Impact of Climate Change on Livestock and agricultural Production in Nepal

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Abstract

This study finds out the perception of local Nepali community particularly of mountainous region of Gorkha district on adjustment of bad impact of climate change. The central point of research is about the control of livestock in the context of shifting of grass and supply of water. The research comprises of mixed-methods combining quantitative and qualitative data in Gorkhas Harmi Bhanjyang to know the effect of climate change on livestock supervision. Different methods such as household censuses, key informant interviews, focus groups discussion and observation of participants were used to gather information from local community, as well as cultivators and herders. Due to the changing climatic condition the study has shown that in present scenario, Harmi-Bhanjyang water sources are depleting in devastating manner which directly or indirectly affect farming practices as well as fauna. Conventional sources of water like ponds and streams have declined in such a way that springs are becoming less and the rate of flow of water is worst eventually leading to natural hazards such as droughts and landslides. Now the people of rural areas are migrating from the areas of uncertain climate to the region of stable climate due to the various reasons. Among them, the shortage of water for animals and for irrigation in farming practices contributes the more. Due to the changing climatic condition, huge number of livestock have been affected due to lack of rice straw, grazing land, and fodder especially for buffalo and cow. In analyzing the effect of climate change in case of adaptation and putting local people in trouble, increasing temperature and changing weather patterns have played tremendous role in distressing traditional agriculture practices. Particularly this study focuses on the serious effect of climate change on farming practices and in the case of animals in community of Harmi. Inhabitants of this community may not know about the effect of climate change but they feel various aspects such as huge difference in temperature, effect of precipitation either very low amount or very high and patterns of seasons. People who adapt to very low area of farming and have very low population of livestock suffer many difficultis and the study focuses on the importance of engaging traditional knowledge of local community into plan of adaptation. It searches for harmony and good focus to help for rural community and make rural people aware about the effect of change of climate.

Keywords: climate change, Harmi Bhanjyang, livelihood, livestock management

Introduction

Local communities are highly affected by change of climate, which is the result of human activities and individual on livestock and agriculture. Even though contribution of Nepal is low to global emission, Nepal has seen high warming ratio and unpredictable weather pattern which significantly endanger the rural population's livelihood based on agriculture activities and animals (Shrestha & Wake, 2000). Even though the impact of climate change is felt acutely in local level, mainly in rural societies which rely upon natural resources the issues is global one, this study focuses mainly on mountainous Gorkha district to study how they are adjusting to climate change. This concentrates on how livestock are handled in this condition of shifting water and grass sources. More than 80% of Nepal rural populations depend on agriculture activities for their livelihood (ICIMOD, 2006). Rural communities are endangered by climate change like increase in temperature, varied showers and weather event like flood, drought and landslide. Rural life depends on livestock management system which is threatened by change in environment and agricultural productivity is disturbed (Shakya, 2003; Alam & Regmi, 2004). In response to these environmental changes, various ancient knowledge and adoptive strategy have been developed by residents of rural areas. Even though there is enough local knowledge and experience most literature on climate change has concentrated on the scientific aspect. Due to this, there's emptiness in our understanding of how rural society perceives & adapts to climate related changes, especially in relation to livestock management and resource accessibility (Poudel, 2010, 2011). The primary objective of this study is to bridge this gap by examining the ways in which rural communities in Gorkha's Harmi Bhanjyang are adapting to the changing climate. More specifically, the study will examine the effects on livestock management and the availability of grass and water resources. The study aims to offer a better understanding of the relationship between local livelihoods and climate change by investigating into local coping mechanisms and adaptation strategies. Cultural ecology, which stresses on the interaction between human societies and their surroundings, especially how communities adjust to environmental changes through cultural practices, serves as the theoretical foundation for this investigation (Marino & Sweitzer, 2009). This study highlights how important it is to combine local people's knowledge with scientific knowledge to upgrade climate change adaptation. It shows how there is a gap in the literature by looking at local adaptive strategies and presenting how past knowledge can guide successful response to

environmental complexities. This encourages deeper and understanding of climate resilience according to the circumstances.

