

Climate change: Trends and farmers perceptions in Chepang community of Chitawan district, Nepal

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Abstract- To access the trends and farmers perception on temperature and precipitation in Chepang community, a research was conducted in Chitawan district of Nepal in the year 2016. Two VDCs, Shaktikhor and Siddhi were selected purposively and sixty households from each village were selected randomly for the study. Primary information was collected from household using semi-structured interview schedule and secondary data were collected from Department of Hydrology and Meteorology (DHM), Kathmandu. **Microsoft Excel and SPSS program was used for descriptive and trend analysis. Mann Kendall test is used to determine the trend of climatic variables. 50 percent of the respondents perceived about increase in summer temperature, 37% perceived increase in winter temperature and 58% of respondents perceived decrease in rainfall amount.** Monsoon rainfall was in decreasing (0.541 mm per year) trend and the overall trend of rainfall was also decreasing over the time (1983-2014). Maximum and minimum temperature was increased significantly over the time (1983-2014) by 0.013⁰C and 0.0075⁰C per year respectively. The analysis of climatic data strongly supports the farmer's perception. There is still a significant proportion of population, who are not still known about the change in climatic patterns. They cannot adopt the appropriate mitigation measures to reduce adverse impact of climate change in their farming systems until they were aware about changes in climatic parameters. This clearly shows that, NGOs, INGOs, and Government sectors should working together at grassroots level for raising awareness towards climate change parameters and their impacts on farming systems. The findings of this study can be useful for making effective policy and plan.

Key words: Temperature and rainfall trends, People's perception, Chepang community

I. INTRODUCTION

Climate change refers to the increase of earth temperature due to the release of gases such as CO₂, CH₄, CFCs, N₂O and O₃ into the earth atmosphere (IPCC, 2007). Change in temperature is the major indicator of climate change which rises at the rate of 0.06⁰C per annum. Such a rise in average temperature is variable across the country (Gautam and Pokhrel, 2010), higher in the mountain and Himalayan (0.08⁰C) as compared to low-lying Terai (0.04⁰C). Rural communities are expected to be affected more due to excessive dependence on climatic variables and limited adaptive capacity to the changes (UNFCCC, 2009). The climatic factors, affect millions of livelihood around the world (IPCC, 2007). Nepalese agriculture is highly dependent on the climatic condition; hence even small change in climatic condition could largely affect the food security in the country (Bhandari, 2008). Nepalese agriculture is one of the worse hot sectors due to climate change (FAO, 2007b). Extreme weather condition such as irregular rainfall, drought,

flood, cold waves, relative humidity, which ultimately decrease the productivity of crops (NAPA, 2010). The Nepalese agriculture production system is highly uncertainty and vulnerable for two reasons. First, the existing system of food production is highly climate sensitive because of its low level of capital investment and non-adoption of modern technological options. Second, agriculture is the main source of livelihoods for a majority of the population i.e. 65% population depends on agriculture (MoAD, 2015). Rising temperature, variation in summer and winter temperature, erratic and higher intensity of rainfall for few periods has increased number of droughts and floods, more often; with landslides, water shortage and increasing land degradation. Similarly, farmers are unable to plant the crops in appropriate time which certainly lowers the production and ultimately affect the food security. In developing countries like Nepal, insufficient research and credible evidence on the impacts of climate change is a major challenge. The research on community vulnerability within the country is very less. Micro scale vulnerability assessment is more important than macro level in our context which has high diversified climatic patterns. Hence, local level study is important (Sharma, 2009).

