

Household and community responses to impacts of climate change in the rural hills of Nepal

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Abstract The research was designed to answer how households and local communities in rural Nepal are responding to the impacts of climate change. Using four villages as case study units, a mixed method approach was adopted in a multi-scaled process carried out at community, district and national levels. The research found that adaptation practices being adopted differ according to household well-being and are largely governed by access to education, information and resources within the community. Responses such as livelihood and income diversification, internal migration, share cropping, taking consumption loans, use of alternative energy and use of bio-pesticides were found to mostly vary according to well-being status of the interviewees. Development of adaptation plans, strategies and support mechanisms should take account of the different adaptation practices and needs of households. If such individual situations are not considered, adaptation responses may be ineffective or even be maladaptive and increase vulnerability. The research also found that the autonomous, unplanned and reactive nature of adaptation practices chosen by rural communities can contribute to further inequity and unequal power relations. The knowledge generated from this research contributes to understanding of how climate change contributes to vulnerability, but also how local practices and lack of an effective climate policy or response measures may magnify the effects of many existing drivers of vulnerability in terms of maladaptation and increasing social inequalities.

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1 Introduction

Climate change is a global issue. Although natural variability plays an important role, anthropogenic warming is substantially contributing to this change (IPCC 2014; Williams et al. 2015). The adverse effects of climate change and variability on Nepal are significant due to its poor economy and fragile geography. Significant warming has been experienced at high altitudes in the hills and mountains of Nepal (Du et al. 2004; GoN 2010). In mountainous areas, over the last 100 years, temperature increases have been higher than global averages (Du et al. 2004). Some of the observed impacts of climate change and variability in Nepal have been erratic rainfall, unpredictable onset of monsoon seasons, glacial retreat, storms, landslides and drought (GoN 2010). These occurrences have led to crop failure and decreased food and livelihood security, induced water scarcity, increased prevalence of some human diseases and increasing income insecurity (Gentle and Maraseni 2012).

More than 60% of the cultivated area in Nepal is fully reliant on monsoonal rainfall (CBS 2011), and unpredictable weather patterns are affecting production of staple crops (Urothody and Larsen 2010). The most vulnerable are poor people, who depend on dryland agriculture with limited livelihood options and low adaptive capacity in these circumstances (Mertz et al. 2009). Households dependent on agriculture have been found to be more vulnerable than those whose livelihoods are based in other sectors, mainly because of the greater impact of climate change/variability-related hazards to them, such as (1) erratic rain and snowfall, (2) unusual or unseasonal frost (3) increasing incidence of landslides and gully formation and (4) erratic hailstorm and winds (Adger 2003; Gentle and Maraseni 2012). Hazards related to farm productivity included increasing coverage of invasive weeds, increasing incidence of crop damage from insects and crop diseases and increasing incidence of livestock diseases (Gentle et al. 2014). Research conducted in our research area also confirmed that climate change is adding vulnerability to the livelihoods of poor communities and households who are already poor and experiencing social discriminations in the form of marginalisation and inequality (Gentle 2014). Researchers (O'Brien et al. 2007; Gentle and Maraseni, 2012) indicated that impacts of climate change to the livelihoods of people depend upon a combined effect of both climatic and non-climatic factors. The finding has been instrumental in designing a conceptual framework of this research to understand how local communities are responding the combined risks and vulnerabilities resulted by climatic and non climatic factors such as inequity, exclusion and poor governance (Fig. 1).

Concerns and experiences of a changing climate have led to the development of adaptation strategies (Adger et al. 2003; Hulme and Shepherd 2003). Adaptation is considered a planned approach to adjusting socio-economic and ecological systems in response to climate change and its consequences (Smit et al. 1999). The Intergovernmental Panel on Climate Change (IPCC) (2007a) defined adaptation as 'adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities'. Adaptation practices occur at different spatial scales (local, regional and national), across different sectors (e.g. water resources, agriculture, tourism, public health) and employ a wide array of actions (physical, technological, investment, regulatory, social, market). Furthermore, various actors are involved and different climatic zones require tailored adaptation strategies, as do countries based on their state of development (IPCC 2007b).

Autonomous or spontaneous adaptation responses are distinguished from planned or deliberate adaptation responses based on the climate stimuli (Smit et al. 2000; IPCC 2001). Adaptation responses may be anticipatory (proactive), concurrent (during) or reactive (responsive) (IPCC 2001). Adaptation responses can be short-term or longer-term, employed