Research Problem

Human and other natural cycle are changing day by day and are making problem in daily life by changing in flora, fauna, production ratio and components of ecosystem due to rapidly changing phenomenon of world called as climate change (IPCC, 2001). The indigenous communities of people in countries such as Nepal are in danger although they have agriculture and animal husbandry as main source of income. To be able to cope with adaptation requires need assessment of causes and possible future impact of climate change on rural people (NARC, 2011) In the present context it is important to overview how indigenous communities are adapting to their indigenous community such as in Harmi Bhanjyang, Gorkha and their responses towards rising environmental effect. A number of indigenous people have various methods for knowing environment because of their strong attachments with cultural activities and daily things (Crate & Nuttall, 2008). The people of local community acquire great knowledge about climatic conditions such as wind, rainfall, hail, by common senses as seeing, listening and feeling (Roncoli et al., 2009). By the analysis of how the community sees and responds to climate change the study has goal to accumulate the experiences of changing climate and its effect in the sociocultural aspect of rural Nepal. In the rural area of Nepal where farming and animal husbandry are the main source of income, the effect of climate change is seen as temperature rising unexpectedly, either too low or downpour rainfall and melting of glacier putting whole ecosystem in danger. (Crate, 2008). According to Linquist (2007) mountainous region totally depend upon nature in forest, water and soil so they are reactive towards climate change. Due to less availability of water, feed and grazing area it puts whole livestock production in danger and results in endangerment to rural livelihoods (Chaudhary et al., 2007). Although the information about climate is rising rapidly, rural community has very few knowledge on how to cope with this challenges.

Objective

a) To investigate how grass and water availability have affected local communities in recent decades due to weather variations and climate change.

b) To investigate the coping and adaptation strategies in livestock management in response to climate change over the past few decades.

Literature Review

Though Nepal does not play role in greenhouse gas emissions through severe pollution, it is facing different effect of climate change pushing towards risk. As noted by Chalise (1994), Nepal is more at danger of climate change due to its topographical situation and high dependence on farming and livestock. According to Shrestha and Wake (2000), In comparison with the other climatic factors, temperature in Himalayan region rose by 0.06oc every year between 1977 and 1994 and shows that higher altitude is more at risk of temperature showing higher rise of temperature in comparison to lower altitude regions such as Siwalik and Terai regions. According to Shakya (2003), farming practices were affected by natural disasters such as floods and landslides and insufficiency of water caused by rising rainfall and changing rainfall patterns. It is further supported by the data of Ministry of population and environment (MOPE, 2004) which have noted that there is yearly rise and seasonal temperatures with cold months and pre-monsoon seen to have contributed the greatest rise. Due to the effect of climate change, it is hampering both ecosystem and people; it is precisely seen affecting under- developed countries like Nepal which directly and indirectly has impact on farming practices and feed (Brown & Funk, 2008; Regmi & Adhikari, 2007). Rural people of Nepal which are totally dependent on animal and farming practices are facing the effect of climate change. The effect of climate change is seen triggering natural calamities such as flooding, landslide, droughts which are frequent affecting life of rural individuals, as highlighted by Alam and Regmi (2004). Moreover, these sectors are at risk due to the effect of climate change which can result in lower production by lowering pasture land (NARC, 2011). A number of study have been conducted by various scientists which focus on climatic factors such as rainfall patterns and temperature, but due to the lack of information and experience they are facing problem. Anthropologist Poudel's (2010, 2011, 2012) research throws light on perception of rural people of Nepal in response to change of climate. For instance, Poudel (2012) demonstrated that the inhabitants of Kathmandu have wise knowledge about climate change by merging aerial data with locally available knowledge. Similar to this, Poudel (2011) views that the people of Kirtipur create mechanisms for handling of climatic condition using social aspect and indigenous knowledge. Rai (2010) focuses on importance of using fixed method which are on topic and the significance of incorporating indigenous knowledge for global adjustment. Though different types of research have been conducted but there is lack of research in field of agro-livestock in relation to climate change. Very few researches have been conducted about

