

IMPACTS OF CLIMATE CHANGE ON THE LIVELIHOOD OF LOCAL PEOPLE: A CASE FROM JETHAL V.D.C., SINDHUPALCHOWK DISTRICT

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ABSTRACT

This research study was carried out in Jethal V.D.C. of Sindhupalchowk district. The objective of this study was to find out the impacts of climate change on livelihood of local people and effective adaptation mechanism to cope with climate induced disasters. For finding this facts, households questionnaire survey were administered and qualitative data were collected through households interviews with 10% of total population. Both primary and secondary sources of data were used in order to find out the perception of the local people on climate change and their coping strategies. In this study, landslide, drought and soil-erosion were found to be the major climate induced disasters. However, it was clearly indicated that landslide was one of the most prevalent climate induced disaster. The local people of Jethal V.D.C. have also perceived changes in temperature and precipitation pattern as well as increase heavy unseasonal rainfall resulting major disastrous climatic events and outbreak of diseases. Every year, the landslide washed away the huge amount of fertile soil and converting it into barren land in the area. About 60% local people lived with shortage of food sufficiency for about 6 months in a year. The local people do not have sufficient water sources near their communities and they have adapted to the impact of climate change by simply applying local measures and choosing safe places. The landslides damage the huge agriculture land every year. The local people also have applied trace farming and plantation to cope with landslides and they often select the crops like potato, maize, millet, wheat barley which are grown in irrigated land. Empowering the local people with knowledge about climate change and equip them with skills through trainings to diversify their livelihood asserts. Moreover, the further research is recommended and the existing options and policies should be implemented effectively to cope with the changing climate and improve the livelihoods of the people of Jethal V.D.C. Sindhupalchok.

KEYWORDS: Climate change, impacts, adaptation, livelihood, Jethal VDC

INTRODUCTION

Climate change is the variation in global or regional climate over a time. It includes quantity of light, temperature, humidity, wind, water etc. which average about 30 years (Dara, 2002). Thus the change in weather conditions of an area

over long period of time is called climate change. These changes affect the agricultures, mobility of animals, hydrological cycle, thermal gradient between the poles and equator wind pattern, distribution of rainfall etc.

The scientific and technological revolution has given multiple facilities to mankind but at the same time man made activities are responsible for depletion of resources and upsetting the delicate balance between the various components of the environment. They are excess use of fossils fuels, deforestation, and desertification, loss of fertility of soil, rapid industrialization, and increase of automobiles and so on and all of these activities are responsible for global climate change by emitting the greenhouse gases. The global change in temperature will not be uniform everywhere and fluctuate in different regions of the world. The places at higher latitudes will be warmed up more during late autumn and winter than the places in tropics. Poles may experiences 2 to 3 times more warming than the global average. The increased warming at poles will reduce the thermal gradient between the equator and high latitude regions decrease the energy available to the heat engine that drives the global weather conditions. This will disturbs the global pattern of winds and ocean currents as well the timing and distribution of rain fall, shifting of ocean currents and the change the climate of Iceland. Nepal's climate change is influenced by the Himalayan mountain range and the south Asian monsoon (NAVST, 2009). The climate, pre-dominating influenced by the monsoons is westerly disturbance, is characterized by the four distinct seasons: pre monsoon, monsoon, post monsoon and winter. The average rainfall is approximately 1800mm but there are marked spatial and temporal variations both in north-south and east-west. The monsoon is the most abundant in the east and declines west wards, while winter rains are higher in the North West and declines south eastwards (Practical Action, 2009). Higher rainfall is experienced in the central and mid hill regions around Pokhara and north east of the Kathmandu valley. The rainfall pattern and other weather parameters directly affect the livelihood of the people. The agriculture crops grown in Nepal are broadly divided into two groups, food crops and cash crops. The major food crops are paddy, maize, wheat, millets, barley, pulses, and potato. Paddy, being the land allotted to food crops. Cash crops occupy 18% of the arable land. The major cash crops include sugarcane, jute, tobacco, tea, cotton and cardamom. The most of the aforementioned crops are produced in the Terai region of Nepal. Legume crops grown in the country include lentil, pea, cowpea, soybean, chicken pea, green gram and black gram. Mustard, rapeseed, linseed, ground nut etc. are some important oily seed crops. In case of fruits citrus, apple, walnut, mango, banana, peach, plum and pear are common. The vegetable crops include cucurbits, tomato, potato, legumes and some leafy vegetables such as green mustard etc. About 80% of paddy is produced in the Terai region of the country and the maize, millet and potato are basically the hill crops (ABTRACO, 2008). The productivity of all these crops directly or indirectly depend on climatic parameters.

