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Local People's Perception on Climate Change at Kamalamai Municipality, Sindhuli

Basanta Kumar Neupane[1] Ashok Acharya[2] Luna Thapa[3]

Abstract

Climate change (CC) has become one of the intervening issues in the last few decades. Climate change can severely affect the way community is living, prominently the developing countries. Climate change brings out wide ranging effects on water resources, agriculture, human health and biodiversity. The study was conducted in ward number 3, 7, 8, 9, 10 and 13 of Kamalamai municipality Sindhuli, Nepal. The methods adopted for the data were key informant interviews, group discussions and observations. In order to support the primary data and secondary data were also used. The secondary sources of Data were obtained from the public documents of the different ministries, departments, Central Bureau of Statistics and journal articles. Group discussions, Key informant interviews and observation were carried out to identify the impact of climate change on vegetation and agriculture. The findings of the study show that majority of the household perceived the impact of climate change on vegetation and agriculture while very few people were unknown about the impact. Climate change expected to cause many other climatic hazards, which directly affect the economy and livelihoods of the people.

Key words: climate change, perception, agriculture, temperature, rainfall

Introduction

United Nations Framework Convention on Climate (UNFCC) change defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time period. The impacts of climate variability and changes on agricultural production are of global concerns. IPCC, 2013 showed that globally average combined land and ocean surface temperature has increased by 0.85°C (IPCC, 2013).

[1] Central Department of Geography, Tribhuvan University, Kathmandu, Nepal.
Corresponding e-mail: geo.bneupane@gmail.com

[2] Central Department of Agriculture, Agriculture and Forestry University, Chitwan, Nepal.

[3] Central Department of Environmental Science, Tribhuvan University, Kathmandu Nepal.

Nepal is exposed to multiple hazards due to variable geo - climatic condition, young geology, unplanned settlements, deforestation and environmental degradation and rapidly increased in population (Nepal, 2011). Climate change (CC) has become one of the intervening issues in the last few decades. It can severely affect the way community is living, prominently the developing countries (Bowen, 2011). It brings out wide ranging effects on the environment related sectors including water resources, agriculture, human health and biodiversity. The effect is just one of the many factors that influence people livelihood (Miller, 2011). The poorer and the most vulnerable country of the world depend directly on natural resources through agriculture, water resources, forestry for their livelihood. Climate change is the main issue at both national and international phenomena (Khadka & Pathak, 2016). The means of production available to a given individual, household or group can be used in livelihoods. The livelihoods of over 70% of all Nepalese are based on agriculture and forest resources (Sapkota & Rijal, 2016).

Livelihoods of rural poor in Nepal mostly depends on agriculture; and Climate Change (CC) possess immense challenges for them, specifically people relying on natural resources for livelihoods and have limited capacity to adapt. This has resulted adverse impact on their economic and environmental spheres due to weak institutions, knowledge gap and other priorities. Nepal has been facing an unpredictable effect of climate change in recent years with rapid rise in temperature (>0.06^{0}C), rapidly retreating glaciers, erratic rainfalls and increase in frequency of extreme events such as flood, landslide, drought, untimely onset and exhaust of monsoon (Nepal, Devkota & Bhattarai, 2012). Consequently, there has been heavy toll of human, animals, crops and vegetation every year. Climate change impacts are directly visible in terms of low production and productivity of agricultural crops that ultimately leading to food insecure situation (Malla, 2008). The dominant activities of people residing in study sites are farming. Traditional farming system is practiced this area. Very few farmers are doing modern agriculture.

During the past 32 years data of Nepal shows increase of temperature by 1.8°C and the average temperature increase was recorded as 0.06°C (Baidhya, Shrestha & Shaikh, 2008). Developing countries like Nepal are more susceptible to the climate change and its impacts due to their limited capacity to cope with hazards associated with changes in climate. Malla (2008) has revealed that with an average of 0.06°C a year rise in temperature but 1.8°C has been recorded in Nepal (Dell, Jones & Olken, 2012). They concluded that higher temperature has wide raging effect on agriculture. And this context, it has made an effort to understand the local people's

perception on climate change impact in Kamalamai Municipality, Sindhuli district, Nepal.

