the people strongly believe that their socioeconomic status has important however, they feel that they have not received as much again. The researcher questioned the workers about their burning problems. There are categorized and presented below.

4.21.1 Lack of Drinking Water

Most of the respondent complains about the lack of drinking water. Most of the water resources are disappeared because of climate change and lack of monsoon. Some of the drinking water plan is conducted but not properly managed. There are no sufficient resources the respondents opined that it is very difficult for sanitation and good drinking water.

4.21.2 Lack of Transportation

The people of Chhatedhunga VDC walk from more places. There is no available sufficient road in monsoon the means of transportation are not available so the people walk to one place to another is difficulty. likewise, when returning from the working place sometime is to spend on

the roads. They get tired because of long walks and can't do work, very well. There has not provided transpiration facility even though the people have been facing many problems on the way.

4.21.3 Lack of Other Facilities

According to the indigenous respondents, they have observed the melting of ice and glaciers, and environmental changes in their traditional territories for many years. Although they are not familiar with scientific data on climate change, they are experiencing the disappearance of foods, medicinal plants and herbs and they feel certain that the changing climate is the reason for the changes they are experiencing in their daily interactions with the local environment.

In many areas, a greater proportion of total precipitation appears to be falling as rain than before. As are result, winter is shorter, this effects due to climate induced economic, dislocation, decline, conflict, crop failure, and associated malnutrition and hunger and (iii) indirect effects due to the spread and aggravated intensity of infectious diseases due to changing environmental conditions. The latter effect includes the expansion of vector borne diseases such as malaria and dengue, and water related diseases such as diarrhea.

However, there are also expected to be positive climate change induced effects on the health status of certain populations in the chhatedhunga VDC high altitude areas, formerly too cold, will open up to new types of agricultural production and new livelihood opportunities, people will find their homes and villages more comfortable due to warmer conditions and the risks associated with cold and respiratory diseases will be reduced as the use of fuel wood for heating is reduced. Valuable infrastructure, such as hydropower plants, roads, bridges, and

communication systems, will be increasingly at risk from climate change. Entire hydropower generation systems established on many rivers will be in jeopardy if landslides and flash floods increase, and hydropower generation will be affected if there is a decrease in the already low flows during the dry season.

CHAPTER-V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Agriculture Is the dominant sector of Neplese Economy. More than so percent of its population are involved in agriculture. But cultivated land in Nepal is only 18 percent of its total area. So, the little cultivated land and increasing population pressure has caused the large scale of unemployment problem in agriculture sector. Agriculture plays an important role in providing employment opportunity for people and to solve the unemployment problems to some extent. However, there are also expected to be positive climate change induced effects on the health status of creation populations in the hill region. High altitude areas will open up to new types of agricultural production and new livelihood opportunities, people will find their homes, and villages more comfortable due to less cold conditions, and the risks associated with cold and respiratory diseases will be reduced as the use of fuel wood for heating is reduced.

In the chhatedhunga VDC, the most of the respondents the impact of climate change is positive, they say, According to respondents of VDC, Farmers are growing new vegetables such as cauliflower, cabbage, chili, tomato and cucumber which used to need greenhouse to survive. Local fruits have better sizes and tastes. New plants that only used to grow at lower altitudes can now be found. Many note the fact that their district is greener than it was a few decades ago. Local residents say this is because of the changing say this is because of the changing climate rather than technological inputs or improved seed varieties.

Now, Various studies have been conducted covering almost change covering almost all the aspect of impact of climate change on agriculture but till now there has not been any study regarding the climate change and its effect on agriculture. This study mainly has consent rated on agricultural in chhatedhunga VDC of Terhathum district.