Climate changes further increase the frequency and intensity of extreme climate events and cause adverse impacts on crop production and the environment. This trend is expected to continue during the current century due to continue

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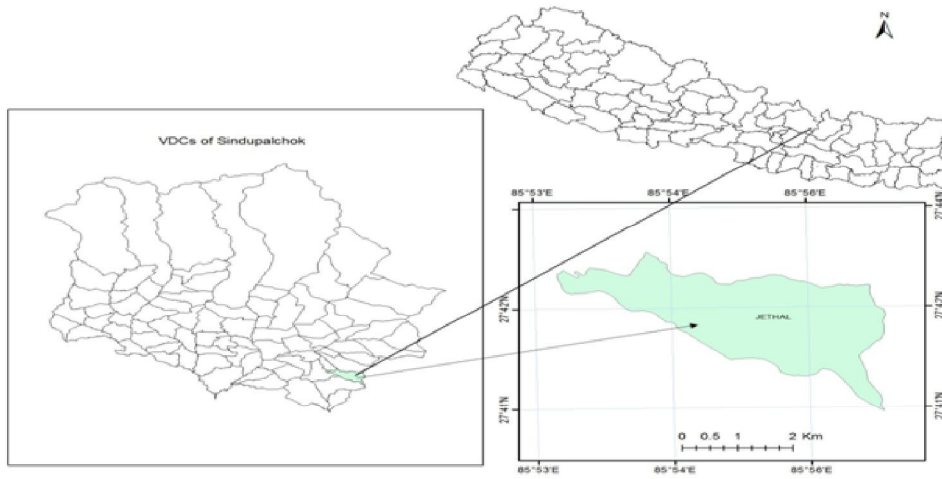
greenhouse gases emissions. Even more harmful is the increased climate variability caused by climate change which create temperature extremes, longer drought and flood periods. The climate change and variability will increase pressure on natural resources and will affect food security, especially to rural livelihoods in Nepal. These issues are compounded by greater agriculture dependence, continued agriculture in hazard prone areas in Terai and rain mid hill regions of Nepal. Thus, the main purpose of this study was to access the perception of local people regarding the changing climate and its impact on their livelihood and to analyze the local adaptation and mitigation measures to cope with changing climatic conditions.

MATERIALS AND METHODS

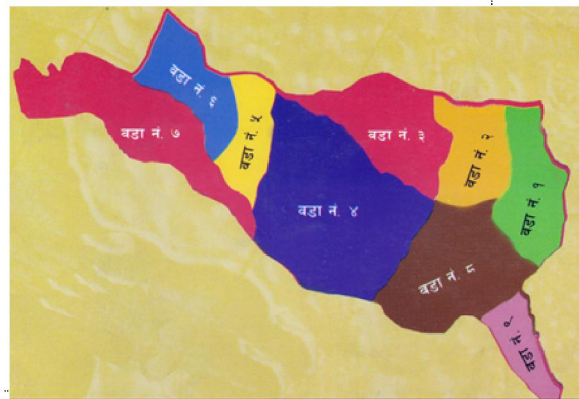
Jethal V.D.C. of Sindhupalchok district was selected to carry out this research. The research study adopted is exploratory as well as descriptive in nature. The exploratory method was the collection of quantitative and qualitative data from the structured and semi-structured questionnaire.

Study Area

Map 1: Jethal V.D.C., Sindhupalchok District



For this research, the primary data were collected during field visit through household survey questionnaire, key informants interviews, focused group discussions and field observation and the secondary data were obtained from the published and unpublished materials, journals,



books, articles, newspapers and magazine, websites and government publications. The 10% of populations of total 650 households were sampled for the household questionnaire survey. The focus group discussion was conducted among people of all wards of the Jethal VDC with randomly. The informal interview was also conducted during the study period. The 65 samples were taken randomly by using following formula (Arkin and Colton 1963):

$$n = \frac{NZ^2 P (1-P)}{Nd^2+Z^2P (1-P)}$$

Where,

n = sample size

N = total number of households

Z = confidence level (at 95% level z=1.96)

P = estimated population proportion (0.05, this maximize the sample size)

d = error limit of 5% (0.05).