Methodology

Study area

Six wards (3, 7, 8, 9, 10 and 13) of Kamalamai Municipality Sindhuli district, Nepal has been selected for this study. Kamalamai Municipality is the one of the larger municipality of Nepal. It is an old settlement of Sindhuli. It is located on province number 3. It is located between latitude $26^0$55'N to $27^0$22'N and longitude $85^0$15'E to $86^0$25'E. Dudhauli municipality and Tinpatan rural municipality to the east, Golanjor and Ghyanglekh rural municipality to the north, Marin rural municipality in west, Sarlahi, Mahottari and Dhanusha District in south border of Kamalamai Municipality.

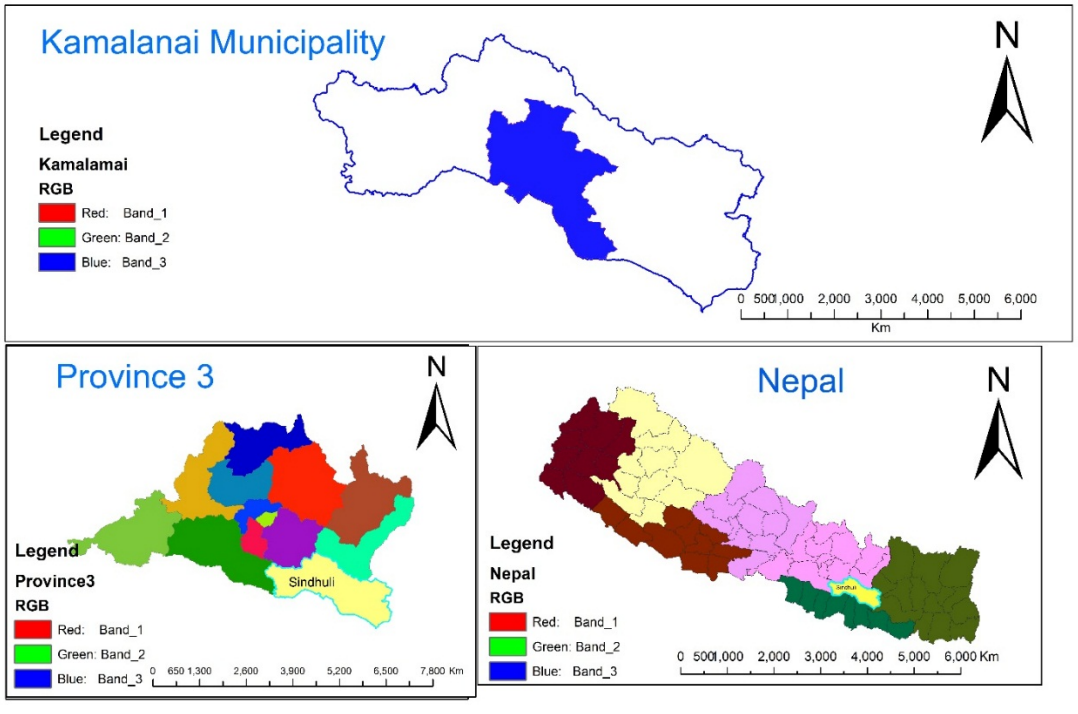

Figure 1: Location map of study area

The total area of Municipality is 482.57 square kilometer and total population of municipality is 77,845 (CBS, 2011). The population density is 137.95 persons per square kilometer. The climate varies with elevation and other physical factors. Winter is the driest and summer the wettest season. Rice and Maize are the major

crop of Kamalamai Municipality (Neupane & Dhakal, 2017). National Sample Census of Agriculture 2001-2002 indicated that nearly 93% of the total area was owned by farm households (NPCS, 2001). The National Living Standards Survey 2010/11 shows the average size of agricultural landholdings in Kamalamai Municipality to be 0.75 ha, with nearly 65% of farmers having landholdings of less than 1 ha, and 8% owning more than 2 ha (CBS, 2012).

