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Local Knowledge on Climate Change: Insights from Orange Farmers in Namsaling Village, Ilam District, Nepal

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Abstract

This journal article investigates the knowledge and experiences of orange farmers in Namsaling village, situated in the Ilam District of Nepal, concerning climate change. The study aims to assess farmers' awareness of climate change, its impact on orange cultivation, and its effects on their family economy. Data were collected through semi-structured interviews and focus group discussions with orange farmers. The findings demonstrate that farmers possess a substantial understanding of climate change and its implications for their agricultural practices. They have observed changes in temperature, rainfall patterns, and occurrences of pests and diseases, directly affecting orange production. Farmers have adopted various adaptive

measures, including altering cultivation practices, cultivating genetically modified crops, implementing irrigation systems, and using organic fertilizers to sustain their family economy. However, challenges such as limited access to climate information, financial constraints, and the need for additional training hinder effective climate change adaptation in the region. This study offers valuable insights into the experiences and perspectives of orange farmers, emphasizing the importance of targeted interventions to enhance their adaptive capacity and promote sustainable orange cultivation amidst the challenges posed by climate change.

Keywords: Climate Change, Orange Farmers, Knowledge, Experience, Adaptation

Introduction

This journal article examines the experiences of orange farmers in Namsaling village with regard to climate change, as well as the production of local knowledge and the coping mechanisms employed by these farmers to sustain their family economy. Climate change refers to a shift in climate patterns that can be directly or indirectly attributed to human activities, resulting in alterations to the composition of the global atmosphere. The United Nations Framework Convention on Climate Change (2010) defines climate change as a change in climate that goes beyond natural variability observed over comparable times. The Intergovernmental Panel on Climate Change (IPCC, 2005) recognizes climate change as any alteration in climate over time due to natural variability or human activity. While the term "climate change" commonly refers to statistical distributions of weather patterns, the local farmers' understanding of climate change differs from the scientific perspective (Roncoli, Vadwan, & Rhoades, 2012).

In recent years, anthropologists have increasingly focused on the social practices and cultural implications surrounding the modeling and scenario development of climate change, as well as its global impacts (Peterson & Broad, 2009). Anthropologists bring sensitivity and dedication to addressing global warming from local perspectives, considering local experiences, perceptions, knowledge, and adaptive strategies (Roncoli *et al.*, 2009) [18]. Anthropological research provides valuable insights into the current climate crisis, as local communities have directly experienced and observed the complexities of climate change, highlighting the vulnerability of these communities (Crate & Nuttal, 2009) [7]. While climatic and natural scientists often view climate change as a singular variable, it is a nexus of natural and cultural factors, encompassing both material and non-material aspects and encompassing global and local phenomena (Barnes & Dove, 2014). While scientific studies using meteorological data are important, they often lack the human dimension (Carey, 2010). In this context, anthropologists argue for a critical understanding of how local communities comprehend climate change on the ground, as they serve as key witnesses to climate change in their immediate surroundings (Riedlinger & Berkes, 2000; Cruikshank, 2001; Crate, 2008; Crate & Nuttal, 2009 [7], 2016; Barnes & Dove, 2014; Poudel, 2016). Unfortunately, the experiences of the people

of Namsaling, including the stories, myths, and realities associated with climate change, as well as the loss of local knowledge about seasonality and the disruption of long-standing agricultural patterns, have received limited attention from scholars.

Orange production is a significant cash crop in the Ilam district, providing a vital source of livelihood for the local population. This paper is motivated by the fluctuations observed in orange production in Ilam, which are perceived differently by individual farmers. Some farmers attribute the diminishing size and quantity of oranges to a failure to first offer the fruit to the Gods/Goddesses, while others believe it to be a consequence of divine anger. Drawing on the study of Viliui Sakha in Siberia, anthropologist Crate (2008) emphasizes the importance of local narratives and stories as primary research agendas. Crate shares an ethnographic account of an age-old story narrated by a Sakha elder, where the temperature range of Sakha personifies winter as a bull. This narrative provides insights into how local people conceptualize and engage with their environment, deeply rooted in their culture and history. The aim of this paper is to explore the farmers' understanding of climate change through the lens of orange production. It has two main objectives: documenting the local knowledge and understanding of climate change among the community and examining the adaptive strategies adopted by orange-producing farmers in Namsaling village to sustain their family economy.