After the collection of data, the information were organized into different headings, topics, and then they were coded and the simple statistical package as pie chart and bar graphs were used to analyze the data.

RESULT AND DISCUSSION

Populations with Ethnicity

Jethal V.D.C. is situated at Sindhupalchok district in the Central Himalayan region of Nepal. Its area is 16.12 sq. km. This V.D.C is near about 1500 m to 2100 m above from the sea level and the average annual temperature ranges from 24 to 30 degree centigrade at the summer season and falls down upto zero degree at the winter season.

In the VDC, different castes of the people are living together but the Newar and the Tamang are dominant. There is unity in diversity in Jethal as the slogan commonly used in Nepalese society. The distribution of population in the V.D.C. is given below (Table1).

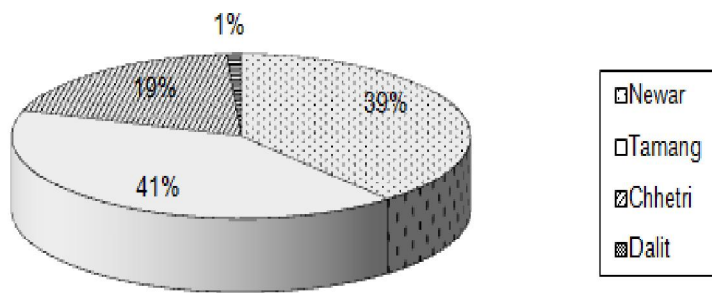
Table 1: Caste-wise Population Distribution of Jethal VDC

S.N.	Castes	Female	Male	Total	Percent
1	Newar	1084	1131	2215	63.19
2	Tamang	467	481	948	27.05
3	Chhetri	134	138	272	7.8
4	Helmu	26	32	58	0.17
5	Bishowkarma	7	5	12	0.04
Total		1718	1787	3505	100

Source: *Village Profile, Jethal, 2068*

In the given Table 1, Newar and Tamang were found in the dominant composition as 63.19% and 27.05%.But Helmu and Dalit are in recessive composition as 0.17% and 0.04% respectively. Depending on ethnicity, the major groups of

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the respondents were Newar 63%, Tamang 41%, Chhetri 19% and 1% Dalits. The population with ethnicity group is shown in the figure 1.

Figure 1: Populations with Ethnicity

The respondents of the population comprises of 69.2 percent males and 30.8 females. The distribution of male and female population in study area is given in following Bar Diagram:

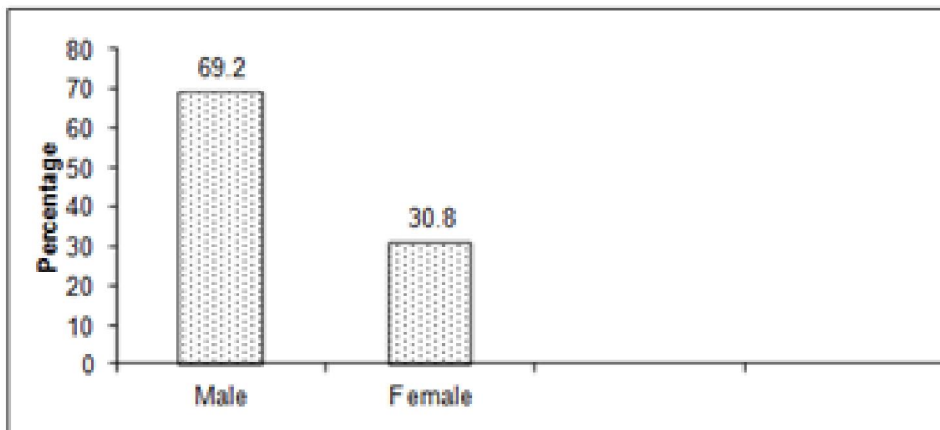


Figure 2: Respondent of population with gender

Education Attainment

The literacy status of the sample households of the study sites were categorized into two groups. The respondent who did not know how to read and write were classified as illiterate. The literate people are classified into different sub-groups such as primary who had 1 to 5 years of formal education; those who had 6 to 10 years of formal education belonged secondary; the respondent who had 12 years of formal education belonged higher secondary; the respondent who had an associate degree or above were classified as higher education. Education status of respondents is represented as follows:

Table: 2 Education attainments of respondents

S.N.	Education Attainment	Percentage
1	Illiterate	30%
2	Literate	70%
2.a	Primary	36%

2.b	Lower Secondary	20%
2.c	Secondary	9%
2.d	Higher Secondary	4%
2.e	Higher Education	1%

Source: Village Profile Jethal V.D.C. Sindhupalchok

Occupation Status

People in this V.D.C are engaged in different occupation. But agriculture is the main occupation of the villagers. About 80% of the people in agriculture, hotel sector 5 percent, government service 4 percent, business 2 percent and the daily wages 8 percent were involved.

