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Research Paper

Caste-wise differences in livelihood activities that affected adaptation against extreme weather events and climate variability

Bijaya Neupane

Department of International Environment and Development Studies, Norwegian University of Life Sciences, Norway.

*Corresponding author. E-mail: bijayandml@yahoo.com.

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Abstract. This research investigated how livelihood activities of different castes of people within a community forest user group at two sites (Laxmi Mahila CF and Jalbire Mahila CF) in Gorkha district of Nepal adapt with local weather events and climate variability. The factors affecting the adaptive capacity of different castes of people were also analysed. The main weather events and climate variabilities found in the study sites were increase in dry periods, changes in rainfall pattern and increase in temperature. There were three main groups of castes at the study sites: higher castes (Brahimin and Chhetri), ethnic castes (Newar, Gurung and Magar) and lower castes or marginalized castes (Damai and Sarki). The wealth ranking of households was categorized into rich, medium and poor groups. It was found that the livelihood activities of households varied according to castes that affected their adaptive capacities. The higher castes people were mainly involved in government jobs and teachings while the ethnic groups were more involved in local trade and local business. In contrast to this, the lower or marginalized castes were mainly engaged in local labour works and forest dependent activities. The people belonging to lower castes had limited livelihood options than other two groups and thus had less adaptive capacity. They were more dependent on forest products for their livelihoods but the establishment of community forest was not solution for their livelihood activities. By comparing the two different local communities, it was found that the adaptive capacity of Laxmi Mahila CF was higher than that of Jalbire Mahila CF. Adaptation activities of two communities were found different regarding changes in species composition, local trade, income generating activities, cattle composition and seasonal jobs.

Keywords: Adaptation, adaptive capacity, local trade, species composition, seasonal jobs.

INTRODUCTION

Climate variability is the way by which climate changes yearly above or below the average long term value whereas climate change is the long-term change in average weather conditions (temperature, precipitation, wind), typically measured over 30 years (Dinse, 2011). According to IPCC's Fourth Assessment Report on Climate Change 2007, climate change refers to any changes in the climate due to natural variability or human activity that persists for long period, usually decades or longer and can be recognized by means of statistical tests (Pachauri, 2008). The extreme weather events are the meteorological events (e.g., extreme temperature, precipitation and storms) that have great effect on the local community (Greenough et al., 2001). Weather events and climatic changes that have been reported in Nepal include late monsoon, irregular rainfall, flash floods, hotter summer and less cold winter (MFD, 2011). In the recent years, local people have been experiencing a shift in climate conditions, including increase in climate variability in the recent years, such as prolonged droughts and irregular rainfall in Nepal (Bartlett et al., 2011).

Livelihood can be defined as the living conditions of individuals or households that provide access to capitals: natural, physical, human, financial and social through institutional or social process (Ellis, 2000). Majority of the people (about 80%) rely on agriculture for their livelihood and follow old cultivation practices in Nepal (Regmi et al., 2009a). Agriculture is the main source of economy of Nepalese though only 27% of country's land is cultivated and 1/3 of that land is irrigated (Dixit, 2010). Around 70% of Nepalese population rely on subsistence agriculture for living (NCVST, 2009). Changes in climatic conditions such as an increase in dry periods affect rain-fed agriculture system in hilly regions of Nepal, in particular the crop productivity. Due to delayed rainfall, farmers had to face severe problem for planting rice seedling (Bartlett et al., 2010). Increase of forest fires in dry periods, pests and diseases in crops, livestock and human population have become frequent in Nepal due to climate variability (Bhatta, 2011).

Pachauri (2008) on IPCC's fourth assessment report 2007 defined adaptation as the ability of a system that can moderate possible damage, can take benefit of opportunities and manage with the effect by adjusting to climate variability and change. Because of its low emissions combined with high vulnerability, adaptation may be a higher priority than mitigation in Nepal, despite of the fact that the international community have focused more on mitigation. Some rural communities of Nepal have developed several adaptation measures based on their local knowledge and experience such as changing the crop species, cropping pattern and farming techniques for managing the climate variability and change (Bhatta, 2011; Malla, 2008; Tiwari et al., 2010). Some previous studies suggested that local farmers of Nepal have also developed adaptation measures such as less water use, greater cropping intensity, changing in crop species, crop cultivation time, harvesting time, crop diversification, micro-irrigation and small-scale storage to adjust during climate variability (Baral et al., 2010; Gauchan, 2009; Tiwari et al., 2010). In Nepal, there are various examples of informal community based adaptation practices. E.g., subsistence farmers have started to adjust their cropping seasonal calendar and have coped with drought through increased collection of local medicinal herb (WFP, 2009). In addition, adaptation also means diversifying into other non-agricultural activities such as trade, which has been important in managing climatic variability that can support rural livelihoods. E.g., in the high altitude of Nepal, the communities earn money by collecting and selling valuable NTFP "Yarshagumba" (*Cordyceps sinensis*). Also, in the hilly regions of Nepal, the sources of income are production and selling of vegetables, dairy products, chicken and eggs (Macchi et al., 2011). However, the productions of these commodities are reduced due to lack of enough water and local resources.

