Chapter I
Introduction

1.1 Background

Nepal is a land lock country, located at the centre of Himalaya, with the characteristic of inhabitation of a huge range of ethnic and indigenous groups. These communities occupy about 37.2 percent of total population (Census 2001). According to Census 2001, About 101 ethnic and indigenous group has been identified and almost all of them belong to Tibeto-Burmese or Mongoloid and Indo Aryan category. Among them Tamang community is one of the main indigenous community of Nepal with rich cultural and historical significant. They are mostly concentrated on the central part of Nepal particularly in adjacent districts of Kathmandu and in capital city. However, the distribution of Tamangs is ranging from east to west and north to south of Nepal. A dense settlement of Tamang community is inhabited in accessible regions of the country but the every aspects of developments requirement of this community are very weak and could not streamline themselves to contemporary development activities comparing to other communities. Many historical evidences have showed that they were intentionally deprived from the many opportunities and all the development activities by the government. In this cruel condition, now this community have been victimizing by the global problem of climate change.

In present context, Climate change has become hot issues all over the world and is considered to be a critical global challenge and recent events have also demonstrated the world's growing vulnerability to climate change. There are no countries either in form of developed or undeveloped remain impervious to this global problems. Like the rest of the world's developing countries, the climate change effect in Nepal is severe due to its extreme poverty, geographical and climatic condition, highly dependency on natural resources, which are deteriorating and becoming fragile, inappropriate agricultural practices and lack of enough resource to cope with the changing climate and its impacts. About 31% of Nepal's population is below the poverty line and 95% of them live in rural areas (MoF, 2005). Moreover, as much as 70% of the rural population is poor and fully dependent on agriculture; local food production hardly covers three months of the annual household needs (FAO,

2004). The country had a surplus cereal production two decades ago but it is a net importer these years (MoPE, 2004). In the context of increasing population in the country, issue of food security and people's health are extremely affected by the impacts of climate change.

Nepal experiences extreme monsoonal rains during July to September and very low precipitation during December to February. Monsoon floods due to heavy rain cause acute disasters such as loss of human life and property, mudslides and infrastructure damages. Lack of water during the dry seasons has a chronic impact on the lives of people; particularly most of the population directly depends upon agriculture for their livelihoods. Shortage of water during the dry season reduces yields from irrigated crops and threatens the food security of the region (Rees *et al.*, 2004). Sharma *et al.* (2006) states that changes in water availability in the monsoon, pre-monsoon and the post-monsoon season and shifting of the hydrograph have a direct impact on the Nepalese agriculture. The agriculture perspective plan (APP, 1995) stated that the current irrigation facilities may not have sufficient water during dry seasons in the future due to climate change. The 2001 IPCC Third Assessment Report concluded that the poorest countries would be hardest hit, with reductions in crop yields in most tropical and sub-tropical regions due to decreased water availability, and new or changed insect pest incidence.

With all these issues, there are most necessary to illustrate the impacts of climate change on society and its culture. Therefore, I tried to explore them here through the study of Tamang community of Sarlahi district.

1.2. Statement of research problem

Climate change has become hot issue worldwide and is considered to be a critical global challenge and recent events have demonstrated the world's growing vulnerability to climate change. There are no countries either in form of developed or undeveloped remain impervious to this global problems.

IPCC (1996) has pointed out that there are substantial uncertainties on global impacts of climate change when applied at the regional or local level. There is no long history in the process of understanding vulnerability and possible adaptation measures to reduce impacts of climate change. Limited scientific research has been carried out to determine the level of possible impacts of climate change on the society.

Poor community, vulnerable society or country is the most impacted group in the changing climate due to the lack of enough resources to adjust the challenging condition. Nepal is a developing country in the world. Its low economic strength, inadequate infrastructure, low level of social development, lack of institutional capacity, and higher dependency on the natural resource base makes this country vulnerable to changing climatic system including variability and extreme events.

Moreover, the climate change impacts are expected to impose hardships on indigenous people such as the Tamang people of Nepal. They directly impact the economies through loss of traditional economies activities; economic revenue, economic opportunities and threaten their cultural and social practices.

One example of the affect on climate change into their socio-economic condition force the out migration of tribal youth to seek economic opportunities expected under severe climate impacts (or their daily lives limited to the indoors) could lead to further erosions of tribal economies and culture.

Tamang people of Harion VDC is most vulnerable to the climatic changes because of their highly dependency on natural resources such as fuel wood, timber for house construction, fodder for their livestock. All Tamang community of the area is involved in agriculture and livestock farming directly or indirectly. These sectors are highly dependent on weather condition of locality. A heavy reliance on agriculture makes this community's economy very sensitive to climatic variability and social and economic condition is highly impacted and finally hampered the entire development of that community.

Therefore, it is important to measure the impacts of climate change, to identify the adaptation measures and thereby reduce the potential consequences of climate change at local level in future. Specifically this study was tracked along with the following research questions:

- What is the climatc fluctuation in study area that feels by Tamang community?
- What types of climatic variables impact them most and their impacts on economic, social and cultural life of Tamangs? such as change in cropping

pattern and crop maturity period and agricultural productivity (vegetable, serial crop & cash crop farming)

- What is the Socio-economic condition (Education, occupation, income, sex, health) of Tamang people of Harion VDC?
- How the change in climate affects the culture of Tamang community in long term?
- What types of adaptive measures in culture, social and economic practices they use against the impacts of climate change by using their intimate knowledge or indigenous practices to overcome from those impacts?

1.3. Objectives of the study

The focus of this research is to explore the impacts of climate change on social, cultural and economic condition of marginalized group Tamang of Sarlahi district. In more specific, the objectives are categorized into two sections as outline below:

1.3.1. General objective

To analyze the impact of climate change in social, cultural and economic condition of Tamang community of Harion VDC and their indigenous practices applied to be adapted against the impacts of climate change.

1.3.2. Specific objectives

- To analyze the impacts of climate change in social and cultural aspects of Tamang community in Sarlahi district
- To analyze the impacts of climate change in economic condition of Tamang community
- To identify the indigenous strategies of Tamang community for adaptation of changing climate

1.4. Theoretical framework

In this study I have used the theoretical concept of cultural adaptation used by J. Steward. According to it, people who depend upon natural resources for their subsistence develop their own approaches to adapt to changing climatic condition through their daily practical life. These people also have an intimate knowledge regarding nature and its changing events than other people.

According to M. Glantz (2003), climate can be viewed from three different perspectives: “climate as a constraint to social, cultural and economic development; climate as a resource to be fully exploited to society’s advantage; and climate as a hazard that can spawn other hazards and disasters”. Without balanced ecosystem, every aspect of societal and cultural development has been imbalanced and couldn’t sustain for a long time. The study further emphasized on the analysis of impacts of climate changes on the social, cultural and economic aspects of Tamang community of Harion VDC Ward no. 2 and 9. If we saw the history of cultural formation and reformation, they all had been formed to be adapted to the surrounding climate and natural events. Many cultural practices were instrumented so as to protect and conserve the nature and valuable species of flora and fauna. This means the interrelationship between societal culture and climate and its events have a long history and interdependent to each other.

Indigenous people are primary inhabitant closer to nature and natural resources, thatswhy most of their cultural practices are related to nature and natural resources than other non- indigenous people.

Chapter 2
Literature Review

2.1 Historical Background of Climate Change and Development of Society and culture

To see or analyze the impacts of climate change on human society, the study of human agency and society are most important and can find out the exact impacts of climate change on human society and their culture. Societies constitute with the various size and scale of organization, social differentiation, subsistence activities, productive strategies and ideologies. They are maintained, reproduced and transformed as a result of the impact of day to day practices by individuals who are constrained by their perceptions, beliefs, norms, values and mind sets (cognitive schemata). In hunting-gathering society, the group is small and differentiation of occupation is minimal. Such groups are intimately familiar with the seasonality and different habitats over a large region. Within that context they are also detected environmental changes that ultimately directly or indirectly related to climate change which is due to changes in endogenous landscape responses or to overhunting or overexploitation of certain resources.

The impact of global climatic warming on world populations beginning ca. 16000 cal BP, as well as subsequent severe climatic fluctuations-particularly the droughts associated with the Younger Dryas (Calibrated Radiocarbon Years before present (Cal. BP) 13000-11600) varied widely depending on the local expression of the global climatic events and the local environmental settings. The origins of food production were first of all a matter of a sequence of social transformations brought about by changes in the mode of subsistence in response to climatic fluctuations involving population situated in vulnerable sub arid ecotonal habitats. In North Africa and Southwest Asia (the NASWA region), northern Levant, the southern Levant and the Sinai, the Nile Valley, the African Sahel, the Mediterranean coastal region of North Africa and the series of massifs in the Saharan. In these habitats, people responded to local conditions by making the most appropriate decisions given local opportunities, available resources and their perceptions of the food potential of specific subsistence modes. In these all areas, sedentary life was registered as highly risky under unstable climatic regimes and that similar

steps were undertaken to intensively utilize cereals and probably keep animals.

In the Levant, some of farming hamlets developed into mega-villages with elaborate social organizations, ritual and art. During 10600-8800 cal BP which is known as Pre-Pottery Neolithic Period (PPNP), naked six-row barley and free-threshing bread and hard wheat were cultivated. In northern Levant and central Anatolia, cattle were domesticated by 8800 cal BP (Bar-Yosef 1998) and in Greece domesticated cattle appear ca.9000 cal BP and pigs and goats ca. 10,000 cal BP (Halstead 1996) . Mortuary "skull cults" and evidence of rich symbolism suggests that ritual and religion might have played a major role in group dynamics as a means of alleviating conflicts and promoting solidarity. Some group opted to pursue hunting and foraging, while others continued to lead a nomadic life with the adoption of domesticates especially animals eventually evolving into pastoralists (Simmons 2007, 167).

In the succeeding period 8800-8200 cal BP, the end of the PPNP, population in the southern Levant shifted east, particularly to highland Jordan where they established a series of very large settlements or mega-village. By 8200 cal BP, the mega villages were suddenly depopulated. The PPNP came to a sudden end. The collapse of the PPNP was not a local event; this pronounced, millennial, global and abrupt cold event (Alley et al.1997) was a severe "environmental crisis" (Cardova 2007). The period 8200-8600 cal BP was characterized by unstable climate with a shift from forest to maquis in the northern Levant and more olives in the southern Levant (Rosen 2006). It was under this climatic regime that village communities were established with greater reliance on a mixed farming-herding economy that established the foundation of the Mediterranean agro system (Butzer 1996). Dairying apparently led to the widespread use of pottery for keeping and serving milk, butter, yogurt, cheese and other milk products. The Neolithic communities in the Levant appeared to have maintained a heterarchical social organization with an emphasis on religion and ritual as a means of group solidarity (Simmons 2007).

According to Smithers and Smit (1997) for the interpreting the impact of climatic perturbations on social systems and the probable adaptive responses, the intensity of the impact depends on the magnitude, areal extent, frequency, duration and suddenness of the climatic disturbance and the system responds depending on its stability, resilience, vulnerability, flexibility and scale. As a result, the system will either fail (collapse) if people are incapable of overcoming the negative impacts of climate change in time or undergo

remedial actions if people do not or cannot act in time through effective coping mechanisms.

Some attention has been given to the role of climate in the breakdown of complex state societies especially during the third millennium BC (de Menocal 2001; Weiss 2000). A climatic deterioration ca. 4200 has been detected in many areas (Dalfes, Kukla, and Weiss 1997; Drysdale 2006) and is considered a cause for the breakdown of complex societies at that time. Complex agrarian societies evolve through time into metastable organizations that are vulnerable to internal or external perturbations. Internal perturbation results from mismanagement, rivalries among elite groups, or revolts, while external perturbations are due to adverse unforeseen consequences of farming e.g. salinization, erosion, pollution, depletion of key resources), attacks by foreign enemies, climate change and undermining the life-support systems.

In Central America and China also show marked differences in the pace and timing of cultural developments in response to global climatic events. In Central and South America, wet conditions from 14,600 cal BP with a maximum from 13000 to 8,800 cal BP led to the formation of lakes, attracting hunters and foragers (Messerli et al.2000). In central Chile Paleo-Indian occupation ended as a result of rapidly increasing aridity ca. 11000 cal BP that caused mega faunal extinction (Nunez, Grosjean and Cartajena 2001) As a result of the drought Paleo- Idians retreated to ecological refuges around lakes (Zarate, Neme, and Gil 2004). In the Atacama Desert (Altiplano of Northern Chile), the first period of human occupation came to an end by ca. 9000-8800 cal BP. Hyperarid conditions from 8800 until 4000 cal BP made the region inhospitable (Messerli et al.2000). Extreme events at Querbrada Puripica from 8800 to 5500 cal BP contributed to the transformation of Archic hunters into the complex Late Archaic cultural tradition (Grosjean et al. 1997).
The few areas blessed with flowing water e.g. Puripica on the western slopes of the High Andes, provides evidence of domestication by 5500 cal BP and a shift to farming with channel irrigation and terracing after 3300 cal BP. Since the shift from hyperarid to more humid conditions with a return of rain-fed lakes occurred ca. 4000 cal BP, domestication would have been achieved under hyperarid condition, farming under more moist conditions. The shift to farming coincided with a large scale reoccupation of the Atacama area (By 3400 cal BP). Data on climatic variability over the past 3500 years in the Yucatan Peninsula (Mexico) (Curtis, Hodell, and Brenner 1996 and 1995)

reveal that the period 3500-1800 cal BP was wet. Afterwards exceptionally arid events occurred at AD 862, 986 and 1051.

The period AD 980-1050 also correlates with the first phase of the Medieval Warm Period, which is manifest in Europe, North Africa and North America. Curtis et al. (1996) attribute what they refer to as the Classic Maya Collapse (AD 750-830) to droughts. They also note that other cultures in South and Mesoamerica experienced declines at or near the time the Classic Maya Collapse, citing the abandonment of Teotihuacan, Mexico around AD 750-800, and the collapse of the Andean Tiwanaku at about AD 1000. Shimad et al. (1991) also suggest that the prominent pre-Hispanic culture of Mochica with its heavy dependence on large scale irrigation experienced an upheaval as a result of a series of severe sixth-century droughts, including one of the severest droughts of the past 1500 years in AD 562-594.

Some of the most salient global climatic events that have had a significant impact on the course of human civilization appear to have been connected with cold events associated with equatoward shift of the Intertropical Convergence Zone (ITCZ). This, in turn, causes droughts in a transcontinental belt that extends from Central Mexico and the Andes to China (Hussan 2002a). In China, Cohen places the initial period of rice domestication at 14600 cal BP in the south at Hamadong,16000-13000 in the Xia Ren Phase in northern Jiangxi (Xianrendong and Diatonghuan sites) and 13000-10800 during the Wang Phase (Cohen 1998). A subsequent shift from garden to paddy rice agriculture occurred in the Jiangxi phase (11000-6800 cal BP). Liu (2004) links the emergence of sedentary villages with pottery, dogs and pigs to 11000-9700 cal BP in the central plains with the advance of monsoonal rainfall northward into the present arid and semiarid regions. It appears that the transition to the intensive collection of rice was linked to the postglacial warming commencing 16000 years ago. During a period of warm and wet climate from 9800 to 4500 cal BP, early Neolithic cultures were established in the Yellow River valley from 9000 to 7000 cal BP. Under more humid and warmer conditions from 7000 to 5000 cal BP, populations increased rapidly. According to Huang and Zhang (2000) pollen, phytoliths, and carbonized grains reveal that cultivated varieties of rice occurred slowly from 7000 to 6300 cal BP, with maximum variation from 6300 to 5500 cal BP (Late Neolithic) due to effective artificial selection. Millet also appears with sedentary villages at 10,000-7000 cal BP. During the period 6000-5500 cal BP, the number of agrarian settlements increased dramatically. According to Stanley and Chen (1996), Neolithic settlements in the southern Yangtze delta plain dating from 7500 to 4400 cal BP began within five hundred years of delta formation as a result of sea rise, continued sea level rise led to a rise

in ground water level and poor drainage, resulting in a shift of Neolithic settlements eastward toward higher, more restricted areas of the Yangtze delta chenier plain. The transition to fortified settlements in the middle reaches of the Yangtze in 6400-6100 cal BP (Yasuda et al.2004) coincided with the onset of arid conditions as a result of decreased monsoon activity and cold climate. Rapid urbanization at 5300 cal BP also coincided with a period of drier conditions in the Eastern Sahara. A period of abandonment of settlements at 4000 cal BP apparently was caused by the 4200 abrupt cooling event (Yasuda et al. 2004). Liu (2004) recognizes the multiple roles of population increase, shifts in the course of the Yellow River, soil erosion from farming and climatic fluctuations in the rise of hierarchical complex societies in China as a result of conflicts leading to political integration. The Longshan culture in the Yellow River valley declined around 4000 cal BP. Wenxiang and Tungsheng (2004) similarly recognize a collapse of Neolithic cultures around Central China at the time of the 4000 cal BP cooling event.

2.2 Climate Change, Society and Social System

For balancing human needs and protecting the earth's life supporting systems, a principle challenge facing the social science, ecological professionals, and decision makers in all countries is how to create initiatives that reflect the interconnection between economic prosperity, a healthy environment and social equity. Fundamentally, the impact of climate change that matter to society and social system are not limited to direct bio-physical impacts but also include many indirect effects on health, income, employment, the price, availability and quality of goods and services, property value and losses.

Wealthy societies can spare resources to support adaptation, can better afford to make required changes in technology and infrastructure, and can more easily endure climate-related losses. Within societies, climatic harms and opportunities will not be equally distributed among individuals and communities: some will face greater burdens than others. Moreover, high rates of economic and population growth can themselves impose stresses on natural systems, through rising pollution (including greenhouse gases), congestion, and demands for land and resources, potentially increasing this systems' vulnerability to climatic stresses. Technology can also increase society's vulnerability to climate, particularly to extreme climate or weather events. This can happen because modern societies are organized around the

available technologies, and become dependent on them. For an example: contemporary American society relies in critical ways on electric power, transportation, and communications systems, all of which can be disrupted by extreme events if systems have not been adequately designed to deal with them. Large scale loss of power lines in an ice storm can have catastrophic effects on a modern industrial society, even though all societies, including early industrial ones, functioned without widespread electrical service only a century ago.

For particular communities or activities, the most important factors shaping climate vulnerability might be as diverse as local zoning ordinances, housing styles, or building codes, popular forms of recreation, the age and degree of specialization of capital in particular industries, world market conditions, and the distribution of income. For example, the vulnerability of American agriculture to past climate extremes has been shaped by a host of socioeconomic factors, including the size and structure of farm families, agricultural practices and available technologies, markets for alternative crops, available capacity for storage and transport, groundwater accessibility, local and nationwide markets for capital and labor, bank lending practices and the nationwide organization of banking and capital markets, global trade rules, and public policies (Socioeconomic context for Climate impact assessment, Parson, E.A).

IPCC fourth assessment report shows that the worlds' poor, already struggling to achieve their basic needs for food, water and health, will suffer the worst effects of climate change. Poor communities can be especially vulnerable in particularly those concentrated in high risk areas. They tend to have more limited adaptive capacities and are more dependent on climate sensitive resources such as local water and food supplies (IPCC 2007). In the same context, women in their roles as the primary manger of family, food, water and health are hit the hardest and must deal very directly when the impact of climate change are brought home (Wiser et al 2007). Women make up 70% of the world's inhabitants living below the poverty line (Rohr 2006). When a poor community in Mexico's Yucatan Peninsula in hurricane struck, there would be three to four women dead for every man (Aguilar 2008). The reason for the disparity is that women due to the culturally specific evaluation of their gender, face different vulnerabilities and many live in conditions of social exclusion such as exclusion from social skill learning such as tree climbing, swimming which help during floods, restrictions on women's movement in times of crisis prohibiting women from living the home without a males' permission, unequal allocation of food resources to girls and women

rendering them physically weaker in time of evacuation and crisis (Aguilar 2008).

2.3 Climate Change in Present context

According to United Nations Framework Convention on Climate Change (UNFCCC 2000), climate change defines as a change of climate which is attributed directly or indirectly to human activity that alter the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

The UN Intergovernmental Panel on climate change in September 2007 has estimated that the mean global surface temperature has increased by about 0.3 to 0.6 degree Celsius since the late 19^{th} century to the present and the warming rate became more pronounced during the second half of the last century due to the increase in anthropogenic green house gas concentration in the atmosphere (IPCC, 2001b).

A significant rise in temperature can trigger several uneven events, such as melting of the ice, the loss of significant marine life and biodiversity and ultimately effects on agricultural production and supply, economy, food security, human health and overall development of the society as well as nation.

Many studies show that poor, many of whom are indigenous peoples, are highly vulnerable to climate change in Nepal because of lack of access to profitable livelihood opportunities and their attachment to natural resources by culturally, socially and economically which force them to be more affected by climate change. Additionally, the culture and social practices of indigenous community is going to disappear because of gradual depletion of natural resources that they use as food, medicine, uniform and also use the plants and animals' parts with having the symbolic meaning when performing religious rituals. This trend is also increased in weak economic condition.