Major Crops and Crop Calendar

The major crops grown in the study area were potato, maize, millet, wheat etc. The potato is the major crop and vegetable for commercial scale, and most of the people in the study area were benefitted from potato farming. They were selling potato in co-operation with Sildhunga center for collection of vegetable and potato seeds in Kalimati Tarkari Bazar.

Table 3: Crop Calendar in Jethal VDC

S.N.	Crops	Plantation Time	Riping Time
1	Potato	Kartik	Paush
2	Paddy	Ashad	Kartik
3	Wheat	Kartik	Chaitra
4	Maize	Chaitra	Shrawan
5	Millet	Ashad	Kartik

Source: Field Survey 2013

New Vegetables

Most of the respondents said that they are growing new paddy and Bro-Cauli as new food crop and vegetables. About 57% respondent said that Bro-Cauli would be the new vegetable because they can grow and sell Bro-Cauli and earn for their livelihoods. About 43% respondent said that New Paddy would be the new crop because it can be grown in winter season. Due to which they can solve the problem of buying rice from the market.

Food Sufficiency

Agriculture production produced in the field of Jethal VDC was not sufficient for their livelihood. About 20 percent respondents said that the crop produced in their field was sufficient only for less than 3 months. The 60 percent respondents said that food was sufficient for 3-6 months; the 15 percent respondent said that food was sufficient for 7-12 months and 5 percent respondents said that they had no production and they had to buy food from market or elsewhere for their livelihood.

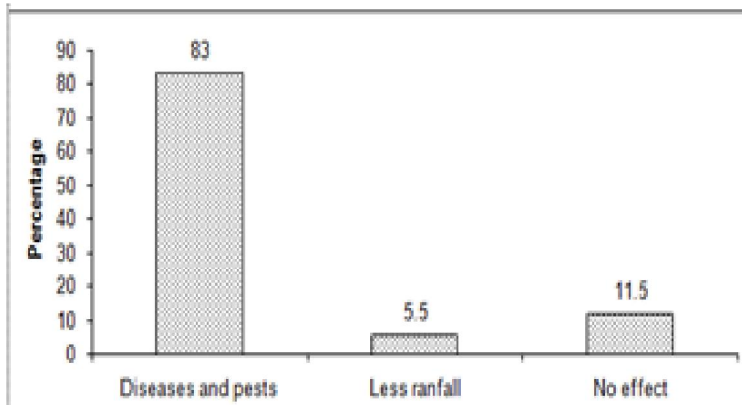
Energy

According to the field survey conducted in Jethal VDC almost all people depend on firewood for cooking purpose and electricity for lighting. The Sun-koshi hydropower generates 28 mega-watts and connects to national grid. They got electricity regularly from Sunkosi hydropower because Government has the policy to provide electricity regularly for local people (V.D.C Profile, 2068).

IMPACT AND ADAPTATION STRATEGIES OF CLIMATE CHANGE

Agriculture

Farmers in Jethal VDC noticed that the agriculture production has been reducing in the recent years. About 64.9 percent respondents said that production was



decreasing, 30 percent respondents said no significant change was noticed in production and 6 percent respondents said that there was increasing in agricultural production. Here, the

Figure 3: Perception on Decreasing Agricultural Production

increased production was because of the modern techniques applied by the farmers to increase the production. The major practices villagers applied are terrace farming in sloppy lands and use of chemical fertilizers. The 83 percent respondent said that the decrease in agriculture production is due to disease and pest, 5.5 percent respondent told that less production due to less rain and snow fall. 11.5% respondent reported that there was no impact on agriculture production.