Tools and techniques

The study was based on extensive field survey in six wards of Kamalamai Municipality. In order to obtain data, different methods such as, focus group discussion, key informant survey and field observation were held. Six focus group discussions (FGDs) were conducted with farmers, school teachers, local political leaders, social workers, representatives of local and international non-governmental organizations (NGOs and INGOs), business people and another related person. In addition, 36 key informant interviews (KII) were conducted, six from each ward. The informants included local level leaders, heads of educational institutions, representatives of government line agencies (GLAs), representatives of INGOs, members of water user groups, members of community forest user groups, member of women saving group, and member of different farmer group. The participants in FGDs and KIIs were over 50 years old, as these people were considered to have greater experience with climate variability and sufficient memory of significant weather events.

Results and discussion

Understanding of local people's perceptions on climate change is described in the following section. Some proxy indicators were developed for climate change based on people's responses about the sort of changes they were observing, and interpretations were based on the reported impacts.

People perception on climate change

Rapid rise in temperature (>0.06°C), erratic rainfalls and increase in frequency of extreme events such as floods and drought like situation are some of the effects Nepal is facing during the last few years (Karki, Mool, & Shrestha, 2009). Majority of the household (76%) expressed that they perceived the impact of climate change while 11% perceived no impact of climate change and 13% respondent were unknown about the impact. Paudel (2016) also indicated that there are varying level of climates in Nepal that are prevalent in diversified topography and vegetation. The Earth's average temperature has risen by 1.5°c over the past century, and is

projected to rise another 0.5°c to 8.6°c over the next hundred years. Nepal is one of the least developed country in the world and was ranked as the 4th most vulnerable country due to the impacts of climate change by Maplecroft in 2010, but, in contrary, it is one of the least contributors to global GHGs emissions, emitting 0.027% of global total (Sapkota & Rijal, 2016).

Figure: 2 and 3 represents peoples' perception about temperature change and precipitation in Kamalmai Municipality of different ward in 2019. Majority of the respondents (78.45%) expressed that they perceived the increased temperature in 2018. Majority of the respondents (42.34%) perceived the decreased rainfall and (18.78%) perceived the change in timing of rains in Kamalamai Municipality. Based on the available information it was reported that the average temperature in Nepal is rising by 0.5^0 Celsius per decade (Lama & Devkota, 2009). Because of climate change it is reported untimely start of monsoon rainfall that resulted rain deficit in the eastern Terai lowlands in 2005/06, reducing crop production by 12.5% nationwide (Malla, 2008). In agriculture, about 10% of agricultural land was left fallow due to rain deficit on the one hand, while on the other hand in the Midwestern Terai faced heavy rain with floods, which reduced crop production by 30% (Regmi & Bhandari, 2013).

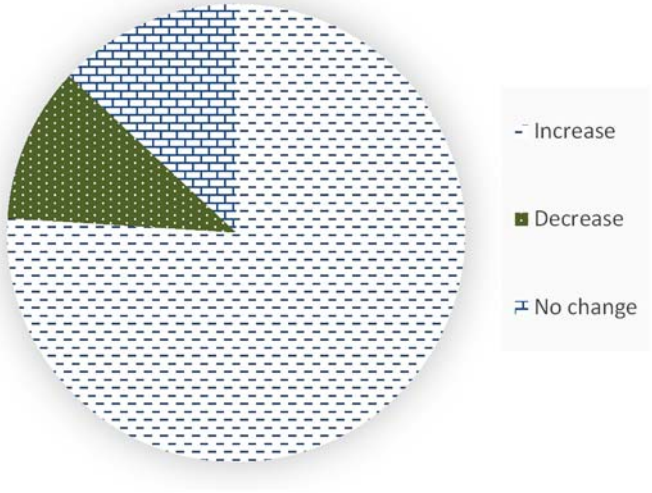

Figure 2: Perception about rain fall in Kamalamai Municipality; Source: Field survey, 2018