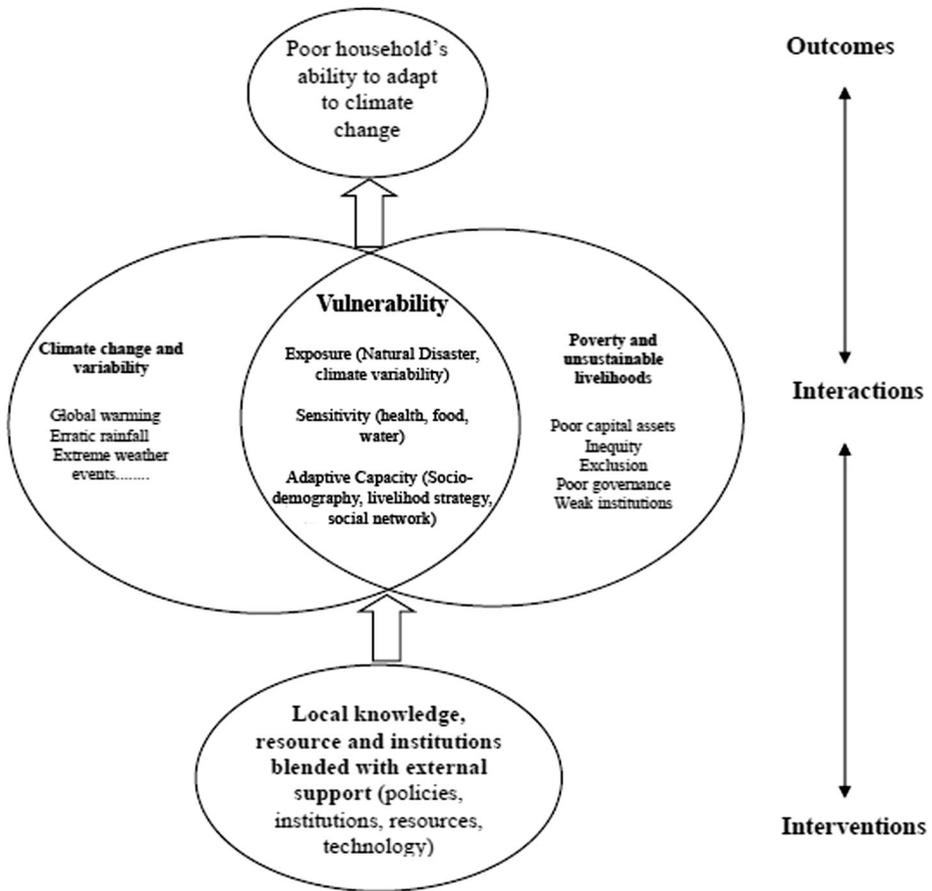


Fig. 1 Research framework

locally or be more widespread, and can be technological, behavioural, financial, institutional and informational based (Smit et al. 2000). However, IPCC (2014) highlights that the adaptation responses, including planned adaptation initiatives, are seldom undertaken in response to climate change alone rather than they are usually embedded within broader sectoral initiatives.

Although climate change is a global phenomenon, the impacts are mostly felt locally (Adger et al. 2004; Race et al. 2016). Consequently, adaptation responses are developed individually and collectively. This is to ensure that households or community groups can better utilise their traditional knowledge, social capital and available external supports (Adger et al. 2004). Both society and individuals adapt to the adverse impacts of climate change over a period of time either through adjustments to reduce vulnerability or by enhancing resilience in response to observed extreme events (Barnett 2001). Resource-dependent communities, historically, have managed weather-dependent natural resources such as forestry, fish stocks, livestock and water resources, through various coping and adaptation practices (Agrawal 2001; Adger 2003; Alexander et al. 2010). However, most adaptation strategies adopted by rural communities are targeted to respond to short-term shock events rather than as strategically planned initiatives. Thus, the responses are autonomous rather than strategic (Smit et al. 2000; Bates et al. 2008) and are generally applied in socio-economic sectors where capital (such as technology and money) investment is low

(Sohngen and Mendelsohn 1998). There are some arguments that adaptation to short-term climate variability can contribute to climate change adaptation in the longer term (Burton 1997). However, other studies (Nelson et al. 2007b; Brooks et al. 2009; Ziervogel and Zermoglio 2009) state that coping strategies in response to short-term climate variability may not always contribute to long-term adaptation and may even increase vulnerability and maladaptation.

Studies determined that rural communities in Nepal, through use of their traditional knowledge, have adapted to climate change by developing various strategies and garnering new knowledge and skills to manage resources and enhance adaptive capacity (Regmi and Bhandari 2013). To support local efforts and to mainstream climate change adaptation, the Government of Nepal has introduced the following: (1) National Adaptation Programme of Action (NAPA) to climate change, 2010, (2) Climate Change Policy 2011 and (3) a National Framework on Local Adaptation Plans for Action (LAPA) 2011 (Regmi and Bhandari 2013). However, the extent to which existing experience, knowledge and capacity is able to meet needs for successful climate change adaptation is uncertain. Likewise, how local knowledge is embedded with external support in the forms of policies, institutions, resources and technology is not known. Considering the gap, this research was designed to assess how communities in the rural hills of Nepal are adapting to climate change, how their adaptation is underpinning livelihoods and how external support is embedded with local knowledge and efforts. Particularly, (i) how different well-being groups in the context of socio-economic hierarchy are adapting to climate changes and how external supports are available and utilised by local communities to adapt to climate change (Fig. 1).