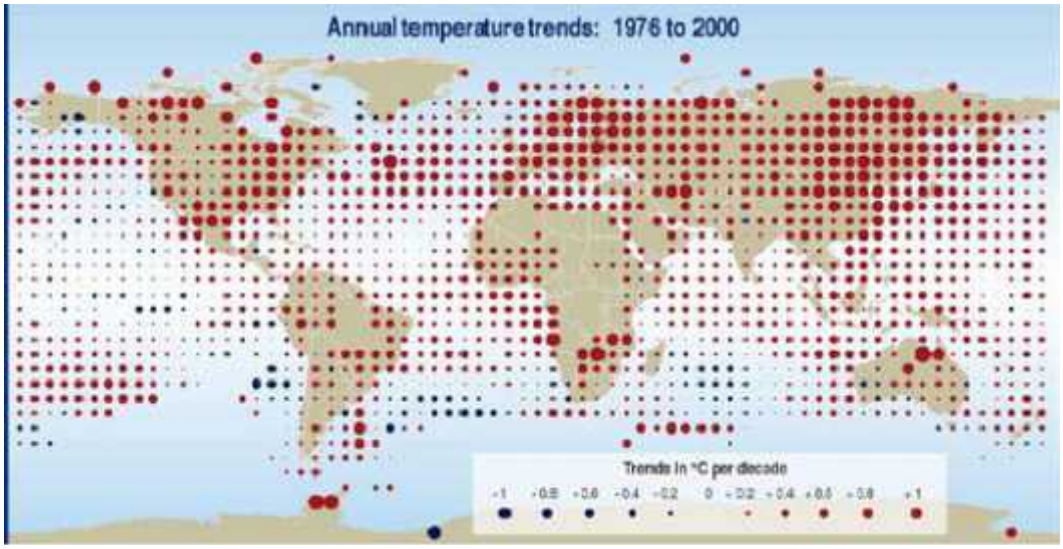
2.3. Impacts of climate change

2.3.1. Global context

Climate change is about the growth of greenhouse gas emissions due to the burning of fossil fuels, resulting mainly from industrial activities and

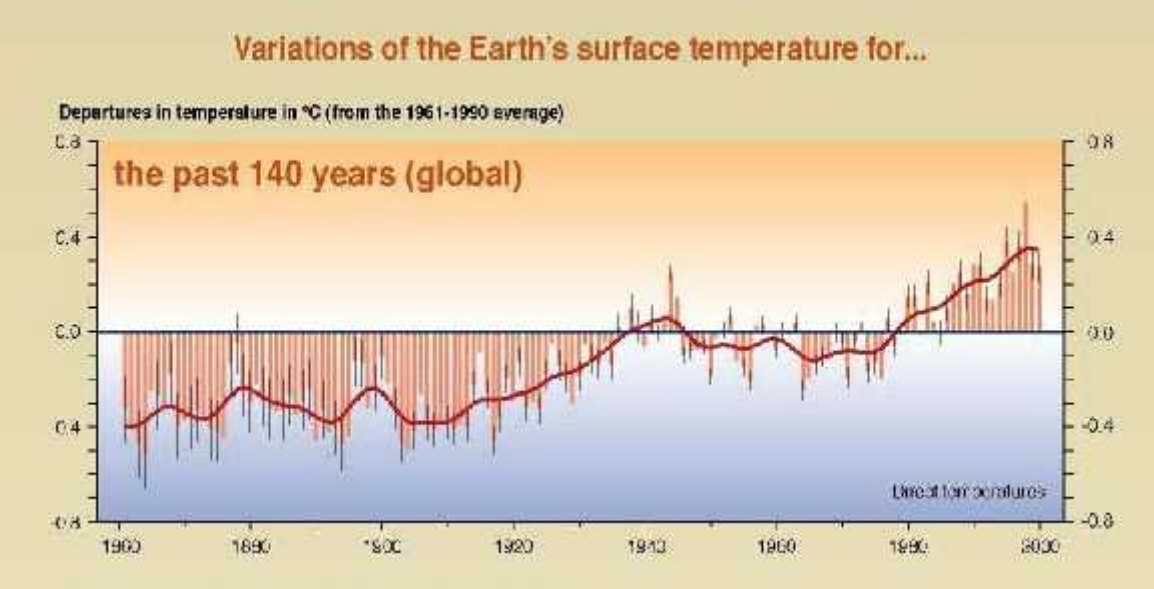
transportation means, contribute the concentration of carbon-dioxide levels in the atmosphere. Further, increasing concentration of carbon dioxide in the atmosphere is become worse when rapidly increasing deforestation is continuing which absorb gases and prevent to release into the atmosphere. The increasing concentration of carbon dioxide and other gases in the atmosphere also affect the greenhouse layer and generate more heat which cause the rising temperature in the earth. Temperature records of the earth have been available since 1861 only. Before the instrumental period, temperature of the Earth has been estimated using different indirect tools and methods such as tree rings, coral, ice cores, ice sheets, borehole measurements, glaciers, ancient sediments, sea level changes etc (IPCC, 2001a). The long term temperature record derived from the palaeoclimatic records shows clear evidence of fluctuation in temperature resulting in glaciations and deglaciations periods in the history of the earth since its formation some 4 billion years ago (Coughlan *et al.*, 1991). Global average surface temperature (the average of surface air temperature over land and sea surface temperature) records from 1861 to 2000 show that the earth's temperature is increasing (See fig. 1). Also show that the warmest period is at the second half of the twentieth century, especially in two periods, 1910 to 1945 and 1976 to 2000. Over the 20th century the increase has been 0.6±0.2º C (IPCC, 2001b).

Figure 1: Annual temperature trends for 1976 to 2000 (IPCC, 2001a)



Source: IPCC, 2001a

Figure 2: Variations of the Earth's temperature (IPCC, 2001b)

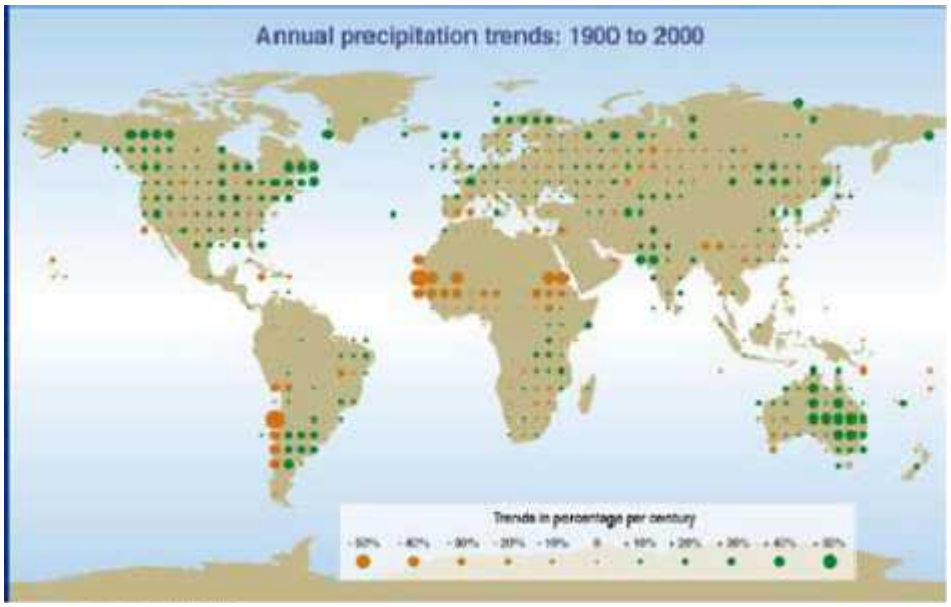


Source: IPCC, 2001b

The 1990s were found the warmest decade and the 1998 was the warmest year in the instrumental record since 1861 (IPCC, 2001b). Since the 1950s both daily maximum and minimum temperature have increased and the rate of minimum temperature increase is nearly double the rate of maximum temperature increase (IPCC, 2001a).

Increasing global surface temperature is triggering the uneven events which lead to change in precipitation and atmospheric moisture, because of a change in atmospheric circulation, a more rapid hydrological cycle and an increase in the water holding capacity throughout the atmosphere. Despite the irregularity in the trends of precipitation in the last century (see fig 3), the annual average precipitation in mid and high latitudes is increasing while that in tropics and sub-tropics is decreasing (IPCC, 2001a).

Figure 3 : Annual precipitation trends for 1900 to 2000 (IPCC, 2001b)



Source: IPCC, 2001b

Monsoon circulation system has been dominated the climate of South Asia. The influence of monsoon circulation is dominant over the southeast of the Himalayan region (Nayava, 1980).

Kothyari and Singh (1996) analyzed the monsoon, annual rainfall and annual temperature capturing the data of long period in India including the data for the Ganga basin which show that temperature is increasing and precipitation is decreasing since the mid of the 1960s.

2.3.2. Impacts of climate change in National Context

Nepal is a land-locked country which contains 8 of the 14 highest mountain peaks in the world, including Mount Everest (at 8848 m). There is therefore extreme spatial climate variation in Nepal – from a tropical to artic climate within a span of only about 200 kilometers.

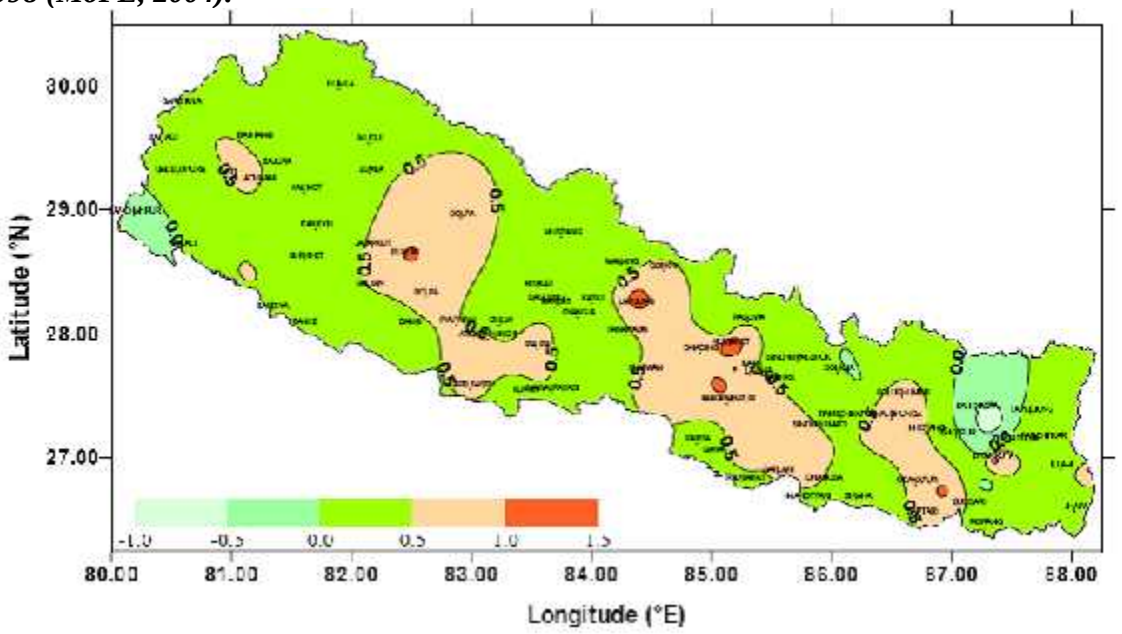
Observation and analysis of regular meteorological data such as temperature and precipitation in Nepal are very limited. The data show that temperature of Nepal is rising which can be felt more pronounced in the high altitude of Nepal (4000-8000m msl) and the Middle Mountain (1500-2700m msl) where as the warming is significantly lower in the Siwalik (700-1500m msl) and

Terai (below 750m from msl). The warming in the winter is more pronounced compared to other seasons.

The analysis of meteorological time series of the Koshi basin (Eastern Nepal) from 1947 to 1993 shows an increasing tendency of temperature (Sharma *et al.*, 2000b).

Analyses of maximum temperature data of 49 stations in Nepal reveal that warming trends after 1977 ranging from 0.06 to 0.12 ºC per year in most of the Middle Mountain and Himalaya where as in the Siwalik and Terai show that warming trends less than 0.03ºC per year (See table no 1). Temperature records of five ecological zones show that the temperature rising trend are different in different altitudinal ranges. The trend is more pronounced in Trans-Himalayas and Middle mountains region. This increasing trend of temperature makes the livelihood of community harder in the area comparing to other ecological zones.

Figure 4: Observed mean annual temperature trend (ºC) per decade for the period1981 to 1998 (MoPE, 2004).



(Source: MoPE, 2004)

Analysis of temperature based on 80 stations of Nepal from 1981 to 1998 (Fig: 4) show that temperature is increasing at the rate of 0 to 0.5 ºC per decade in major part of the country. However, the overall temperature in the country is rising at the rate of 0.41ºC per decade and seasonal rising trend of temperature during pre monsoon, monsoon and winter are 0.43 ^{0}C, 0.43 ^{0}C and

0.37^{0} C per decade respectively (MoPE, 2004). The warming trend is more pronounced in higher altitude than in lower as in the Tibetan Plateau (Liu *et al.* (2000), which is similar to warming trend of Nepal (WWF Nepal, 2005). However, the magnitude of trends is much greater in Kathmandu than in all other parts of Nepal (Shrestha *et al*., 1999; WWF Nepal, 2005).

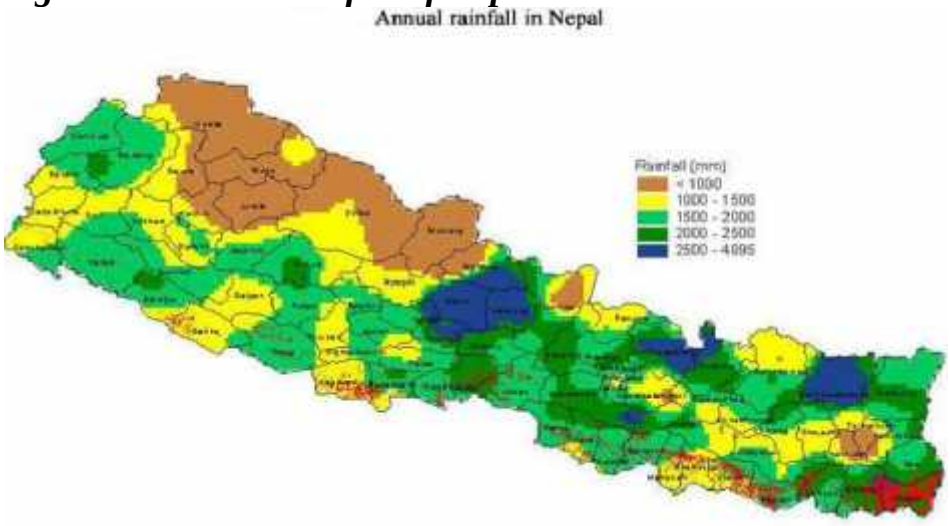
Table 1: Regional mean maximum temperature trends in Nepal from 1977–2000 (°C per year)

Region	Season				Annual
	Winter(Dec-Feb)	Pre-monsoon (March-May)	Monsoon (June-September)	Post-monsoon (Oct-Nov, Dec or Jan)	
Trans-Himalayas	0.12	0.01	0.11	0.1	0.09
Himalayas	0.09	0.05	0.06	0.08	0.06
Middle Mountains	0.06	0.05	0.06	0.09	0.08
Siwaliks	0.02	0.01	0.02	0.08	0.04
Terai	0.01	0	0.01	0.07	0.04
All Nepal	0.06	0.03	0.051	0.08	0.06

Updated after Shrestha et al., 1999, Perspectives on water and climate change adaptation, ICIMOD

The data accumulated from 80 stations of Nepal showed that the Terai and western region of Nepal have a negative precipitation trend where as in the hills and mountains of west Nepal and the northern part of eastern Nepal have a positive trend with a maximum increase of 1100 mm/decade. On the other hand, the eastern and central part of Nepal face a negative trend of <700 mm/decade.

Figure 5: Annual rainfall of Nepal



(Source: MoPE, 2004)

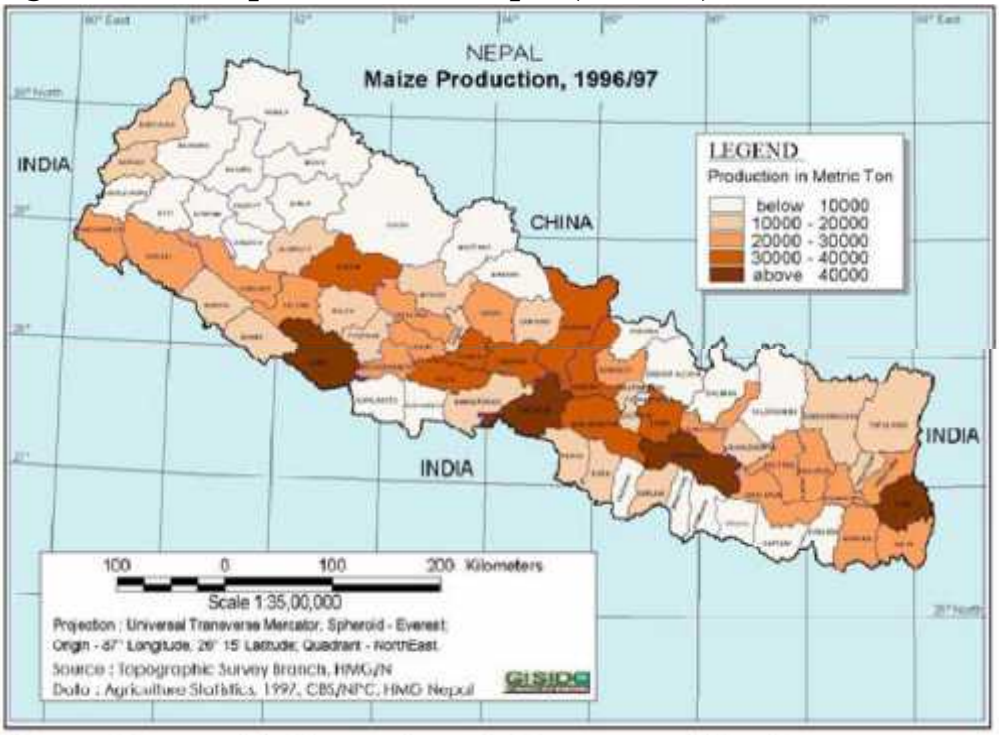
The overall average trend for Nepal indicates that the annual average precipitation over Nepal is decreasing at the rate of 9.8 mm/decade (MoPE, 2004). But the data collected from Koshi basin (Eastern Nepal) from 1947 to 1993 shows the increasing trend of precipitation (Sharma *et al.*, 2000b).

2.3.3. Impacts on Agriculture

Agriculture is a backbone of the economy of Nepal. About 80% of Nepal's population depends on agriculture directly and indirectly for their livelihoods and it covers around 27% of total land area, and contribute to 40% of the GDP of Nepal.

The agriculture in Nepal is so vulnerable to climate change due to rising temperature, long drought, low precipitation, hailstorm, soil temperature, accelerated soil-matter decomposition and changes in micro-floral and micro-faunal metabolism and natural disaster such as floods, landslides etc. The magnitude of impacts is difference in diverse locality, altitude and crop species. A study showed that in the middle to high latitudes may experience increase in productivity where as in the tropics and subtropics rain-fed agriculture yields are likely to decrease (IPCC, 1997). A study done in India by Kavi Kumar (2003) showed that a 1 ºC rise in mean temperature in India would have no significant effects on wheat yields, while a 2 ºC increase would decrease wheat yields in most places of India. 4 º C temperature rises might cause a wheat yield reduction in Nepal upto 60% of the potential yield (Pradhan, 1997). Rice production is decreasing with a decrease in monsoon flow (Sharma *et al.*, 2006). Rice yield increases from 0.09 to 5.5% at 4°C increase in temperature and 20% increase in precipitation, but beyond that the yield would continue to decline. In case of maize, it was found that increased temperature would lead to decreased yield of maize. However, rice, wheat and maize respond positively under double CO2 for wheat goes as high as 60%, rice yield 21% and maize yield 12% (MoPE, 2004).

Figure 6: Maize production in Nepal (1996/97)



(Source: Topographical survey branch, Government of Nepal)

Figure 7: Paddy production in Nepal (1996/97)

(Source: Topographical survey branch, Government of Nepal)

In the context of Nepal, there are many things lacking in agricultural sector that need to be improved such as adoption of advance technique, unscientific or traditional agricultural practices and diversification of cropping pattern for the mitigation of changing climate. The agriculture of Nepal is largely depends on rainwater and seasonal basis with traditional cropping system. Many evidence show that crop diversity plays a significant role to adapt in changing environment (Hajjar et al.2008, Zhu et al.2003). Agro-ecosystems also deliver important regulating services such as soil protection, erosion control, pollination, carbon sequestration and the maintenance of soil and water quality.The agricultural yield reduction in 1997/98 ranged from 11% to 38% compared to the average of the preceding 10 years (MoPE, 2004).

2.3.4. Impacts on Socio-Economy

Vulnerability to climate change depends not only on natural factors, but also on economic, social, and cultural condition which the societies have since a long period. It also depends on people's status, attitude, behavior, relationships, and power because they all are related to climatic variables directly or indirectly. Nepal is a multi-cultural country with diverse ethnicity; ethnical and social practices and values are based on or related to nature and natural resources which is affected by climate change hindering the life of people and their livelihoods severely.

In Nepal, There are a big gap between income and consumption; the richest 20% of the population consume 53.3% of the resources where as the poorest 20% of the population consume only 6.2% of the resources (CBS, 2004). This shows the inequality to the access of resources and power that can be created an unfavorable situation in the society and its development. About the 82.5% of the population are living below the international poverty line of US $ 2 per day (World Bank, 2003) which indicates that Nepal is one of the poorest countries in the world.

A study done in Humla district shows that food availability is reduced and increased malnutrition due to agricultural and environmental insecurity such as increase level of drought for production, lack of infrastructure and social networking**.** This condition forces the young man of Humla to move to other parts of Nepal as well as India for the employment and weaken their livelihood, economic and social status severely. They are forced to live the life under a lacking condition. Later on, it becomes habitual for them as a part of culture.

Climate change impacts make the life instable and force the people to move towards another new place for the better opportunity to live. A study done in Mongolia by climate change unit of Mercy Corps 2007 shows that severe drought in 1999-2000 had killed many rural livestock of Mongolia which forced them to relocate to the capital and other provincial centers. At that time almost 30% of livestock loss in Mongolia and as a result, agricultural production fell down, economic growth slowed and thousands of herders left without the any sources of income. Many people had fallen into poverty which triggered the series of other issues such as social insecurity from weakened community networks, increase in alcohol abuse, domestic violence and marital breakdown.

According to working paper No.3 of CLACC Nepal (2004); adverse impacts of climate change on development of Nepal by Bimal Raj Regmi and Mozaharul Alam, due to higher temperature increased evapo-transpiration and decreased winter precipitation and the precipitation from November to April would impact the winter and spring crops and reduced the yields of rice and increased the food insecurity. This would impact severely more in the population living in Terai plain and hilly area than the population living in other areas.

Vivian, 2003 shows that from 1954 to 2002, floods have affected over a million people in Nepal and killed 5,003 people (24% of deaths from all disasters), left almost 70,000 homeless (45%), and damaged amount almost US$ 990,613 (75%). This shows that natural disasters severely disrupt the livelihoods and community development of Nepal and they are also forced to sell off their productive assets and move to safer places for the safer future with a big struggle among new people and location.

2.3.5. Impacts on Health

Climate change can affect health both directly and indirectly. Directly through the stress of heat and injury from severe conditions due to climate change, and indirectly through the changes of disease carriers pests like Mosquitoes and the environmental hazard such as prolonged flooding, drought, erratic rainfall etc, and the availability of food.
Sufficient healthy food required for a good health. It is only possible when these required foods can have easily without any scarcity to whole family, society and nation for a whole year. To the contrary, the situation has not

remained same in these days. Food insecurity is arising day by day all over the world. Among them Nepal is one of the most victim of food insecure country because of low production in agriculture due to changeable climatic variable experiencing since years ago.