Different strategies have been adopted to minimize environmental risk and ensure food security and high agricultural production. Terraces on steep hill slopes have been made to reduce erosion on one hand and in the other hand to obtain benefits of irrigation. According to respondents, they achieve output of terraces techniques in hill slope. Another strategy adopted by the villagers is the selection of crops like potato, maize, millet, wheat barley which are grown in un-irrigated land. Specially potato, Cauli Flower and Bro-Cauli are grown and collected in cooperation with Sildhunga center for collection of vegetable and potato seeds. Imported and Improved varieties like as paddy, potato and Bro-Cauli have high production potential but have less resistant to hail and rain. The native varieties are resistant to local climatic deviation but their productivity may be low. The unseasonal foods and cash crops have also been practiced in this area.

Generally, corns are kept on the "Suli" /Urim and grains are stored in Bhakari (Storage materials made out of bamboo). Nowadays people are using remittance to overcome the crisis in food stuff which is one of the examples of proper utiliza-

tion of remittance for crisis management. Besides, this they use wages from their construction, money selling livestock etc. to fight with food crisis.

People are using different strategies to keep livestock at proper condition. The livestock is the important source of local people living in this VDC Jethal. These are also important source of manure for plant and agriculture. Even though animal rearing is not increasing due to lack of fodder and grazing field, the importance of livestock cannot be ignored in the life of people of Jethal V.D.C. In the summer season local people take their livestock at the higher altitude upper part of V.D.C. and in winter season they take their livestock at the lower altitude near Danda Pakhar.

Water Resources

The 61 percent respondents told that they made local tap near the source of water by their communities making canal for drinking and other purpose. 21 percent respondent said they were using pipe water for drinking and other propose and 18 percent respondents told that no measure was applied for drinking and other purpose and they were getting water from direct source where it is

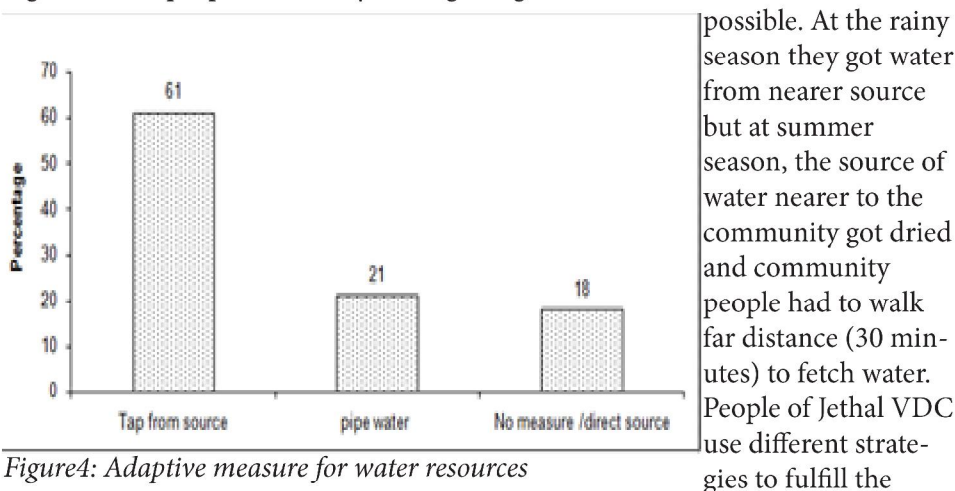


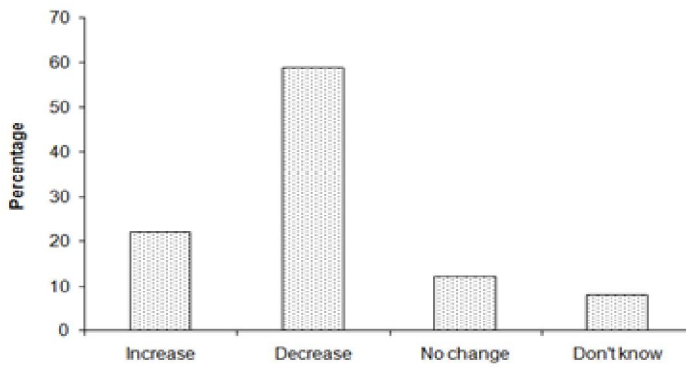
Figure4: Adaptive measure for water resources

water needs. Most of the agricultural activities are performed on the rainy season. Many seasonal crops are planting despite the lack source of water resources. They have made canal from water resources to their communities to full-fill their need of water. Pipe taping system is also adopted their which has made by government support

Forest and Biodiversity

Majority of population in the study site depended on forest production for their livelihood. Community people used forest for fulfilling their basic requirement of fodder, firewood, timber etc. The local communities had limited forest resources in order to meet all their demand of forest products. And it causes high pressure on the forest, increasing deforestation and loss of local species. The field survey showed that 58.9 percent respondents told that loss of species at local level, 21.1 percent respondents said that increased in biodiversity, 12 percent said

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no change in biodiversity and 8 percent have had no idea about it.