Literature Review

Climate is always associated with particular place and region. People are always aware about the local event of their surroundings. Their day-to-day life interaction and observation attributes the idea. One of the earliest examples of traditional knowledge in climate change research Berkes and Riedlinger's (2000) work showing the value of traditional knowledge in climate change research. The benefits of considering traditional knowledge of climate change has been suggest by several authors (Fast and Berkes 1998, Cruikshank 2001, Vedwan and Rhoades 2001^[22], Poudel 2012). Cruikshank's (2001) research in the Glaciers and climate change identified oral history as providing insights on past climate. Actually, oral history and tradition also helps us to understand climate change. Believing with Cruikshank, the orange producer famers of Namsaling has long experiences and one's own worldviews rooted in oral history and myths through which they tell about changes in weather pattern in their surroundings, especially about the orange production.

Those anthropologists who focused on their study on agricultural domain explained the climate change through weather/climate and crop interaction. They argued that farmers' understanding of climate change is shaped through their life-time observations of crops-weather interaction. They argued that farmers' knowledge and understanding is rooted on the window of crop performance (Vedwan, 2001, Vedwan and Rhoades, 2001^[22], Roncoli *et al.*, 2003 and Poudel, 2016). For instance, Poudel (2012)^[16] in his study about farmer's perception and knowledge on climate change of Kirtipur of Kathmandu valley argued that farmers are key eyewitness accounts about weather fluctuations which they have been observing in lifetime. He argued that farmers recall and understand climate variability by weather-crop interaction, and events associated with climate and weather

and climate fluctuations and their perceptions are shaped by both physical visibility and cultural frame.

Vedwan and Rhoades (2001)^[22] explain perception of climate variables while ultimately being constructed by finite range of their values are most proximately structure by the interception of the personal objectified histories as embodied in the habitus of social actors and the field of agriculture as a repository of differential practices and strategies. The perception of climate change is informed and structured by the dynamic nature of human environment relationship. This study examines effect of climate change, local people knowledge and their responses about climate change. They described climate change by farmer's point of view. Their analysis based on cultural model of climate change, which is more related to my research. Similarly in order to understand how humans would response climate change it is essential to study people's perceptions of climate and the environment in general, like wise I was looked at how humans would respond to climate change. Local knowledge of climate should be incorporated to understand the impact of climate change.

Local people having their own culture to understand the event of climate by seeing, knowing, watching and experiencing it. People's perspectives over natural hazards are by their feelings, seeing and experiencing in local level even viewing upon those natural phenomena. On the other hand, perception is treated as an exclusive property of individuals (Vedwan, 2006)^[23]. It is achieved by his own activity that he/she plays role in the community system. The certain environmental phenomena the process of perception is also a process of action (Ingold, 1992). Most of the historical event of climate and weather shared by the community people and transmitted one to another generation. Anthropologist has begun to explore the empirical relation between local knowledge and climate phenomena (Roncoli *et al.*, 2009)^[18]. Climate phenomena are understood through the knowledge and response with cultural values. People of a particular region are rooted culturally in local level which is not addressed by scientific disciplines but it needs cultural knowledge for its valuation. Today a large number of anthropologists have been paying attention to traditional or indigenous knowledge system and climate change (Ingold & Kurtilla, 2000, Vedwan & Rhoades, 2001^[22], Rancoli *et al.*, 2003).

In "Stolen Harvest: The Hijacking of the Global Food Supply," Shiva delves into the destructive impacts of commercial agriculture and genetic engineering on the food industry. In the context of Namsaling, local residents attempted to cultivate genetically modified orange plants, but unfortunately, these efforts did not yield any fruit.