A study done in Makwanpur district by Practical action in 2007 showed that the disease-carrying pests such as Mosquitoes can breed in the previously cool area because of warmer temperature than before, which can cause the Malaria in the area. In this day, the outbreak of Kalajar, Malaria and Japanese encephalitis are increasing in Terai area which is definitely as a result of climate change.

According to International Food Policy Research Institute, Impact on Agriculture and Costs of Adaptation 2009, in a no-climate change scenario the number of malnourished children in South Asia would fall from 76 to 52 million between 2000 and 2050, and from 24 to 10 million in East Asia and the Pacific. Climate change will erase some of this progress, causing the number of malnourished children in 2050 to rise to 59 million in South Asia and to 14 million in East Asia and the Pacific, increasing the total number of malnourished children in Asia by about 11 million. Malnutrition that is considered the single most important factor threatening global health which is responsible for 15% of total disease worldwide and is closely related to climate.

2.4. Climate change and indigenous community

Most of indigenous people live in bio-diverse and fragile ecosystems of the planet which makes them more vulnerable to the impacts of climate change due to their direct reliance on the local natural systems for their well-being and their disadvantaged socioeconomic standing caused by historical, political and social processes of discrimination.

Assessment of the impacts of climate change and mitigation policy has focused mainly on reduction of emissions and building adaptation strategies to overcome the impacts catastrophic future trends rather than the recognition of the unique situation of indigenous peoples. Protection of indigenous territorial rights and self-determination are, therefore, most required for protection of some of the most important areas of biological and cultural diversity area in the world (Indigenous peoples & Climate change: Human rights 2009) Current climate change science and policy do not provide

participatory, trans-disciplinary and multicultural frameworks necessary for empowering indigenous peoples to build resilience through their own self determined process of development and adaptation. It is most necessary to attract the attention of all stakeholders to differentiate the impacts on indigenous communities and the ecosystems they inhabit. Otherwise, this group will be disproportionately affected by impacts of climate change and during the aid distribution process as well.

At the same time, due to continuous hinder of climate change both environmentally and politically to indigenous people, they potentially success to hold the long history of knowledge and cultural practices to how to manage and adopt on changing climate based on their experience.

In Nepal more than 60 Indigenous group lives with their unique and different culture and social practices, and mostly about 80% live in rural area. Most of these groups are living in deprived and vulnerable area of climate change in the country which forces them to live under server poverty in lacking of all kinds of opportunity and facilities to be coped with impacts of climate change. Because of all these reasons, they are severely impacted group of the country. Among them, Tamang people are one of the main indigenous groups of Nepal found in all three ecological zones: Himalayan, Hilly and Terai region of the country ranging from eastern to western Nepal.

2.5. Present Policies and strategies concerning climate change

For people to cope with our current natural and cultural environmental changes, many countries worldwide including Nepal started to incorporate policies and strategies to allow to sustainably maintaining healthy, resilient communities in the face of climate change. Many countries have developed policies and strategies to mitigate or to adapt the climate change in worldwide. Likewise, the Government of Nepal (GON) and other non-governmental organizations and private sectors started to endorse the strategy of environmental management. For example, the GON has taken policies initiatives for environmental management that includes the *National Conservation Strategy (*NCS) 1989, *Nepal Environmental Policy and Action Plan (*NEPAP) 1993, National Parks and Wildlife Conservation Act 1973, Water Resources Act 1992, Forest Act 1993 and Environmental Protection Act 1997, Convention on Biological Diversity in 1992, the country's biodiversity strategy 2002 as part of the UNDP/GEF biodiversity Conservation Project. Nepal also has signed the United Nations Convention on Combat Desertification (UNCCD) in 1996.

Chapter 3: Research Methods

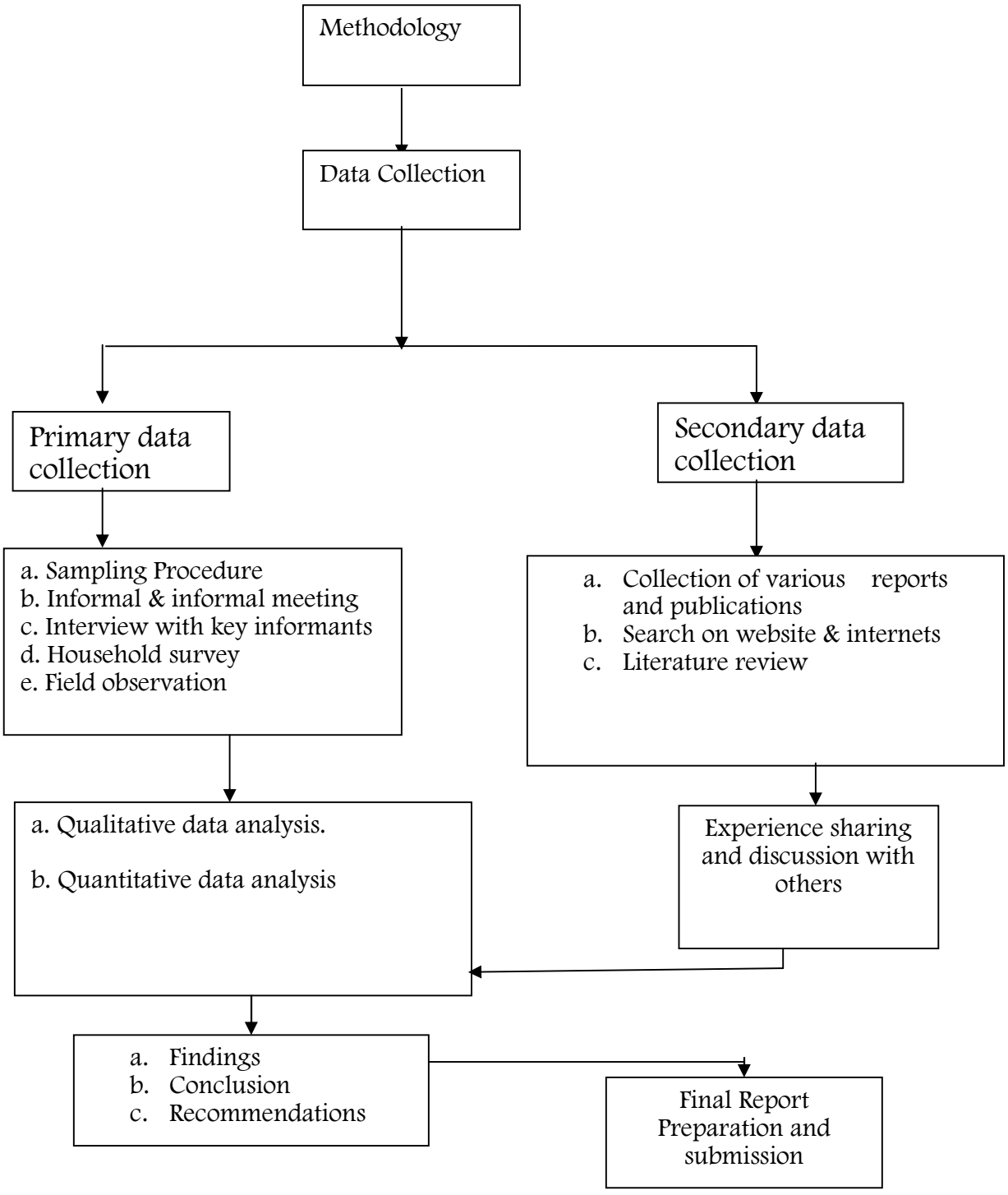
3.1. Research Design

This study was focused on how climate changes affect social, cultural and economic life of Tamang community of Harion VDCs 2 and 9. The traditional or indigenous practices they have applied either directly or indirectly to overcome from those impacts which includes the adaptation methods of their daily life.
Various methodologies were applied to collect the information from field that includes both primary and secondary data. The study area comprises about approximately two hundred households of Tamang community.

This research was conducted through the simple and the most appropriate methods of data collection such as household survey, direct field observation, formal and informal meetings and interviews with key persons. Data was analyzed based on collected information then set the research findings and its implication accordingly. Detail methodological framework diagram is shown below (see figure 8).

Figure 8

Detail methodological procedure is shown below in chart



3.2. Selection of Study Area

Many studies have already evidenced that poor community, vulnerable society is the most impacted group in changing climate due to the lack of enough resources to adjust the challenging condition. Its low economic strength, inadequate infrastructure, low level of social development, lack of institutional capacity, higher dependency on the natural resource and agriculture base economy makes the society or community more vulnerable to changing climatic system and its extreme events.

With all above issues, I have run my research on Tamang community of Harion VDC because about 99% Tamangs of the area are involved in agriculture and livestock farming directly or indirectly. A heavy reliance on agriculture makes this community's economy very sensitive to climatic variability and its uncertain events. There are not any other non-agricultural employment options which force them to be most impacted to the changing climate. Only few are involved in business sectors. Their livelihoods are heavily dependent on natural resources such as timber, fuel wood and fodder. Every year they have been facing burden of low production from their land due to changing climatic variables like rising temperatures, long drought, increasing evapo-transpiration, delay rainfall in monsoon, decreasing winter precipitation and unusual severe cold in winter. Decreased precipitation from November to April impacts the winter and spring crops heavily. Rice yields fall in the area, which is the main source of food for them. Tamang ethnic group of Harion VDC whose livelihood, culture and ritual practices is totally dependent on natural resources. Low production of land, lack of sustainable market of agricultural product and still following traditional agricultural practices are restricting them to improve their livelihood.

As economy is the main bond for the development of other aspects of the society. It influences cultural practices, social structure and the whole social system. Similar case can be seen in Tamangs of Harion. As a result of adverse effects of climate change on agricultural production, this community's economy worsens deeply and puts the hardship on their cultural and social life. In long term, it will threaten the culture of Tamangs and hamper the social development in the area.

Therefore, this research was conducted on this vulnerable community who are highly influenced by the changing climate in all aspects of their life. It is tried to explore the sum of impacts of climate change on Tamangs of Harion

VDC and tried to make aware them on adaptation measures against the impacts of changing climate and how to strengthen the resilience capacity at local level. This research also aimed to draw the attention of Tamangs of Harion on the causes of climate change such as degradation of forest and inappropriate land use system and its consequences in their life in future.

3.3. Sampling Procedure

This research was followed the systematic random sampling to gather the data from field. 100 representative sampling units was selected and tried to cover about 50% of the whole unit. Generalization of whole study area was made being based on the collected data from the sampling units.
Research included both primary and secondary data collection methods.

3.4. Method of Data collection

3.4.1. Primary data collection

Primary data was collected through various methods such as household survey, direct field observation, interviews with key persons and, formal and informal meetings.

a. Field Observation

Firstly, field was visited frequently for observations of the study area to know more deeply about the social structure and cultural systems of the community. Observation of land use system and agricultural pattern was done on the basis of season. Similarly, in order to find out the more exact information, observed the several cultural practices so closely when they were practicing it.

b. Questionnaire Survey

Household survey carried out by using semi-structure questionnaires as an information collection tools. For it, different questions were set to interview the respondents with various groups like different occupational group, disadvantage group from the study area.

c. Interview with key informants

There are many key persons in every society who play the significant role in their society and also have more knowledge in comparison of others. To get the important information, some interviews were done with the key informants like teachers, religious leaders (Lama), social workers and political leaders.

d. Formal and Informal meetings

Many formal and informal meetings with concerned groups and individual were done as its necessity. Sometimes, it becomes hard to get the some sensitive information through formal meetings, so need to catch that information by the informal meetings. Information regarding to social, cultural and religious practices and rituals are directly attached to the sentiment of the community. So, these kinds of information need to hold through informal meetings.

3.4.2. Secondary data collection

The secondary data includes the information collected through records and reports written by different organizations (ICIMOD, IPCC, UNDP, and WWF), and individual researchers on different aspects of global warming and climate change. Similarly, social and cultural information and the information regarding Tamang peoples were collected from central library, TU, Kirtipur Tamang Ghedung, Kathmandu and NEFIN, Kathmandu. Meteorological data were collected from Department of Hydrology and Meteorology (DHM), Kathmandu. Necessary information was also collected from relevant websites.

3.5. Data Analysis and presentation

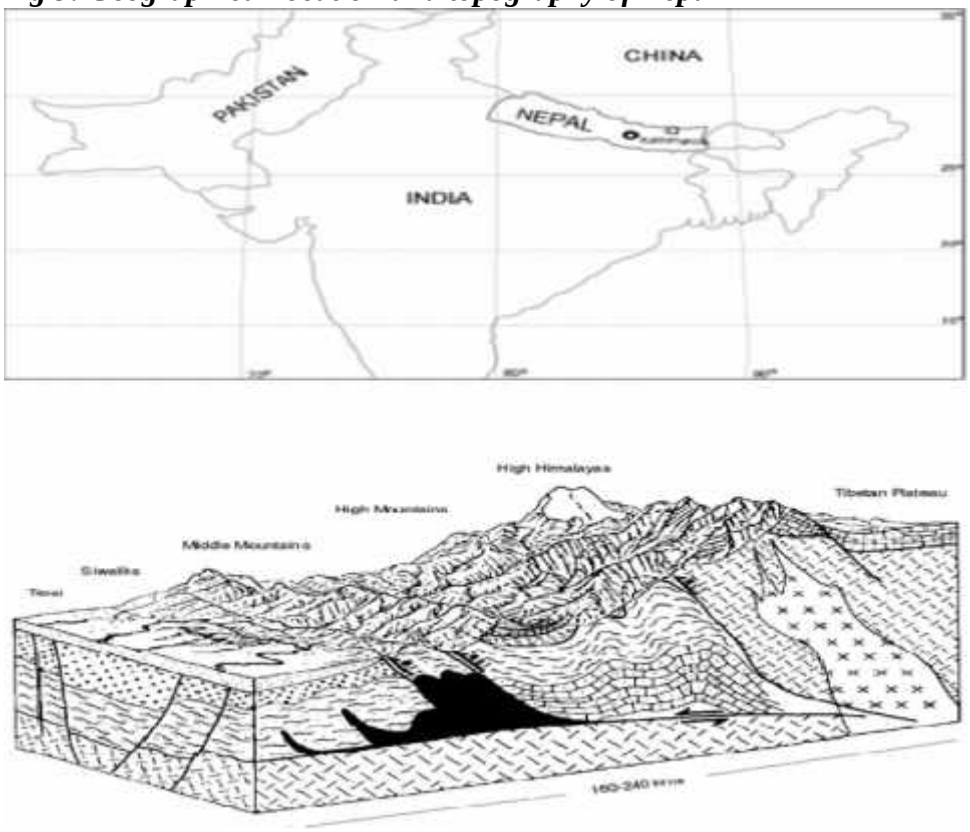
Firstly all collected data was processed through editing, coding, classifying and tabulating. Different statistical measures like diagram, figure, charts and tables were used for presenting and analyzing data. Meteorological data, temperature and rainfall pattern were interpreted as calculating the average value of temperature and rainfall on the basis of monthly, annually and ten years (from 1999 to 2008) data. Socio-economic condition and prospects are intangible and can't measure directly in some cases for example for the economic condition, what types of crops and livestock raised, trend of off-farm employment and the unemployment rate etc can give the information about the economic condition of respondents. So it was measured indirectly as well and; the recommendation was made based on findings of data.

Chapter 4
Socio-Economic Profile and Climatic Condition of Study Area

4.1. Introduction to Study site

Nepal is divided into five geographic regions: Terai plan, Siwalik hills, Middle Mountains, High Mountains (consisting of the Main Himalayas and the Inner Himalayan Valleys) and the High Himalayas and, ecologically Nepal has divided into three regions: Terai region, hilly region and Himalayan region.

Fig 9: Geographical location and topography of Nepal

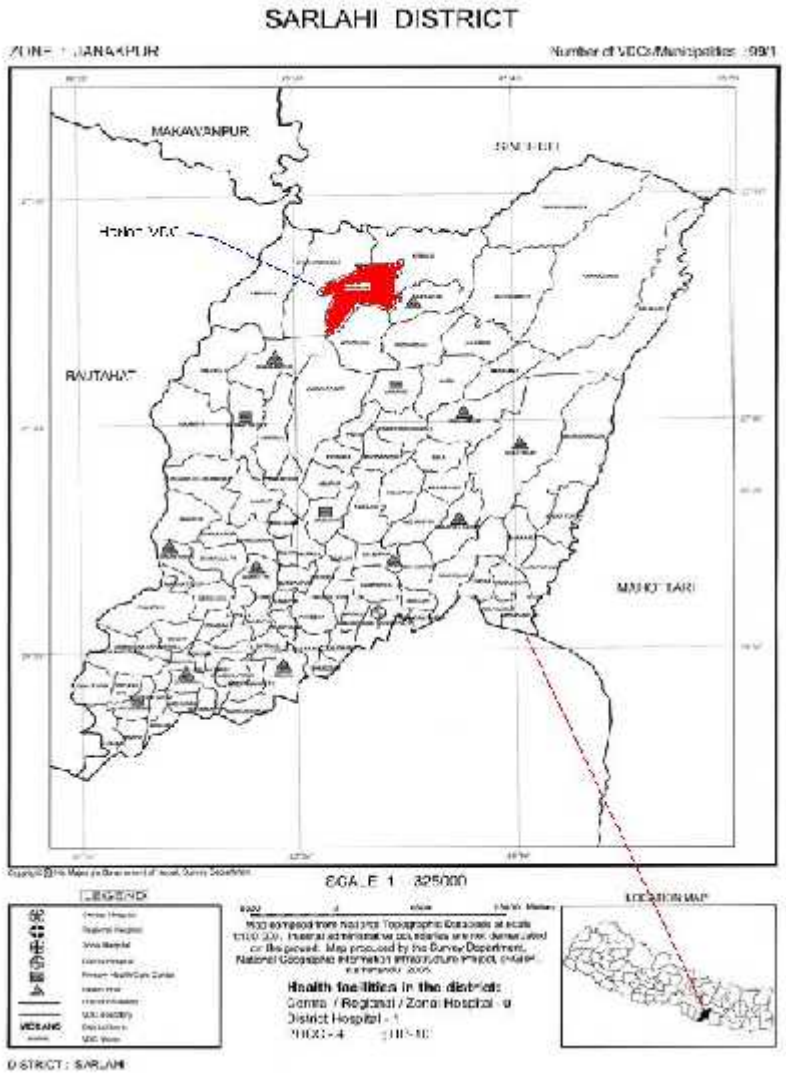


(Source: Topographical survey branch, Government of Nepal)

Terai region is the southern narrow and low land plain strip which occupy less than one-third of the total area with the characterization of tropical and subtropical belt of flat, alluvial land stretching along the Nepal-India border and paralleling to the hilly region (Fig: 9). It is the northern extension of the

Gangetic Plain in India, commencing at about 300 meter from msl to about 1,000 meter at the foot of the Siwalik Range. Tarai includes several valleys (*dun*), such as the Surkhet and Dang valleys in western Nepal, and the Rapti Valley (Chitwan) in central Nepal. This region is known as a main source of food production to supply to other parts of Nepal which is drained and nourished by several rivers. Additionally, it has the largest commercially exploitable forests. In the early 1990s, however, the forests were being increasingly destroyed because of growing demands for timber and agricultural land. It comprises 23% of the total land of Nepal & nearly 48.4%, the largest population of Nepal is inhabitant in this region (CBS 2002).

Figure 10: Map of Study area, Sarlahi district



Source: Sarlahi district profile, 2067

Sarlahi district is one of the Terai district of central Nepal which is located between latitude 26^0 45'N to 27^0 10' N and 84^0 41' E to 85^0 50'E longitude with the altitude ranging from 60m to 659m from mean sea level (MSL). East-west high way (Mahendra high way) passes through the district, Bankey River (Mahotari district) to the east of the district and Bagmati River (Rautahat district) to the west of the district as the political boundary of the district. Similarly, Churia ranges to the north separates the district from the neighboring district Sindhuli and Bihar (South India) lies to the south of the district (See figure 10).

In figure 10, the area is highlighted by red color is study area, Harion VDC, which lies in northern side of the Sarlahi district. A region that in the past contained malaria-infested area covering thick forests, commonly known as char kose jhadi (dense forests approximately twelve kilometers wide) and around in 1991 this area became the most popular destination for the land-hungry peasants of the hilly region.

4.1.1. Population of Sarlahi district

Harion is one of the most populated VDC in the whole district even more than district headquarter, Malangawa municipality. According to respondent, this village was covered with very dense forest and roaming tigers and bears around the village decades ago. There was almost absence of human settlement at that period but later, Government made a provision for settlement of people in that dense forest known as Charkose Jhadi after the eradication of Malaria from the area. Then, people were migrated there from mountainous region and other parts of Nepal. The migration process is still running in this area especially from hilly area of Nepal. This VDC comprises of multicultural and multi-ethnical communities with the dense population. Recently, Harion VDC is proposed as a municipality by Government of Nepal.

As table 2 shows, total Population of the district is 63, 5701 (M-32, 9182 & F-30, 6519). About 78.28% populations involve in agriculture and only 21.71% depend on non-agriculture sector. Population increasing rate is 2.55% and population density 504.93/km² (Population census 2058).

Table 2: Population of Sarlahi district

Nature of Population	B.S. 2028	B.S. 2038	B.S. 2048	B.S.2058	B.S.2066 (estimated)
Male	Not available	206091	254964	329182	402644
Female	Not available	192775	237834	306519	374924
Total	175543	398766	492798	635701	777568
No. of Household	Not available	71667	88141	111076	135864
Population increasing rate	Not available	11.32	2.64	2.55	2.55
Population Density (per sqr KM)	139.4	316.7	391.4	505	617.60
Gender ratio		1.07	1.07	1.07	
Urban population			2.9	2.9	
Rate of population involved in Agricultural sector (%)				78.29	
Rate of population involved in non agricultural sectors (%)				21.71	
Economically active population (%)			44.9	36.86	

Source: Sarlahi district profile, 2067

Harion VDC is diverse business oriented area in the district. Composition of society is accumulated by different groups both Indigenous and non-Indigenous groups migrated from the different locality of the country. They are followers of Buddhist, Hindus, Muslim and Christian by religiously and their cultures are also influenced by their religion. But some similarities can be observed in food habit, dresses, design and structure of household and also in social requirements. Single and joint family pattern are existed in this VDC. By religion 34,534 (5.43%) population believe in Buddhism in which main follower is Tamang in the district, where as Muslim is 7.45%, Hindusm 86.74%, Chrischian 0.08% and others are 0.30% (See table 3 below).