2 Research methods and study location

2.1 Research location

The research adopted a multi-scaled and multi-phased data collection process. Data collection was carried out at community, district and national level in three phases involving key actors. Community level data were collected in Lamjung district of Nepal during two field trips: the first field work from December 2011 to April 2012 and the second in May 2013. Lamjung district is located in the western mountains of Nepal where over two thirds of the district population depend on subsistence agriculture (Fig. 2). The overall vulnerability analysis in Nepal is based on data generated by Department of Hydrology and Meteorology (DHM). According to this analysis, the researched district is ranked as very high vulnerable to the impacts of climate change. The district has a diverse mix of people in terms of culture and ethnic identity including several indigenous castes (*Gurung, Magar, Tamangs* and *Dalits*). Four villages of the district were selected for the case study, two from the downstream area (altitude about 500 amsl) and two from the upstream area (altitude above 1000 m) along the Marsyangdi River (Fig. 2). Community Forest User Groups (CFUG) were selected as the unit of research and analysis, with one CFUG from each of the four villages. CFUGs are the most widespread community-based organisations in Nepal responsible for managing forests, all over the country through people's participation.

2.2 Research methods

A mixed method approach was adopted, using an interpretivist perspective (Tashakkori and Teddlie 2003). The political ecological approach had a complementary role in linking ecological, social and political dimensions with critical paradigms in this research (Springate-

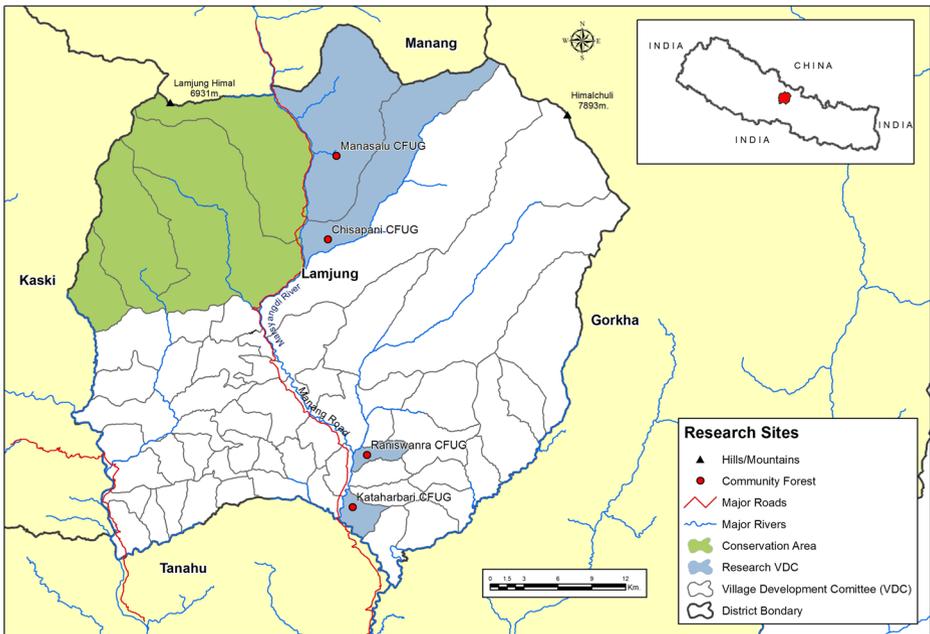


Fig. 2 Map showing location of research area

Baginski and Blaikie 2007). Qualitative methods as a primary technique of data collection included in-depth community level interviews ($n = 50$) and 11 focus group discussions (FGD) with 117 participants combined with participant observation by the key researcher. The quantitative method included face-to-face household surveys with 133 respondents.

Participatory well-being ranking was conducted at the research sites to categorise the research population into four well-being strata (well-off, medium, poor and very poor) based on the relative well-being position of households in the community using local criteria of relative poverty (Mosse 1994). The criteria identified to rank well-being were their assets such as land holding size, quality of land, quality of house, food sufficiency, income sources, status of money lending and borrowing, number and quality of livestock. Educational status and social status of the family were two other criteria. Interviewees for in-depth interview were selected purposively representing all well-being groups, gender, caste, ethnicity and location. Respondents of household survey were selected using a stratified random sampling process representing all well-being groups including 38 well-off, 50 medium, 29 poor and 16 very poor from four research villages. Data generated from household survey was analysed using Statistical Packages for Social Science (SPSS). The FGD was conducted with women and in marginalised communities to encourage them to collectively discuss and answer research questions. Qualitative data generated through interviews and FGDs was recorded, transcribed and analysed using NViVO 10 through a thematic hierarchical approach (King and Horrocks 2010). The survey, interviews and FGDs were guided by questions around: (i) how are communities adapting (responding) the changes with individual, household and collective actions, (ii) do individual and collective actions vary according to well-being groups?, (iii) are there any traditional or indigenous practices in the community to support and guide adaptation practices? and (iv) what are the services and facilities available to the community to support adaptation?