climate change in the case of livestock which provided general strategy in Nepali rural community for surviving in the harsh environment. As per Thornton et al. (2007), livestock of many people are at vulnerable stage due to the impact on the resources such as water, pasture land and food. Adjustment techniques such as migration of people from generation to generation and combination of livestock and trees can be a possible measure for coping with climatic pressures. (IFAD, 2009) The socio-cultural and ecological aspects of local communities address such strategy but majority of research do not pay attention. After having knowledge of cultural ecology, it focuses on flexible method that society produces the changes to decrease the bad impact of climate change (Bolin, 2008). Adger et al. (2003) study shows that it is very important to consider local things other than global aspects which primarily focus on special wants of backward society. In the context of climate change scientific and ecological aspects are engaged in the literature but there are various things which are not covered by local community mainly in agropastoralism. The study from the regional approach will fulfill adjacent gaps primarily in livestock management in relation to climate change. The research will focus on ecological and sociocultural aspects to save indigenous information in adaptation to climate change.

Theoretical Framework

The vibrant interplay between the human and environment which is examined by the conceptual system of traditional bio- ecology which assists as the base for this inquiry. As a branch, human science gives information about the civilization of people in space and time, engaging with other applied extensions such as bio-science, mechanics, phonetic and archaeological science (Kottak, 2002). The basic element of anthropologist is to know the conversation among the human and nature which represents human, tradition, manner and methods of resources (Ingold, 2000; Leichenko & O'Brien, 2008). Traditional nature model is applied to verify the ecological elements which affect traditional methods and adjustment of people. As illustrated by the important representation, that changes in the climatic condition has collected the factors of finding policy and the strength of human environment which is essential to elaborate the techniques in which human accommodates to an altering nature. This model authorizes for a wider investigation in the sociocultural on site investigation to consider the context into real way of life (De-walt & De-walt, 2002).

Methodology

The study shows impact of climate change in livestock especially in cattle supervision in rural village of Harmi Bhanjyang Gorkha using mixed method by both quantitative and qualitative data. In the research the majority of population is from local villagers specially individuals who take care of livestock. The research comprises of data of two rural villages of Harmi Bhanjyang. The information collected from the inhabitants of every family was used for interpretation of age, sex, literacy and employment. For collection of data for primary data focus on group discussions, interview of key informant, census of household and observation of field was carried out. Census of household gives valuable insights into socio-economic aspects of local individuals while interview with key person provides deep information with the experience gained from daily lives of particularly persons who are engaged in looking after animal and farming. In focus group discussions eleven individuals of different ages are selected who have knowledge of environment and its bad situation for inspection of climatic changes. The bad impact of climate such as hailstorms, drought and the information of livestock, water resources and pasteurization was also observed by participant's secondary source of information by Central Bureau of Statistics and the Department of Hydrology and Meteorology go with the primary data. Quantitative and qualitative analysis was used to gather data. Quantitative data was interpreted by using simple statistical techniques while qualitative data was interpreted by patterns and themes. While taking information from respondents, ethical guidelines were followed during discussions and conversations. With more Centre of attention on Harmi Bhanjyang the research uses approach like cultural ecology to analyze the findings in support of socio- cultural norms of the society.

Findings

In the research, seasonal precipitation, indigenous ponds, and rivers contribute as major sources for water supply which are significant for managing crops and livestock. The water collected from rainfall is used for cattle in sanitation and for drinking purpose while stream water is used to irrigate whole rice field. Moreover, indigenous ponds and new water supply system as piped water supply system are not sufficient to meet wants of people and livestock. As a result, water collected during spring is taken as alternative to meet the scarcity of water. Some years ago the situation was not the worst as compared to present days; monsoon rainfall was sufficient for the important food crops like rice and maize. But now due to the effect of climate change only 15 to 20 days in monsoon season have heavy rainfall. The