Table 3: Population by religion in Sarlahi district:

Religion	Population	Percentage
Buddhist	34543	5.43
Hindus	551410	86.74
Muslim	47364	7.45
Chrischian	498	0.08
Others	1886	0.30

Source: Sarlahi district profile, 2067

In Harion VDC, Indigenous people occupy 27.5% (4674 population) where Tamang is dominant. Similarly, Dalits occupy 8.2% (1395 population) and others 64.4% (10957) of total population (See table 4). The area of Harion VDC is 19.545 and the population density of Harion is 1065.5 (in B.S.2066). The total population of Harion in B.S. 2066 is 20,826 where as in National population census showed in B.S.2058 was 17,026. The total number of voters participated on Civil election 2064 was 14,966.

Table 4: Population by the Indigenous categories in Harion VDC:

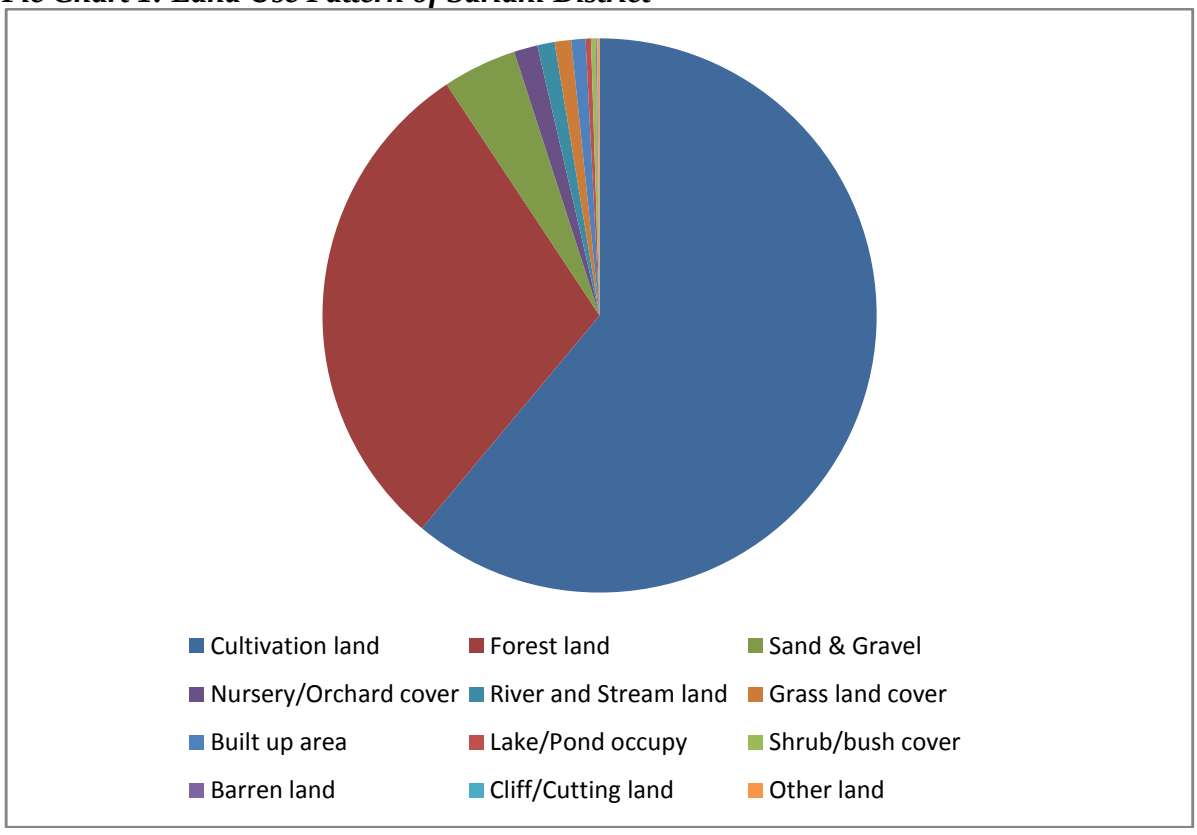
Average family size	No. of Household	Population B.S.2058					
		Male	Female	Total	Indigenous group (27.5)	Dalit (8.2)	Others (64.4)
5.44	3127	8706	8320	17,026	4674	1395	10957

Source: Sarlahi district profile, 2067

4.1.2. Land use pattern and agriculture system of Sarlahi district

Sarlahi district is one of the famous cultivable districts of the country and rice, maize, wheat, sugarcane and vegetables are predominant crops. Out of total land in the district, 66.57% (83839 hector) of land is used for the cultivation purpose (See Pie chart 1& fig 11).

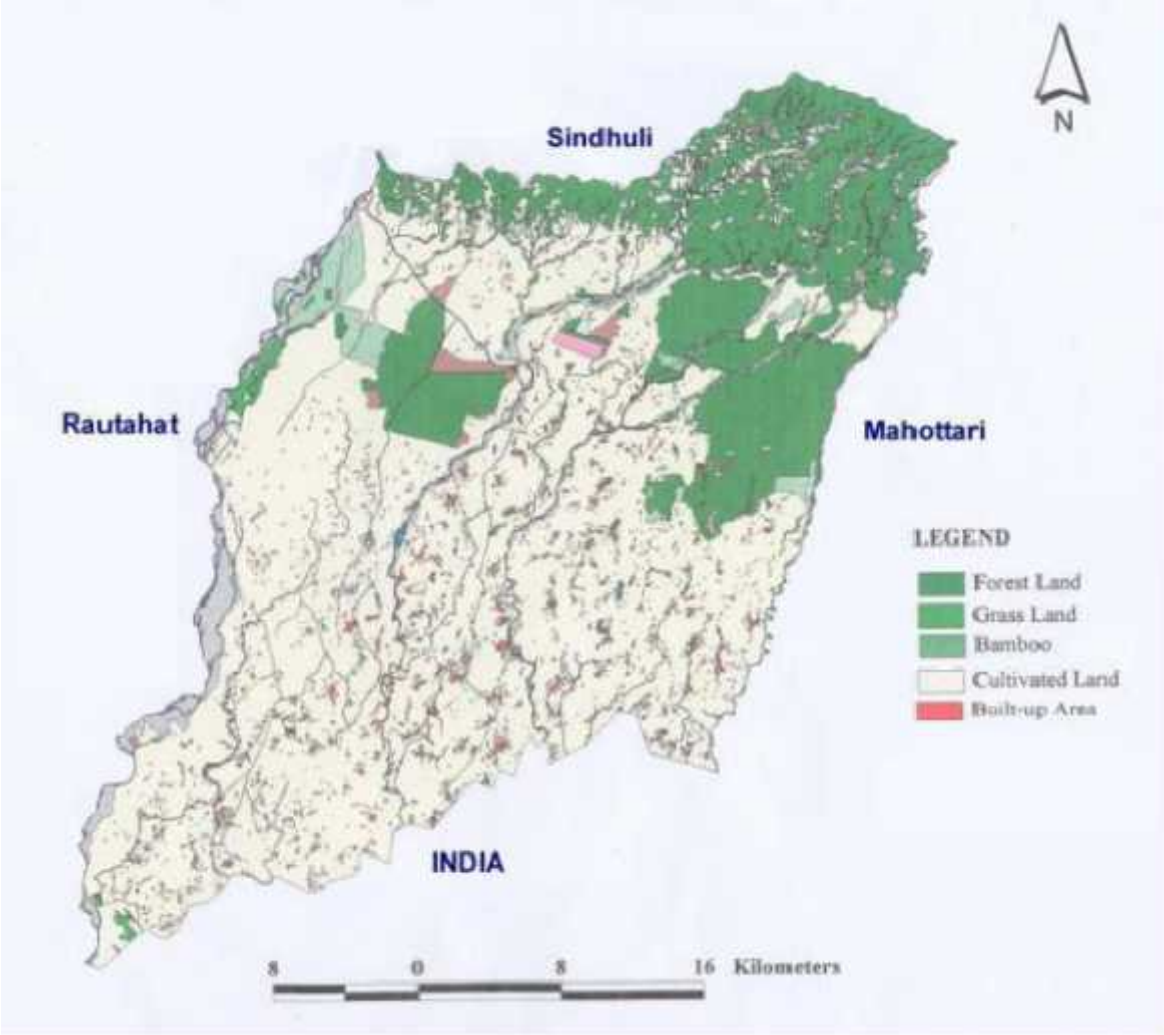
Pie Chart 1: Land Use Pattern of Sarlahi District



Source: Sarlahi district profile 2067

Similarly, Forest land covers 23.31% (29362 hector), sand and gravel land occupy 4.71% (5934 hector), Nursery/orchard covers 1.48% (1858 hector), river/ stream land is 1.12% (1406 hector), grass land covers 1.04% (1311 hector), built up area is 0.91% (1142 hector), pond/lake occupy 0.34 % (422 hector), land covers by shrub/ bush is 0.30% (374), barren land is 0.07% (88 hector), cliff/ cutting land is 0.03% (38 hector) and other land is 0.14% (172 hector).

Figure 11: Land use map of Sarlahi



Source: Sarlahi district profile, 2067

4.1.3. Health condition of Sarlahi District

Health condition of Sarlahi district is mostly influenced by the weather of the area like severe cold in winter cause the death of many older people and in summer, hotter temperature and impure drinking water cause the diseases of vector borne and intestinal worm, diarrhea. As shown by the table 5 below,

some dangerous diseases like tuberculosis, malaria, Kala-azar, Leprosy and intestinal worms' cases are seen mostly in the area.

Table 5: The most dangerous disease of Sarlahi district

S.N.	Name of disease	Percentage	
		1999	**2004**
1	Case finding rate of tuberculosis	NA	113
2	Malaria incidence per 1000 population	0.29	0.01
3	Kala-azar incidence per 100,000 risk population	35.90	0.30
4	Leprosy prevalence rate per 1000 population	27.23	4.70
5	Intestinal worms	2.95	2.55

Source: NNIPS, Sarlahi, 2004

4.1.4. Educational status of Sarlahi district

Total literacy percentage of the district is 42.13%, out of which male literacy is 51.2% where as female literacy rate is 33.06%. Adult literate rate is 30.06% where male 42.8% and female 17.8% (See table 6). This data shows that women literacy program should be organized by the district education office of Sarlahi.

Table 6: Literate status of Sarlahi:

Literate	2028	2038	2048	2058	2062	2066
Total	8.2	15.6	26.2	36.17	42.13	
Male	13.7	24.0	38.0	46.86	51.2	
Female	2.4	6.5	13.5	25.83	33.06	
Adult literate				30.7		
Adult literate (Male)				42.8		
Adult literate (Female)				17.8		

Source: Sarlahi district profile, 2067

Table 7 shows that there are 24 government or community schools in Harion VDC and 10 Boarding schools run by private sectors. Out of total, 13 are pre-nursery schools, 7 primary schools, one lower secondary school, (secondary school's data isn't available), 2 higher secondary schools and one college run by government and community. 10 boarding schools; 2 primary schools, 6 secondary schools and 2 higher secondary schools are run by the private sectors. This data shows that Harion VDC is becoming the educational destination for the students of the district and other district as well.

Table 7: Educational institutions of Harion VDC

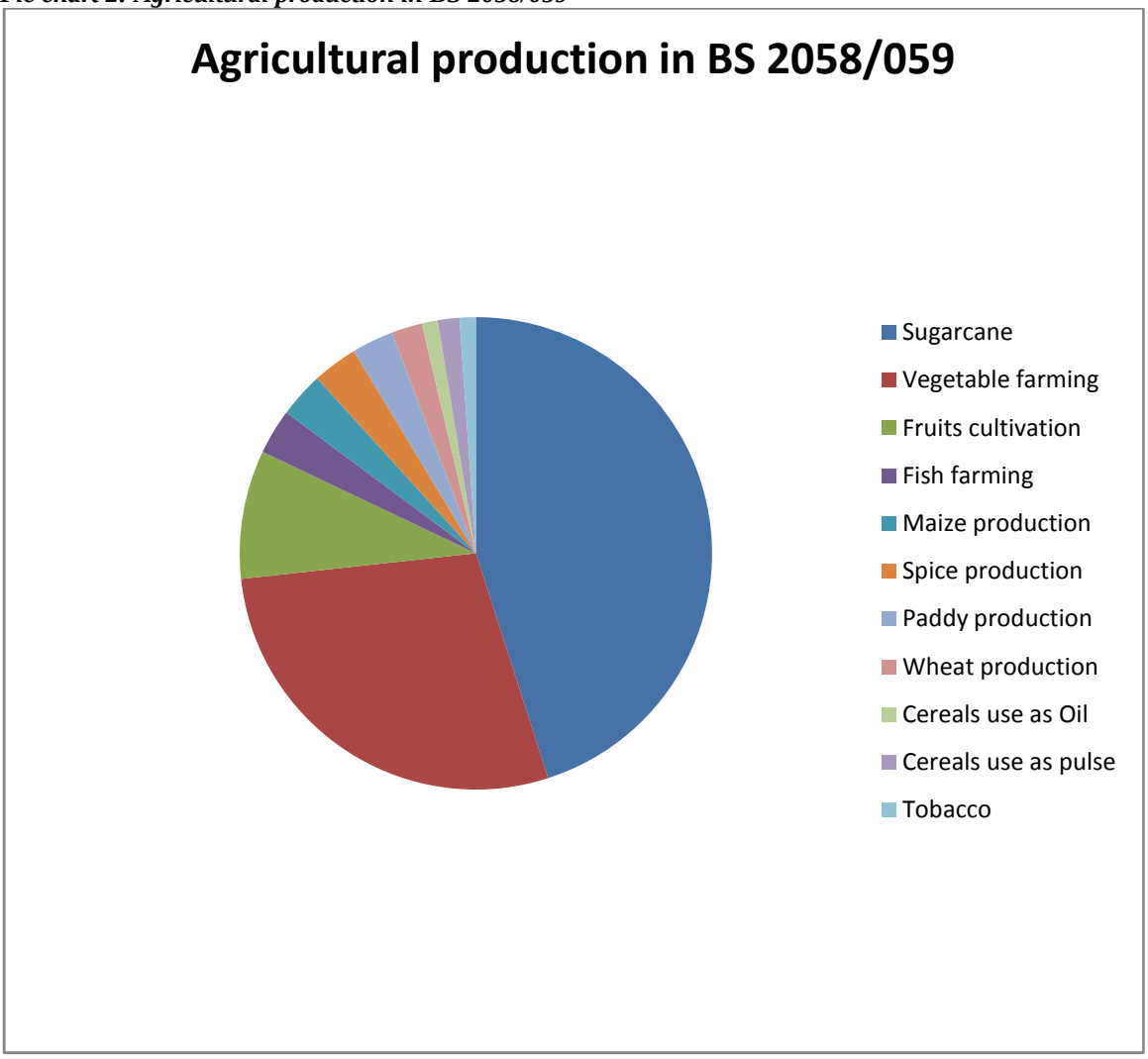
Educational Institutions								Total
Pre-Nursery (Bal Bidyalaya)			Primary	Lower Secondary	Secondary	Higher Secondary	College	
School	Communal	Total						
Government/ community	8+5	13	7	1	NA	2	1	24
Boarding schools	-	-	2		6	2		10

Source: Sarlahi district profile, 2067

4.1.5. Agriculture, livestock farming and poverty stratification of Sarlahi district

This district is one of the main cultivated districts of the country. Its 66.57% of land is use for cultivation. Agriculture is the main source of economy of the district. Major crops; paddy, wheat, maize, Telhan (use for oil), Dalhon (cereals use as pulse), cash crops; sugarcane, Tobacco and the seasonal fruit and vegetable have been cultivated in area. The following Pie chart 2 shows that sugarcane cultivation is the most famous in the district covers 45% of total production in fiscal year B.S.2058/059. Then, vegetable farming covers 28.18 %, fruits cultivation 8.79%, fish farming 3.1%, maize production 3.1%, spice cultivation 3.08%, paddy covers 2.84%, wheat production 2.1%, Telhon (mustard, sun flower, rapseed, teel, linseed, groundnut) 1.10%, Dalhon (Gram, Lentil, Peas) 1.49% and Tobacco production covers 1.1% of total production in B.S.2058/059.

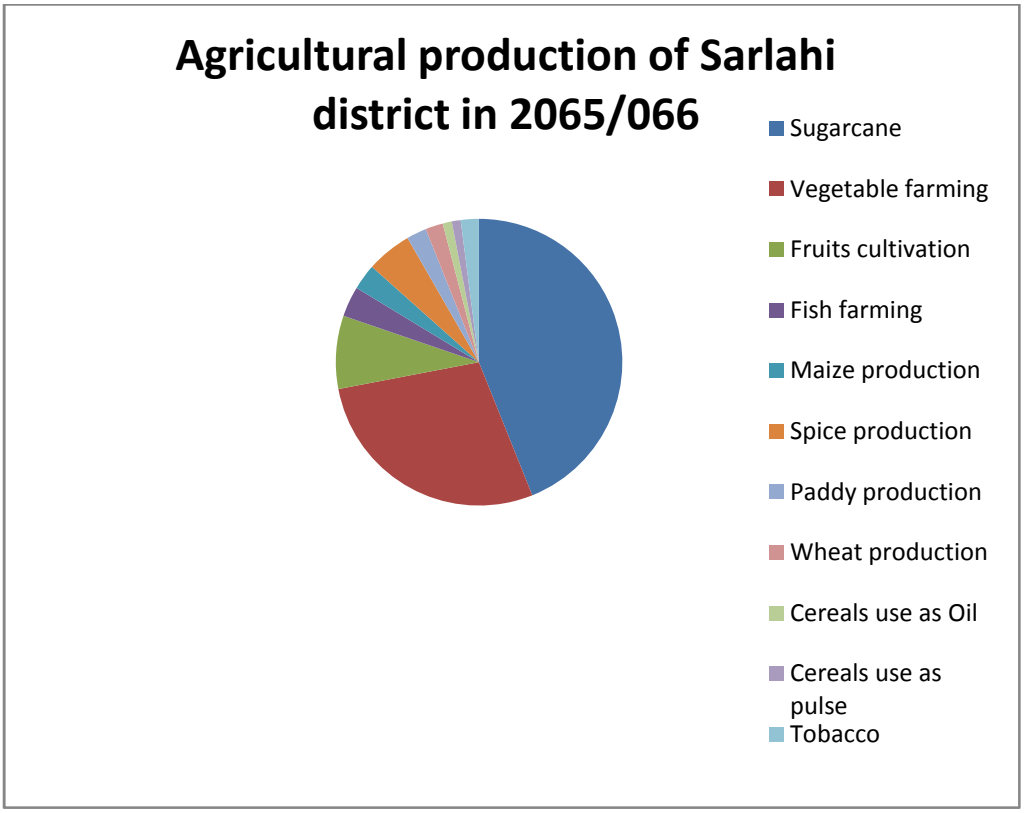
Pie chart 2: Agricultural production in BS 2058/059



Source: Sarlahi district profile, 2067

Similarly, production integration in fiscal year 2065/066 shows that sugarcane production cover 45%, vegetable farming 28.77%, fruit farming 8.45%, spices farming 5.21, fish farming 3.5%, maize production 3.0%, paddy production 2.33%, wheat production 2.0%, Tobacco production 2.1%, Dalhon production 1.04%, Telhon production 1.05% of total production in metric ton (See Pie chart 3). Pie charts also show that the production capacity of land is decreased in fiscal year B.S. 2065/066 comparing to fiscal year 2058/059.

Pie chart 3: Agricultural production in BS 2065/066



Source: Sarlahi district profile, 2067

According to study done by Nepal Nutrition Intervention Project-Sarlahi (NNIPS), over 58% of household are solely farmers, 26% are day laborers (either agriculture or other sectors),12% are involved in private business either as shopkeepers or employees and only 4% are Governments employees. That study also showed that economic status by ownership of land that categorized the people of Sarlahi into 4 categories: first; very poor are 26% who don't have land, second; poor are 45% (who have less than 1 hector land), third; middle are 25% (have 1-4 hector land) and fourth; upper or richer group are 4% (> 4 hector land). But now it is diversifying into small business, employment in foreign country (mostly in Gulf country) and some are job holders in Government services and private companies and offices. Their livelihood is totally dependent on agricultural sector directly or indirectly. They have been experiencing a lot of changes in their life comparing to their past especially in cropping pattern and their life style due to changing climate and highly increasing population in Terai.

Large portions of the crops including rice, corn, tomatoes and vegetables transported to other parts of Nepal. Sugarcane is another main cash crop of the area that has been replacing the cereal crops gradually.

According to study done by NNIPS, Sarlahi is the one of disaster affected district in Terai especially by flood. It is recorded that disaster effects for the past 32 years 1971-2001 in the district are shown as deaths-973, Injury 564, Affected families-378,164 and total loss at that time values in Rs. in million is 90,974.6.

As a part of agriculture, livestock farming is another main occupation in the district. Many people's livelihood is relying on livestock farming. Mainly, cow, buffalo goat and poultry farming are farmed. As following table 8 shows that number of cow 153827, buffalo 63102, goat 168980, sheep 1894, pig 5921, poultry 163645 and duck 7566 recorded in B.S.2065/066. Farming of livestock is not only as an income sources but also a sources of meat and milk which are the main diet of the local people.

Table 8: Number of livestock in Sarlahi district (065/066)

SN	Types of livestock	Total Number
1	Cow	153827
2	Buffalo	63102
3	Goat	168980
4	Sheep	1894
5	Pig	5921
6	Paultry	163645
7	Duck	7566

Source: Sarlahi district profile 2067

Table 9 shows that the poverty stratification of Harion VDC with some major indicators. According to data, the families who have sufficient food available for less than 3 months are 10-25% and backward family is ranked as 10-25%. Status of primary schools is less than 10% and the status of health post is 10-25%.

Table 9: Poverty stratification of Harion VDC

Indicators	Family food sufficient for less than 3 months	Backward family	Status of Primary schools	Status of Health post	Participation of women, indigenous and Dalit in strategic planning and program implementation	Gender inequality	Family in danger	Number of Banks
Status	10-25%	10-25%	Less than 10%	10-25%	26-40%	Little	Less than 5%	12

Source: DDC Profile 2067, Sarlahi

Participation of targeted groups such as women, dalits and indigenous in strategic planning and programs are ranked as 26-40% where as gender inequality is seemed little. Percentage of family which is in danger is less than 5% and the numbers of banks which provide banking services in the area are 12. As according to these indicators Harion VDC is just normal and ranked as medium in stratification of poverty comparing to other VDCs of the district.

