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Perceptions of Climate Change Impacts on Tharu Livelihoods: A Case Study from Birendranagar, Nepal

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Abstract

This study set out to explore how the Tharu community in Birendranagar Municipality, Surkhet District, experiences and responds to the impacts of climate change, particularly in areas like farming, health, income, and the environment. Information was gathered through discussions, interviews, and observations involving 35 community members and one knowledgeable local for their insights. Although climate change is a prominent issue in the world and country, depending on discussions, very little attention is given to climate's impact on indigenous peoples, such as the Tharu, and its mitigation implications. Moreover, research shows that Nepal's Himalayan regions, especially the middle and higher altitudes, are particularly vulnerable. Within this context, the investigation revealed that Tharu people hold varying attitudes and experiences with respect to the impact of climate change on their agriculture, health, and the natural environment. On the one side, the results draw attention to the difficulties of rural communities in adapting to weather variability and environmental modification. However, they also show that rural groups are relatively less informed of the adverse effects of climate change than urban groups. Additionally, the paper brings attention to the implementable tactics being used by the Tharu people in their attempts to manage these difficulties and reduce their effects on their lives. As a conclusion to this research, however, it is highlighted that solutions must be developed with a special focus on the specific challenges faced by rural and indigenous peoples, so as to truly ensure that their voices are heard and their needs are heeded appropriately.

Keywords

Climate change, Tharu community, Biodiversity, Livelihoods, Adaptation Strategies.

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1. Introduction

Climate change is a ubiquitous power that affects the globe on many levels and is one of the most pressing global issues of the 21st century. It is of important environmental, economic, and human health implications. According to Malla (2008), climate change influences the daily lives of people in various ways, impacting agricultural production, health systems, and natural ecosystems. Nepal is one of the countries most affected by climate change, with its diverse topography and dependence on agriculture exacerbating the problem.

Average annual temperature of Nepal rose by 0.03°C-0.06°C respectively between 1977 and 1994 and at an accelerated pace in higher altitude areas than in the low lands (Gurung and Bhandari, 2009). This rate of warming is far greater than the global 0.74°C average warming for the 20th century. Additionally, such weather extremes are also frequent enough, with the monsoon period being shortened and rainfall intensity rising causing traditional agricultural practices to be compromised.

Climate change has created profound problems in Nepal, in the form of altered climate conditions, decline of biodiversity, water stress and the transmission of tropical diseases like malaria and dengue. It has also resulted in more landslide and flood events, which present a serious threat to humans' lives and property. Carey (2007) claims that local communities may possess insider knowledge of the effects of climate change, which could be distinct from scientific storytelling. These communities offer important insights on climate change at shallow ground level, with regard to disasters, and glacial advances.

Studies in Nepal reveal the growing problem of increasing precipitation extremes with serious implications for water management and farm systems (Karki et al., 2017; Devkota et al., 2017). Simultaneously, agro-meteorological information services have also been instrumental in providing farmers with tools for

decision-making based on climate-resilient choices in adjacent areas such as India (Nesheim et al., 2017). But in other parts of the world, including Africa, concerns about the reliability and access to climate data, thus, hamper development of accurate adaptation policy (Dinku, 2019).

The importance of indigenous knowledge systems and local perspectives in describing climate impacts and designing adaptive responses, most notably in the Himalayas or the Tibetan villages settlements (Negiet al., 2017; Byg and Salick, 2009a, 2009b) has been key. Evidence from Ghana and Mongolia yet again illustrates the challenges in connecting scientific methods with folk practices and incidences in farmers' adaptation to climate variability (Ndamani & Watanabe, 2015; Marin, 2010).