Research Gap

Upon reviewing extensive literature, it is evident that numerous studies examining climate change from the perspective of local communities assert that traditional knowledge significantly contributes to a deeper understanding of climate change. Riedlinger and Berkes (2001)^[17] underscore the value of traditional knowledge as a localized expertise serving as a source for climate history and baseline data. This is particularly emphasized in the context of long-term community-based monitoring. They define traditional knowledge as a cumulative body of knowledge, practices, and beliefs evolving through adaptive processes and transmitted across generations via cultural

means. Consequently, local people, particularly farmers, are well positioned to report and testify about weather fluctuations based on their lifetime experiences and observations.

I want to focus on specific agriculture production i.e. orange because it has long history of production for a long period they observe its fluctuation and they may have knowledge from long-term experience, observation and oral tradition in their local surrounding regarding orange production and fluctuation being caused due to climate.

This research paper's focal point was that human dimensions on weather climate and season especially farmer's experience, perceptions, and its impact on their economics life. In spite of the scholarly recognition of the local knowledge about climate change there is still lack ethnographic studies, which exclusively focussed on heterogeneity knowledge of local people. Dealing with heterogeneity knowledge my research will provides new insight to thinking about local knowledge regarding climate change and it will be contribute to bridge the gap of knowledge in Nepali anthropology.

To consider weather and climate change it is useful to look at mechanism by which weather affects agricultural output. Parry (1978) summary of this mechanism includes change in length of the potential growing season, planed growth rate, mean yield, variability of yields, level of crop certainty or the probability of given yield, yield quality, sensitivity of plans to agricultural inputs with Parry's potential effects as a background, I choose orange as an indicator because increase temperature influence on the quality and quantity of orange. Orange production is related to people livelihoods and its fluctuation directly affects their economic factor. Local people are not only observers of climate changes but are also actively trying to adopt to the changing condition to sustain their family economy. Reducing vulnerabilities, developing coping mechanisms, and implementing adaptive measures are the solution of climate changes.

The setting

In the Ilam district, there are several places where farmers have been cultivating orange commercially. Namsaling was a pocket area of orange production and it has long history of producing orange but orange cultivation of Namasaling has been gradually declining over the last few years due to climate change. The study site Namsaling is a hilly area situated in the eastern part of Ilam district. This area spreads over the height and attached with Churia range with varied topographic condition in southern part. It depends on the climatic condition of Himalaya range because of its height. It directly strikes over this area and balances the appropriate climate for orange production. Due to terrain landscape, the area was suitable for understanding the climate change and, its impact on orange production. Six wards mainly depend on orange production in Namsaling village. *Ramritar*, *Khaggaun*, *Tamanggaun* and *Dadagaun* were selected for detail research purpose with recommendation of local people.

The village is mixed in terms of caste and ethnic groups. The main caste and ethnic groups are Brahmin, Chhetri, Tamang, Rai, Limbu, Yakkha and Dalits who are living for several generations. However, Limbu are the traditional habitat of the area (Caplan, 1972). Rai and Limbu have their own language which they used to communicate within own groups whereas others groups use Nepali language to

communicate to others. This area is steep down to northern part with dense forest resources where Bhramins, Chhetri and Newar are living together but the Rai, Limbu are at the bottom of the study area. There are diversified group with social harmony of people. There are **1299** households in Namsaling. The population is 5752, among them 2778 are male and 2974 are female (Population Census, 2068). This study was conducted at four villages namely, *Ramritar*, *Khagegaun*, *Tamanhgaun*, *Dadagaun*. Total households are 589. The dominant groups of this area are Rai, Limbu, Chhetri, Bhramin and lastly the minority group is Newar and Dalit. When we talk about the historical background of orange farming we find various ethnic groups engaged in orange farming. Some of them are the Yakkha, Tamang, Rai, Limbu, Brahmin, Chhatri. To begin with, people of Yakkha community are found to be engaged in the orange farming profession from long time pass to till date.