4.1.6. Climate of Sarlahi district

Harion VDC located at the northern side of Sarlahi district adjoining to Sindhuli district. This VDC comprises Chure hill and plain land altitude ranging from 150 m to 300m which is cooler than other southern side of the district. Altitudinal range is lowering from Northern to southern side of the district. Rapid deforestation started after eradication of Malaria makes the area drier and deplete or deepens the surface of ground water level that is the main cause of lacking of drinking and irrigation water in the area.

Slightly difference in altitude determines the climatic condition of the district and shows the different micro-climate. Northern side of the district including study area is cooler and intensity of rain is more than in southern parts of the district which influenced by monsoon. About 80% rain found in rainy season and only 2.3% found in winter. Average rain of the district is 1699.6 mm in a year. The climate of the study area is consisted of hot season lasting from April to May, the monsoon lasting from June to September, and a cooler dry season lasting from October to March. Average maximum and minimum temperature is $31^{o\ c}$ and $20^{o\ c}$ respectively and it has been recorded that highest and lowest temperature in the district are $42^{o\ c}$ and $4^{o\ c}$ respectively.

4.1.7. Tamang people of study area

Tamang people of the study area are largely dependent upon agriculture but now some are involve in private business and government and private office. They are followers of Buddhist culture and tradition and speak own language called Tamang, which is the branch of Tibeto-Burman language group. According to CBS 2001, approximately 92% of Tamang can speak their mother tongue. CBS 2001 shows that the literacy rate of Tamang people were 51.8% and Likewise, Nepal Gender and Social Exclusion Assessment (GSEA, 2004) shows that approximately 61% of these people live below the poverty line i.e. less than US$ 2 per day and susceptible to the effects of changing climate because they are highly dependent on natural resources culturally, socially and economically.

Tamsaling, the land originally inhabitant by Tamang speaking community, which extends from Budhi Gandaki of western part to Dhudh Kosi of eastern part of Nepal and from the Himalayan range of northern part to Chure and Siwalik hills of southern part of Nepal. now Tamang community are living in Terai region and have been migrated to Terai from hilly region looking for better opportunities for the better life after eradication of Maleria in Terai.

a. Tamang Population

According to National Population Census 2001, it shows that 12, 82,304 Tamang population which comprise 5.6% of total population of Nepal. The census of 2001 has traced 33,740 populations of Tamang in Sarlahi district (DDC Sarlahi Profile 2067). Concentration of Tamangs in the district is concentrated in northern side of the district particularly along the east-west road (Mehendra Raj Margh).

b. Religion/Culture

Tamang people are the follower of Budhism. 100% Tamang from the study area are celebrating festival Losar, Buddha Jayanti as their major festivals and performing their rituals as Buddhism and its philosophy.

Buddha Jayanti is the most important festival of Tamangs which celebrate on the sacred day Baishakh Purnima (Full Moon day) on the occasion of Lord Buddhas' Birthday and on the same day he was enlightened and went into nirvana. To mark the day, all Tamangs visit to Monasteries then pray and offer the butter lamp for the peace and prosperity of all living beings. They celebrate Buddhajayanti as peace day with the communal efforts either in Gumba or other communal place by organizing different kind of programs. A

very important religious speech on Buddhism is given by Lama Guru to the community on that day. This speech also teaches the younger generation on the Buddhism, its importance on life, religious and cultural practices that their ancestors followed. On the same day, they also organize the rally and exhibit the Tamang cultural and traditional programs.

Lhochar is main and the most important festival of Tamangs. It means Tamang's New Year (Lho mean Year and Chhar mean New). They celebrate Lhosar in February (Magh) exchanging wishes to each other. On that day they go to visit monastery and offer the butter lamp and pray for the prosperous, healthy and happy life over a year. Also take a Khada as blessing from the Lama Guru and respected members of the family. Tamang are dress up with own custom and also perform the cultural program. Special bread called Khapse locally is made only on the occasion of Lhosar and distributed to the guest. Lhosar is followed for several days. In other day they invite the relatives for feast and enjoy the moment with great enthusiasm. During the festival, Tamangs are not only invite and feast each other but they also get the time for exchanging, sharing and expressing sorrow, difficulties and happiness of whole year. This opportunity helps them to understand each other more deeply and build the mutual relationship strongly.

Dressing culture of Tamangs of Terai is totally different with the Tamang of mountain and Himalayan region. According to some of older respondents, they were used Tamang dress that was very heavy as used by the Tamang of mountain area, when they were migrated to Harion VDC in 1950 or after that. They had changed their dresses as what Terai people worn to be adapted them to the climate of Terai rather than modifying their own Tamang dresses in the context of climate of Terai. This adaptation strategy made them away from their own uniform. Ultimately, it has been impacted the dressing culture of Tamang people of Harion as well as Terai. It means the dressing culture of Tamang of Harion was already impacted in the area. Further, now the changing climate particularly rising temperature is pressuring them be far away from their own dresses.

c. Language

Tamangs' mother tongue is Tamang, which falls in Tibeto-Burman language group. According to the census of 2001 92% of the Tamang people speak their own mother tongue in whole country. 100 % Tamang of study area uses their mother tongue as a means of communication during their daily work but

the interest of younger generation is going to be different which can be effect the Tamang language in future.
Recently, Government of Nepal starts to teach Tamang language in primary level schools as mother tongue in Kavrepalanchowk, Sindhupalchok, Makwanpur and Dhading Tamang dominant districts of Nepal.

d. Life cycle ritual practice: (Birth, Marriage and Funeral rites)

It includes all main ritual practices that are done during the time of child birth, marriage and funeral rites. These three main practices in Tamang community are doing differently. Usually, Lama a religious leader is played the main role in performing all rituals practices in Harion VDC, However, there are Bonpo and Tamba who are also consider as a ritual performing leaders. These all rituals practices are directed as the philosophy of Buddhism.

4.2. Temperature and rainfall pattern of study area

In Sarlahi district there are four stations established in Patharkot, Karmaya, Manusmara and Malangawa. For this study, data were collected from Patharkot and Karmaya stations because there is not any climatic or meteorological station set in Harion VDC. Only Karmaya station records rainfall and temperature both, and Patharkot station records only rainfall. Karmaya lies between latitude 27º07' and longitude 85^0 28' and the altitude of 131m and Patharkot station lies between the latitude 27^0 05' and longitude 85^0 40' and at the altitude of 275 m. These both stations are very close to study area. In this study, the data records from year 1999 to 2008 were collected from Department of Hydrology and Meteorology (DHM), Nepal. Data of year 2009 and 2010 are not available. Ten years change projections suggested that temperature and rainfall patterns become more variable with both increases and decreases. Being based on data of ten years (1999-2008) the temperature fluctuation and rainfall pattern of the area is elucidating below.

4.2.1. Temperature (Temperature records from 1999 to 2008)

Temperature is the most important climatic variable used in every impact analysis of climate change. So, when talking about the impacts of climate change it should not be ignored. It is determining the impacts of climate change significantly.

Temperature data, recorded in Karmaya station, Sarlahi from 1999 to 2008, is analyzed here. Average temperature records at Karmaya station show that the maximum temperature of study area is fluctuated more rapidly than the minimum temperature within ten years (1999-2008). The chart 4 shows that the highest average maximum temperature (31.67^0) is seen in 1999. Then gradually down in 2000 (30.59^0), 2001(30.47^0) and in 2002 (30.62^0), a fall of temperature continued went down in 2003 (29.78^0) and 2004 (30.49^0) . After that again, went up in 2005 (31.51^0) and 2006 (31.43^0) and, again it fell down to 30.47^0 and 28.39^0 in 2007 and 2008 respectively.
Similarly, the lowest minimum average temperature was recorded in 2001 (19.7^0). Minimum temperature maintained almost at same level in 1999 (20.47^0) and 2000 (20.15^0) then fell down in 2001 (19.7^0) but again went up in 2002 (21^0), and slightly fall and rise continued in 2003 (20.75^0), 2004 (20.44^0), 2005 (20.62^0), 2006 (20.75^0), 2007 (20.38^0) and 2008 (20.31^0).

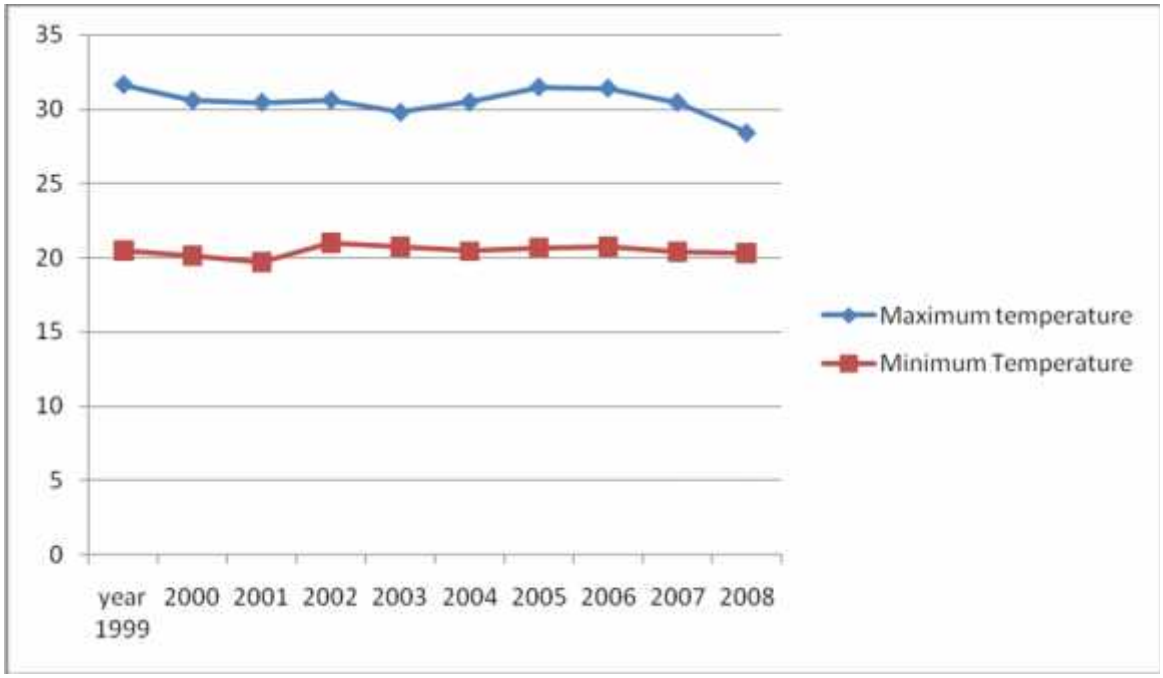
Temperature data of 1999, 2000, 2001, 2003 and 2004 show that winter was very cold and summer was very hot in Terai. These mean cold wave flowing for one or 2 weeks or longer than it and it causes the death of many old and poor people who don't have warmer clothes and safer habitat against the cold weather. Since years ago, it is recorded that there are at least 6 people are died every year in Harion because of long cold wave and sever cold in winter. Immediate fluctuation in temperature was shown in these years. Rapid and immediate fluctuation in temperature makes life harder. It can pose several health problems like diarrhea, flu and fever due to change in weather and also affects agricultural production. As shown in table 10 below temperature of the area was become hotter from April to August. Then it was decreased continuously from September to November and very cold day in December and January. From mid February to March temperature of the area is gradually increasing and becoming warmer than in December and January. Similarly, data of 2002, 2005, 2006, 2007 and 2008 show that the winter was warmer and summer was hotter in the area. It means the shorter winter and long hot and drought summer. With rise in temperature, failure of agricultural production is increased both in winter and summer crops which further puts extra burden of food insecurity, malnutrition and incidence of heat related infectious diseases. Rising temperature directly influence the breeding of malaria protozoa and create suitable climatic condition for the breeding which intensify the invasiveness of mosquitoes in the area.

Table 10: Temperature record of Karmaya station (from 1999 to 2008)

Department of Hydrology and Meteorology, Nepal

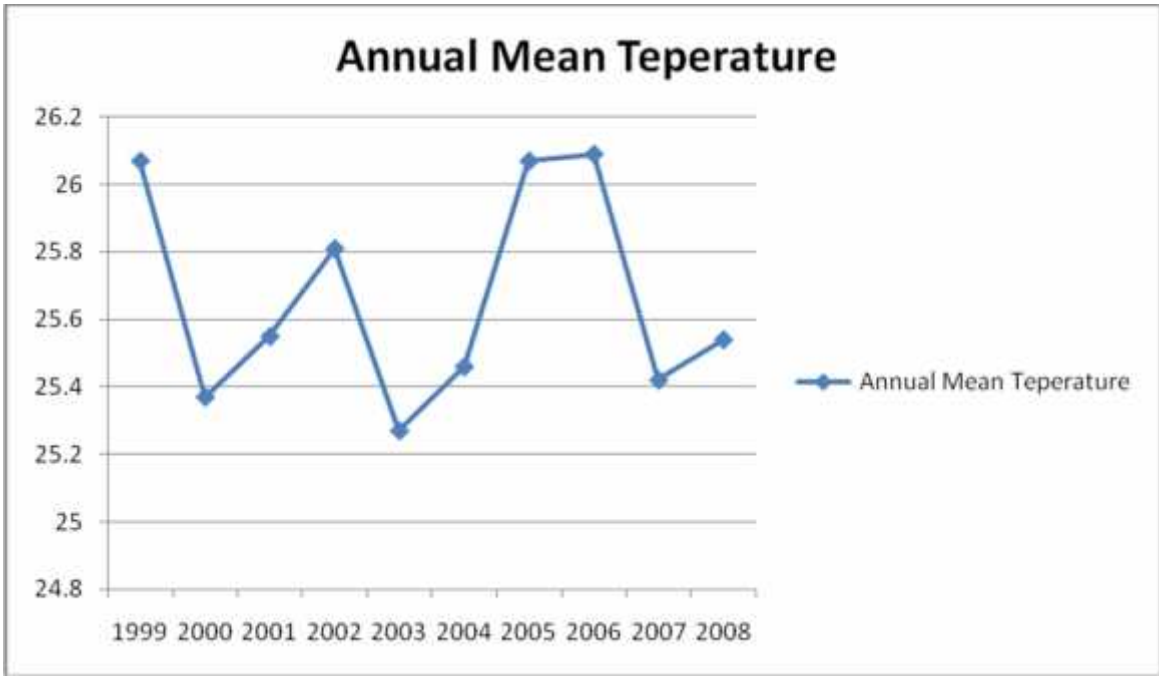
The average maximum and minimum temperature chart of ten years show that the maximum temperature in the area fluctuated rapidly up and down where as minimum temperature was almost flowing constantly. The highest average maximum temperature within these ten years was recorded in 1999 (31.67^0c) and the lowest average maximum temperature in 2008 ($28.39\ ^0$ c). Similarly, the highest average minimum temperature was seemed in 2002 ($21\ ^{0\,c}$) and the lowest average minimum temperature in 2001 ($19.7\ ^{0\,c}$).

Chart 4: Average Maximum and Minimum temperature of study area (Karmaya station)



The trend of annual mean temperature of Harion VDC over ten years (1999 - 2008), the highest annual mean temperature was recorded in 2006 ($26.09\ ^{0c}$) and the lowest in 2003 ($25.27\ ^{0c}$). The almost same level of annual mean temperature was recorded in 1999 and 2005. Then, went down slightly and little bit fluctuation was seemed in 2000, 2001, 2002, 2003, 2004, 2007 and 2008 (Chart 5).

Chart 5: Annual Mean Temperature of study area (Karmaya station)



4.2.2. Rainfall record from 1999 to 2008

Any changes in rainfall patterns have an adverse impact on agriculture eventually affecting the economic well-being of people, the economy of farmers, which depends on traditional subsistence-based agriculture, become more vulnerable and difficult.

The rainfall pattern of study area that were recorded in Karmaya and Patharkot stations of Sarlahi district showed in four charts dividing into four sections.

Rainfall data recorded in Karmaya station from 1999 to 2008 shows that the highest rain fall in summer (July) was recorded in 2004 (1934.2mm) and in 2002 July (1099.8mm). It means the intensity of rain was very high which caused the flooding in the area and the below chart is also showing that the rainfall was starting in June and almost ending in September. The concentration of rain was in rainy season only. The highest winter rainfall was recorded in February 2003 (42.6mm) and in February 2007 (37.5mm). But this chart 6 shows that the winter rainfall was very little from October to

February and even up to March. The absent of winter rainfall severely hampered the success of winter crops.

Chart 6: Rainfall pattern of study area recorded in Karmaya station, Sarlahi (1999-2003)

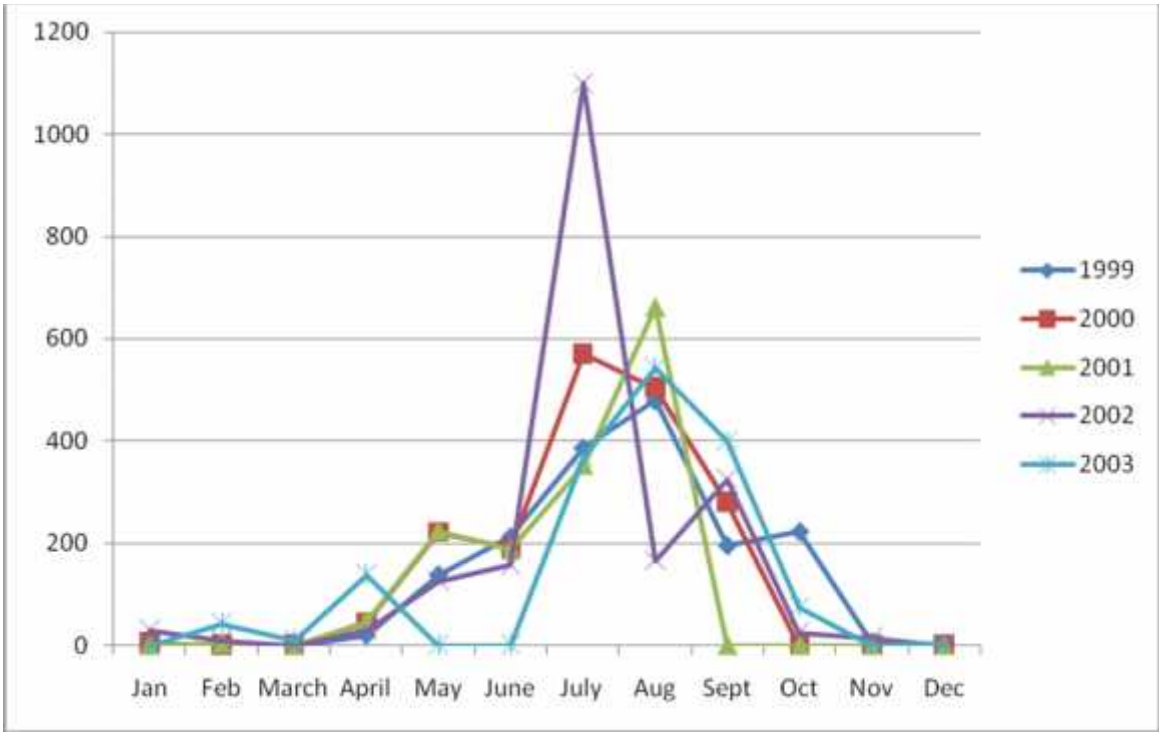


Chart 7: Rainfall pattern of study area recorded in Karmaya station, Sarlahi (2004-2008)

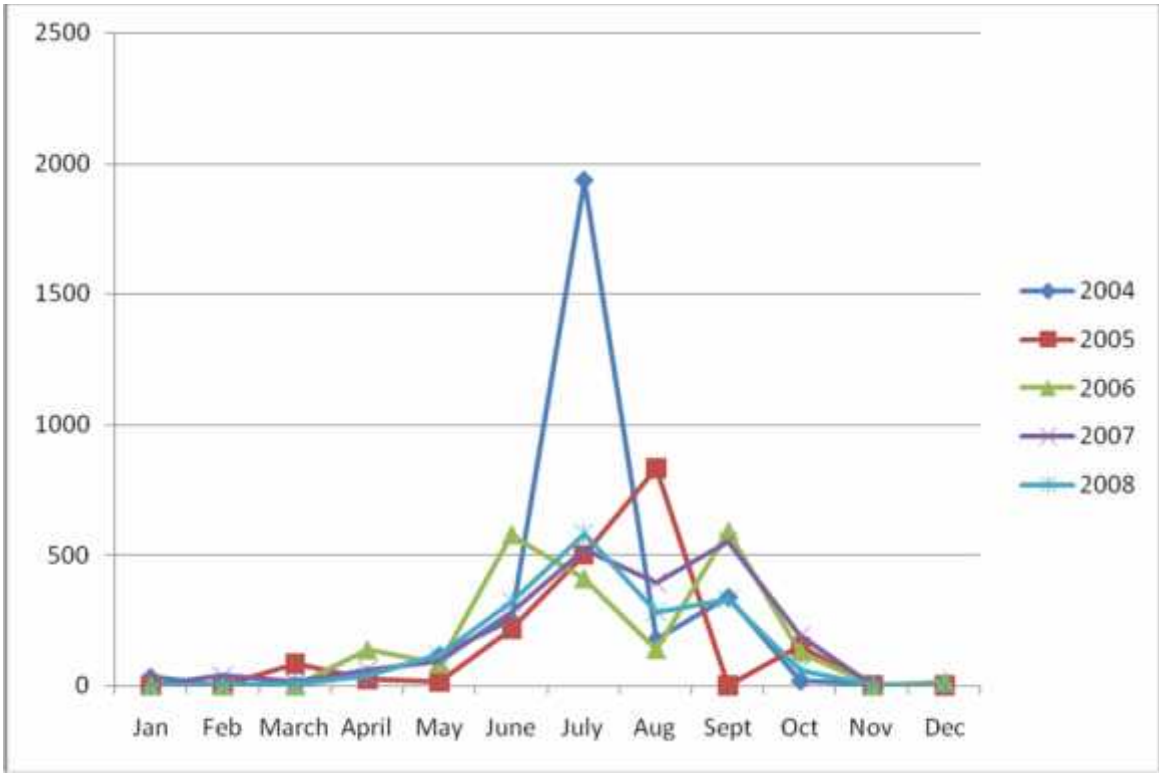
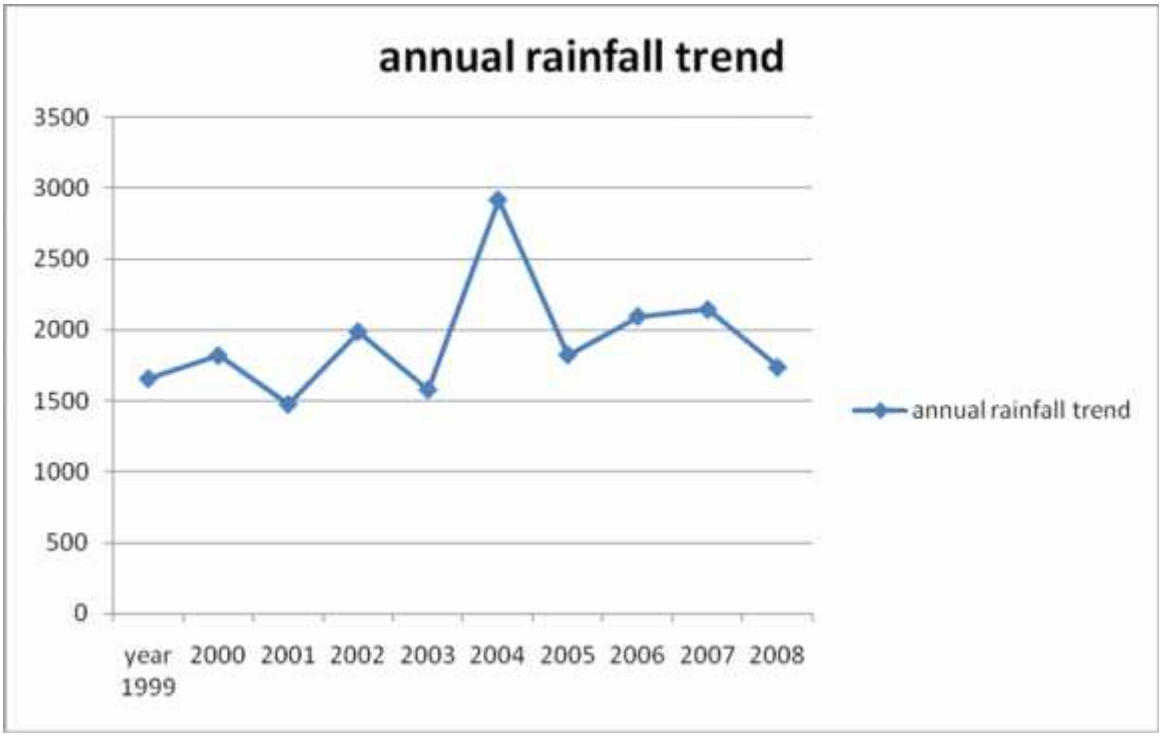


Chart 8: Ten years total rainfall trend as Karmaya station recorded



According to records of Karmaya station, the highest annual rainfall recorded within these 10 years were in 2004 (2915.5mm) and in 2007 (2144). Winter rainfall in 1999, 2000, 2005 and 2006 was almost not seen. It means no rainfall in winter in those years. According to study, absent of rainfall in winter is harmful for the winter crops. As chart 6 & 7 (1999-2008) shows that occurrence of monsoon was gradually shifting from June to July. Variability in the onset of the rainy season has lead to variation in the start of the planting season of rain fed rice. The delay of onset of rainy season adversely affects the cultivation system and low production especially for paddy. It was also showed that concentration of rainfall of whole year was only in rainy season. It means the heavy raining intensity in rainy season or over raining is also not favorable for the agriculture and causes flooding in study area.