According to 5th assessment report of the Mach *et al.* (2014), compared to the 20th century, the average annual temperature will rise by more than 2⁰C in most of the South Asia by the mid of 21st century, and by the late of 21st century, the temperature increases will exceed 3⁰C and as much as 6⁰C in high altitudes under a high-emission scenario. In addition, it has been suggested that warming of more than 2.5⁰C could reduce global food supplies and contribute to higher food prices (UNEP and UNFCCC, 2002). The amount of precipitation varies significantly across the country because of the non-uniform and rugged terrain. Analysis on precipitation data recorded in all-Nepal (1948-1994) and sub-regions (within Nepal from 1959-1994) showed a large inter-annual and decadal variations (Shrestha *et al.*, 2000). Similarly, a study conducted on the annual precipitation data from 1976-2005 from 166 stations across the Nepal revealed the overall an increasing trend of precipitation (Practical Action Nepal, 2009). Furthermore, the projection also revealed an increasing trend of rainfall intensity during monsoon and post monsoon while this showed a decreasing trend in winter (MoEnv, 2010). **The objective of this study is to analyze the perception of farmers towards climatic pattern and to know about whether these perceptions match with recorded data or not.**

II. MATERIALS AND METHODOLOGY

Study area

Saktikhor and Siddhi VDC of Chitawan district were selected purposively for the study. The study sites were selected purposively because dominance of Chepang population resides in these areas. One cluster was formed in each representative village of the Chitawan district for assessing the trends of climate change. Each cluster consisted of 60 households and there were altogether two clusters i.e. 120 households for the study. The respondents were selected above the age of 40 years, since they could provide the valuable information regarding the past trends of the climatic trends.

Chepangs: The study community

Chepangs are one of the indigenous people inhabiting since time immemorial in the remote geographical terrain of Dhading, Makwanpur and Gorkha districts of Central Nepal (Limbu and Thapa, 2011). According to the 2003 Census, the total population of Chepang has been recorded to be 52,237 in Nepal. Out of which, 18,413 people live in Chitawan (35.24 percent) followed by

17,237 in Makawanpur (32.99 percent), 2,734 in Gorkha (5.2 percent) and 10,328 in Dhading (19.77 percent) district (CBS, 2003).The primary occupation of the Chepang is agriculture. **Khoriya land is their prime means of survival. The major crops grown in khoriya are Maize, Millet, Cowpea, black gram, broom corn millet, buckwheat and rice bean.**(Limbu and Thapa, 2011).Chepangs still depend upon wild and uncultivated edible plants (Maharjan et al., 2010). Due to rugged topography and stony nature of the land, only a small percentage of Chepang households are fully food self-sufficient (Piya et al., 2011a). Food self-sufficiency and food insecurity is the most prominent issue in the livelihood of the Chepang community. Only one percent of the Chepangs have cereal food surplus and about 60% of the families have food that does not last more than six months (NCA, 2004).The rest of the months they depend on wild and uncultivated foods and wage labor work to meet their food demand (Regmi et al., 2006).Insecure land tenure and possession of citizenship certificate is the most important issue for most of the Chepang community (Aryal and Kerhoff, 2008).

Data collection and analysis

The research primarily depends on datasets that were obtained from Department of Hydrology and Meteorology (DHM), Kathmandu. Household survey was conducted with local people regarding climate change perceptions. The meteorological station records the daily maximum temperature, minimum temperature, and accumulated precipitation. All the climatic data (1983-2014) were from the Department of Hydrology and Meteorology (DHM), Kathmandu.

Household survey

The field survey in Siddhi and Saktikhor VDC of Chitawan district was conducted through using semi-structured interview schedule. Each interview schedule was used to collect qualitative information on the community's perception of climate change and experience of weather events, such as rainfall and temperature. Qualitative data about perception were analyzed by using SPSS tools and Microsoft Excel.

Trend analysis

The annual trend of climate was analyzed for the following variables: Temperature (annual maximum and minimum at Rampur station) and precipitation (annual accumulated quantities at Rampur station). The existence of positive or negative trends among all the considered variables was determined using nonparametric trend test methods. The Mann Kendall trend test is a nonparametric rank-based procedure, robust against the influence of extremes.

The map of Nepal displays the distribution of two groups: Shaktikhor and Siddi. Shaktikhor is concentrated in the western region, specifically in the districts of Dhaulagiri and Annapurna. Siddi is concentrated in the central region, specifically in the districts of Kathmandu and Bhaktapur. The map also shows other districts and a scale bar indicating distances up to 20 Kilometers.