Climate change has had tangible effects on food security and agricultural production in Nepal and has led communities to implement varying coping strategies to reduce risk (Budhathoki & Zander, 2020; Dhungana et al., 2020). Research examining the spatial and temporal variability of extreme climatic events, such as precipitation and drought risks, provides valuable insights for designing targeted adaptation strategies (Talchabhadel et al., 2018; Dahal et al., 2016). Policy work, such as the National Adaptation Programme of Action (NAPA), has been successful in mobilizing inclusive and systematic building resilience to climate risks in Nepal (MOE, 2010).

However, from an international perspective, climate impacts warrant adaptive actions that draw on local experience, especially in climate-impacted areas such as Africa, the Himalayas or others experiencing large-scale climate-induced risks (Zvobgo et al., 2022; Chaudhary et al., 2021). Together, these results highlight the complex issues associated with climate change and the role of science, policy, and community engagement in developing climate resilience.

In this context, this research is intended to examine views of the Tharu indigenous group residing in Birendranagar Municipality, Surkhet District, with respect to the influence of climate change on their type of economic activity. It specifically examines how climate change affects agriculture, health, biodiversity, and economic systems, contributing to a deeper understanding of the local and indigenous narratives on this critical issue.

2. Literature Review

The term “climate change” often refers to global warming, but it encompasses broader changes in climatic patterns, including temperature, precipitation, and wind. The National Academy of Sciences defines climate change as any significant alteration in climate measures over time, whether due to natural processes or human activities (Sapkota, 2064). Climate change has been a topic of discussion for decades, but its multifaceted impacts are increasingly becoming a focus of research.

Anthropology offers a special view of climate change that focuses on the inseparable nature of cultural, social, and environmental factors. Anthropologists claim that human adaptation, migrations, and evolution have been affected by a dynamic climate. For example, Marry Doguls points out that good climate conditions in Africa allowed the emergence and development of hominids. Likewise, climatic characteristics of the Ice Age heavily affected human behavior and adaptation (Barnes et al., 2013).

The Himalayan area, and in particular Nepal, is highly susceptible through climate change due to its delicate ecosystem and socio-economic systems (Ojha, 2022). Khattri and Pandey (2021) are observed to recommend that traditional socio-ecological systems in the area are threatened by alterations in rainfall regime, rise in temperature, and biodiversity depletion which are all affecting traditional livelihoods. In districts like Manang and Mustang, rainfall patterns have reversed in recent years, leading to shifts in agricultural practices and housing structures (Dahal, 2009).

Climate change also has significant health implications. Increases in temperature also set conditions for it to be carried by vector-borne diseases, such as malaria and Japanese encephalitis (CARE, 2011). Moreover, with the tendency for heatwaves to become more frequent, floods, and droughts to turn more severe the situation complicates health risks. Gurung (2009) has highlighted that the consequences of climate change on health can be further aggravated by limited health infrastructure, especially in the rural world.

Farbotko (2012) has claimed that climate change is a material issue and a narrative issue and that this issue needs the incorporation of various perspectives to get a comprehensive grasp of climate change impacts. Local knowledge, especially knowledge of indigenous peoples, is of great benefit in recording the impacts of

climate change and in creating appropriate adaptation strategies. According to Poudel (2018), employing ethnographic approaches to capture the experiences of local populations is of great value, as the latter can offering what is missed in the scientific approaches.

This research is based on such viewpoints and attempts to analyze the effects of climate change on the livelihood of Tharu community of Birendranagar Municipality. It tries to make a contribution toward a more complete understanding of climate change and its effects, by integrating local stories and empirical evidence.

3. Research Site and Methodology

The study was carried out in Birendranagar Municipality, Surkhet District, which is in mid-hill zone of Nepal. Home to a variety of ecological systems and an exuberant cultural legacy, particularly for the Tharu people, the region is located in the middle Himalayas and susceptible to the effects of climate change. Through the past decades, dramatic alterations in the biodiversity, agricultural systems, and climatic scenario have made this area the best testing ground to examine the consequences of the climate change on local lives. The survey used an exploratory design to look into the views of the Tharu community on climate change. In this manner, this strategy was chosen to examine emerging and underexplored phenomena. Thirty-five respondents were selected through purposive sampling and one informant for key informant interview in Raharpur Village to include respondents who have one or more of the relevant experiences and insights. Data collection methods included interviews and key informant interview.