Similarly, Patharkot station, Sarlahi shows that the highest rainfall year was in 1999 (2321.8mm) then in 2006 (2270mm) within these ten years. The rainfall in winter was recorded in 2002, 2003 and 2006. Except these years, winter rainfall was almost absent (See chart 9 & 10).

Chart 9: Rainfall pattern of study area recorded in Patharkot station, Sarlahi (1999-2003)

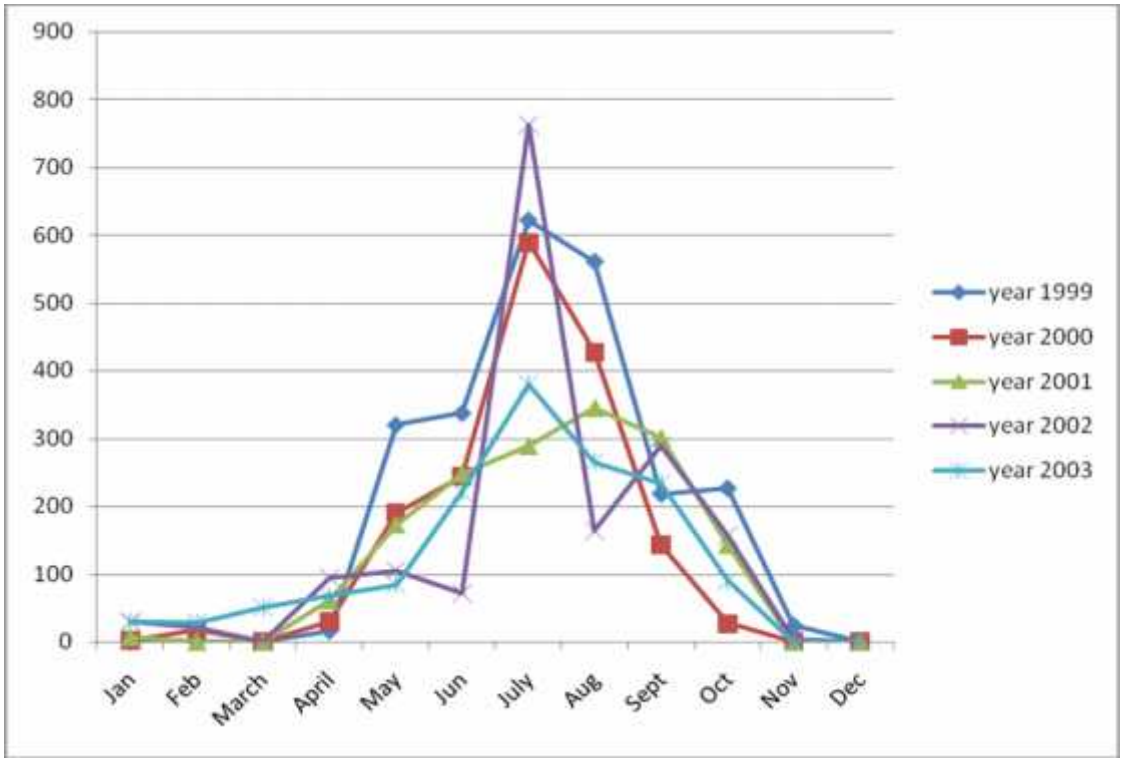


Chart 10: Rain fall pattern of study area recorded in Patharkot (2003-2008)

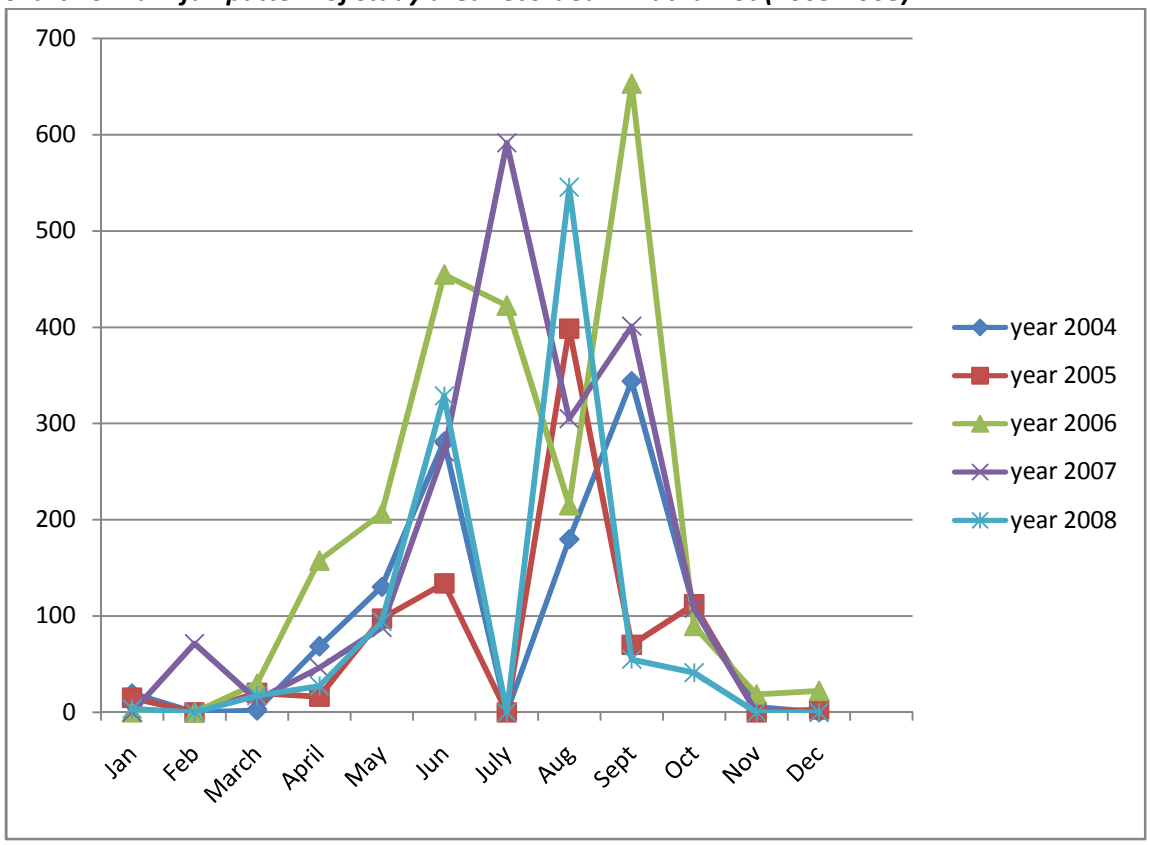
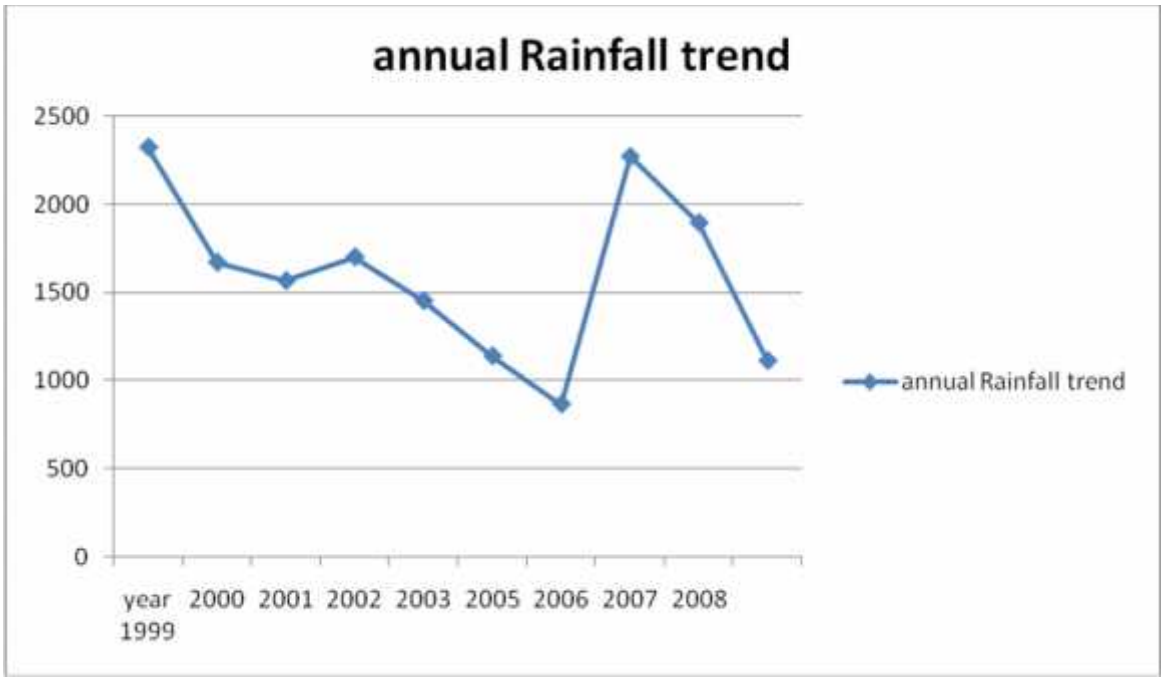


Chart 11: Ten years average annual rainfall trend of study area as Patharkot station recorded



Chapter 5

Economically active Household	Total Population	Economically active	Economically Inactive

Impact of climate change on Tamang community

5.1. Impacts on Economy

Economy is foundation of the society which determined entire development of society. Economically, Tamang people of Harion VDC is the most vulnerable to the climatic changes because of their highly dependency on natural resources such as fuel wood, timber for house construction, fodder for their livestock and their livelihood is dependent on agriculture which is totally influenced by the changing climate. Data given in Table 11 Shows that economically active population of Harion is 7852 (Male-4892, Female-2960) where as total population of Harion VDC is 12574 (Male-6614 & Female-5960) and economically inactive population of Harion is 4722 (Male-3000 & Female-1722).

Table 11: Economically active household and population in Harion:

Total HH	HH involved in economic activity	% of HH	HH not involved in economic activity	Male	Female	Total	Male	Female	Total	Male	Female	Total
3127	1136	36.33	1991	6614	5960	12574	4892	2960	7852	3000	1722	4722

Source: DDC Profile 2067, Sarlahi

Economically active household is 1136 (36.33%) where total household number is 3127 and economically inactive household is 1991 (63.67%). This data shows that the economically inactive household and population are very high in Harion VDC.

Table 12: Economically active Respondents:

Total respondents			Economically active respondents	Economically Inactive respondent
Male	Female	Total	55 (69%)	25 (31%)
60	20	80		

Source: Field stud, 2067, Saralhi

Out of total respondents, economically active is 69% and inactive is 31%. Economically active population is seemed more than inactive population (See table 12). But they don't have much larger income sources and a big population is dependent on agricultural sectors which are categories as farmers and small business holders. (See Table 11-economically active respondent). It means the impacts of changing climate in every household level are higher in Tamang community.

5.1.1. Impact on Agriculture

Out of total household 3127, only 2001 households are involved in agricultural sector where as 1126 household are involved in other sectors in Harion VDC. As shown in Table 13 agriculture, livestock farming and poultry farming is integral occupation in Harion VDC.

Table 13: household involved in agriculture in Harion:

House hold	**Number of Household**							
	Only Agriculture	Only Livestock farming	Only poultry farming	Agriculture & Livestock farming	Agriculture & Poultry	Livestoc & Poultry	Agriculture, Livestock & poultry farming	Nothing having
3127	340	197	4	1008	8	46	398	1126

Source: DDC Profile 2067, Sarlahi

Among all categories given above table 13, the integration of agriculture and livestock farming is the most popular occupation, after that agriculture, livestock and poultry farming, agriculture only then livestock and poultry farming, agriculture and poultry farming and only poultry farming respectively. The table also shows that the household involved in agriculture is 1754, in livestock farming 1649 and in poultry farming 456 households. It means the agriculture is the most appropriate occupation in Harion VDC which is adversely affected by the changing climatic variables mostly long drought, rising temperature and uncertain raining.

The data show that agriculture is the most important source of livelihood among Tamang of Harion VDC. Out of total economically active respondents (55 respondents), 48 respondents (87%) are involved in agriculture and the small business related to agriculture, only 4 (7%) are service holders in government and private sectors and 3 (6%) are school teachers (See table 14). Tamangs of Harion are following traditional planting pattern, relying on rainwater and the seasons. Now these traditional patterns of agricultural practices are heavily disrupted by unpredictable and unusual rains or prolonged droughts and heavily occurrence of hailstorm.

Table 14: Number of respondents involved in agricultural sectors

Total respondents			**Economically active respondents**			
Male	Female	Total	55 (69%)			
60	20	80	Farmers	Service holder	Teacher	Small business holders
			42	4	3	6

Source: Field survey 2067, Sarlahi

During the survey of this study, Cereal crops like maize, paddy, wheat, mustard and gram were the main crops that produce by the Tamangs of Harion. Except those they also cultivate sugarcane, seasonal vegetables and seasonal fruits as cash crop.

A heavy reliance on agriculture made this community's economy very sensitive to climatic variability and its changes which are weakened the economic condition of the Tamang community. 75% of total respondent told that the total production from agricultural land is stand only for 5-7 months, after that they have to dependent on market and 15% are totally dependent on

market for whole year. Only 10% of them have not to buy from the market because they have enough land for production. Even though, the agricultural production is decreased due to long drought, low rainfall and increased in temperature comparing to last 10 years. The food scarcities months have increased and made them more vulnerable economically, so they are forced to go to foreign country for employment.
Each year, the increasing population has no option rather than relied on agriculture and its related activities due to very limited opportunities in non-farm sectors.

Tamang ethnic group of Harion VDC whose livelihood, culture and ritual practices is totally dependent on natural resources. Low production of land, severity of pests on agricultural production due to climate change, lack of sustainable market mechanism of local product and still following traditional agricultural practices are restricting them to improve their livelihood. According to respondent, Terai has been facing extreme and long foggy days during winter which were not occurred in the past. According to precipitation data explained above, the monsoon season of the study area is shifting from Ashad to Shrawan. This late raining in Monsoon is delaying the plantation of paddy and maize, and ultimately hampering the whole agricultural system and production of agricultural products. In the past normally monsoon (heavy rainfall) was started in Ashad (mid July) but now it is experienced shifting to Shrawan. It has affected the agricultural production negatively. They are experiencing agricultural land is changing into fallow land due to low rainfall and long drought. Also unusual moisture stress severely damages or even kills paddy that receives as much as 200 mm of precipitation in a day and then receives no rainfall for the next 20 days. Complete crop failure usually occurs when severe drought stress takes place during the reproductive stages. Rain deficit and heavy rain, induce flooding, both cause the reduction of crops production. The rising temperature is also putting several negative effects on agricultural system in the area. Due to it, invasive disease, pest and weeds on crops, fruits and vegetable making the farmers of Harion worried and they have to face the heavy loss of production every year which drag them back economically. A disease which converts Jack fruit (Rukh Katahar) into white color was seemed in the area which was never seen before. According to respondents it was because of delay rainfall which is necessary for the growth of Jack fruit.
Similarly, a long cold wave and chill day often for 15 to 20 days makes the winter crops almost failure every year. Tamangs of Harion VDC has been facing failure of crops especially tomato, mustard and lentil due to heavy

cold wave and long fuggy days in winter. Tamangs of Harion shared a bitter truth, last year only, 70% of Tomato cultivated by Tamangs of Harion had destroyed due to the long cold wave and severely chill days. The events were occurred rarely decade ago but now it is occurring frequently. Tomato cultivation is another main cash crop for them. It puts extra burden into their livelihood. Same case was observed in other area as well which are considered as main zone of Tomato cultivation in the district. Because of it, the local market price of Tomato at that time was fluctuated highly and also market of Kathmandu and other main cities of the country were affected by the high price of Tomato where they are supplied from these areas. Likewise, the winter chill days also hamper the production of mustard in the area.
An increasing trend of almost absence of winter rainfall since some years reduced the production of wheat and now the Tamang of Harion are not interested more to cultivate these crops and want some drought resistant crops. Their first choice is sugarcane cultivation.

Out of total respondents, about 85% of respondent have been influenced by flooding and damaging their crop and swept away cattle during rainy season. Agricultural lands of them are in flood affected area by the seasonal river Chapini Khola in eastern side of this VDC. Remaining 15% respondent haven't been influenced by this event directly.
This kind of reduction in agricultural products pressurize them to be dependent on market for food which was not in past. The low productivity and increasing dependency on market has resulted rise the price of market commodity, which has further marginalized the Tamangs of the area. Increasing trend of population and decreasing agro-land and low production of agricultural product of the area forced the Tamangs to search other means of income.

5.1.2. Impact on Seasonal Economic activities of Tamangs of Harion

Tamangs of Harion who are keenly observing climate at micro level and its effects in their livelihood. They have intimate knowledge of seasonal change and set their social, cultural and economic activities accordingly. They are experiencing four types of climate; dry and hot season (Chaitra to Jestha), Monsoon (Asad to Bhadra), autumn (Asoj to Mangsir) and winter (Mangsir to Falgun). Based on these 4 climatic seasons, they move and engage in different kind of activities. In hot & dry season which starts from Chaitra to Jestha (Mid March), they usually harvest the winter crops and store safely

after drying. And they also engaged to prepare the land for summer crops, then sow the summer crops like maize and paddy (Prepare beds for seedlings production & seed sowing) if it is rained on time and kept the soil moist for the germination of seeds. Sometimes they are unable to sow the seeds due to lack of soil moisture until last of Jestha. This kind of delay puts severe effects on crops production and sequence of cultivation. They also celebrate Buddhajayanti as a main festival of their culture during this time. So, they also become busier in repairing and building houses.

Monsoonal season starts from Asad to Bhadra sometimes goes to Asoj. During this season they are totally busy only on agricultural activities like transplanting paddy, the harvesting of maize, preparing seedlings and transplanting of Tomato and other vegetables. This is the main season of cropping.

After a cloudy and rainy days, in autumn (Asoj to Mangsir) sky seems clear and creates a pleasant environment. During this season summer crops like paddy and maize are harvested and stored safely as a stock food for whole year. After harvesting summer crops, they are engaged in preparing the land for winter crops like mustard, lentils and wheat etc. Besides, the planting and harvesting of sugarcane is started. Sugarcane is another main cash crop of the Tamang of Harion.

Winter is started in Mangsir and lasted in Falgun. This season is characterized by the long fuggy days with the severe cold wave which can be the cause of death of elder people of Harion. There are so many death events recorded each year that cause by severe cold day and night. According to Tamang of Harion, they are suffering by these cold days adversely since last decade. They had lost the Tomato by 70% of total production last year only which was heavy loss to them. Vegetable farming is another means of livelihood of Tamang people of Harion. Normally, Terai people have a little bit free time in this season but that is not applied to the Tamangs of Harion because it is the second most busies time for them. At this time they are busy in harvesting of sugarcane, a major cash crop of the area, and supply it to the sugar mill. At this time, labor works is heavily demanded but can’t available locally. The cross-border (Indian) labors are hired as an agricultural labor especially for the sugarcane harvesting. In this busiest season, Tamangs of Harion are engaging on the celebration of their greatest festival Losar which is in Magh (February) that keeps them totally busy.

The above mentioned seasonal movement and activities indicate that all the activities and movement of Tamangs of Harion is based on the climate and its variables of the area which can be hit their livelihoods adversely if changes occurred in climatic variables with the fluctuation on climatic events.