Most of respondent (97 percent) told that they were applying adaptive measures to control deforestation with the help of community forest user group. 2 percent

Figure 5: Local Perception on Biodiversity

respondents said that they are using biogas and 1 percent respondents said that they used cooking gas (L.P.G). There is no specific strategy to reduce the impact on biodiversity of climate change. They have formed a consumer and conservation committee to protect the community forests which is the policy of Government of Nepal.

Because of this committee, there is dense forest conserved and it has played a great role to support biodiversity conservation of the VDC. Okhrene Samudayak Forest Consumers and Conservation Committee and

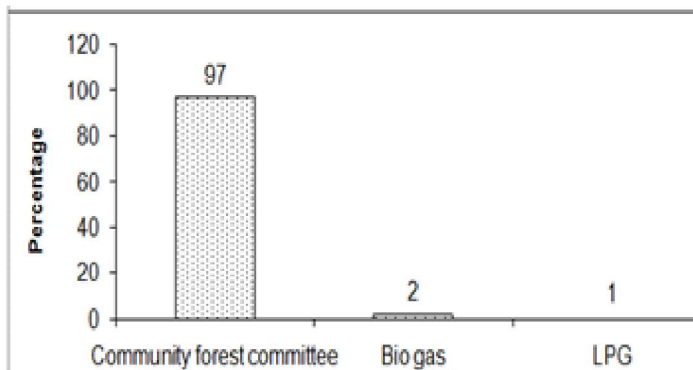


Figure 6: Adaptive measures to control forest resources

Golme Aiselukhark Samudak Forest Consumers and Conservation Committee are the major organs to protect the forest and biodiversity in the VDC.

Human Health

According to respondents the patterns of rain fall and snow fall changed due to change in temperature in the study area which had both direct and indirect effects on health human

beings. 83 percent respondents said that there was high impact on health where as 10 percent respondents said no impact on health and 9 percent respondent reported that they had no idea about the impacts.

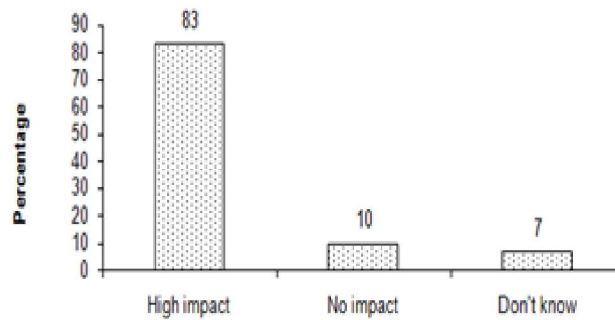


Figure 7: Local Perception on Health Impacts

The local communi-

ties have observed prevalence of mosquito and fly in recent years were the cause of diseases. The people also perceived the occurrence of disease like diarrhea, typhoid, cholera, Jaundice, eye infection, headache and cold fever. The increase of number of mosquitoes was the result of climate change and increasing rate of temperature. Many impacts on health have been seen on Jethal V.D.C Sindhupalchok and increasing day by day. For serious health problem they used to go to the hospital situated at Mankha V.D.C, Khadichour Sindhupalchok. For normal health problem, they used to go to the health post situated at Jethal -5, Sildhunga. They also apply local techniques like using mosquito net while sleeping, boiling water before drinking, eco-sanitation as constructing toilets, etc.