3 Results

Individual, household and collective actions to address the impacts of climate change on livelihoods were autonomous and short term in nature. Many actions practiced by communities were compulsive in nature rather than planned. Using a thematic hierarchical analysis guided by NVivo 10, responses from interviewees are categorised into five categories of adaptation practices as per similar research (Agrawal 2010). The categories include (i) diversification of income and agriculture, (ii) spatial adaptation through internal and external migration, (iii) adoption of new technologies, (iv) common pooling of resources through collective actions and (v) access to financial resources and risk reduction measures (Table 1).

3.1 Diversification of income sources and agriculture practices

Livelihood diversification options reported by the interviewees ($n = 28$, 56% of total) were basically diversifying their income sources and agricultural practices (Table 1), including moving from subsistence agriculture towards other employment opportunities and diversification of agriculture practices and renting out agriculture land by well-off land owners to poor and landless families. As reported by a well-off informant from Manasalu CFUG, ‘...our main occupation is farming but it is not profitable due to many uncertainties. It is not possible to survive only through agriculture... We left our land barren and now doing other jobs for survival’. Likewise, six interviewees (12%) who were diversifying their income sources were involved in local businesses. An interviewee, who was an hotelier of medium well-being group from Chisapani CFUG, claimed that livelihood diversification was an important response after experiencing a landslide on his farm: ‘...it is just two years I am in hotel business. Before that I was a farmer. About half of my land is damaged by landslide and it is also very hard to grow crops where there is no irrigation facility’.

Nineteen interviewees (38%) reported that the agriculture production system has been changing with an increase in share cropping. Among them, seven interviewees (five well-off and two medium) were renting out their farming lands, and 12 interviewees (five poor and seven very poor) had rented farmlands from land owners for share cropping. Share cropping agreements were based on annual verbal understandings between land owners and tenants. Land owners provided land and seed, while tenants provided all agriculture inputs such as ploughing and field preparation, labour, fertilisers and pesticides. At the end, land owners kept enough grains from the final product as seed for future planting, and the remainder of the product was shared between the land owner and tenants on a 50/50 basis. This appeared to be a good strategy for land owners to share their risks and uncertainties and to get income from the land where they were already facing loss of production due to high production cost, lack of labourers and increased uncertainty from unpredictable weather patterns. A well-off interviewee, who had rented out land for share cropping, indicated: ‘...we can’t work ourselves, labourers are very expensive and thus agriculture is not profitable. The unpredictable rainfall has increased further uncertainty. I have rented out my land for share cropping’. Meanwhile, poor and very poor tenants without land reported that share cropping was a primary activity due to a lack of other opportunities.

Increased share cropping, wage rate and money lending was based on verbal understanding without supported by government rules. Interviewees reported that such practices are leading to increasing dependency between well-off land owners and poor tenants. Many very poor tenant interviewees reported that share cropping has increased their vulnerability as they had to invest in all agriculture inputs in less predictable seasons of crop farming.

Table 1 Adaptation practices reported by interviewees (Adaptation practices according to thematic hierarchy using NVivo 10)

Adaptation practices		Practices according to well-being groups (number of interviewees)			
		Well-off (<i>n</i> = 12)	Medium (<i>n</i> = 13)	Poor (<i>n</i> = 13)	Very poor (<i>n</i> = 12)
1. Diversification of income sources and agriculture practices	1.1 Livelihood and income diversification (28, 56%)	11	6	8	3
	1.2 Agriculture diversification (17, 34%)	6	6	5	0
	1.3 Leaving farming land barren (14, 28%)	4	4	5	1
	1.4 Renting in land for share cropping (14, 28%)	0	0	5	9
	1.5 Renting out land for share cropping (6, 12%)	4	2	0	0
2. Spatial adaptation	2.0 Internal and external migration (20, 40%)	8	6	4	2
3. Adoption of new technologies	3.1 Adoption of more suitable crop varieties (16, 32%)	5	4	4	3
	3.2 Access to agriculture services (15, 30%)	5	5	3	2
	3.3 Use of agri-chemicals (insecticides, pesticides and fungicides) (13, 26%)	2	4	5	2
	3.4 Alternative energy (biogas and LPG) (12, 24%)	6	6	0	0
4. Common pooling of resources through collective actions	4.1 Local infrastructure (drinking water, road, irrigation facilities) supporting adaptation practices (18, 36%)	7	4	3	4
	4.2 Landslide control and soil conservation activities (6, 12%)	2	2	1	1
	4.3 Support received at the time of emergencies and natural disaster (6, 12%)	2	2	2	0
5. Access to financial resources and risk reduction measures	5.1 Access to community-based micro-finance schemes (34, 68%)	6	9	8	11
	5.2 Consumption loan from money lenders and indebtedness (16, 32%)	0	0	4	12
	5.3 Livestock insurance (6, 12%)	2	2	1	1