5.1.3. Impacts on Livestock Farming

Decade ago, there was a large open ground for common herding which is the riverbank of Chapini and Lakhandehi rivers. But later, these riverbanks were encroached by the outsiders as well as insiders for the agricultural purposes especially for the cultivation of sand tolerant crops and vegetables. Respondents told that the situation was created by the low production of agricultural product due to changing climate of Terai and to maintain the food scarcity. This kind of trend hugely hampered the income source of livestock farmers in lacking of land for grazing. Out of total respondents (80), more than 50% had already given up this occupation though 22% are still kept farming livestock just for milk for their family rather than as a business and only 28% of total respondents have farmed livestock as a side business. Villagers are faced a shortage of dairy product like milk, curd and ghee locally which they consider as a local diet for their family. In long term, it will affects health condition of Tamangs of Harion.

5.1.4. Impacts on Health

Health is the most important wealth of human beings. Unhealthy life can affect the economy of People adversely; loss of cost for treatment, hamper sources of income and put the lives and well-being of people at risk.

Climate change impacts on human health are huge but poorly understood in the society. It is estimated that in 2000 alone, climate change was responsible for 2.4% of cases of diarrhea worldwide and 6% of cases of malaria. Climate change can affect human health directly (e.g. impacts of thermal stress, death/injury in floods and storms) and indirectly through changes in the ranges of disease vectors (e.g. mosquitoes), water-borne pathogens, water quality, air quality, and food availability and quality.

In Harion VDC, According to census B.S.2058, there is 3127 household where as in B.S. 2064, number of household is increased up to 5045. Out of total households, 4276 (84.6%) household have the access to pure drinking water and 2230 (44.2%) household have facility of Toilet (See table 15).

Table 15: Number of households have access to safe drinking water and use toilet in Harion VDC

Number of	Number of	Number of Household use	Number household use

household in B.S.2058	Household in B.S. 2064	safe drinking water		Toilet	
		No. of HH	Percentage	No of HH	Percentage
3127	5045	4267	84.6	2230	44.2

Source: District profile 2067, Sarlahi

This data indicate that the facility of drinking water in Harion VDC is well facilitated and safe. But in case of Tamang community of Harion 2 & 9, 70% have safe source of drinking water locally called "Kal" underground water pulled out through the Tube, and 38% have toilet. However, during the survey of this study, Tamangs of Harion are suffering from lack of drinking water. Because their main source of water Kals are drying out by 45% in March/April (Dry season). According to respondents, the rate of drying out the Tube is in increasing trend in the area. They shared it is because of increasing temperature and long drought in the area since some years ago. In shortage of safe and easily available water, Tamang of Harion wards no. 2 and 9 are becoming the victim of many diseases like skin disease, diarrhea and losing their time to fetch the drinking water every day. Overall, it affects the health condition of Tamangs of Harion.

Impact on health of Tamangs of Harion from climate change arise from: direct stresses like heat waves, flood, drought and storms lead to increase mortality and changes in the distribution of some disease vectors, ecological disturbance altered infectious diseases, disruptions of ecosystems on which humanity depends such as reduced food yields and food scarcity and increase the number of malnutrition and gastro-intestinal and cardio-respiratory particularly for the mental development of children, and the elderly women who become more vulnerable to this condition. During this time health services has been also burdened by an increased patients, A study done in 1999 and 2004 by NNIPS shown that skin disease, Diarrheal diseases, Intestinal worms, ARI, and Pyrexia of unknown origin are the most top five diseases found in area (See table 16). Same study shown that the incidence of Malaria per 1000 population-0.01%, Kala-azar per 100,000 the most risk population-0.30%, Leprosy prevalence rate per 1000 population-4.70%, Intestine Worms-2.55% and case finding rate of tuberculosis-133.

Table 16: The most top five diseases of Sarlahi

S.N.	**Name of disease**	**Percentage**	
		1999	**2004**

1	Skin Disease	6.90	7.77
2	Diarrhoeal diseases	3.62	5.35
3	ARI	2.74	3.46
4	Pyrexia of unknown origin	2.58	3.39
5	Intestinal worms	2.95	2.55

Source: NNIPS project, Sarlahi

Increasing events of hot waves and flooding during hot & summer, and flowing of cold waves during winter pose the adverse effects on the health condition of Tamang community of Harion. Those rapid fluctuations in climatic events are the cause of incidence of Tuberculosis, skin diseases, Eye and ear diseases, Diarrheal diseases and intestinal worms. During the survey of this study, Tamangs of Harion shared that they have been facing the incidence of different kind of diseases more frequently since a decade and have to manage extra expenses for the health of family every year especially for the children, women and the elderly members. There is only one health post established by Government in Harion which provide primary treatment only, for more advanced treatment people should pay high cost in private nursing home and also should go either to Birgunj or to Kathmandu which pose more economic burdens to them. These increasing trends of illness in a family are weakened the economic and social condition of family.

5.2. Impacts on society and culture

5.2.1. Social structure

Social structure contains family, religion, class, economy and law that can influence the whole social system such as economic, cultural, legal and political systems of the society. For the development of society, the most necessary process is transformation of social structure in a manner which improves the capacity of the society to fulfill its aspirations.

The degree of vulnerability and the impact of climate change are dependent on social structure and its practices which are either related to climate change or not. Every sector of society is affected by climate change and its variables directly or indirectly. If the society does not have enough resources and essentials to mitigate in the emergence, the hardest effects will have to face by that society.

a. Family

Impact of climate change in social dimension is observed at family level, a basic social unit of society, to capture the exact impact of climate change on society. In Tamang society of Harion, single and joint families are in practice. But due to various reasons, the family has been broke apart as sons separated from parents and brothers after his marriage. About 95% of respondents during survey told that they were separated from their parents as well as brothers. The family break down into single family has been in practice among Tamangs of Harion since a long time ago but the present burdens put over them by the failure of agricultural yields due to uneven climatic fluctuation has intensified it and compelled them to accept it and live independently though sometimes they are not intended to be separated from the family. Tamangs of the study area shared it is an economic catastrophe within a family. This social unit is regulated by the social system and social rule. At the time of separation, the family property is equally divided among the sons. If parents are alive, they each receive a share. Landholdings are extremely fragmented, both geographically and socially. After increased in the number of single families among the Tamang of Harion, the trend of going foreign land for the employment (both young man and woman) is also increased. This trend definitely made them wealthier than before but at the same time it has carried the so many disadvantages as well for the family as well as society. According to respondents, the case of divorce, polygamy and second marriage are increasing in the areas which are affecting the family negatively especially for the children of those families and it can also increase antisocial activities in that society.

Social development including comparative progress of social structure and social system according to surrounding changing climate is the most considerable factor to reduce the degree of impact of climate change socially. Some social practices elevate the vulnerability of society to the impacts of climate change like separation from the family. Most respondents felt that it is very difficult to maintain the whole family after separation because everything is fragmented into small pieces more importantly property such as land and house which decreased their status socially and economically. They are not separated only economically and socially with their family but also separated spiritually and made them away from their beloved one. In most cases, a debate, either small or big and sometimes goes up to court, has been occurred between family members during the process of separation. It broke or weakened the social unity and relationship among kinship. Further, it

stopped the helpfulness, communication and sharing of information to each other. To reduce the impact of climate change, the strong and continue networking and communication are the most important component according to many studies. It means Tamangs of study area are more vulnerability in changing climate.

b. Population growth and in-migration

There is an interesting tale about the name of Harion VDC. Previously, name of this VDC was "Hariyo Ban". It means Green Forest but later it was calling Hariyowan then changed in Hariwan and now it calls Harion. This fact shows that this VDC was covered with a dense forest as a part of Charkoshe Jadi of that time and no presence of settlement because of Malaria in the area. Later, the present Government decided to resettlement in the Terai after the eradication of Malaria. As in other parts of Terai, Harion VDC was also become the most coveted internal destination for land and land- hungry hill peasants. They were attracted to the area by the economically richer forest and productive agricultural farm land drained and nourished by several rivers. However, in the 1980 to 1990, the forests were being increasingly destroyed because of growing demands for timber and agricultural land in Harion VDC. Population growth rate in Terai was in an alarming rate. It was higher than the national average (2.25% per annum) during the period of 1991-2001. Due to higher rate in –migration, it was estimated that within 1964-1972, approximately 120,000 ha of forest was deforested in Terai; out of which 56,000 ha was due to spontaneous migration and illegal settlement (FAO, 1999). Similar case was seemed in Harion VDC and it was become the most populous VDC in the district and the trend is continue in an alarming rate after it was proposed to declare as a Municipality by the Government. High rates of population growth can impose several stresses on natural resource and system, through rising pollution and needs more resources to provide the basic necessary facility for them.

Now the situation is completely changed and there is only small patch of forest remain in the northern side of the VDC and all the forest land were converted into agricultural land and now again it is converting from agricultural land into settlement area which is reduced the food production capacity of the area and the community of this VDC now have to be dependent on the food imported either from India or other parts of the country. At the same time, Tamangs of the area have been also experiencing low production of their agricultural product due to fluctuation occurred in

raining pattern, long drought and rising temperature and long foggy and chill days in the winter which cause the failure of winter crop in the area. These all causes elevating the price of food day by day that makes the life harder than before especially for poorer people of the VDC. According to respondents, the life has become more expensive to fulfill even the small desire of life due to no increment in the source of income comparing to the rising price of commodity as well as others such as children's education, health and transportation facilities.

c. Social security and social movement

The security condition in the area is becoming fade day by day. Tamang community is suffering by the several fearing events like gang fight, domestic violence and insecurities of wealth. The frequent rate of the events happening (almost once a day) in the area is proved that the security condition is going to be worse. According to respondents, it is happening because of the low production of agricultural production, low income and increasing population in the area. It is also accelerated by the open border between Nepal and India, and the conflicting situation of the country. People have got threaten from the criminal demanding large amount of money. They are also suffered by the theft who has stolen the household stuffs and valuable goods like jewelers and also the livestock during night. These types of events are recurring over the whole year especially during the festive season (Dasain & Tihar). At that time, people collect and arrange the expenses for the festival and also wore the expensive jewelers.

Tamangs of Harion are the one of primary victim of those problems. They are not only suffered by it, but also dominated and given trouble hugely by the other non Tamang people who were migrated in the area from the hilly area and the southern side of Nepal even from Bihar, India. According to respondents, in around B.S 2010, there were a large number of Tamangs lived in and only least number of non Tamang community found there but later, Tamangs of Harion was going to be replaced and dominated gradually by the non Tamangs economically, socially, culturally and politically. These all cases forced the most of Tamang went back to their own area or in Hilly regions for the safety of their life. However, later after establishment of democracy, they were again migrated into the area and the trend of migration is still continued in the area. But the present conflict and the unsecure condition of the area again put them in problematic life in the area which impacts adversely all aspects of their life like economic movement, social security, cultural and religious performance in Harion VDC. To fight against

this situation, Tamangs of Harion are united together as an organization named “Manesang”.

d. Social norm, value and System

Abrupt climate changes impacts the social values and norms abruptly and then misbalance the whole social systems. It is comparatively easy for the society to adapt to gradual and anticipated changes. Rapidity and surprises of the abrupt climate change makes society more vulnerable, unable to adapt on the situation which further cause the collapsing of the society. In context of Tamangs of study area, there was not any kind of difficulty to find daily labor for agricultural works for the landowners but now the situation doesn’t remain same as before because the large numbers of labor workers have been fleeing for the employment and also settle themselves in urban area for the better employment and benefits. There is a big scarcity of labor in the area for the agricultural purposes. So, labors are highly demanded particularly in the main season of cropping. This situation fades the relationship between landowners and landless labors. Because, in feudal system, landowners always discriminate the labors and pay them very low wage. Now, instead of discriminating the labor, they are treating in a better way with a better wage. It means the social system of Tamangs is gradually changing in study area. For this change, there is an indirect impact of climate change. Out of total household of Tamangs in Harion, 40% of them have been forced to go to foreign land due to the threats put by the impacts of climate change on agriculture. By the foreign employment, the economic condition of Tamangs are improved slightly which indicate by the changes in the structure of house construction. Previously they constructed the houses with mud, hey and wood but now some of them are constructing cemented house which is converting the physical structure of Tamangs settlement in Harion 2 and 9.

5.2.2. Culture

Culture can be expressed as “the way of life we do around us concerning either within family or out of that or relationship with society and nature and use of technologies”. Culture dictates social behavior. It has a powerful force that can enable certain activities, and constrain others. Cultural values have significant bearing on climate change adaptation. For example, where a strong culture of mutual self- help and co-operation exists, adaptation strategies may benefit from tapping into and building upon the social capital as well as social development. As reflected by changing lifestyles, culture is

not remained same in a changing climate and influences globally. A study done in China shows that China's climate has played a crucial role in the development of Chinese culture and continued to influence China's progress.

Climate change has adverse effects on culture of Tamang community of Harion VDC. They realized that climate change have been affecting every aspects of their culture such as dresses, performing ritual practices and celebrating the major festivals and overall the living system of their life.

a. Dress

Tamang dress is the identification of Tamng whether they are from Terai, Mountain or Himalaya. However, the Mountain and Himalayan region is the origin of Tamang dress and culture. According to study done by Ajitman Tamang, there are two types of Tamang dress available in the country; first wear in Himalayan region and second wear in Mountain region. Out of total Tamang population in Nepal, 14.28% of Tamangs are living in Terai region but they don't have own dress like Tamangs of Mountain and Himalaya. According to respondents, many years ago, when they were migrated from mountain area into the Terai rigion, they were come with their dresses and culture. Now there is no existence of those all because of the high influence of climate of the region as well as culture of other community. Cultural assimilation is a good strategy to be adapted in new region but it doesn't mean to lost the own culture and identity forever. It will be better if they can disseminate their culture wherever they go to save the culture and their own identity. So, Tamangs of Harion need to disseminate their dress or culture with some modification with the climate of Terai.

Table 17: Tamang dresses of Himalayan and Mountain region

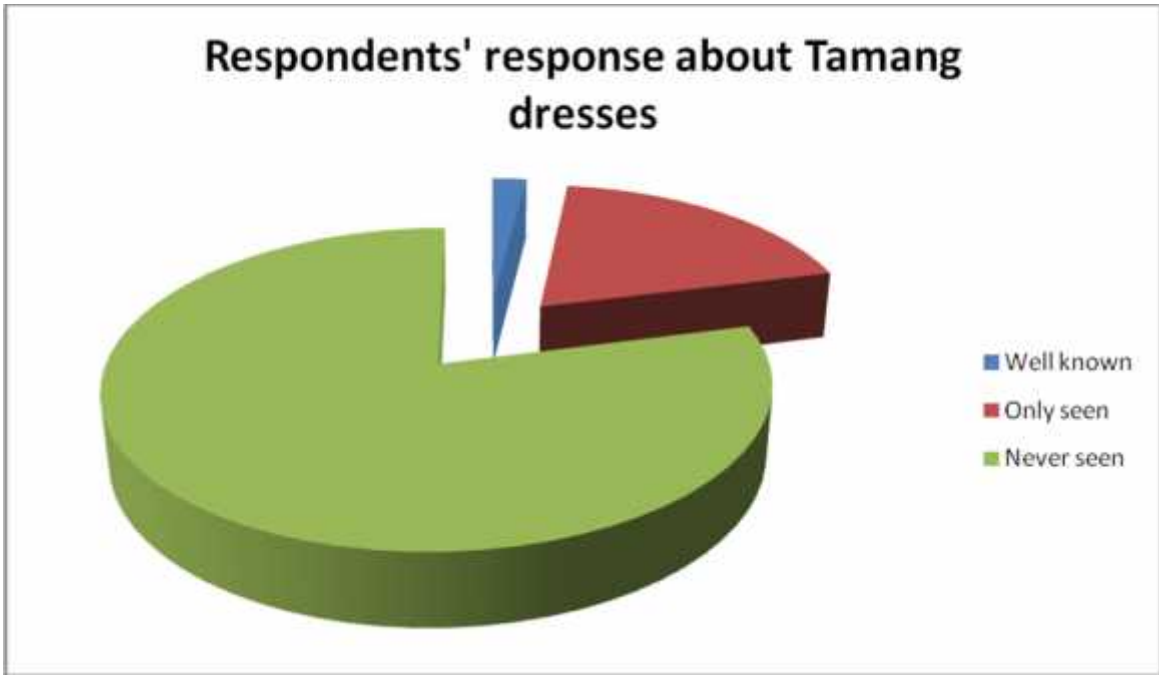
SN	Himalayan Region		Mountain Region		Remarks
	Male dress	Female dress	Male dress	Female dress	
	Shyade	Shyamo	Kulagi/Tagi	Shyamo	
	Shyoldo	Angdung	Gya/Goto	Shyama	
	Key	Darmo	Key	Dormo	
	Tokkaai	King Gap	Tokkaai	Pangde	
	Surkaai	Pang Kap	Surkkai	Kitti/Pangden	
	Shompo/Doja	Kitti/Pangden	Pane/Panaai	Gya/Ga	
	Singsing Shompo	Thimokey	Toduk		
	Toduk	Singsing Shyonbo	Sudam/Surlung		
	Sudam	Shyama			

		Gya/Gah			

Source: Ajitman Tamang, Tamang Textile and Ornaments

As table 17 shows that Tamang dress for male in Himalayan region are Shyode, Shyoldo, Key, Tokkaai, Surkaai, Shompo, Singsing Shompo, Toduk and Sudam, and for female are Shyamo, Angdung, Darmo, Kinggap, Pangkap, Kitti/Pangden, Thimokey, Singsing Shonbo, Shyama and Gya/Ga. Tamang dress for male in Mountain region are Kulagi/Tagi, Gya/Gato, Key, Tokkaai, Surkaai, Pane/ Pannaai, Toduk and Sudam/ Surlung, and for woman are Shyamo, Shyama, Darmo, Pangdey, Kitti/ Pangden and Gya/ Ga. These dresses among Tamangs of Terai have been almost unfamiliar because they have been using other dresses what the other Terai people wear. According to all respondents, 80% respondent felt that they are observing the changes in dressing, food habit and life style of Tamang because of rising temperature and putting economical burdens on them. During the survey, only 2% of respondent told the name of Tamang dresses (See Pie chart 12), 19% respondents have just saw the dresses and 79% didn't know even never saw the Tamang dresses and didn't know the name of them. This data shows that the dress and uniform that is the identity of Tamang community is becoming extinct in the area especially among coming generation. These kinds of situation threaten the dressing culture of Tamang community in Terai where large population of Tamang is settled down. At the same time, few of them also shared that they couldn't wear thick, heavy Tamang dresses and those particularly suitable for climate of mountain because of hot temperature in Terai but it can adjust as Terai's climate like done by the Tamang of Mountain and Himalaya. Only few of them wear their favorite & lovely dresses occasionally only during festive season.

Pie Chart 12: Respondent's response about Tamang dresses



Source: Field survey, 2067

b. Festival celebration

Traditional practices and celebration of festivals demonstrates the different kind of relationship with climate and its changes. The Tamangs of Terai have distinctly different ways of life socially and culturally comparing to mountain and Himalayan region's Tamangs. Its main cause is different in climate and its variables. All the Tamangs of Harion are follower of Buddhism. They celebrate Buddha Jayanti, Lhosar, Ghunia (Bhadra) Purmima as a main festival in Terai. They also celebrate the Maghe and Saune sankranti. 90% of respondents told that low production in agriculture due to long draught, rising temperature and low rainfall which slowed down the economic condition of them. This downwards economic condition reduced the trend of celebration of festival, performance of social and ritual practices. Now, those practices have been celebrated just as a formality not a grant event as before. This means the value and importance of festivals is diminished gradually as according to changing circumference. Because in this stressful situation, all the attention and resources is focused to fulfill basic needs of people rather than developing society and conducting cultural and ritual practices. During this period, social norms and value are also ignored. There are no laws and justices for anyone during those situations which further impacts the society negatively and ultimately it can stop the speed and direction of social development in future.

According to many studies, the unity and communal efforts can reduces the significant degree of impact of climate change on that society by planning proper adaptation strategies, increasing resilience power through strengthening their institutional or organizational and individual capacity with a common initiation. Festival can play its multiple functional roles to unite the community together for the development of whole society. Buddhajayanti, a special day for Tamangs of Harion, is considered as a peaceful day, played an important role to unite the community together and to abolish the conflict that existed between individuals and communities through the mutual realization and understanding. The Tamangs of Harion shared that celebrating festival is the means of forgetting or being away from all the sorrow and bitter moments of life for a while and live the life with great enjoyment. But the economic downwards due to the unfavorable climate of Terai for the agricultural production have been severely impacted the tradition of celebrating Buddhajayanti. According to respondents, they used to enjoy a lot in this holy day celebrating different kind of programs but since a years ago, the situation have not remained same due to economic stress and couldn't pay all attention in arranging those all requirements to celebrate the day with fullest entertainment because they have to pay more attention to fulfill the basic needs of their family in this highly costly life. Agricultural product is reduced dramatically which has been threatened by climate change; flooding, low rain fall, long drought and rising temperature. There is no other non agricultural option as an income sources. Young people, who had participated actively to organize the festivals, went to foreign countries for the employment. 90% of respondents told that they celebrate their festival not with great efforts as much as they did years ago, whereas 10% respondents didn't know about it. The festival celebration just for formality is in increasing trend in the area which can extinct the culture of Tamang community in future. These all causes reduced the interest and efforts of Tamang community towards their tradition and the way of celebration of the festivals and in a long term it can impact the whole culture negatively.

c. Religion

Religion is a system of belief which regulates the society in a proper way for the betterment of the whole society or community. All the custom, tradition and ritual are performing according to religious belief and system. So, in the society there is an important role of religion. But the trend of believing and the practices of religion do not remain same forever; it gets changing according to time and necessity. In present context, the changing climate keeps the stresses upon the

society to change their religious system and practice to be adopted in the changing climate. Otherwise, it will be extinct from the world. To preserve the own culture and religion, everybody especially indigenous community should be consensus to the impact of climate change.