In terms of economic condition of the orange farmers, whose life and livelihood is fully dependent on orange income, life has been severely hampered. Many informants have said to me that they would receive more than thousand hundred rupees by selling oranges one at a time. To that received of money they would use in the schooling of their children and household activities. Similarly, they would use this money to benefit their health while necessary. Their family chores also are fulfilled from the income of orange production. In addition, diseased orange plants and production of quantity of oranges have life wrenching effect and consequences. A slight change in temperature has all to do with the great change in the life of many people. This is a good example of climate change. It is a sour reality that climate change severely affecting the life of people who have lower economic status.

Methods

The fieldwork conducted in Namsaling took place in 2018, with a specific focus on collecting qualitative data pertaining to local knowledge, farmers' understanding, and responses to climate change using various methods to gather data, including engaging in conversations with farmers, observing their interactions with the natural environment, and documenting their narratives and stories. This approach facilitated a contextualized understanding of the impacts of climate change on the agricultural production in the region. Valuable insights were also derived from informal discussions with local elders, which provided a broader perspective on the changes occurring and their consequences for the farming community.

To supplement the primary data gathered during fieldwork. This secondary data was classified based on the specific research objectives, ensuring a systematic approach to the study. Subsequently, a comprehensive data analysis was conducted, involving organization, sorting, coding, reduction, and pattern identification. This analytical process aimed to create a coherent and comprehensive interpretation of the data, addressing the research questions that guided the study.

In addition to the primary and secondary data collected during fieldwork, relevant information from various external sources was also incorporated into the study. These sources included books, journals, internet resources, and previous research studies, which enriched the understanding of the subject matter and provided a broader context for the analysis.

Discussion

It has been explained the perceptions of the local people on rainfall, temperature and weather in terms of social heterogeneity. Rural people interact and understand the local climatic phenomena according to the significance of landscape. They are aware about climate fluctuation while doing subsistence practices in their living world. Local people have different perceptions on climate change, which is largely based on their lifetime observation of their surrounding by close interaction with environment and local activities. When asked about the change in climate, informants most often began their response by describing the changed pattern in the local climatic condition particularly with respect to the change in rainfall pattern, temperature increase during their lifetimes as well as the impact due climatic related risk and disaster.

Changes in Rainfall Pattern

It was reported that the rainfall has also fluctuated in amount and it has shifted in time. People compared the frequencies and amount of the rainfall that they have noticed in their lifetime. Mr. Bhubhan Limbu of 82 years, a local resident of Namsaling, shared his experience as follows:

"I came here from Dhankuta village and continuously living here since 1960s AD. At my early period, enough rainfall (in winter / summer) used to be prevailing in this place. For ten years, the winter rainfall is almost rare whereas the summer monsoon is also uncertain. Sometimes it falls heavily and sometimes it does not. In addition, due to fluctuated monsoon, the production of rice reduced to half in amount. It directly affected in vegetable and fruits production."

Changes in Temperature

Like change in the rainfall pattern, there are changes in temperature of their area. Namsaling lies at the attitude of 500 meters to 2020 meters above sea level. The informants claimed that the place is getting warmer in comparison to the past days. According to them the days and nights in the winter seasons used to be very cold in the past. However, during recent years, they are experiencing less cold winter days and nights. Similarly, during summer season, the days and nights are becoming hotter according to them. Mr Chandra Bahadur Rai of 71 years said,

"Until 2007, I would use thick woolen blanket in winter night, but now it is not needed." In Namsaling, Krishna Dahal (52) shared his experiences about change in climate as other informants did according to him: "Generally, in the past the winter season last with the start of March (2nd week of the Falgun), but now-a-days it has become hotter after the second week of February the (end of Magh). It creates difficulty in working in the field. For past ten years, we have changed our working time, we have begun to work in the morning and the evening instead of the daytime which we used do in past."

From the above illustrations, it is clear that people have their own way of understanding about the phenomena happening in their surroundings. They frame their understanding in relation to the activities they have performed the course of

their existence. From the above-mentioned narratives, it is clear that people have been observing & knowing the change in their environment. They offer an alternative way to explain the change than scientific explanation.