Since the agriculture type is labour intensive, the agriculture sector is seriously affected by the out-migration of adult people in the community (Massey et al., 2007). Poor and marginalised people called "dalits" are more vulnerable to climate variability and change. Within these groups, women are mostly affected by the impact of climate variability and change (Sagun, 2009) because women spend most of their time in agricultural activities and caring their children in Nepal. The poor and marginalised people in Nepal have access to fewer adaptation options. So, there is need for local level studies on adaptation processes in order to develop policies that can help those communities (ISET, 2008). Local people might be aware about the local climatic hazards and their impacts but they are seldom familiar with global climate scenario and adaptation techniques (Regmi and Adhikari, 2007).

Adger (2006) has reported that the characteristics of socio-ecological systems determine the vulnerability (susceptibility to harm from stresses) of a community towards the environmental and social changes, that affects the adaptive capacity. The adaptive capacity of rural community especially the poor people is low because they seldom receive emergency aid (support from local organisation, government, neighbours that includes food, clothes, and housing) even after climatic shocks or stresses (Regmi et al., 2009b). Poor people who depend on natural resources and who have few capital assets and livelihood options have low adaptive capacity and become more vulnerable to climate variability and change (Dulal et al., 2010). Many rural areas in Nepal are not easily accessible, have very few resources and facilities. In hilly areas of Nepal, the poor people have limited livelihood options (Charmakar and Mijar, 2009). They have inadequate access to even basic infrastructures such as drinking water, health services, education and electricity. The poor people having low land holding size and less productive land are becoming poorer and poorer due to land fragmentation in Nepal (Adhikari, 2008). Due to land fragmentation among sons/male members in Nepalese family, there is insufficient land for future land security and these people become more vulnerable to climate variability and change. Though some studies were done with respect to wealth classes (rich and poor) in some local communities (Dulal et al., 2010; Regmi et al., 2009b; Charmakar and Mijar, 2009) but the caste-wise study of adaptive capacities of local people has not been extensively studied so far in Nepal. Thus, this research was executed with the goal of assessing how different castes of people in two diverse local communities of Nepal were adapting with extreme weather events and climate variability through their livelihood activities.

MATERIALS AND METHODS

Study area

The two study sites are located in mid-hills of Nepal, where agriculture and animal husbandry were dominant

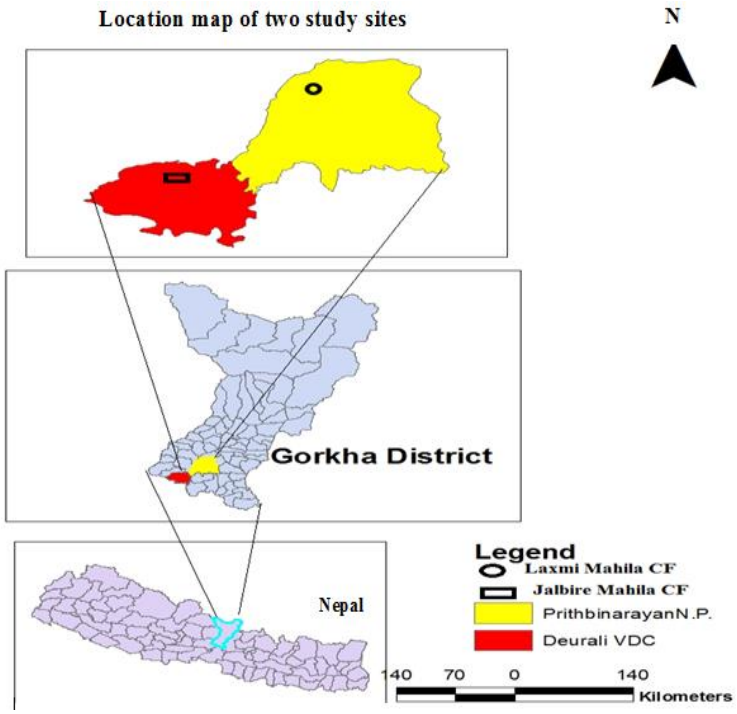

Figure 1. Study area.

economic activities. Jalbire Mahila CF is situated in Deurali VDC in Gorkha district and Laxmi Mahila CF is situated in Prithbinarayan Municipality in same district of Nepal (Figure 1).

Data collection

Structured, semi-structured and unstructured questionnaires (Bryman, 2008; Kothari, 2009) were used to collect information regarding impacts of climate variability on farming practices and socio-economic conditions of local people. Twenty-five households were selected from each study sites using purposive random sampling technique (using records of households provided by president of CF) so as to represent each class of people with their wealth rank rich, medium and poor.