The present study is based on filed survey in order to fulfill the specific objectives of the study and exploratory research design is supplied a combination of purposive sampling method has been adopted. In this study, only 40 percent respondents were selected for interview. Both primary and secondary data are used for this study. The method of primary data collected for the questionnaire, instructed interview, observation and check list. Secondary data has been collected from the available literature such as; records, reports, publication of different related offices and possible resources. Data have been analyzed descriptively. These study both qualitative and quantitative data have been collected curative information has been tried to interpreted and quantitative information has been demonstrated by the means of percentage and graph. There are various castes/ethnics, age groups participated in the study, area. The untouchable casts (Damai, Kami,Sarki) is also resident of the study area.

There are no organizations working on climate change and how to adapt to its impacts, neither are there organizations working on public education on the issue. Awareness raising, education, capacity building and advocacy programmes on climate change and its impact on indigenous livelihoods are therefore needed in chhatedhunga communities.

While the effects of climate change on agriculture and its associated hazards have assessed, there is paucity of information on its effects on vegetation, as well as plant succession on recently deglaciated soils. Communities are highly dependent on natural resources for the ecosystem services that they perform provisioning services as genetic resources, food, fiber, fresh water etc. Regulating services as regulation of climate, water and human diseases, supporting services as productivity, soil, fertility and nutrient cycling. Therefore understanding the effects of climate change on soil and vegetation dynamics in important for assessing impacts on chhatedhunga livelihoods, as well as for implementing effective conservation strategies.

Attractive greenery environmental development, tourism industry employment creation and gender development reflect that positive sign of climate change in local development.

5.2 Conclusion

Impacts of climate change can be categorized both positively and negatively. In a positive sense, winters will be less cold and more vegetation can be produced in high altitudinal areas of chhatedhunga VDC. However, the rise in mean temperatures currently projected to be as high. For an alternative perspective, we can divide the impacts of climate change in chhatedhunga among various sectors; water resources, health, forestry agriculture, biodiversity, economy and so on.

In chhatedhugna VDC, more than 80% of the population depends on agriculture, which is predominantly fed by monsoon system directly affects the production of food. Climate change may be intensifying the spread of mosquitoes, related diseases such as malaria, dengue fever, Ross River virus. It is seen that a mosquito problem has emerged in the

Study area. Respondents of chhatedhugna VDC reported changes in biodiversity such as early budburst and flowering, new agricultural pests and weeds, and the appearance of mosquitoes. They also reported that temperature increases appeared to be more rapid at higher altitudes, the people of chhatedhunga VDC has warned that the effect of a rise in temperature due to global warming will be greater on winter crops like wheat and millet. The vegetative state of those crops would be shorter with higher temperatures, thus lowering productivity. All these scenarios are showing that cropping systems could change with climate change.

5.3 Recommendations

On the basis of opinion expressed by respondent and according to the findings of the study the following recommendations are as follows in order to improve people status in chhtedhunga VDC of Terhathum district.

1. Reduction in water availability in basins fed by glaciers that are shrinking as observed in some places of chhatedhunga VDC.
2. The Scarcity of water have shown in the Chhatedhunga VDC.
3. Changes in water availability due to change in precipitation and other related phenomena e.g. Groundwater, recharge, evapotranspiration.
4. Water availability reduction, Stalinization of water resources and lower groundwater leveling more places of chhtedhugna VDC.
5. The crops have not production enough for the livelihood before long time.
6. Information is lacking on the issue of climate change and adaptaion in the indigenous communities in the chhatedhunga VDC.

Participatory research to explore indigenous people's knowledge and experiences related to climate change, its impacts and adaptation strategies is therefore importation.

7. There are no organizations working on climate and how to adapt to its impacts, neither are there organizations working on public education on the issue.

   Awareness raising, education, capacity building and advocacy programmes on climate change and its impact on indigenous livelihoods are therefore needed in chhatedhunga communities.

8. Networking, co-ordination, lobbying and communication to ensure the appropriate implementation of international and national climate change conventions and policies that take into account indigenous people's rights, knowledge and customary systems are important.