Eleven interviewees (22%) reported that they were responding to changing climate by changing their cropping patterns. Six interviewees mentioned that they were practicing late planting of potatoes to protect the crops from the impacts of frost. As a well-off interviewee explained, ‘...we do have impacts on potatoes due to frost. If we plant potatoes on early winter we do face frost as the frost. Now, I do plant potatoes in late winter to protect them from the frost’. Sixteen interviewees (32%) reported that they started practicing agriculture diversification. Vegetable farming was reported as an attraction for some interviewees. As one farmer said, ‘...now we’ve got some training on cash crops and vegetables. We are now using the plastic tunnel (green house) for tomato farming. It is more profitable and less risky than weather dependent cereal crops’.

Eight interviewees were practicing animal husbandry, including cow and buffalo rearing, apiculture and poultry. As reported by one of the poor interviewees, livestock farming is a better strategy than crop farming due to climate uncertainty: ‘...there is no certainty in crop production due to erratic rain, so livestock is good for us. Dairy cooperative is helping us in marketing of milk’. Fourteen interviewees (28%) revealed that they were not actively cultivating their farmland due to uncertainty and low production. One well-off interviewee claimed that a large percent of farm lands are abandoned and barren in Manasalu village: ‘...we have non-irrigated farming land in the uplands but it is barren these days. If you see the farming practices of this village, about 40% of farming lands have been abandoned for the last 12 years’.

Leaving farming land abandoned was reported by migrant interviewees as an alternative strategy as they do not see benefits in farming in the non-irrigated uplands. However, for households still living in the uplands, this strategy of leaving their land barren has serious implications for their livelihoods, as there is a lack of alternative livelihood options.

Interviewees from different well-being groups reported that livelihood diversification was an interest and need for all well-being groups. However, the options for livelihood diversification are to seek education, increase skills and obtain information and financial resources. Consequently, poor and very poor households struggled to diversify their livelihood options while the diversification options were mainly afforded by well-off and some medium wealth households. Poor and very poor households were confronted by unaffordable options and added risk.

The survey data revealed that respondents engaged in an average of 2.4 different agricultural activities such as crop farming, vegetable farming, livestock rearing and farm forestry. The diversity was slightly higher in the case of well-off and medium households than very poor and poor households. The Kruskal-Wallis rank sum test indicated a significant relationship ($\chi^2 = 41.5713$, p value = 0.0001) between agriculture livelihood diversification index and well-being status of the respondents. More agriculture-based livelihood activities are considered to be less vulnerable to climate change impacts.

3.1.1 Spatial adaptation through internal and external migration

Twenty interviewees (40%) reported internal migration as an adaptation strategy. Most of the reported internal migrations were from remote hills with non-irrigated uplands to the valley floors called *Besi* where there was fertile land and the places were close to other facilities (i.e. ‘pull factors’). The major push factors for the migration were repeated crop failure, decreasing agriculture production and scarcity of drinking water together with other non-climatic factors. Interviewees migrating from remote hills to the *Besi* area were mostly well-off families who could afford land and houses in the *Besi* area. As reported by one poor farmer from Raniswanra CFUG, ‘...those who are economically strong have already migrated to Besi to find better services and facilities. Those who are living in this area are mostly poor’.

Nine interviewees (18%) reported that at least one member of their family had migrated to the Gulf countries to work as a labourer. Remittances were considered an alternative income source for subsistence farming. As mentioned by one very poor man from Raniswanra, who was on leave from the Gulf, explained: ‘..We are landless. We do share cropping in other’s land. Farming is unpredictable due to erratic rainfall production is decreasing and cost of production is very high. That is why I took loan from the local money lenders at an interest of 36%/yr and went to Saudi... I am paying back my loan and interest’. However, some poor and

very poor families had migrated to semi-urban areas for wage labouring opportunities following repeated crop failure and increasing hardship from unsatisfactory subsistence agriculture outputs. A poor woman from Manasalu CFUG explained: ‘...my family migrated to this place from a remote village. We had a small piece of land but we couldn’t get any production due to unpredictable rainfall. The land is now barren’.

Several interviewees (over 30%) claimed that many people had migrated from their villages as a result of water stress. As reported by a well-off interviewee from Raniswanra CFUG, ‘...there was a small village near ours but there is not a single house now. The village has been displaced due to scarcity of drinking water’.

Increasing internal migration had also increased population density in areas with accessible and fertile lands, leaving many agriculture lands abandoned in the remote and less-productive uplands. Unplanned internal migration was also reported as one of the major causes of water stress in urban and semi-urban areas.