4. Data Presentation and Interpretation

Climate change is perceived by the local Tharu community as a major threat to their livelihoods, primarily due to its adverse effects on agriculture, water resources, and overall well-being. Changes in climate patterns, such as unseasonal and erratic rainfall, have disrupted traditional farming practices, while increasing temperatures have exacerbated pest infestations and diseases in crops and humans. These shifts have led to a growing sense of uncertainty and insecurity regarding food availability, agricultural productivity, and daily life.

The community has also observed significant changes in water resources, which have directly impacted irrigation and drinking

water availability. Local respondents associate these challenges with broader climatic changes, including delayed monsoons, reduced rainfall, and prolonged drought periods, which have intensified their vulnerability.

4.1 Impact of Climate Change on Agriculture

Rainfall patterns in the region have become increasingly irregular, with significant variations in timing and intensity. These changes have caused floods during the planting season and droughts during critical growing periods, leading to reduced crop yields and food insecurity. Respondents described struggling to maintain their livelihoods, as they have to work harder to secure basic food needs due to declining agricultural productivity.

One of the critical impacts of low rainfall has been the gradual disappearance of water resources and the degradation of wetlands. Table 1 provides an overview of the perceived effects of low rainfall on water resources in the community.

Table-1 : Effects of Low Rainfall on Water Resources

S. No.	Effect on Water Resources	Respondents Number	Respondents (%)
1.	Drying of water resources	11	31.42
2.	Reduction in pond water levels	10	28.57
3.	Loss of wetlands	14	40.00
Total		35	100.00

Source : Field Survey, 2024.

The above table shows that 31.42% of respondents reported drying water sources, while 28.57% highlighted declining water levels in ponds. Additionally, 40% noted the loss of wetlands, which has severe implications for irrigation and household water use. Wetland degradation, driven by erratic rainfall, has also contributed to the aridification of previously fertile areas, further straining agricultural productivity.

The community observed that the reduced availability of water for irrigation has made it increasingly challenging to maintain traditional farming practices. Delayed monsoons and insufficient rainfall have disrupted the cropping cycle, shortening the growth and maturity periods of crops. As a result, farmers are left with lower yields and higher risks of crop failure.

4.2 Effects of Low Rainfall on Agricultural Production

The impacts of reduced and irregular rainfall on crop production are significant and far-reaching. Table 2 highlights how these changes have affected the agricultural system.

Table-2 : Effects of Low Rainfall on Agriculture

S. No.	Effect of Low Rainfall	Respondents Number	Respondents (%)
1.	Increased production	—	—
2.	Decreased crop production	21	60.00
3.	No change in production	4	11.42
4.	Difficulty in cultivation	10	28.57
Total		35	100.00

Source : Field Survey, 2024.

The above table indicates that majority (60%) of respondents reported a decline in crop production, attributing it to inadequate rainfall and shifting climatic conditions. Another 28.57% mentioned facing significant challenges in cultivation due to changes in weather patterns, such as prolonged dry spells and unseasonal rain. These respondents explained that traditional farming methods are no longer sufficient to cope with the unpredictable climate, requiring new strategies and techniques.

4.3 Effect of Irregular Rainfall on Agriculture

Irregular rainfall poses an additional challenge, causing both flooding and inadequate water supply at different times. Respondents shared their experiences of crop damage due to excessive rain or waterlogging, while others struggled with low yields from insufficient irrigation. Table 3 summarizes these findings.

Table-3 : Effects of Irregular Rainfall on Agriculture

S. No.	Effect of Irregular Rainfall	Respondents Number	Respondents (%)
1.	No cultivation	4	11.42
2.	Crop drowning	2	5.71
3.	Flooding	14	40.00
4.	Irregular crop production	15	42.85
Total		35	100.00

Source : Field Survey, 2024.