III. RESULTS AND DISCUSSION

3.1.1. People's perception

The result(Figure 1) indicate that, 50 percent of the respondents perceived that increase in summer temperature, 20 percent perceived a decrease in summer temperature, 6 percent perceived neither increase nor decrease and 24 percent of respondents were not aware about change in summer temperature pattern. 39 percent of respondents perceived that increasing in winter temperature, 37 percent perceived decrease in winter temperature, 3 percent perceived neither increase nor decrease and 21 percent of respondents were not aware about change in winter temperature pattern. Same perception was found by Thapa M.S. (2010), while conducting household survey in Chepang community of Chitwan district.

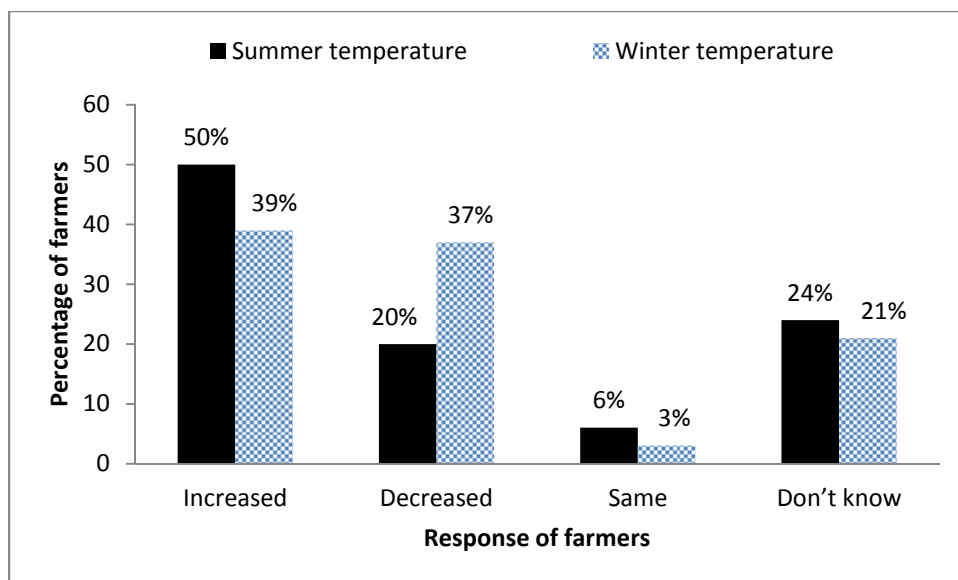


Figure 2. Perception of farmers towards changing temperature

3.1.2. Observed Trend

Analysis of the maximum and minimum temperature of last 32 years (1983 to 2014) of Rampur Station (Figure 3) shows that maximum temperature and **minimum temperature increased** significantly over the time by 0.013°C and 0.0075°C per year respectively. The average maximum temperature was less than the national average maximum temperature which was 0.06°C per year (Baidya et al., 2008). The trend analysis supports the farmer perception that the summer was hotter and winter was also hot as compared to the past. Though this warming trend is in line with the average annual temperature increases in the area. Therefore, the local farmer's perceptions appear to be in line with the statistical data in the region (Shrestha et al., 1999).