3.1.2 Adoption of new technologies

Sixteen interviewees (32%) reported the use of alternate forms of energy such as biogas and liquefied petroleum gas (LPG), mainly for cooking purposes, which is helping them to save fuelwood and improve health conditions. As explained by one of the well-off woman interviewees from Kataharbari CFUG, ‘...installation of biogas reduced women's time and workload...We don't need to go to the forests to collect firewood. It has helped in saving fuel wood and improving women's health’. Sixteen interviewees (32%) reported that they were adopting drought tolerant, improved and hybrid varieties of paddy which had high production in comparisons to local varieties. As mentioned by one of the well-off interviewees, ‘...there is more attraction to drought tolerant varieties where rainfall is unpredictable’. However, as reported by interviewees from remote areas, these varieties were only available in the areas close to service centres.

The survey data revealed that 38% of the respondent households had installed biogas and LPG as an alternative source of energy. However, installation and use of alternative energy was significantly associated ($\chi^2 = 45.6934$, p value = 0.0001) with well-being status of households as 82% of well-off, 26% of medium, 24% of poor and none of the very poor households were using biogas or LPG as an alternative source of energy.

Ten interviewees (20%) mentioned that they were increasingly using insecticides, pesticides and fungicides on their crops. The most common treatment in use was the fungicide against frost in the potatoes. As described by an interviewee, ‘...we need to put chemicals for the frost. Those who plant potato without seed treatment have to put medicine several times. If the seed is not treated we must put medicine 5-6 times’.

Data analysis revealed that individual and household level responses to climate change mainly varied according to individual/household well-being status and occupation. The responses related to use of alternative energy and bio-pesticides were found to mostly vary according to well-being status of the interviewees. Application of these responses was mainly based on availability of resources (such as land and money), education, information, knowledge and skills.

3.1.3 Common pooling of resources through collective actions

Fifteen (30%) interviewees reported that they were affiliated with agriculture cooperatives to enhance their access to agriculture services, technology and markets. Nine interviewees

explained that the agriculture cooperatives had provided improved and drought resistant crop varieties, fertilisers and loans to buy livestock. As reported by one interviewee, '...seed production cooperative has been established and the cooperative is facilitating research on developing drought tolerant varieties of paddy'. Another interviewee identified various benefits of the agriculture cooperative as '...there are 25-30 households in agriculture cooperatives. We can get seeds and fertilizers on time and at a good price'. Three interviewees revealed that they had recently established a milk collection centre at the village as part of dairy cooperative, which was encouraging and promoting farmers to raise livestock and sell milk.

Eighteen interviewees (36%) described their involvement in collective actions to develop community infrastructure to protect and manage water resources, to promote soil conservation and landslide control activities and to increase access to market and services by road construction. Fourteen interviewees (28%) had contributed to collective actions in the construction and renovation of drinking water systems. As explained by one informant from Kataharbari CFUG, '...for the drinking water project we collected 2,000 Rs from each household and did 32 days voluntary work from all members. Now 18 households are benefitting from this. Many traditional water sources are gradually drying and there is a scarcity of drinking water'. A similar story of local community cash and labour contributions towards a drinking water project was revealed from Raniswanra CFUG. As mentioned by an interviewee, '...we provided Rs 120,000 cash and labour contribution from each household for a ...drinking water project. This project covers 70 households out of 140 households affiliated with the CFUG'.

Six interviewees (12%), including two well-off, two medium and one each from poor and very poor households, had been involved in collective actions in landslide control and soil conservation related activities. As explained by a woman interviewee, '...there was a landslide in our village...all user group members carried stones for two days and invested 25,000 Rs collectively. The landslide is not controlled yet'. Six (12%) interviewees described the traditional practice of communities supporting households who are in experiencing some kind of emergency or are affected by natural disasters. As explained by one interviewee, '...supporting others in emergency and disaster is our traditional practice and culture. We do collect donations and provide support in emergencies'. However, the results showed that none of the very poor households received any support at the time of natural disaster and emergencies. As reported by one of the very poor interviewee from Kataharbari, '...the local institutions are led by well-off and powerful persons, they make decisions about distribution of resources, poor people never get support even at the time of landslides, flood and fire'.

According to the interviewees, collective action in local development is a traditional practice of communities in the research area. As described by the interviewees and FGD participants, collective actions in infrastructure development were crucial in the context of climate change adaptation as many infrastructure facilities had been damaged by landslides and floods and many water sources were gradually drying. Similarly, collective action in local infrastructure development was believed to enhance the adaptive capacity of the communities. However, as reported, many local institutions are led by local elites and poor households rarely get tangible benefits from these institutions even at the time of emergencies and natural disasters.

3.1.4 Access to financial services and risk reduction measures

Thirty five (70%) interviewees reported that they were affiliated with at least one of the saving and credit cooperatives or mothers' groups and were receiving loans at the time of

emergencies, disasters and crop failure. The cooperatives and mothers' groups run saving and credit schemes at low interest rate than money lenders, also collect money from social events and use accumulated resources in various social and local infrastructure development activities.