Wealth ranking of households (on the basis of food sufficiency, income sources, house structure and land holding size) were carried out with the help of existing wealth ranking records of CF and further revised from discussions of community forest users' group (CFUG) committee members, key persons and local leaders into three strata- wealth class "Rich", "Medium" and "Poor". Besides, 4 group discussions and 10 key informant interviews representing different categories of people: women, male elders, marginalised people, and representative of people working in offices, were carried out.

In this study, annual rainfall and temperature data (1982-2011) recorded by the Lumle Meteorological station, Department of Meteorology and Hydrology, the Government of Nepal, were used. Annual rainfall and temperature data of past 30 years were used to examine whether crop productivity and the livelihood of local people in the study area were affected. This meteorological station is approximately 51 and 62 km far from Jalbire Mahila CF and Laxmi Mahila CF, respectively. This meteorological station was selected because there were no other meteorological stations in or nearby the study sites.

Data analysis

Data were analysed using statistical softwares: MS excel and Sigma plots with versions 2007 and 2011, respectively. Sigma plot was used mainly for analysis of socio-economic data whereas MS excel was used for processing meteorological data and producing charts and graphs.

RESULTS AND DISCUSSION

Climatic events and shifts

The information obtained from the questionnaire and key informants' survey suggested that among the different climatic hazards, there was a trend of heavy rainfall with hail storms and long dry periods becoming common and frequent in the recent years in the study area (Table 1)

Table 1. Type of extreme weather events in the study area.

CF	Most frequent weather events	Mostly occurring time/season	Duration of occurrence
Jalbire Mahila and Laxmi Mahila	Intense/heavy rainfall with hail storms/thunderstorms	July, august, September	2-3 months
Jalbire Mahila and Laxmi Mahila	Long dry periods	February, March, April, May	4 months
Laxmi Mahila	High wind velocity/storms	March, April	2 months
Jalbire Mahila	Flood	July, August	2 months

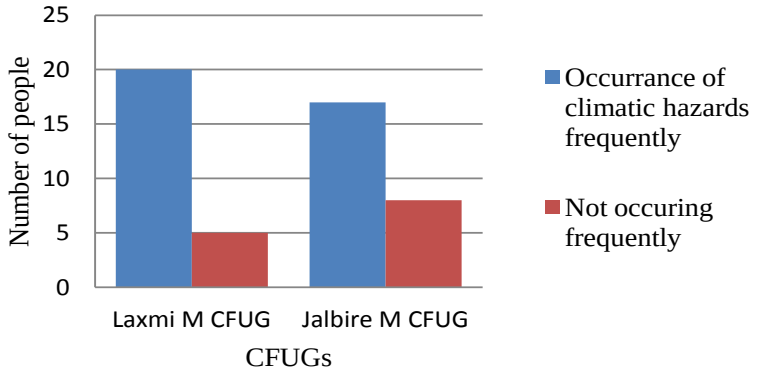

Figure 2. Perception of local people on occurrence of climatic hazards.

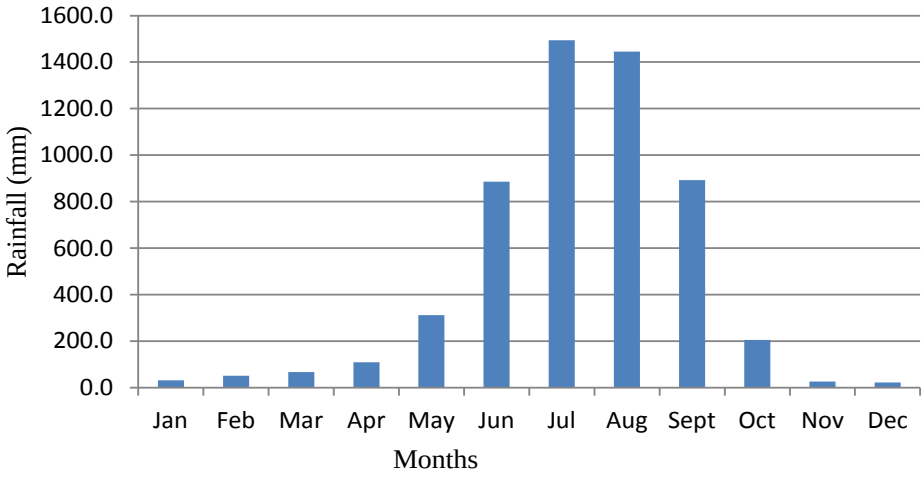

Figure 3. Average monthly rainfall data of 30 years (1982-2011).

though most predominantly in Laxmi Mahila CF (Figure 2). During the field visit, the local people reported that they were experiencing hailstorm and thunderstorm even in winter season, that normally expected to occur only in the autumn period in the past.

Meteorological data

The local people's perception of climate variability and change was studied with supplement information that was obtained from the data collected from the meteorological station. Some perceptions were in accordance with the climatic data whereas some were in contrary with respect to the climatic data.