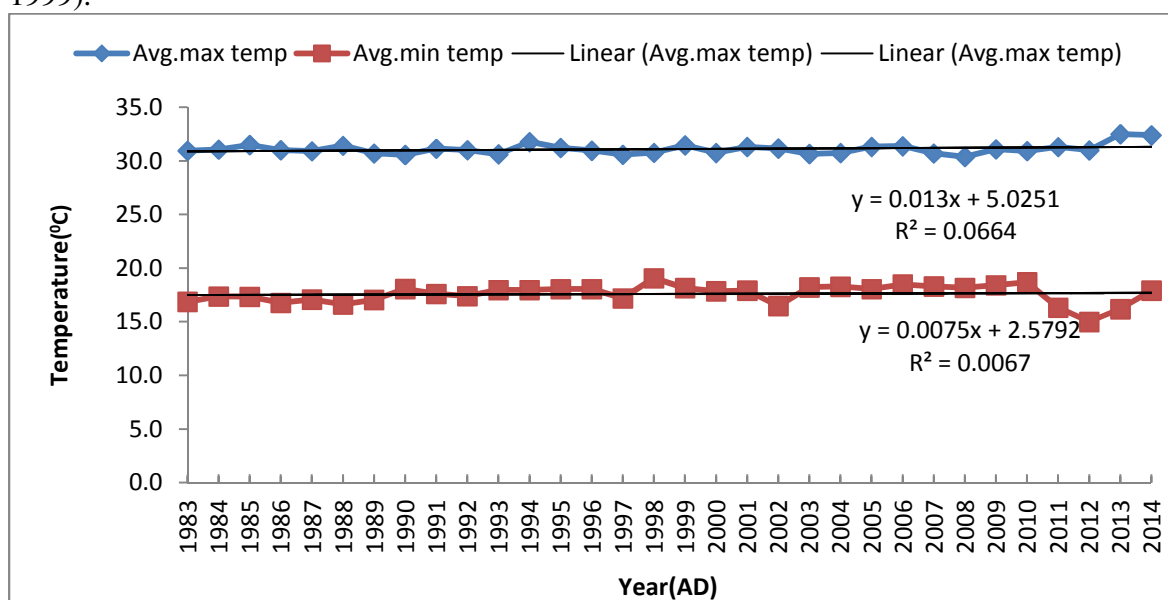


Figure 3. Trend analysis of maximum and minimum temperature over the last 30 years (1983 – 2014) in Rampur station, Chitawan

3.2.Precipitation: Trends and People's Perception

3.2.1. People's perception

The informants were asked to provide information on changes in precipitation pattern over last 20 years. They reported that the precipitation pattern has changed and that they are experiencing decrease in rainfall length duration, rainfall amount and rainfall time became unpredictable in recent years.

Table 1 Perception of farmers towards change in rainfall pattern

Rainfall amount	Village				X ² value
		Siddhi	Saktikhor	Total	
	Increased	9(16.0)	12(19.0)	21(18.0)	1.23
	Decreased	33(58.0)	37(59.0)	70(58.0)	
	Same	11(19.0)	8(13.0)	19(16.0)	
	Don't know	4(7.0)	6(10.0)	10(8.0)	
Rainfall length duration					
	Increased	7(12.0)	8(13.0)	15(13.0)	0.79
	Decreased	32(56.0)	36(57.0)	68(57.0)	
	Same	6(11.0)	9(14.0)	15(13.0)	
	Don't know	12(21.0)	10(16.0)	22(18.0)	
Rainfall time					
	Earlier	5(9.0)	7(11.0)	12(10.0)	1.99
	Later	8(14.0)	7(11.0)	15(13.0)	
	Same	7(12.0)	5(8.0)	12(10.0)	
	Unpredictable	25(44.0)	34(54.0)	59(49.0)	
	don't know	12(21.0)	10(16.0)	22(18.0)	

Figures in parenthesis indicates percentage

The study shows that majority of the respondents (58 percent) perceived decrease in rainfall amount as compared to past while 57 percent respondents perceived decrease in duration of rainfall. 49 percent respondents perceived that rainfall time is unpredictable as shown in Table 1.

3.2.2. Observed Trend

The rainfall of the last 32 years at the Rampur Station as shown in Figure 4 indicate that rainfall pattern is irregular. The overall total rainfall, monsoon rainfall and post monsoon rainfall were all varied across the time horizon. Non- monsoon rainfall and monsoon rainfall was in decreasing trend and the overall trend of rainfall was also in decreasing order. The analysis of climatic data strongly supports the farmer's perception. These strongly indicate that farmers in such scenario couldn't predict the usual rainfall pattern and they were compelled to change their cropping calendar. The trend analysis showed that the total precipitation was decreased with 0.33 mm per year in this station.