Table-3 indicates that 42.85% of respondents experienced irregular crop production, while 40% reported flooding due to heavy rains. Crop drowning (5.71%) and disrupted cultivation (11.42%) were also noted as significant consequences of erratic rainfall. These issues highlight the pressing need for adaptive measures to mitigate the adverse effects of unpredictable weather on agriculture.

4.4 Impacts of Temperature on Agriculture

Rising temperatures have further compounded the challenges faced by the Tharu community. Higher temperatures have disrupted natural growth cycles, increased the prevalence of pests and diseases, and reduced the germination period for seeds. Table 4 illustrates these impacts.

Table-4 : Impacts of High Temperature on Crops

S. No.	Effect of Irregular Rainfall	Respondents Number	Respondents (%)
1.	Irregular flowering	11	31.42
2.	Reduced germination period	4	11.42
3.	Spread of pests/diseases	20	57.14
Total		35	100.00

Source : Field Survey, 2024.

The above table shows that more than half of respondents (57.14%) reported widespread pest infestations and crop diseases due to rising temperatures. Additionally, 31.42% noted irregular flowering of plants, leading to lower yields and delayed harvests. Reduced germination periods (11.42%) further compound the problem, as farmers struggle to adapt to changing growing conditions.

4.5 Broader Impacts of Rising Temperatures

The effects of increasing temperatures extend beyond agriculture, influencing daily life, health, and economic stability. Table-5 provides insights into these broader impacts on next page. This table shows that a large portion of respondents (42.85%) observed an increase in insects such as flies and mosquitoes, which are associated with higher temperatures. Additionally, 14.28% noted the emergence of new diseases affecting humans and livestock. These challenges have added to the community’s healthcare expenses and reduced their overall quality of life.

Table-5 : Problems Caused by Rising Temperatures

S. No.	Effect of Irregular Rainfall	Respondents Number	Respondents (%)
1.	Increased insects (flies, mosquitoes)	15	42.85
2.	Emergence of new diseases	5	14.28
3.	Irregular rainfall impacts	15	42.85
Total		35	100.00

Source : Field Survey, 2024.

Respondents also highlighted the social and economic burdens of these changes, including increased mortality rates among the elderly, higher disease prevalence, and reduced livestock productivity. The cumulative effect has been a significant strain on the community's resources and resilience.

4.6 Loss of Biodiversity

The effects of climate change on biodiversity in Raharpir, Birendranagar, are becoming more and more obvious. Degradation in temperature by air and land and irregularity of rainfall and climate has led to extinction of both plants and crops that have long supported the community. Forests, grasslands, and wetlands are all losing condition in consequence of which ecological and economic resources are deteriorating. Irregular flowering and fruiting periods of crops and plants, such as rhododendrons blooming prematurely and oranges ripening earlier than usual, disrupt agricultural cycles. These ecological changes, caused by climate change, are at risk of not only biodiversity but also cultural identity and provision of food security in the area. During my fieldwork, one of my respondents, Prem Tharu, aged 47, expressed it as follows:

I am Prem Tharu, I lived in Raharpir, Birendranagar my whole life. I have witnessed the transformation of our forests and fields over the last 10 years more than I care to remember. Trees and plants which were once the cornerstone of our lives are vanishing. We used to have plenty of Kafal (*Myrica esculenta*), Kaulo (*Maesa chisia*), Lapsi (*Choerospondias axillaris*), and Rani Sallo (*Cupressus torulosa*), but now these trees are rare. Some have disappeared entirely. Medicinal plants including Pipla (*Piper longum*) and Gurjo (*Tinospora*

cordifolia) which our seniors used for curing diseases are no longer available in this location.