Figure 3 shows the distribution of average monthly rainfall of 30 years (1982 to 2011). The amount of rainfall is highest in July and lowest in December. Since the rainfall is mostly occurring during June to September, this period is called monsoon period. The months November to April received little rainfall. So, the crops grown in these months do not get sufficient water which results in low productivity. The agricultural lands of many households in the study area were not access to irrigated

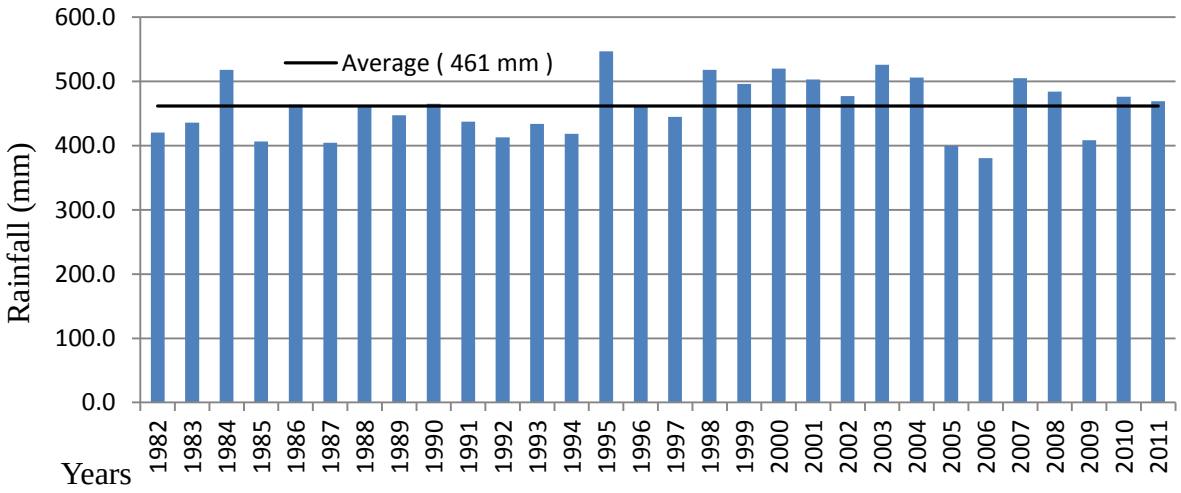

Figure 4. Average annual rainfall data over 30 years.

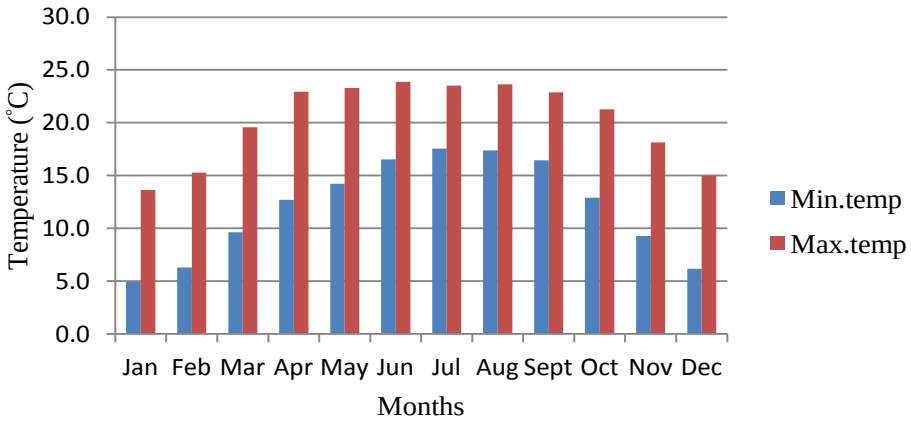

Figure 5. Monthly average temperature data of 30 years (1982-2011)

water (Source: field visit). Due to the variation in seasonal precipitation in the locality of Nepal with frequent and intense floods and droughts, the situation of uncertainty was developed mainly with respect to rain-fed agriculture (Karkee, 2008).

Figure 4 shows the average annual rainfall data of 30 years. There is no evident trend in rainfall from 1982 to 2011. However, it is observed that the years 2005 (399 mm) and 2006 (380 mm) had received less rainfall in comparison to average value which is 461 mm.

Again, by analysing average monthly rainfall data of monsoon period (June to September), there was no such significant shift in rainy season in this meteorological station contrasting with key informant interviews observations that people have experienced shift in rainy season in the study area. So, there was no apparent trend in the average monthly monsoon rainfall from 1982 to 2011. The local people have experienced that rainfall occurs mostly from July to September. But, they further reported that rainfall used to occur mostly from months June to August about 20 years ago, which might be due to climate change. Greenough et al. (2001) have also reported that the shift in rainfall period is caused by the climate change.