Given area's dependence on orange, they had done commercial farming. However, climatic conditions have become more critical for people's livelihood strategies in Namsaling. When orange production declined, it was not possible for grow orange to farmers and similar crops to easily shift over to other crops, because of massive start up investment for trees nurtured. In this regards an elderly farmer (aged 75) narrates his life history about orange production and its uncertainty:

"Namsaling was very cold before 45 years ago and there used to be very healthy production of oranges, lemon items, peers, guava, *bhogate*. One orange plant used to yield 100 kg of oranges those days. In addition, all those products used to be sold in Sanischere bazaar of Jhapa district carrying them in the back of people '*Dhakar*'.

Oranges would yield in the low terrain of Namsaling village. In addition, slowly and gradually the height level of orange to give yield is increasing. The alpine location of 35 years ago Namsaling has become '*Aual*' (temperate zone) due to increase of temperature no citrus items are produced in this area now a day.

To yield orange those days we had to do nothings more than planting at but now a days we have to care orange tree like a child. However, the yield of orange tree has drastically decreased. Now a day is an orange plant just gives 15 kg oranges only. Contrary to the previous time, oranges now a day are small, sour, and difficult to peel. In the recent past three years the production of oranges is the worst case."

An orange farmer narrated his story about orange production he (aged 72) said,

"The production of an orange has drastically decreased at present in comparison to the past. Around one and half decades ago, we used to have very good income from orange farming but in the last 2-3 years, it has plummeted. In the past, one orange plant would yield around 200 kilograms orange fruits while it yields only around 30 kg. Small plants simply give around 5 kg only. The orange in the eastern flank are not giving any production."

Similarly, another farmer (aged 58) narrated the loss of orange production like this;

"It has been 2-3 years orange trees damaged. They are not giving any production, Orange trees suffer from diseases. When leaves of orange plant become yellow, they do not yields any oranges. Probably it is due to the climate change and my source of income has decrease. I feel frustrated when I have a side in the orange orchard. In the past the orchard used to yield oranges in full yellow colour now a day it is nothing like that."

Similarly, another informant aged 70 local residences of Namsaling village shared his life history he said:

"Our ancestral home is in Dhankuta and orange is our ancestral profession. Our grandfather worked here, my father did the same and I am engaged in the same profession. I do not remember what my grandfather did but I remember the agricultural activities. However, there is great difference in the time of my father and our time we have our big orange orchard and we used to look down from our home the all yellow orchard. Big and yellow oranges used to be testy and juicy. Furthermore, our father brought paddy-harvesting land from the income of orange. I owned this land from 1990's BC and now I have got 27-28 *ropani* land full of orchard. I brought some improved variety of orange plants and planted in the existing garden initiated by my father. It gave good yield from around 8-10 years. I was able to buy a piece of land at Ilam bazaar from the income of orange. Every year, I would earn Rs 1 to 1.5 million by selling orange fruits. In 2014, I earned one million seventy five thousand from orange and the next year (2015) I earned only 0.7 million and in 2016 I was only earned 83 thousands by selling orange. I think, the next year, I may not earn more than more than 15 thousand."

These narratives state that orange farming of Namsaling is in crisis due to climate change. Each year, farmers are losing their income rooted on orange production. In my discussion with the local orange producer farmers, it was reported that quality and quantity of orange production is not the same for local and hybrid varieties of plant. The local variety of orange are still giving the good yields than hybrid variety. Regarding to it, a local farmer Balkumar Rai (55) stated like this:

"My father had planted local breed of orange plants, which are still giving good yield. These plants are attacked by disease this year only. However, I have planted 150 improved (*kalami*) saplings that gave good product around 5-7 years. They are almost attacked by diseases earlier than local breeds. They do not bear orange. Some of the plants fruited, but they were small, sour in taste, colourless, hard skin, difficult to peel out than the past. It is difficult to separate its segments.

No orange are like that of the earlier time. They are neither big in size nor they testy. Nothing now days are like before. The harvesting time of orange has changed. In the part the used to ripe in the month of November, (*Kartik*) and they got good price. Now a days, they ripe only in December (*Manshir*). I am thinking to leave this profession and start new one. I feel frustrated when I visited the orchard."