required amount of water has changed drastically foe farming and other animals due to the effect of climate change. After analysing the data of ten years and from the view of old people there comes point that natural resources such as springs, wells and rivers have depleted. Among various factors, the important factors that affects water supply are natural calamities such as droughts and landslide. Day to day drying of water reduces daily amount of drinking water which ultimately affects irrigation in agriculture and livestock and makes people desperate for searching water resources. For responding to such demand, piped drinking water systems are started but it is also not enough and people start to collect river water in tank making worst situations for local women. One respondent, Kalpana Dhakal (59), stated that women in the community are now under more stress as a result of this circumstance. Water scarcity primarily affects women because of our role in gathering water, and resources are getting harder to come by. As a result, we are having trouble adjusting to this climate change because the strain on the livestock management system will only increase problems like the depletion of water supplies. In contrast to men who worked in social services and marketing and who migrated to India and the Gulf countries in pursuit of employment, women predominantly engage in domestic work and farming. We are forced to fetch water from a distance of one kilometer these days. Collecting water is one of our responsibilities. As a result, we are burdened with more work than men due to water scarcity. In the study area goats, buffalo, and cattle are the main animals raised, where animal farming play important role towards local populations. The main animals selected for the purpose of meat are goats and he-buffalo, whereas cows and buffalo are kept for their milk. These animals, like chickens, have various uses, for earning money in cash, food items, and performing traditional rituals. Especially in local festivals, goats and cows are known for its traditional cultural importance. As an old profession, growing livestock increases an income of community and their reputation in the society. The most popular livestock in Harmi Bhanjyang are goats and buffalo, and since all of the animals are feed at their place and do not make open and free so a good ratio of stored feed is needed. During the whole year rice straw is used except in month of July and June when farmers use stored products such as silage, grass of rice field for supporting nutrients.

The management of animals by indigenous people is made more difficult by the obstruction on their ability to have forests products such as foliage and fodder. The livestock farming system has seen considerable changes over the last 15 to 20 years, which the respondents saw a combination of both natural and social factors. These include changes in

the climatic patterns that ultimately affect in water supply, pasteurization of land as well as the increase in animal health. Furthermore, changes in the value of production function such as use of soil, labor availability, alternative revenue rivers are examples of profitable factor that have affected the animal farming system. Consequently, the methods and working of animal farming within the community have been transforming.

Table 1

Types of Livestock Owned by Respondents and their Household

Livestock Type	Number	Percent
Cow	31	12.6
Buffalo	82	33.5
Goats	124	50.6
Ox	8	3.3
Total	245	100

There is a decrease in livestock, especially cows and buffalo, as Table 1 illustrates. According to a key informant, the proportion of people raising livestock has dropped by 50% over the last ten to fifteen years. due to the shrinkage of some fodder trees, the loss of local grass species, the reduction of grazing land, and the lack of feed. The local inhabitants also view that landslide factors, excessive drought, and fires in forest were among the climate troublers causing a wide diminish in population of livestock. In the community Livestock farming is the main source of income.

Older respondents also blame it on climate change and the extended drought that has been happening in recent years. According to focus group discussions, the effects of climate change on water resources appear to be more severe than those on other resources. Accordingly, the supply of dwindling water change into dwindling agricultural output, which in turn has an immediate impact on animal.

Similar to the change in the pattern of rainfall, the elderly population in the study location shows a notable transformation in local temperature. According to participants in the study, the temperature is rising more than it was a few days ago. They claim that although the winter days and nights used to be extremely cold in the past, but the scenario have changed and are feeling less cold. The days are changing and having higher temperature in the summer as well. One respondent, Sita Sapkota (71), provides the following explanation for her temperature observation: The temperature has changed significantly from earlier. The past five years have seen a daily increase in temperature. The village lived in a cold, temperate climate. I feel hot in Harmi right now, just like in Terai. There weren't any mosquitoes when I was a kid, but these days they can be found even during the winter.