In addition to this, local people have experienced irregular distribution of rainfall during the monsoon period. With reference to the information collected from group discussions, some days during monsoon received heavy rainfall with hailstorm while some days received gentle drizzle. They also added that the heavy unexpected rainfall with hailstorm had destroyed fruits and vegetable crops of many households in the study area.

Figure 5 shows that the temperature varies during the year with highest value in June and lowest value in January. The months March, April and October receives less rainfall (Figure 3) but the temperature is still high during these months (Figure 5). So, according to key informants survey and group discussions, the local people were experiencing drought during these months

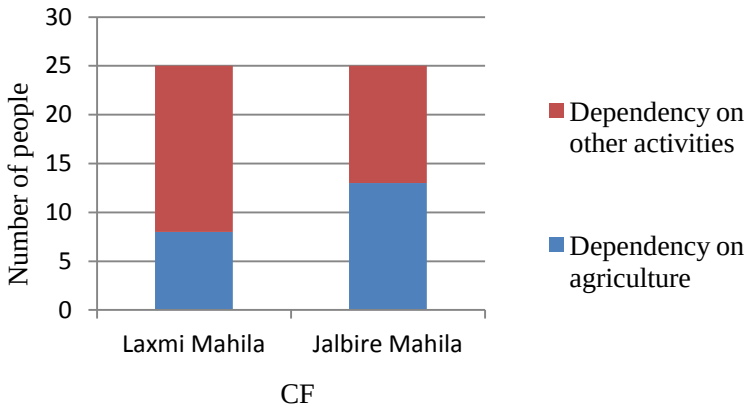

Figure 6. Dependency of local people on agriculture and other activities.

and some other months with less rainfall.

Different forms of capitals affecting livelihoods and adaptive capacity

Physical, natural and financial capital

There were close inter-linkages between different types of capital, especially social, human and natural, since education levels, socio-economic status and trade appeared to be linked in the study sites.

From the analysis of questionnaire survey, it was found that both male and female were involved in agriculture and animal husbandry for their income sources in Jalbire Mahila CF whereas more female were involved in these activities in Laxmi Mahila CF. The male were engaged in local business activities, government jobs, teaching and so on (other than agriculture related activities). The main reason for these differences was higher proportion of higher caste people such as Brahimin and Chhetri in Laxmi Mahila CF than Jalbire Mahila CF (CFOP, 2009, 2011). This difference and shifts in climatic conditions are important because climate variability is likely to affect areas with the highest dependence on agriculture, such as Jalbire Mahila, more severely (Figure 6).

Livelihood activities were strongly differentiated by social characteristics or groups (higher castes, ethnic castes, marginalised castes) at both study sites (Tables 2 and 3).

The information obtained from questionnaire survey and group discussions showed that among these social groups (Table 2), the people who were having local fruits and vegetables business, undertaking daily-basis labour works and selling local fishes were mostly affected by extreme weather events and climatic variability. The castes mainly affected were Newar, Magar, Sarki and Damai. Due to the pattern of irregular rainfall and long dry period, these groups of people were facing difficulties in performing their works, especially farming, trade and local labour.

Mainly medium class and financially poor categories of people belonging to all castes (CFOP, 2011, 2009) were engaged in local trade (Table 3) for their livelihoods support as well as in managing impact of extreme weather events and climate variability. Among the above castes, the poor people were mostly “dalits” or marginalised/ socially excluded people (Damai and Sarki) in the study area (CFOP, 2009, 2011) who were more affected by the impact of climate variability because they had limited livelihood options and did not have alternative income sources. Similar result was shown by Charmakar and Mijar (2009) and Dulal et al. (2010).

Human and social capital

Key informant survey provided the information that the study area had fairly similar physical, natural and financial capital, although some variation in species composition and income of people (Table 2). However, there was significant variation in human and social capital in the study area. From the field study, women were found to be more active and capable in managing forest and other social activities in Laxmi Mahila CF than in Jalbire Mahila CF. Participation of women was also found to be high in every activity in Laxmi Mahila CF (Figure 7). Those differences were mainly due to the level of education and caste composition of users in the study sites. There were higher proportion of higher caste people such as Brahimin and Chhetri in Laxmi Mahila CF than Jalbire Mahila CF (CFOP, 2009, 2011) and these higher caste people were found to be more educated (Figures 8 and 9). The level of education had played vital role in capacity building of women in Laxmi Mahila CF. However, the gender-wise education level of the study area was not investigated specifically (Figure 8). The figure only shows that people of Laxmi Mahila CF were more literate than Jalbire Mahila CF.

In Figure 9, primary education was found to be higher in Laxmi Mahila than Jalbire Mahila CF, although the secondary education and above was found to be same in both CFUGs. Similarly, the illiteracy level was also higher in Jalbire Mahila CF.

Table 2. Livelihood sources and types of agricultural activities within different social groups.