The experiences of elderly peoples reveal that the amount of orange has been declined and size, colour, taste has been changed compared to previous years. The production amount of orange recorded from District Agriculture Development Office also verifies the farmer's experiences."

Farmers shared their experiences and they said that those 30 years ago, there was quite nice orange orchard in the riverside. Many farmers had planted orange trees and got good production. One young tree used to give nearly 120 kg per year. Gradually farmers were tempted to plant orange trees that were upside. During the time, favourable climate was not seen upside the climate was quite cold there. When the year passed the temperature rose up the summit. Therefore, orange trees started dying from the riverside. 30 years after, almost 10 km up from the riverside, favourable climate is being seen from the orange production. According to the farmers, they say that climate change causes to decrease the production. They have used pesticide, organic and chemical fertilizer next verities of orange trees even they have not controlled to stop dying. Due to decline the orange production, they are facing the economics challenges. One local farmer whose main income is orange production said that:

"I am orange farmer the main income of my home is orange farming. This is my ancestral profession. Its income used to sustain all the expenses of family including the study of my children. However, from some years now it is difficult to sustain my family from the income of orange. In spite of all good care, orange trees have declined to yield good produce. I cannot think of replacing it as I have invested a lot of capital and time in an orange. I am in dilemma what to do and what not to do."

One woman who always worked on orange orchard (aged 45) said that:

"I do not know the reason of not frustration of orange. I have more care then before, providing fertilizer time, managing irrigation. Even so, there is no orange frustration. In the past, it was nice area without much care trees would give full tree yield. I do not know what has happened now."

Orange farmers, whose life and livelihood is fully dependent on orange income, life has been severely hampered. Many informants have said to me that they would receive more than thousand hundred rupees by selling oranges one at a time. To that received of money they would use in the schooling of their children. Similarly, they would use this money to benefit their health while necessary. Their family chores also are fulfilled from the income of orange production. In addition, diseased orange plants and production of quantity of oranges have life wrenching effect and consequences. A slight change in temperature has all to do with the great change in the life of many people. This is a good example of climate change. It is a sour reality that climate change severely affecting the life of people who have lower economic status.

Conclusion

In summary, the study area is facing the significant challenge of climate change. This phenomenon has resulted in alterations in rainfall patterns and an increase in pesticide usage within the region. The local community has been profoundly affected by these changes, with notable shifts

observed in temperature, rainfall, and overall weather conditions throughout their lifetime. The implications of climate change are evident in the drying and decline of plantation areas, reduced productivity, and the depletion of local plant species and resources. These climatic uncertainties present considerable challenges to the livelihoods of the local population, necessitating adaptive responses to cope with the changing conditions.

Notably, rainfall patterns have become increasingly erratic, both in terms of quantity and in terms of timing. Moreover, there has been a substantial rise in temperatures. The direct impact of climate change on orange production has prompted farmers in Namsaling village to adopt local adaptive strategies to mitigate climate-related risks. The changing climatic conditions have significantly affected the community's livelihoods, with some farmers successfully transitioning to alternative crops such as cardamom, Amleso, iskus, and wheat. However, others have faced challenges in shifting to different crops due to the substantial initial investment required for nurturing new trees.

This study provides clear evidence of climate change occurring in the area. The local community has experienced changes in temperature and rainfall patterns over the past 15 years. These changes are reflected in indicators such as declining rainfall, shifting monsoon seasons, warmer winters, fluctuating rainfall within short durations, prolonged droughts, soil erosion, landslides, and increased outbreaks of pests and diseases. The impact of these climate conditions is already visible and poses a severe threat to the community's livelihoods, particularly in terms of agricultural production and income. While the term "climate change" may not be widely recognized within the community, individuals are acutely aware of the phenomena due to the significant changes they have witnessed in temperature, rainfall, and weather patterns throughout their lifetimes. This understanding of climatic risks and disasters profoundly affects their existing socio-cultural and economic systems. Additionally, exploring local perceptions of ongoing climatic events provides valuable insights into how individuals observe and interpret these phenomena.

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