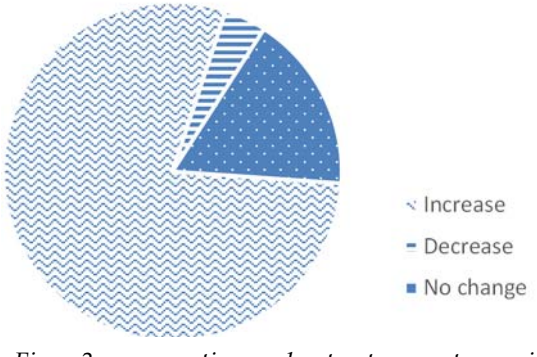

Fig 3: perception about temperature in Kamalamai Municipality; Source Field survey 2018

The participants of the FGD responded higher temperature, erratic rainfall, hailstones, drought and landslides in last decades that had affects in subsistence agriculture of Kamalamai Municipality. People in the different wards of this municipality were able to recognize that temperatures have increased and there has been a fluctuation in the rainfall pattern. They had faced the problem of irrigation water storage and long drought during the years which had shifted their growing season period later. Infestation of weeds had increase with increasing incidence of pest and diseases, which had increased their cost of production. Indigenous crop varieties could not cope with the present environmental conditions of Kamalamai Municipality. Farmers suggest that precipitation is growing more erratic, days are becoming hotter, pattern of winds, fog and hailstorms have altered and that farmers are becoming more vulnerable (Table 1).

Table 1: People perception of climate change variables within last 30 years

Climatic variables	**Perception**
Hot days	Increasing
Cold days	Increasing
Pre monsoon	later and decreasing
Monsoon	later by two weeks
Post monsoon	Increasing
Winter monsoon	Decreasing
Dew	Decreasing
Fog	Increasing
Hailstorm	Increasing

Source: Field survey, 2018.

People have strong feeling about climate change. According to them number of hot days was increasing in this area. The annual number of hot days was perceived to have increased. From 1977 to 1994, mean annual maximum temperature in Nepal increased by 0.06^0 Celsius (Shrestha, Wake, Mayewski, & Dibb, 1999). Now, average temperature rise is estimated at 0.5^0 Celsius per decade, which is very high compared to several other developing countries. People of this study area perceived that there are the number of cold days are also increasing in winter season. They reported on increasing trends of cold days resulting in loss of crop in winter season. In addition, increasing hot days also loss the crops. The both causes affects due to climate change. Increasing number of cold days in winter season, temperature was minimum and might be the result of increased winter fog, which have adverse effects on crop production and human health. The impact of climate change (CC) on water resources is likely to affect agricultural systems and food security. This is

especially critical in a least developed country (LDC) like Nepal where a high percentage of the population is dependent on agriculture for its livelihoods.

Mean annual precipitation for Nepal does not show a clear trend with reference to both increases and decreases: -34 to +22% by the 2030s; -36 to +67% by the 2060s; and -43 to +80% by the 2090s (NCVST, 2009). This is, in part, because the exact effects of CC on precipitation levels in the region are based on complex factors governing the Asian monsoon and their interaction with increased carbon dioxide. People perceived that monsoon rainfall was later by two and more weeks that directly effects in agricultural activities. Due to later monsoon the agriculture cycle is postponed 15 days. In this study area they used to plant rice in July 1 but due to climate change now a days farmer start to plant rice at the middle of July. They also noted that the intensity and frequency of rainfall was decreasing. People reported that winter rainfall had decreased and post monsoon had increased. In this area farmer harvest rice in end of October but due to post monsoon there are huge problem for them. Dew has also been decreasing now a day. Recent problem of hailstorms also observed. Five years ago, many farmers were affected by hailstorm. As 60% of crop was damaged by hailstorm. Fog is also increasing in this area. Due to fog, potato is damaged every year.

Table 2: Change in crop calendar in Kamalamai Municipality in the last 30 years.