Our crops have also suffered. Traditional paddy varieties like Kalo Dhan and Atte Dhan, once a staple of our fields, no longer grow. Even the Pani Makai maize, unique to our village and a source of pride for us, is under threat. It pains me to see our agricultural traditions fade away. I have also noticed strange changes in plants. Rhododendrons flower too early in January or February. Oranges are matured in September or October much earlier than before. Even Kavra (*Ficus lacor*) shoots appear out of season. These imperfections worry me about the future of our community and our way of life.

The life story of Prem is a stark example of how climate change affects biodiversity in Raharpir in a devastating way. The attrition of native plant species, with trees, weedy motive crops, and medicinal plants all losing their stands, is a direct statement of the ecological imbalance generated by increasing temperatures and unpredictable rainfall. These alterations upset the local ecosystem homeostasis, resulting in the depletion of key resource ends in the fields of food, medicine, and culture. The aberrant flowering and fruiting cycles reported by Prem indicates the breaking of ecological cycles that will impact by pollinators, dispersal of seeds, and agricultural production. Not only do these have the effect of decreasing the stock of food and income but also the cultural identity of the Tharu community, which is inseparable from land cultivation.

The story highlights the importance of conservation action, to secure endemic species such as Pani Makai, which has ecological, economic, and social value. These impacts can be alleviated through a number of strategies, including the implementation of reforestation, climate-resilient crop promotion, and the recording of indigenous knowledge. The destruction of biodiversity can be prevented in Raharpir through the identification of the causes behind the loss of biodiversity and the engagement of the local population in adaptation measures where securing the natural and cultural heritage of Raharpir for future generations is possible.

5. Major Findings

- » Irregular rainfall led to the occurrence of flooding during planting time and drought during crucial crop growing time,

hampering agriculture production and forcing farmers to perform effort to meet their basic food requirements.

- ▶ Lower rainfall has broken traditional cropping cycles, shortening the duration for crop growth and development and thereby reducing yield and crop loss risk, many respondents identifying the need for adaptation in farming strategies.
- ▶ Unsteady rainfall led to floods, waterlogging, and erratic crop yield which severely disrupted agriculture activity and traditional approaches have proven to be inefficient to cope with all types of weather variability.
- ▶ Higher temperatures have disrupted natural growth cycles, reduced seed germination periods, and increased the prevalence of pests and diseases, directly impacting crop yields and delaying harvests.
- ▶ Increases in ambient temperature have led to higher incidence of insects and emerging diseases which have outstripped the community's health care capacity and increased the economic costs while also impacting the quality of life and weakening the capacity of the community.
- ▶ Climate change has led to the extinction of species of native plants, crops and medicinal plants of great importance to the Raharpir population, which have periodic, erratic flowering and fruiting that disrupts natural ecological cycles, agricultural practices and food security, along with losing cultural heritage.

6. Conclusion

Climate change presents a serious threat to the livelihood of the Tharu community in Raharpir, Birendranagar, in agriculture, access to water, biodiversity conservation, and life in general. The results demonstrate that uncontrolled rainfall, increasing temperatures and long dry spells have impacted traditional agricultural practices, agricultural production and availability of water for irrigation and household use. These developments have also yielded the intensification of pest infestations, the transmission of human and animal diseases, and the deterioration of natural environments which have rendered the community more and more susceptible. The disappearance of native plants, food crops, and traditional medicinal species represents an emerging ecological disruption, which is not

limited to food security, but also affects the cultural identity and traditional knowledge of Tharu people.

In order to cope with these challenges, adaptive and ecological solutions that incorporate local knowledge and experience is highly necessary. Conservation measures, including reforestation, the preservation of threatened, endemic species, such as Pani Makai, and the encouragement of climate-adaptive agricultural practices, are vital to biodiversity conservation and livelihoods security. In addition, educating communities, providing financial opportunities and ICT access, can contribute to protecting their resilience in the face of climate-related risks. Through a combination of local actions and wider policy measures, it is attainable to preserve the ecological, economic, and cultural legacy of threatened populations, such as Raharpir, for future generations.

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