As explained above, they all are follower of Buddhism and their religious life is directed by the theme of Buddhism. According to Buddhism, nobody is allowed to destruct to other living beings intentionally by any kind of our action. But the rapidly changing climatic variables in Terai has been putting stresses on their religious system like the purpose of worshiping, time and type of religious practices that they used to do previously. Out of total respondents, 65% told that they worshiped daily, 25% only in a month (in full moon day) and 10% twice a year (during festival) or as requirements. They told that years ago their purpose of praying was paying for the wishing of rebirth (punarjanma) and to get rid from all the impieties they had been done knowingly or unknowingly but since years ago, they have been praying for the successful cultivation, to keep away all kinds of diseases which possibly can damage their livestock and the betterment of their family for the whole day, month and year. As in other ethnic and non ethnic groups, Tamangs also believe on the divine power and think that it must be kept happy by praying or any kind of offers. Now, the frequency of worshiping has increased in the Tamang community of Harion because the intensity of crop damages, failure of cultivation and the death of their livestock has been increased comparing to last decade. They realized it is happening because of changing pattern of rain fall, rising temperature which induces the different kind of diseases. They set up the schedule for praying in full moon day of every month with a communal initiation. This schedule is turned rotation wise among all the members of community. They also started to accumulate some money from the members to support them who are the victim of the natural hazards like fire, flood and also for the poor people who can't do the funeral requirements of their family member's death as their religious belief and tradition.

d. Marriage

There are usually two kinds of marriage practices existent in Tamang people of study area, one is arrange marriage and, another is love marriage. Out of total, 70 % of respondent are married and out of which 55% has got arranged marriage and 45% had love marriage and among them 3% has got inter-caste marriage. Total of them, 35% got marriage under the age of 20 years old (especially women), 45% got marriage around the age of 20 to 25 years old and only 20% done at age of 25-30 years old. This data show that the underage marriage is still in practice but the trend is reducing now by increasing level of awareness. Out of total respondent, 45% have 3-5 or more children, 42% have 2-3 children and only 13% have 1-2 children.

Now family planning is also used in Tamangs of Harion to keep the women healthier and reduce the number of family size. Only one or two child concept is increasing among the new generation. They are seemed becoming more responsible to the family and for the education of their children because they thought that the life is becoming more competitive comparing to years ago. This practice in Tamang community of study area can take as an adaptation practice in the impact of changing climate.

e. Funeral rite

Funeral rite among Tamang of Harion is done with the Buddhist belief and practice. They consider it the most important ritual of life. About four decade ago, Tamang people of Harion VDC 2 and 9 had been cremated the deceased of their family member in Chure Hill just one hour away walks from their settlement. According to Buddhist culture it must be cremated on elevated land rather than lower land or in river side. As population increased, those crematorium areas were converted into cultivating land by deforestation and encroachment. After that, Tamang people of study area had been cremated the deceased on own land but it was not tolerate for a longer time because the humbly lack of cultivation land for the increasing numbers of family. Then, Tamang people of the area decided to use the open ground of riverside against their religion. For some years, there was not any problem to cremate the deceased. But since ten years ago, this area is also encroaching day by day by the local farmers for the cultivation purposes and there is now no place left for the crematorium. This situation has threatened the culture of Tamang people. With the increasing population and decreasing agricultural product due to impact of climate change pressurized the local farmers to cultivate on this common land as well to survive them in a hardest condition.

Chapter 6
Adaptation strategies

6.1. Adaptation Strategies of Tamang community

Tamang as a main indigenous people of Nepal, have an intricate relationship with their environment, lands, territories and resources in social, economic and cultural aspects. Their livelihoods are highly dependent on natural resources; their territory almost lies in the diverse and fragile ecosystem that is isolated from physical development and access to political and economic opportunities which make them more vulnerable in the changing climate. At the same time, the long burdens of life teach them how to adapt on this critical situation by setting an appropriate strategy of the life according to the changing climate and its impacts.

Indigenous people can significantly contribute for finding solutions which may also be useful for other non indigenous society. They are amongst the first ones to have suffered with the impacts and have significant experience of adaptation; and they interpret and respond to climate change in creative ways, drawing on their traditional knowledge and other technologies (Salick & Byg 2007).

Tamangs of Harion have been experiencing the changes of climate and its impacts on their agricultural, social, economical and cultural practices since decade ago. They have faced many difficulties in their life. When they have to face the difficulties, they also set the solutions or the strategy to overcome from those difficulties and now those strategies become their knowledge or indigenous knowledge.

6.1.1. Cultural Adaptation strategies

Tamangs of Harion are already impacted by the climate change. Their culture and economy are under threat. They have been adopting an adaptation measure to the hardness of climate change through their daily consensus, discussion and observation within themselves rather than through formal long term planning process. Therefore, the capturing, recording and dissemination of such practices are difficult. However, the adaptation practices applied by Tamang of Harion are captured through their institutionalized organization. The name of organization is “Mane Sangh”, established in 2005 as a local organization with the aim to conserve the Tamang culture, tradition and strengthen the economic capacity and also provide the economic and cultural supports to the needy people of their community. Capacity building and additional financial resources would be helpful to enhance their adaptive capacity to the impacts of changing climate. Adaptive capacity can also be heterogeneous within a community especially for women. So, keeping it in mind, Mane Sangh supports women for the small income generating activities through the revolving fund program to strengthen their economic capacity as well as adaptive capacity to the changing climate.

Similarly, Tamang of Harion is performing worship in every full moon day rotationally in every member’s house and pray sitting together for the goodness of their livelihoods and all human beings. Historically, they were migrated from the hilly region into the Terai but later their culture, religion and tradition were influenced by the other culture and tradition. It puts a great threat to them and their culture in Terai. So, they have reconstructed their cultural identity through Mane Sanng to preserve their culture performing

various programs. During the worshiping in full moon, the ritual leader (Lama Guru) teaches them about the life and their culture (way of living), and also teaches about the environment surrounding to them which raise the awareness among them as well as to younger generation. At the same day, they collect the some fund individually and later it is distributed to those members who are willing to do some income generating activity. This fund also provided as a financial support to those who are unable to perform funeral ritual of their family member. According to the respondent, they are benefiting from this program and capacitated them economically as well as culturally and reduce the degree of vulnerability of any kind of changes including impact of climate change.

Years ago, there was a custom of using large amount of alcohol (locally known as Rakshi & Janth) during the ritual performance which was made by maize, rice and wheat. Consumption of large amount of grains for making alcohol had burdened to those families who couldn't afford for it. Now, this kind of trend is reduced and controlled significantly by Mane Sangh because it was not good tradition for society and they also realized that they need to save the food for the shortage of food due to low production of agricultural yield in an impact of changing climate in the area. In this condition, climate change has been affected the culture of Tamang positively as well because the culture which need to improve as according to time and changing circumference is changed by Mane Sangh. Now the attitudes of Tamangs of Harion towards using the alcoholic service during the ritual practices are changing which also reduces the violent behavior during the event.

Mane Sangh also become the common plate form to share own knowledge and experience to each other. This kind of sharing and exchanging of knowledge among all keep them aware to the upcoming events of their life and also the climatic hazards due to climate change. Many study show that for the reduction of impact of climate change and strengthen the adaptation capacity of individual and society, they urgently need to share their knowledge and experiences to each other and make a well and appropriate communication on time. Tamangs of Harion not only share the knowledge of their life through the Mane Sangh, they also institutionalized as an organization for the common goal of development of society which definitely strengthen their adaptation capacity.

6.1.2. Social adaptation strategies

To adapt successfully against the impact of climate change, social adaptation strategies is the important aspects and can't ignored it. Tamangs of Harion

are adapting new practices in their life to be safer. There are so many new techniques and practices are changed according to changing climate and its impacts on their life. These changes include pattern of house construction, family size and its types, needs of society, social norms and values.
According to respondents, ten years ago there were only one storey house made by wood, bamboo and mud but now it is gradually replacing by two storey's house and cemented concrete house. Most of Tamangs share that they feel safer from robbery, snake bite and also from the possibility of fire. There is also a shortage of cow dung that uses to cleanse and smear wall and surface of woody houses. Therefore, most of the Tamangs of Harion prefer the cemented concrete house. These all cases are intensified by the changing climate. Low production in agriculture increases the case of robbery, rising temperature and flooding makes the snake came out from the underground and increase the number of snake bite cases, and a long drought and rising temperature increases the case of fire in the area. Most of the people have left the livestock farming in the area due to lack of grazing land.

Similarly, the family size and type is changed as changes seemed in occupation like more involvement in non agricultural sectors and going foreign land for employment. According to respondents, a decade ago they had a joint and extended family. All members were fully involved in agricultural sectors. Agricultural production was satisfied and fulfilled all the needs of family members. But later agricultural production was going to reduce dramatically due to low rain fall, rising temperature and the long drought occurred in the area and then Tamangs of Harion was involved in non-agricultural sectors to fulfill the needs of their family, couldn't maintain the joint and extended family in that context and the trend of single family was established. The trend of separation from the family was an adaptation strategy of them to overcome from those crises. After separation from father and brother, the responsibility of the family is divided which makes them more comfortable to maintain the single family than the joint or extended family. According to recent survey, now 100% of Tamang family in Harion is single. This trend changes and impacts the structure and system of society and the social needs.

6.1.3. Agricultural Adaptation strategies

Every year, climatic change has brought extreme events like floods, drought, and hailstorms that affect agriculture and its production drastically. This can affect food production in the area greatly in coming years. The present study of potential impacts due to Climate Change on agriculture by HDR, 2007/08

suggests that Nepal is highly exposed and vulnerable to the risk of negative effects.

Agriculture is the primary subsistence of Tamang of Harion. Their livelihood is totally dependent on it. They have been facing so many negative effects of climate change in their crops. Because of that they at every aspect of their life are suffering by the climate change impacts.

Years ago, they used to cover all lands by paddy and maize as summer crop, lentil, wheat and mustard as winter crops. They used to get satisfactory production and sufficient food for their family over a year. But this condition didn't remain same after some years because of climate change started to put so many burdens on their crops and cropping system. Then Tamangs of Harion are started to cultivate sugarcane as an alternative crop in their land. They consider that sugarcane is less damaged by the fluctuation of climatic events. By the cultivation of sugarcane, they have been benefiting more than that from the cereal crops. They also started to cultivate some vegetables like tomato, cauliflower etc instead of traditional crops. For the cultivation of sugarcane, they have got the instruction and financial support from the sugar mill. The cultivation of sugarcane and vegetables instead of cereal and traditional cropping system is one of the adaptation strategies of Tamang community on agriculture. With the initiation of new cultivation pattern, they also started to use more advance tools such as tractor instead of bulls for ploughing and tilling, use irrigation by pumping the underground water and the use improved varieties of crops species. They use green manure to increase the land's productivity rather than chemicals and use the indigenous knowledge; crop rotation, intercropping, Mulching to keep soil moisture for farming vegetable, use bio-fertilizer and bio pesticides to improve soil fertility, to get rid out of effects of weeds and pests that are increased due to the impacts of changing climate. They choose the crop species according to the soil type and suitability of their land. For this, they use their long experienced knowledge of cropping. They plant sugarcane in that land where the production of cereal crops are very low and need to change the species of crops, plant Tomato and green vegetables in more sandy land and plant paddy in irrigated and loamy land.

Tamangs of Harion including all the farmers of Harion VDC has established the organization with the aim to support farmers both technically and financially in cultivation of all kinds of crops, secure farmers welfare and also to maintain the sustainable market of their product specially in favor of farmers. Institutionalizing all farmers definitely can strengthen the capacity of adaptation in the critical condition posed by the changing climate.

Besides these, Tamang of Harion is now gradually involving in the off-farm employment. At the time of this survey, out of total households, 40% household's members are out of country for foreign employment. This is also a kind of adaptation against the impact of climate change. Tamang of Harion answered that low production on agricultural product force them to go to the foreign land for employment.

6.1.4. Adaptation in livestock farming and fuel wood use

Livestock farming is another main source of income of Tamang of Harion. Since the encroachment of common pasture land, they have been facing many difficulties in farming of their livestock. But later, they have been adapted on this situation by planting the fodder tree and grass species surrounding their land and also in small patches of open land. They also started the stale feeding which benefits them in two ways; one they can save their time of going to herd livestock in pasture and another they can use the dung of livestock as a green manure in their crops to increase crop production from their land.

After deforestation of natural forest in Harion, there was the big shortage of fuel wood for cooking in every household of Tamangs. They had to dependent on forest which was very far almost 1 day away from their home. It made their livelihood more critical at that time but now they introduced some alternative measures. They started to plant fodders such as Ipil Ipil and other trees species especially fast growing species such as Eucalyptus, Bamboo and Sissoo on their land, then now they do not have to face the scarcity of fuel wood. Also many households are using the bio-gas for cooking and using more improved stove to save the fuel energy. These ways of adaptation measure they applied are at household level against the impacts of climate change; definitely reduce the degree of vulnerability of Tamangs of Harion.

Chapter 7
Summary, Conclusion and Practical Implication

7.1. Summary

Natural and human systems are exposed to direct effects of changing climate since its history either positively or negatively. But since decades ago, the impacts of climate change have been becoming more hazardous to human and their society.

Tamang community of Harion has agro-based economy and adversely affected by the fluctuation of climatic variables like rising temperature, long

drought, late rainfall in rainy season, severe cool and foggy days and absent of rainfall in winter. The impact of climate change puts a hazardous life to Tamang of Harion influencing their social, cultural and economic life. Considering all these facts and issues, this study aims to explore the impacts of climate change on social, cultural and economic aspects of Tamang community through a case study at Harion Village Development (VDC) of Sarlahi district.

To assess the impact of climate change on social, cultural and economic aspects of Tamang community, various participatory methods were applied to gather the information. Information was also probed through the secondary sources. Similarly, Ten years meteorological data of nearby stations (Karmaya and Patharkot station) of study area were collected from Department of Hydrology and Meteorology (DHM). Analysis was done being based on the primary as well as secondary sources of information.

Agriculture is the main livelihood source of Tamang community of Harion. It had the sufficient source of their livelihood years ago but now agricultural production is not same as before due to changing climatic variables such as rising temperature, late rain and absent of rain in winter, long drought and severe cold wave and foggy days in the winter. Ten years data (from 1999 to 2008) shows that temperature and precipitation of Harion are fluctuating rapidly in short period and also show that the monsoon is shifting from Ashad/ Shrawan to Shrawan/ Bhadra which hampered the whole agricultural system of the area and cause the low production of paddy in the area. Increasing pests and weeds also decreases the yields of crops. The reduction on agricultural production forced Tamang of Harion to involve in non agricultural sectors for the livelihood as an adaptation measure. Besides, they also change the crops species, use cash crop instead of cereal crops, technique of cultivation, use land as its soil type using their intimate knowledge (Indigenous knowledge) on agriculture and institutionalize the farmers under an umbrella for the favor of farmer’s welfare.

Economic status controls the whole social and cultural system of Tamangs of Harion. Due to low production in agriculture since a long time weakened the economic condition of Tamangs because of which couldn’t afford and give enough attention to celebrate their most important festivals and on performance of cultural practices. At the same time they have to concentrate on fulfilling their basic family needs rather than giving attention to celebrate festivals and performing cultural practices. This kind of trend has threatened

Tamang culture in Terai in long term. It also hampers the social systems of Tamangs in the area. The case of divorce, polyandry and polygamy increased in society with increased in foreign employment that influences the social system negatively. To overcome from all these problems, As an adaptation measure, Tamangs of Harion VDC ward no 2 and 9 have been established a local organization called 'Mane Sangh' through which they are performing cultural practices regularly and also strengthening the economy by supporting an income generating activities.

7.2. Conclusion

Tamang is one of the main indigenous groups of Nepal and they spread from western to eastern Nepal but their dominant population concentrates in surrounding districts of Kathmandu valley. Climate change has severe effects on Tamangs of Nepal. All aspects of their life are influenced by the changing climate and pose the hardest hit on their livelihood, culture and society. Because they have a strong attachment with the natural resources and their livelihood is totally dependent on agriculture which are adversely affected by the climatic events. They are become more vulnerable comparing to others due to their poverty, their territory in natural hazard prone area, and inaccessible to the development facilities.

In Terai, Tamangs were migrated from the mountainous districts when Government of Nepal started to establish the settlement in Terai after the eradication of Malaria from the area. Tamang community has slightly different language (using words) in different geographical regions. Similarly, they have distinct dresses and ritual practices according to climatic characteristics and the availability of resources in Terai, Hill and Himal. Though, the rhythm of culture, religion, social ethics and overall Tamangism is same wherever they live, which is directed by the Buddhism.

Impact of climate change in social, cultural and economic aspect of Tamangs of Harion is analyzed through the assessment on social structure and social system, ritual religious practices, and agriculture and income sources. The impacts of climate change on social, cultural and economic aspects of Tamangs are negative in Terai, Nepal. Like in other area of the world, climate change and its variables particularly rising temperature, changing pattern of rainfall, long drought, absent of winter rainfall and the foggy and chill winter have put so many burdens on agricultural production and

cropping system that has been practiced by Tamang of Harion. Further it has hit on the availability of food that can hamper the health of Tamangs and also makes the price of commodity higher which makes them more vulnerable economically. Agriculture is a main source of economy of Tamangs of Harion, there are no other options rather than dependent solely on agricultural sectors. Failure of agricultural production means failure of their life in that year. The continuously changing pattern of climatic variables and its uncertain events are playing main role on the progress of Tamangs of Harion either it is in culture or socio-economic aspects. The increasing trend of young groups going foreign land for the employment especially in gulf countries improves the economy of community in most cases, but not all cases, but at the same time it is providing so many social and cultural detriments in society like spending their young and energetic time in foreign land can reduce the speed of development of their society and culture, and increase the events of family breakdown, arise the cases of taking divorce between husband and wife. These kinds of events affect the social and cultural system negatively.

As adaptation strategies against the enormous impacts of climate change, indigenous and other knowledge has applied by the Tamangs of Harion. They changed the cropping pattern using new technologies, mix cropping, intercropping, Mulching to keep soil moisture for farming vegetable, use bio-fertilizer and bio pesticides to improve soil fertility, spray ash to control pests, use improved varieties of crops, manage irrigation facilities, change species of crops, and gradually become dependent on non-farm sectors like foreign employment and involvement on business and service sectors. For the social and cultural adaptation, they established an organization locally through the combining efforts of themselves which is reducing the vulnerability gradually by strengthening the capacity of individual and society.

7.3. Practical Implication

It is implicated that to overcome from the impacts of climate change, strengthening the adaptation capacity of Tamangs of Harion and an introduction of new technology in agriculture sector can be the best way for the Tamangs of Harion.

Climate change impacts on social, economic and cultural dimensions are not studied hugely. Nepal as a multicultural and multi-ethnical country can be affected more by the impacts of climate change and at the same time, it will

be an appropriate study site for the research purpose on climate change impacts and adaptation strategies which is urgently need to be assessed at the household level, so indigenous, poor and vulnerable people dependent on agriculture and natural resources must be appropriately targeted in research and development activities. Practical implication specifically describe below:

- Culture of Tamangs in Terai has been threatening by the changing climate and its uncertain events. So, Tamangs of the area should be aware on that and should make alive their culture, tradition and social practices as an identity.

- Limited study was done on impacts of climate change on social, cultural and economic aspects of the society. So, more research works should conduct to assess the impacts of climate change on every aspect of society and culture.

- Establishment of an organization (Mane Sangh) to support for adaptation in critical situation posed by climate change is really an appreciative initiation. It must continue effectively and sustainably with the collaboration of more community members in future. It can be replicate to other areas as well.

- Harion VDC is one of the economically active VDC in Sarlahi district which is highly dependent on agriculture. If the situation of low production in agriculture is persisted for a long run due to the enormous effects of climate change, there would be the huge scarcity of food that can affect health, economic and social condition of the community. So, the urgent attention of government and other development organizations need to focus on such a program that can reduce the impacts of climate change on agriculture. For example: irrigation program, seed bank, improved varieties and introduction of drought tolerant species of paddy, maize and vegetable species.

- The government of Nepal should give preference for the conduction of researches to understand and identify the indigenous life system, their adaptation practices and indigenous knowledge used by them in the context of changing climate. That can be a replicable adaptation

measures or an appropriate guideline for other non indigenous community of Nepal.

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Annex I : Some Glimpses of research work:

Household Survey-Asking question with respondents

Offering Butter Lamp on the occasion of Lhosar

Lhosar Celebration

Mane Sangh monthly meeting

Sugarcane cultivation in Harion as a cash crop

Using green manure to improve the land productivity

Transporting manure to cultivable land

Long foggy days damaging the tomato cultivation

Mulching land to maintain the soil moisture

Reducing production of Tomato by chill days in winter delay rainfall

Jack fruit (Rukh Katahar) damaged by the white disease due to

Annex-II

Questionnaire

A General Information

1. Name of Respondent:
2. Address:

3 Household Information:

Sex	Age Group				Educational Status					
	<5	6-20	21-40	>40	Primary	Secondary	SLC	Intermediate	>Diploma	Remarks
Male										
Female										

B. Agricultural information:

1. Total land: Khet: Bari: Kharbari:

Crop	Production Rise or Fall compare to previous year	Causes of low/high production	Any technique apply for more production	Crops Damage by weather	Food sufficiency	
Maize					1-6 month	Whole year
Rice						
Wheat						
Sugarcane						
Vegetable						
Others						

3. How do you manage deficit months?

4. For what purposes, you are using the crops in household?

5. Do you ever feel hardship in agriculture due to climate change in recent year? What are the types of difficulties?

6. Do you experiencing that the time and pattern of precipitation is changing?

7. What types of crops did you farm in your land years ago and what types of crops do you prefer now? Why?

8. Are there any damages in your crops or vegetation production by drought?

9. Have you ever used any local practices to cope with impacts of climate change on agriculture?

10. Do you have any suggestion regarding the reduction of future challenges of climate change in your area?

C Disaster

1 Have you ever seen or experienced any natural disasters in your life?

2 What kind of Natural disasters have to face here most frequently**?**

3 Do you listen about the climate change?

4 What type of effects it does in your daily life?

5 What type of methodologies do you have applied to adapt with changing climate?

6 Do you think climate change is affecting the life both positively and negatively? If yes, can you explain here?

7 What kinds of loss or changes do you face out due to the natural disaster?

a. Agricultural crops loss in quantity:
b. Health condition/ Human loss
c. Livestock lose
d. Social mobility/migration
e. Income sources
f. Cultural change

D Economic Information:

Income Sources	Main Occupation	Subsistence	Employed family members
Agricultural			
Service			
Labor			
Business			
Go out of country for a job			
Others			

What is the main cause that pushes him or her to the foreign country for a job?

Have you faced or seen any losses such as human loss, wealth loss and agricultural land and product loss due to the natural disaster in your area? Can you say when it was?

3 Had you repaired your house after construction of it? When did you repaired last time? How much Rupees did you expend on it?

E Culture:

1. Do you think that climate determine the some aspects of Culture, such as dress? If yes what are those in your community?

2. Are you feeling that food habit is changing due to the impacts of climate change especially impacts on production pattern?

3. Do you think that impacts of climate change in economy (loss of opportunity, life and property) is regressing the progress of culture of Tamang people? If yes how?

F. Social:

1. Do you feel that climate change impacts are constraint to social development?

2. Are there any short term or long-term migration from your village? If yes how many people have been migrated from here annually?