Disasters

Landslide was a major natural disaster in Jethal VDC which damages agricultural field and black topped road. Among the total respondents 63.9 percent said that landslide is the prominent natural disaster, 8.3 percent respondents said

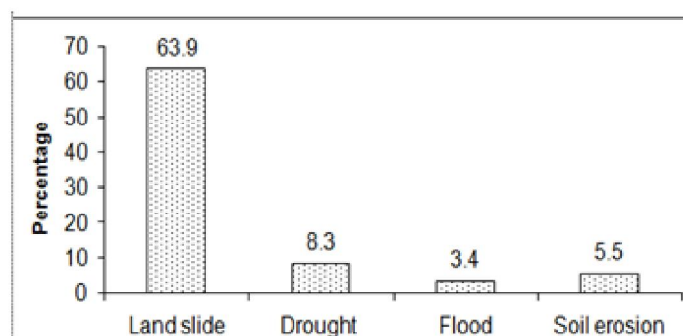


Figure 8: Perception on disaster

drought, 3.4 percent said flood, and 5.5 percent said soil erosion as a serious disaster problem created by climate change in this area.

Climate induced disaster was causing the livelihood problems at local level.

56.7 percent respondents said that climatic disaster had impact on agriculture, 32.3 percent respondent told that impact on drinking water and 9.7 percent respondent told that impact was on infrastructure.

Land slide and soil erosion are the severe problems as natural disaster. In rainy season, land slide affect agricultural land, water source and roads. No specific measures were taken to control land slide but some local communities made retaining wall to control it is not so effective. Communities have low economic conditions and cannot afford high cost of economy so that the local attempts to control land slide are not so effective and sustainable.

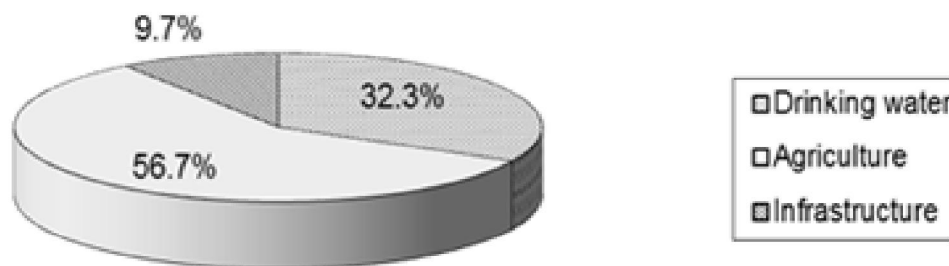


Figure 9: Climate Induced Disasters

CONCLUSION

This study was conducted in Jethal V.D.C. Sindhupalchok district to find the impacts of climate change on local livelihood of people and the coping strategies to be adapted by the people at local level. The finding showed that the people had exactly less idea about climate change. There is less number of presences of governmental and nongovernmental organizations to make them aware on climate change issues. However, local people of that V.D.C. have many experiences and perception about climate change. The Jethal V.D.C is a typical rural V.D.C. where the Tamang and the Newar were the dominant ethnic groups. The education status was not satisfactory, as higher education attainment is only one percent. Most of the people in the area are mainly depend on agriculture production for their livelihoods. Even though agriculture production is the main source but it is not sufficient to feed their community throughout the year because of low crop production. The main impacts of climate change have been observed on the agriculture sector. There is decreasing on the agriculture production comparing with last 30 years and according to the local people the major causes behind this are rainfall, temperature, diseases and the pests.

The patterns of raining has changed i.e. sometime early sometime late as per the local people of the VDC. The biodiversity of the study area have decreased due to extreme dependency of community people on forest. The major challenges and health problems have been observed as diarrhea, typhoid, Cholera, Jaundice, eye infection, headache and cold fever which can also be effects of climate change. The landslide drought, soil erosion, flood are the common natural disaster among with landslide is the most prevalent nature al disaster in the study area. There is also food security problem and average food sufficiency is about half year. Climate induces disaster also had negative impacts on the local environment. The local people of the Jethal V.D.C. are applying some local adaptive/ coping measures to cope with change, especially, in agriculture trace farming and canal making are the main adaptive measures for heavy rain. In this sector local people have also adopted trace farming and change in crop calendar but these strategies are not sufficient to cope with climatic hazards and risk. Food grains are stored in Bhakari made by bamboo and corn are stored in *Suli/Urmi*. However, all these coping and adaptation strategies are not sufficient to cope with climatic risk and hazards. Planned and adaptation strategies and policy making along with local options need to enable to address negative impacts of climate change. In order to mitigate the negative impacts of climate change, high priority should be given to rain water harvesting system, improving the quality of soil, irrigation system and infrastructure development. The study suggests that the immediate need to address the climate change issues for enhancing the local livelihoods through integrating climate resilience activities.

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