9. In chhatedhunga VDC farmers are growing new vegetables such as cauliflower, cabbage, chili, tomato and cucumber, which used to need greenhouse to survive. Local fruits have better sizes and tastes.

10. Many fruits ripen season have change because of climate change.

11. Climate change will have major impacts on ecosystems, land and water resources and major economic sectors such as agriculture.

References:

Andreas, S. (2007). *International development agenda Sustainable Mountain Developmen,* Kathmandu, ICIMOD.

Allord, D. (1992). *Hydrological Aspects of the Himalayan Region*, Kathmandu, ICIMOD.

Armstrong, R.L. (2010). *Asummary of the science Regarding Glacier Melt/Retreat in the Himalayan Hindu Kush, Karakorma, Pamir and Tien Shan Mountain Ranges*, Kathmandu, ICIMOD.

Bandyapahyay, J. Gyawali D. (1994). *Himalayan water resources, ecological and political aspects of management,* mountain Research and Development, ICIMOD.

Balnett, T.P; Adam, J.C. Lettenmarire, D.P. (2005). *Potential Impacts of a warming climate on water availability in snow dominated region,* ICIMAD.

Bush ABG, (2000). *A positive Climate feedback Mechanism for Himalayan glaciations;* Quaternary international.

Baidy, S.K; Mool, P.K.; Shrestha, M.L. (2007). *Climate Profile and observed climate change and climate variability in Nepal.* Kathmandu, Department of Hydrology and Metrology.

Bajrachrya, S.R; Mool, P.K; Shrestha, B.R. (2008). *Impacts of climate change on Himalayan Glaciers and Glacial Lakes, Case studies of GLOF and Associated Hazards in Nepal and Bhutan; Kathmandu, ICIMOD.*

Carney, D (1998). *Sustainable Rural Livelihoods;* London, DFID.

Chalise, S.R; Khanal N.R. (2001). *An introduction to climate, hydrology and landslide hazards in the hindukush Himalayan region,* Kathmandu, ICIMOD.

Chen, Y.N., Li, WH; Xu, CC; Haa, XM. (2007). *Effects of climate change on water resources in Tarim River Basin,* Northwest china, Journal of Environmental Sciences.

Chaulagain, N.P. (2006). *Impacts of climate change on water Resources of Nepal,* PHD Thesis, University of Flensburg, Flensburg.

Climate Institute, (2013). *Vector-borne diseases,* a ccessed, 2013.

CBS, (2006). *Environmental Statistics of Nepal,* Kathmandu. Central Beauro of Statistics.

Dorji, C. (2007). *International Development Agenda Sustainable Mountain Development,* Kathmandu, ICIMOD.

Dahal, N. (2005). *Perceptions Of Climate Change in the Himalayas,* Kathamdu, Journal of Biogeography.

Eriksoon, M, Fang, Ji,.Dekens, J (2008). *How does Climate offect Human Health in the Hindu Kush-Himalyan regions,* Regional Health Forum.

Gurung, H. (2004), *Mountain Reflections, Pattern and Development,* Kathmandu, Mandala Publications.

Gurung, H. (1971). *Landscape pattern of Nepal,* Kathmandu, Mandala publications.

Gautam, N.P. (2005). *Climate Change and its effect,* Kathmandu, The Rising Nepal.

Hagen, T. (1961). *Nepal, Kingdom in the Himalya,* Berne, Kummerly and Frey.

Hasnain, S.I. (2000). *Status of the Glacier Research in the HKH* Region, Kathmandu, ICIMOD.

Li, BL: Zhou, CH. (2001). *Climatic Variation and desertification in west sandy land of Northeast China Plain,* Journal of Natural resources.

Stern, N. (2006). *The Economics of Climate change London,* Cambridge University Press.

UNDP, (2008). *Climate Change Country Profile Nepal,* School of Geography and Environment, oxford, United Kingdom.