People have given information of their earlier times by contrasting them with present times. Some of the increasing temperature factors are mosquitoes, poisonous weeds, and other pests. An additional analogous experience with climate change The 76-year-old Shiva Pokharel describes his experiences as follows: Hot days now start after the second week of February, but until 2000, the winter season usually lasted until March (the second week of the Falgun). The heat makes it challenging to work in the field when winter crops are being harvested. So, instead of working in the middle of the afternoon as we used to, we now work in the morning and evening. Although raising livestock is a profession, the villagers' secondary occupation is livestock keeping. According to the key informant every household uses their animal as source for earning cash, personal use and manure but they do not keep livestock as source for adapting to changing conditions. They say that it is impossible to keep livestock without practicing good farming, and vice versa. The following is how 79-year-old Acchami Sarki described his experience: It was more crucial to use paddy straw to feed our animals, particularly the cows and buffalo. Since rice farming is declining, other food supplies like maize and wheat, which we used to feed our cattle, are also decreasing, making paddy straw more and more expensive and scarce in this area. These days, each household can only keep five to seven animals, particularly goats, to provide manure for our fields. Over the past 20 years, I have sold and decreased the number of livestock.

Discussion

The study shows that it is challenging for indigenous society in adapting to changing climate especially in the case of animals and management of food distribution. For every sector, the sources of water such as ponds, streams and rainfall is somehow needed aspect but it is highly important in the case of farming practices and animal rearing. Nowadays, these sources of water declined heavily due to natural phenomena such as droughts, transformation of rain either too low or too high and depletion of wells and springs. In season of monsoon, there used to be good sources of water for livestock and agriculture but now it is declining in a devastating manner affecting both animals and plants. In our society collection of water is mostly considered as the key role of women, so such duty of women creates more difficult situation because they have to travel long distances for collection of water. Such type of workload creates discrimination among men and women affecting their daily life. The study shows that due to natural phenomenon like landslide, fire in jungle, large duration of drought, reduction in fodder and pasteurization land causes reduction in number of cattle’s and buffaloes in 10- 15 years’ interval of time. The transformation is similar with earlier study on

the effect of climate change on agriculture farmers and the people who are busy pasteurizing animal where their daily living is disturbed by the changing weather and degradation of environment (Morton, 2007). The deep connection of farming and animal is shown by reduction in number of animals which in turn decline crop productivity resulting in low feed for livestock's. Moreover, after seeing the trend of changes internationally, it shows the effect of temperature in more winter season and summer season in agriculture and livestock (IPCC, 2014). Such type of result plays vital role in area of plan and policy for upliftment of environmental and social factors. For example, among different method piped water systems was conducted but these methods cannot fulfill the need of whole area. After making more available sources of water such as collection of rain water it reduced the stress of women in managing resources. The bad impact of climate change on rural people can be reduced by making plan and policy that play vital role in making farming for long term, better animal care and rising pasteurization land. The study is conducted in a very small location with few sample populations so the findings of the study are not generalized for all the regions. So in the future a wide sample of population from all topographical regions must be studied for understanding wider impact of climate. Longitudinal studies show more focus on the impact of climate change in short and long period and take suitable measures for solving it.

Conclusion

The research mainly focuses on the perception of people of Harmi Bhanjyang in the case of climate change which in turn affects farming and livestock activities. Although they are not familiar with the term "climate change" (jalbayu paribartana), the findings demonstrated that the local people are not conscious of the transformation taking place in their environment. The people of Harmi Bhanjyang see transformation in temperature, rainfall patterns, regular droughts, which had serious effect on agriculture practices and livestock. The cultural approach which is strongly attached with soil, forest, and cultural traditions guides their agriculture practices. Due to rapidly changing climate local farmers are facing severe difficulty although they have experience of climate variation. The research also shows that it is very difficult for small and subsistence herders in the local area to deal with these tremendous effects of climate change. Although small herders are important but their sustaining method are not much for dealing with the issues of environment. According to the data, local people information in context of climate change must be included for taking effective decision and creating policy and plans. This shows that government rules and regulations must support local community other than reducing carbon emissions. Moreover,

the research focus that changing of climate is an issue that affects on animal industry, sources of water and pasture land. To solve these burning issues, both international national authorities must play significant role. The study has positive impact on the field of climate change sector by recognizing the importance of local information and knowledge. For developing effective coping mechanisms with the climate change, local society, national and international authorities must coordinate. By maintaining the sectors such as resources, policies and local perceptions for adaptation, practical application of resources is justified. The study comes to the conclusion that by engaging research method as interdisciplinary research and mass attempt, we can diminish the bad impact of climate change and encourage long term and sustainable living of rural individuals.

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