Serial number	Different social groups in both CFUGs	Livelihood sources (mostly involved)	Types of agricultural activities
1	Brahimin (higher caste)	Government jobs, teaching and local business	Growing paddy, lintels, soya bean, seasonal vegetables
2	Chhetri (higher caste)	Teaching, local business and abroad income	Growing lintels, millet, soya bean, seasonal vegetables
3	Newar (ethnic group)	Local business including selling local fruits and vegetables	Growing potato, millet, ginger, garlic, onion, seasonal vegetables
4	Gurung (ethnic group)	Military services, Abroad income	Growing maize, millet, soya bean, potatoes
5	Magar (ethnic group)	Abroad income, selling local fishes, local alcohol, local fruits and vegetables	Growing paddy, maize, millet, potato, ginger, garlic, onion, seasonal vegetables
6	Sarki (marginalised group or dalits)	Driver, carpenter, local level labour in house and other small construction works, selling locally made wooden and bamboo products	Growing potato and seasonal vegetables
7	Damai (marginalised group or dalits)	Small tailoring business, local level labour in house and other small construction works	Growing millet, maize, potato, seasonal vegetables

There were fewer differences in the education level among different social groups (Figure 9). The education level of higher castes people (Brahimin and Chhetri) was greater than other castes people in the study area.

Local adaptive mechanisms and the role of CF

The contribution of CF to the five capitals and adaptive capacity

The contribution of CF to the five capitals and adaptive capacity is given in Table 4.

Adaptation activities in the study area

As both CFs were situated in different altitudinal zone, there were differences found in the species composition. Plant species like *Dalbergia sissoo, Acacia catechu* were planted in the landslides prone areas of Jalbire Mahila CF whereas species like *Cinnamomom camphora, Fraxinus floribunda and Albizia procera* were planted in Laxmi Mahila CF.

Another main cause of differences between livelihood activities in two communities was distance from district headquarter (Gorkha Bazar) and availability of river although the agriculture activities was found common in both sites. Laxmi Mahila CF was close to Gorkha Bazar (10 km) and Jalbire Mahila CF was comparatively far from Gorkha Bazar (35 km). The river named 'Daraudi' was found near Jalbire Mahila CF but there was no such rivers nearby Laxmi Mahila CF. Regarding the livelihood activities other than agriculture, the users of Laxmi Mahila CF were engaged in offices, schools and local business because it was near from the district headquarter whereas most of the users of Jalbire Mahila CF were engaged in seasonal works, fishing and rubber factory nearby (Gorakhkali Rubber Factory).

Only few adaptation activities practised by the local people were directly and indirectly linked with CF. Also, Tiwari et al. (2010) reported that no any governmental and non-governmental organisations have worked in order to make aware and minimize the impact of climate variability and change in the field level. Providing loans to people from the saving fund of CF, collecting fodder from CF for cattle, collecting *Shorea robusta* leaves for

Table 3. Non-agricultural activities (mostly trade) by caste in the study area.

Castes	Non-agricultural activities
Brahimin	Selling vegetables such as cauliflower, cabbage, potato, tomato, sponge gourd, snake gourd, bitter gourd and leaf plates in small scale
Chhetri	Selling maize, soya bean, lintels, vegetables such as cauliflower, tomato, spinach, snake gourd, sponge gourd, pumpkin shoots
Damai	Selling locally made iron weapons, tailoring, weaving and knitting clothes, working as local level labour
Gurung	Selling millet, maize
Magar	Selling local alcohol, fishes, locally made wooden and bamboo products and vegetables like tomato, cauliflower, bitter gourd, ladies finger, sponge gourd
Newar	Selling local alcohol
Sarki	Selling locally made wooden and bamboo products and working as local level labour

NB: Unlike other castes, only some people belonging to higher castes were selling their surplus food and vegetables. Trade were not the major livelihood options and adaptation strategies of higher castes people.

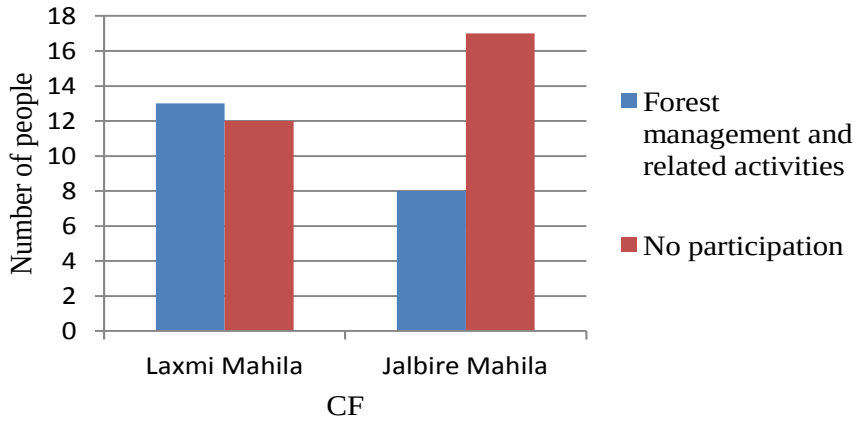

Figure 7. Participation of local people on forest management and related activities.

making leaves plates and producing and selling of local wooden and bamboo products were some examples of adaptation activities linked with CF in the study area.