WHO, (2005).*Human Health Impacts from Climate Variability and climate Change In the Hindu-kush Himalya Region,* Report from an inter Regional Wokshop, Mukeshwar, India.

www.ciwf.org.**uk/climate-change**

www.**ipcc**.ch

https://en.wikipedia.org

www.en.pumpash.com

https://www.jstor.org

www.en.pumpash.com

www.**climateinstitute**.org.au

www.**undp**.org

www.en.pumpash.com

www.**unep**.org

http://www.pnas.org/content/109/40/16089

https://www.**ipcc**.ch

https://books.google.com.np/books

https://books.google.com.np/books?isbn=9400778171u

https://books.google.com.np/books?isbn=1317015851

www.oecd.org › Environment Directorate

.

ANNEX-I

Household survey

QUESTIONNAIRE-2073

1. Name:

2. Address:

3. Age:

4. Religion:

5. Cast/ Community:

6. Marital Status:

(a) Married (b) Unmarried

7. If married how many children have you got?

(a) Son ( ) (b) Daughter ( )

8. Education Status

(a) Literate (b) Illiterate

9. Where is your birth place?

(a) Terhathum (b) Other

10. How the days are going on?

11. What do you take as Occupation?

12. Do you work on farm?

13. Is there unseasonable fruits crops?

14. What kinds of crops as form cultivation?

15. In the agricultural sector do you realize any change because of climate?

16. It is suitable, for agricultural farm in the high altitude area?

17. Where do you stay?

18. How many members are there in your family?

19. How many people of your villagers are involved in agriculture and other occupation?

S.N	Name	Occupation	Remarks

20. Do you have own land?

21. If yes, how much land you have got?

22. What on the following topics is your family member's annual income?

S.N	Annual Income	Rs.
1	Agriculture	
2	Business	
3	Government Service	
4	Others (If any)	

23. What is your families annual expenditure in the following items?

S.N	Expenditure on	Rs
A	Food	
B	Clothes	
C	Education	
D	Agriculture	
E	Health	
F	Festivals	

G	Others	

24. What are the present problems you are facing in agriculture?

(a)

(b)

(c)

25. Is there any organization for agriculture?

26. What about the sense/oware of tourism in local people?

27. What sectors are supporting (economical and technical) for agricultural development?

28. Which organization has been most involved for this sector (Climate change in agriculture)?

29. What the support is done in agricultural development with various activities?

30. How much the local people are active about agricultural activities program?

31. What is the main attraction of this area?

32. What kinds of vegetables are grown by farmers in this VDC?

33. Is there people feel positive or negative about climate change?

Signature: Date: 2073/01/02

ANNEX-II

CHECK LIST

Date: ……

Name: …….. District: …….

Age: ……. VDC: ……

Sex: …… Ward No: ……

Post: ……

1. What is your main occupation for livelihood?

(a) Agriculture ( ) (b) Business ( )

(c) Employment ( ) (d) Other

2. Do you know about climate change?

(a) Yes ( ) (b) No ( )

3. Do you feel about climate change?

(a) Yes ( ) (b) No ( )

4. Is there any possibility of seasonable vegetation in this area?

5. What kind of agricultural activates are doing here?

6. How is going agricultural development in this area?

7. How do you seen the effects of climate in agriculture in this area?

8. Is there any organization working in the agricultural development activities?

S.N	Name of the organization	Estd Year	Works hard done	Re.

9. If any organization, do you think it is necessary for agricultural development.

10.What problems do you think to develop agriculture in this area?

11. How the climates effect the agriculture sector?

12. Is there good or bad effect of climate for us?

13. Is it necessary to change the climate?

14. What is main possibility for the future?

15. How we can face the effects of climate change?

16. At last, if you have any advice or suggestion?

Signature: Date: 2073/01/02

Photos

Chhatedhunga VDC of Terathum word no-7

Hayatung Jharna

Kumbha Karna Himal

Forest of Tenjure