Days shifted by crop				
Rice	Wheat	Maize	Fruits	Vegetable
15 days later	No change	No change	No change	One weeks earlier at summer & two weeks later at winter

Source: Field survey 2018.

Crop calendar of Kamalamai Municipality has considerable changed (Table 2). Planting time for monsoon season crop such as rice, fruits and vegetable are delayed 15 days but harvesting time shifted earlier up to 15 days. The planting and harvesting time for winter season crop such as wheat, maize and vegetable have been shifted by one to two weeks (Rai, Nepal, Rai, & Paudel, 2019). People considered that the harvesting of crop production, vegetable and fruits yields which had a positive input on household income. So many changes have been observed related to human health. Last few years, there are common problem of Mosquitoes,

which was massive increase in summer season as well as problem in also winter season.

Table 3: Perceived impacts of climate change on different sectors

Sectors	**Perceived change**	**Results**
Water resources	decreased in ground water	scarcity for drinking and irrigation
	unpredictable rainfall	problem in agriculture
	drought	desertification
Agriculture	increase in production	food security
	increase in pests and fertilizer	soil pollution
Forest	deforestation	floods and landslide increase
Human health	increase so many new diseasess	decrease quality of life
		cost increase for health

Source: Field survey, 2018

Climate change has several impacts to people and their activities in the study area. People who are highly dependent on agricultural activities are facing so many adverse impacts on their daily activities. Farmer and specially women are highly affected from climate change. Due to temperature raise and deforestation, ground water level is decreasing. People facing problem of drinking water and irrigation for crop in Chure region (Pokhrel, 2015). Women spend many hours for collecting drinking water. Well and *kuwa* are gradually disappeared. Water scarcity, drought and unpredictable rainfall are the main cause for drastic reduction of crop yield. Crop production is increased due to use of fertilizer and pests. Huge number of pests and fertilizer is used for increasing production but in the result soil has been polluted and its production capacity has gradually lost every year. Use of pests and fertilizer are the main challenge for land conservation (Table 3).

Majhi and Danuwar are the major ethnic group of this area. Bhramin, Chhetri and other casts are migrant people. They came from different surrounding area. Majhi and Danuwar dependent on fishing and agriculture. There is no enough fish in Kamala River. Therefore, they are shifting from there. They are more affected from climate change. People of this area are worried about the increasing risk of flood, landslide, and forest fires. They are victim of the increasing number of intensities of extreme rainfall, and hailstorm. Deforestation is another challenge for this Chure area (Singh, 2017). In last few decades a large forest area has been cleared for human settlements.

Conclusion

Climate change adaptation should be the priority for countries like Nepal. Nepal is currently exercising National Action Plan on Adaptation (NAPA) which should be made as comprehensive. Well-coordinated, quick and serious implementation of NAPA will be extremely important to mitigate and adapt to the growing impacts of climate change in Nepal. In Nepal higher altitudes are getting warmer. DHM (2017), shows all Nepal average temperature increasing by at 0.056°C/year while DHM (2015) shows increase by 0.04°C/year.

The study looked at the perceptions of people at climate change in the Kamalamai Municipality. Majorities of respondents had perceived changes in climate and aware of the impacts in different sectors. Majority of the respondents (78.45%) expressed that they perceived the increased temperature in 2018. Majority of the respondents (42.34%) perceived the decreasing rainfall and (18.78%) and changes in timing of rains in Kamalamai Municipality. People in the study area has observed varying levels of climate that have significantly affect. Higher temperature, erratic rainfall, hailstones, drought and landslides in last decades had affects subsistence agriculture of Kamalamai Municipality.

People had faced the problem of irrigation water shortage and long drought period during the years which had shifted their growing season period later and had leads to single crop farming. People perceived that monsoon rainfall was later by two and more weeks that directly effected in agricultural activities. Due to later monsoon there are agriculture cycle was more than two weeks postponed. Agriculture productivity suffer much and attainment of food security would be under tremendous threats. Climate change had been several impacts at people and their activities in this study area. People who are highly dependent on agricultural activities they are facing so many adverse impacts on their daily activities.

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