Some of the major common and different adaptation activities practiced by two communities based on the outcome of questionnaire survey, key informants survey and group discussions are mentioned as follows:

Common adaptation activities in the study area

1. Increase in migration rate of adults towards cities and abroad. So, this might be one of the reasons for decrease in population of Gorkha district since last 10 years period (CBS, 2011).
2. Changing in cropping season/planting and harvesting time. E.g. at past, rice was planted in June and harvested in November. But, now the rice is planted in July and harvested in November.
3. Practicing agro forestry system and home garden by the community.
4. Decreasing dependency on use of fuel woods through improved stoves, LPG or cylinder gas and bio-gas for cooking and heating.
5. Establishing dykes and check dams across rivers and streams, maintaining vegetation cover on slope and barren land, planting trees on road and river banks are some other soil and water conservation techniques (Key Informant Survey, 2012).
6. Receiving loan for keeping cattle and vegetable farming from the local people or forest users' collective fund.
7. Adding chemical fertilizers in the agriculture land to increase productivity that can fulfil the demand of growing family size.
8. Depending not only on prime or major crops (rice, maize) but also on alternative crops/vegetables (cauliflower, tomato, cabbage, spinach, ginger) that could

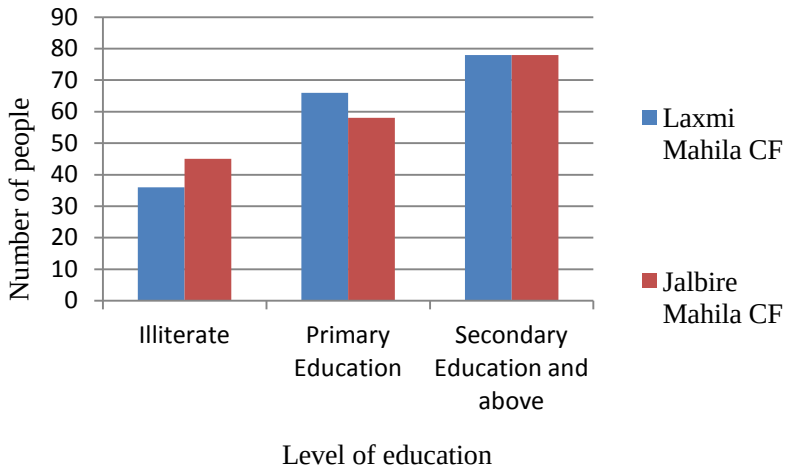

Figure 8. Level of education of local people.

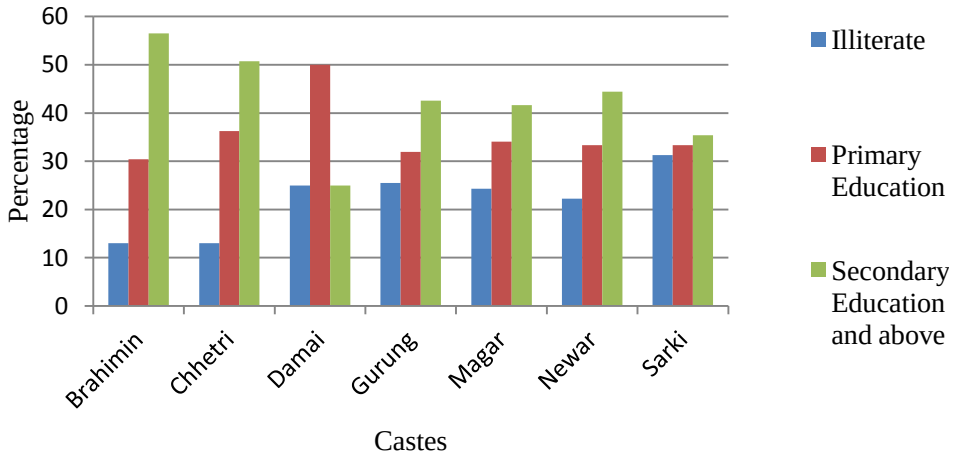

Figure 9. Level of education of local people.

be easily sold in the market in good price.

Due to the variations in slope and altitude, the species composition was found different in two study sites (CFOP, 2009, 2011). So, it was obvious that the local people planting the crop and tree species in two study sites were not similar (Table 5). Besides, local people of Jalbire Mahila CF were more involved in local trade than Laxmi Mahila CF such as selling local alcohol, fishes, vegetables, bamboo and wooden products. As already mentioned above, the local river named “Daraudi” was flowing close to Jalbire Mahila CF which was suitable for fishing and selling in local markets in order to adapt with extreme weather events and climatic variability that can support livelihoods too. There were no such rivers nearby Laxmi Mahila CF. Some local people of Jalbire Mahila CF were also engaged in rubber factory named “Gorakhkali Rubber Factory” which was located only few kilometres away from their community. Most of the local people were found diversifying away from the agriculture since around 10 years due to less output from agriculture which could not complement the expensive local market. However, the poor and lower caste people felt marginalised because they were not included in decision-making regarding the forest, and so the use of CF alone was insufficient to reduce their vulnerability or address social differences and marginalisation that is creating vulnerability in the first place.