Taking a consumption loan to meet ongoing costs at the time of crop failure and emergencies was a major coping strategy of 16 interviewees (32%), including 12 'very poor' (100%) and four 'poor' (31%) people interviewed in this study. Private money lenders had supplied loans to 14 of these interviewees, but other sources of loan cooperatives, mothers' groups, banks, relatives and friends. Although the trend of taking loans from money lenders was decreasing following the formation of cooperatives and mothers' groups which charge lower interest rates, many very poor and poor still had to take loans from money lenders at high interest rates at times of emergency and when they needed a larger amount. As reported by very poor and poor interviewees, the interest rate charged by money lenders was between 36 to 60%/year based on urgency and size of the loan. As described by a 'very poor' interviewee, '...we don't have access to loan from banks so we have to get loan from money lenders...Some money lenders ask 3 Rs, some ask 5 Rs. per month (per 100 Rs). We have to pay whatever they ask'.

Only a few (12%) interviewees reported the initiation and promotion of livestock insurance schemes by private banks and NGOs. Informants described the need for livestock insurance, as livestock casualty from diseases was very common. As reported by one interviewee from Manasalu CFUG, '...there is a livestock insurance promoted by a NGO... We have to pay about 200 Rs per goat in a common fund for livestock insurance. If goats die, the group buys a new goat from the fund'.

Many 'very poor' interviewees (100% of very poor and 31% of poor) claimed that they had been in financial debt over an extended period and they often had to take a loan from one source to pay back the principal and interest of a loan taken from another source. Informants were also of the view that money lending and indebtedness has increased dependency of the very poor and poor households on local landlords and limited their opportunities and capacity to make independent decisions.

4 Discussion

The findings revealed that climate change adaptation practices being followed by rural communities in Nepal were based on their traditional knowledge, skills and practices. The responses were thus ad hoc, autonomous, reactive and short term in nature. The responses were inadequate in comparison to increasing risks and vulnerabilities to climate change as indicated by many studies as limitations of autonomous adaptation (Mertz et al., 2009; Smit et al., 2000; Race et al., 2016).

The research found that many adaptation practices (responses) were varied according to the well-being status of households. For example, the adaptation options such as livelihood diversification, adoption of new technologies and common pooling of resources were largely benefitting to well-off and medium households, those who were utilising their knowledge, skills, access to information, networks, property and resources (Fig. 3). As noted by researchers (Fankhauser et al. 1999; Maru et al., 2014), the effectiveness of autonomous adaptation is only possible when individuals have incentive, knowledge, resources and skills to adapt.

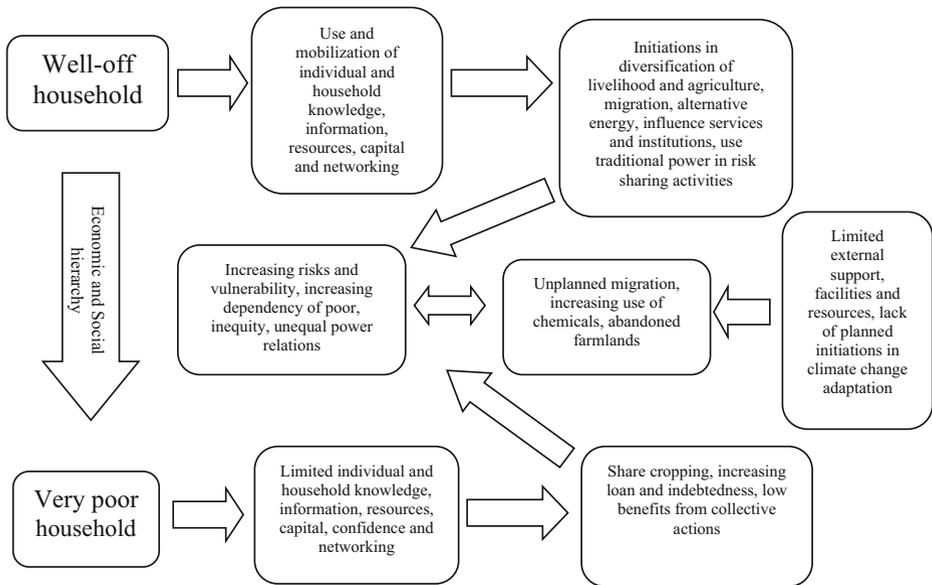


Fig. 3 Household and collective actions in climate change adaptation applied by rural communities and outcomes

Similar to global trend (Shishiso 2009; World Bank 2011), labour migration was found to be in an increasing trend and remittances, as one of the major contributors to household economies, was directly contributing to climate change adaptation (Banerjee et al. 2011). The proportion of households receiving remittances in Nepal is in an increasing trend (24% in 2004 to 56% in 2011) (GoN 2012a). Although remittances was contributing to enable rural communities to accumulate savings and goods to deal with any unexpected challenges, the proportion of very poor families in overseas jobs and earning remittances is very low. Out of 76% of researched families who were receiving remittances from various sources were 84% of well-off, 82% of medium, 10% of poor and 6% of very poor households. Among the very poor families, migration was usually only possible to the areas where the cost of migration was minimal and for low-skilled labour jobs.