About 70 to 90% of the rainfall occurs during summer monsoon (June to September) and the rest of the months are almost dry. Pre-monsoon (Jan-May) rainfall trend doesn't show great variations, but during the last few years of the study (2003 to 2009), there was a substantial decreased in the amount of rainfall especially in monsoon. And again in 2007 this rainfall trend

was found to be increased. These strongly indicate that local peoples in such scenario couldn't predict the usual rainfall pattern. Baidhya *et al.*, 2007 have shown more erratic pattern (unusual high intensity, less rainy number of days) of rainfall in the country. Such events increase possibility of climatic extremes like irregular monsoon, droughts and floods. MoEnv, 2010; Practical Action Nepal, 2009, reported that total rainy days are decreasing and number of drier days are increasing. Moench, 2010 has reported that annual variation in precipitation has increased so far that has increased flooding and erosion and affecting agriculture.

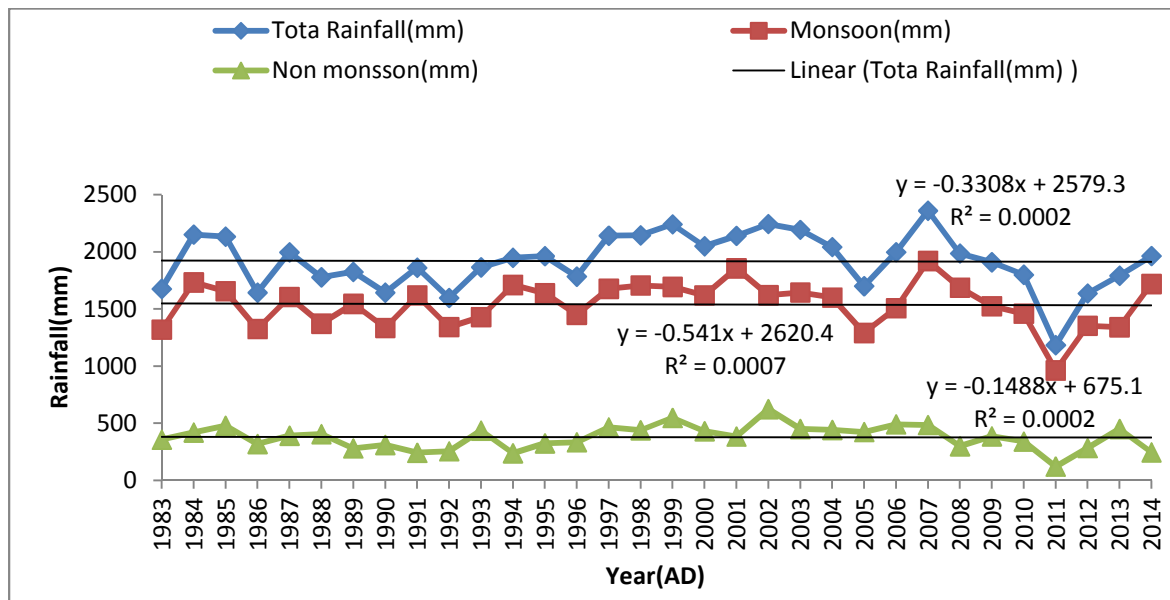


Figure 4. Trend of rainfall in Rampur station in last 32 years (1983-2014)

IV. CONCLUSION

This paper analyzed the trends and farmers perceptions about climate change in Chepang community of Chitwan district. Onset and retreat of monsoon rainfall varies from year to year and is decreasing in trends in long term basis. Furthermore, the actual trend shown by the recorded data was justified by the perceptions of the local people resembling with the findings of the study, whereas summer and winter temperature increasing over a period of time. This clearly indicates the warming trend in the area. This increasing temperature and decreasing patterns of rainfall clearly shows that this area is prone to the drought which may cause decrease in agricultural production. There is still a significant proportion of population, who are not still known about the change in climatic patterns. They cannot adopt the appropriate mitigation measures to reduce adverse impact of climate change in their farming systems until they were aware about changes in climatic parameters. This clearly shows that, NGOs, INGOs, and **Government sectors should be working together** at grassroots level for raising awareness towards climate change parameters and their impacts on farming systems. The findings of this study can be useful for making effective policy and plan.

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