CONCLUSION

Among various climatic risks and hazards, long dry periods and heavy rainfall with hailstorms were often experienced by the local people in the study area. Since more agriculture dependency community is likely to be affected by differences and shifts in climatic conditions, so people of Jalbire Mahila CF were more affected by local climatic risks and shocks due to their more dependency on agriculture than Laxmi Mahila CF. In other

Table 4. Priority of forest products for different classes (castes) of people.

Castes	Mostly used forest products	Ways how they are used
Laxmi Mahila CF		
Brahimin	Shorea leaves	Making leaf plates
Chhetri	Fuel wood	For cooking food in tea shops
Damai	Poles/ bamboo	For making charcoal/ local products like stools, chairs, baskets, racks and frames.
Gurung	Not specified	Not specified
Magar	Fuel wood/ timber	As fuel for preparing local alcohol/ for making wooden products like chairs, tables, cupboard and benches.
Newar	Fuel wood/ poles	As fuel for making local alcohol/ poles for religious activities
Sarki	Poles/ bamboo	For making charcoal/ local products like stools, chairs, baskets, racks and frames.
Jalbire Mahila CF		
Chhetri	Fodder	For cattle
Gurung	Fuel wood	As fuel for making local alcohol
Magar	Fuel wood/ timber, bamboo	As fuel for making local alcohol/ local wooden and bamboo products
Sarki	Poles/ bamboo	For making charcoal/ local products like stools, chairs, baskets, racks and frames.

NB: It was assumed that people who have access to more environmental and socio-economic benefits are likely to be less vulnerable to climate variability and change.

Table 5. Differences in adaptation activities in two community forest users group (CFUG).

Management mechanisms	Laxmi Mahila CFUG	Jalbire Mahila CFUG
Change in species composition	E.g. *Asparagus racemosus*, local cucumber, black basmati rice was not found in Laxmi Mahila CF site. Whereas the species like *Eucalyptus species, Cinnamomom camphora, Fraxinus floribunda, Albizia procera* and sabitri mansuli rice were found during field visit time in that site which was not found 20 years before.	E.g. mustard was not found in Jalbire Mahila CF site. Instead species like *Dalbergia sissoo, and Acacia catechu* were found in that area which were not found 20 years before.
Selling of local resources	Production and selling of bamboo products and leaf plates in a small scale.	Selling of stones from a small stone mine which is located within Jalbire Mahila CF area.
Income generating activities	Cultivation of vegetables by some CFUGs in commercial basis (more women and poor people involvement).	Fishing within local rivers of Jalbire Mahila CF and selling them in the local shops by some CFUGs (more marginal people involvement).
Change in cattle composition and number	Changes in cattle composition (from cow, buffalo to goat, pig)	Keeping less number of cattle than past years.
Off-farm activities	Search/involvement in jobs other than agriculture and farming.	Seasonal employments (working in rubber factory nearby, carpentry, tailoring, collecting wood from flooded rivers, selling seasonal fruits and vegetables in local shops).

words, Jalbire Mahila CF was found to be more vulnerable than Laxmi Mahila CF towards extreme weather events and climate variability. Livelihoods of local people especially belonging to castes Newar, Magar, Sarki and Damai were highly affected by climatic variability and change.

There was greater proportion of higher castes people in Laxmi Mahila CF than in Jalbire Mahila CF. These higher castes people Brahimin and Chhetri were found to be more educated than other castes in the study area. This caste and social marginalisation in terms of education and livelihood opportunities had also resulted in less

capacity of poor and lower caste people to adapt with extreme weather events and climate variability. Mainly the castes Magar, Damai and Sarki were found more dependent on forest resources for their livelihoods but the establishment of CF was not the major solution in order to strengthen the adaptive capacity and improve their livelihoods.

In the face of the above problems, the local people adapted some community-based coping and adaptation mechanisms such as changing cropping patterns and crop species, involving in seasonal jobs, adding chemical fertilisers in agriculture lands to increase productivity, local trade, out-migration and collecting welfare funds.

RECOMMENDATION

This paper discusses and demonstrates the impact of climate risks on people's lives and the ways to adapt to minimize risks. I suggest that the most important step in reducing the risk of climate variability or extreme weather events on agriculture is early warning in the specific place. Though the weather forecast is done only in some major cities in Nepal, but it should be performed site-wise too. Through forecasts of weather can give farmers recommendations package within 3 or 5 days to avoid the negative impact of weather variability, or at least minimize its negative impacts.

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