The need to seek labouring work overseas, and the high cost of travel associated with this strategy, has further promoted money lending as a profitable business for local money lenders. Likewise, seeking a consumption loan for their survival at the time of emergencies, crop failure or loss of production from crops and livestock was the primary and immediate options for very poor and poor families. The loan for poor was only available from local money lenders at high interest (36–60%/year), whereas the interest rate in the banks and community-managed micro-finance institutions was between 12 and 24%/year. However, the government was found to be ineffective in regulating such social practices. Although poor families were using consumption loan as a coping strategy, it was causing indebtedness, was increasing their dependency on local elites and was promoting unequal power relations as indicated in Fig. 3. Thus, the compulsion to adapt to risks and uncertainties by poor households were further pushing them towards further vulnerability and marginalisation (Fig. 3) in the context of historical exclusion and marginalisation (Barnett et al. 2008; Tanner and Mitchell, 2008).

In addition to overseas labour migration, internal migration of rural households from remote uplands to the urban and semi-urban areas was in an increasing trend. Environmental factors such as water-induced disaster, decreasing access to forest resources and declining agriculture productivity are increasingly causing out-migration of rural population in Nepal (Chapagain and Gentle, 2015; Massey et al. 2007; Tacoli, 2009). Population census (GoN 2012b) showed that the population of Lamjung district has decreased by 5.3% in a 10-year period from 2001 to 2011; however, the population of Besishahar, district headquarters of Lamjung, has increased almost three times in the same period. This was as a result of internal migration of poor people from uplands to urban and semi-urban areas withdrawing their agrarian livelihoods and abandoning agriculture and forest lands in the uplands.

Agriculture-based adaptation practices such as agriculture diversification, adoption of suitable crop varieties, adjustment in cropping pattern and changes in agriculture production system were reported. However, these practices were adopted by the limited households who owned agriculture land and had access to information on agriculture technology and services. Agriculture-based adaptation practices have been reported as common adaptation strategies (Regmi et al. 2009; Bartlett et al. 2010) and promoted as preferred adaptation policies (GoN 2010). However, such strategies were found to be ineffective for the very poor households in the research area, as 94% of very poor and about a half of poor households did not own agriculture land, and those that owned limited land were farming on uplands without irrigation facility.

The research findings are similar with Tanner and Mitchell (2008) who claimed that non-poor households can adopt a range of strategies including market-based adaptations, whereas the chronically poor normally depend upon autonomous responses and on social protection derived from public policies. Likewise, similar to Nelson et al. 2007a; Ziervogel et al. 2008; Brooks et al. 2009, the unplanned and short-term coping strategies to climate change impacts may lead poor sections of local communities towards increasing inequalities in the context of socio-cultural hierarchy.

The research shows that although local knowledge and practice is the key to promote community-based adaptation, it is inadequate unless it is blended with modern knowledge, science and technology (O'Brien et al. 2007; Race et al. 2016). The research findings indicate a gap in national adaptation plan and climate change policy of Nepal which is silent to provide solutions on social implications of climate change and to develop adaptation strategies to address both climatic and non-climatic factors as equally contributing to vulnerability.

5 Conclusions

The research findings showed that local communities in the research area are just reacting to the impacts of climate change and variability with their traditional knowledge and with limited resources. However, the impacts of climate change are rapid and unpredictable, and are beyond the coping and adaptation capacities of local communities. At the time of this research, there was very limited external support available for communities to adapt to climate change and there was no effort to address the impacts in a planned way or with external knowledge and resources. The adaptation practices being adopted mainly differ according to household well-being and are largely governed by access to education, information and resources within the community. The research further found that many adaptation responses were short term and reactive in nature and were pushing poor households towards further vulnerabilities, social injustices and promoting to widen unequal power relations in the society (Fig. 3).

The research suggests a strong need to enhance the adaptive capacity of poor and very poor households in Nepal. There is a need to expand and strengthen social networks of poor households. Assisting them with financial planning including debt management strategies and strategic planning of livelihoods is an immediate requirement. The formal adaptation policies and processes need to explicitly understand the underlying causes of vulnerabilities such as ongoing marginalisation, exclusion and inequity (Fig. 1) to address the adaptation needs and aspirations of historically disadvantaged households. A blended approach that includes a combination of traditional and modern knowledge can be a viable option for adaptation in the rural poverty context. There is a need of a deliberate focus of policies, such as ongoing National Adaptation Planning (NAP) process and other sectoral policies and an institutional mechanism to provide the most vulnerable communities with knowledge, skills and practices.

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