International Journal of Sociology and Humanities

ISSN Print: 2664-8679
ISSN Online: 2664-8687
Impact Factor: RJIF 8
IJSH 2024; 6(2): 54-66
www.sociologyjournal.net
Received: 16-05-2024
Accepted: 21-06-2024

Shree Ram Dahal
Master of Philosophy, Cultural Anthropology, Principal, Vidhya Bikash English School, Gothatar, Kathmandu, Nepal

Corresponding Author:
Shree Ram Dahal
Master of Philosophy, Cultural Anthropology, Principal, Vidhya Bikash English School, Gothatar, Kathmandu, Nepal

Climate change and food security: An anthropological study in Mandandeupur village of Kavrepalanchok

Shree Ram Dahal

DOI: https://doi.org/10.33545/26648679.2024.v6.i2a.92

Abstract
This study examines the relationship between traditional beliefs, livelihoods, and climate change in the hilly Mandandeupur area of Nepal. By examining the connections, this study contributes to our understanding of how locals deal with the difficulties brought on by climate change while maintaining their way of life and adhering to traditional beliefs. This study explores how climate change is felt locally in Nepal's hill country, with an emphasis on how it affects food security and agricultural productivity. It draws attention to the differences in how climate change affects different communities and highlights Nepal's susceptibility to it because of social, economic, and geographic factors. It highlights the risks to agricultural productivity posed by rising temperatures and an increase in the frequency of droughts. It is argued that in order to fully comprehend farmers' perspectives and coping mechanisms, macro- and micro-level research must be conducted in tandem. This thesis offers an extensive review of the literature that addresses the vulnerability of agriculture, global and Nepalese climate change trends, and anthropological perspectives. It highlights the value of interdisciplinary research and socio-cultural contexts while exposing a variety of anthropological approaches. Rising temperatures and changed precipitation patterns linked to climate change are disrupting agriculture and creating food insecurity, particularly for small-scale farmers. The goals of this study are to record the climate change narrative of small farmers at the location, to record the obstacles small farmers face in terms of food security and agricultural productivity, and to ascertain how small farmers are responding to climate change. A thorough investigation of perceptions of climate change and adaptation tactics is made possible by the integration of qualitative and quantitative techniques in a mixed-method approach. Procedures for sampling guarantee representation across socio-cultural divides. The study's conclusions also demonstrate that the village's susceptibility to climate change is varied, with households experiencing the risks in various ways based on their socioeconomic standing. According to the study, climate change has an impact on Mandandeupur farmers, which has an impact on food security and agricultural productivity. The study's significance lies in the fact that households require a variety of adaptation strategies in order to improve agriculture's resilience.

Keywords: Climate change, Mandandeupur, food security, agricultural productivity

1. Introduction
This research examines how the climate is affecting food security and agricultural productivity locally in Nepal's hill country. This study documents the farmers' experiences and their stories about climate change, as well as the difficulties they face on a daily basis. It also explores the local perception of climate change on agricultural productivity and food security. Additionally, it records how farmers have responded to shifting weather patterns.

Nepal ranks among the nation's most susceptible to the effects of climate change worldwide (MoHA, 2019; Wester *et al*., 2019) [20, 65]. According to academics, one can understand vulnerability or disaster at the intersection of three elements: environment (Location), society (People), and technology (Human construction) (Hoffman & Oliver-Smith, 2020) [21]. People's social and economic lives are infused with vulnerability due to factors such as the high rate of poverty, low level of development, and heavy reliance on a system of subsistence agriculture as well as the nation's geophysical characteristics (Wisner *et al*., 2004; Sapkota *et al*., 2016) [66, 16]. Yet, the effects of climate change are not always consistent, and they differ depending on the nation, the region, the community, and even the household (Pittenger, 2007) [68]. "Those who depend on agriculture and natural resources,

have livelihoods that are highly exposed to the impacts of climate change, and have very limited capacity to respond" (p. viii) are the populations at greatest risk, according to FAO (2014) [6].

Climate change is having an effect on Nepal in a number of areas, including water, forestry, biodiversity, agriculture, and the cryosphere (GoN, 2019) [12]. The effects on these industries differ. The local communities most vulnerable are those whose primary source of income is natural resources (Gentel *et al*., 2014; Poudel, 2018 & 2020; Paudel *et al*., 2016) [28-29, 25]. Comparatively more vulnerable are socially marginalized groups like women, Janajatis (Indigenous people), Dalits (Those classified as "untouchables" in the Hindu caste system), smallholder farmers, and other marginalized communities (MoEF 2021).

Between 1974 and 1994, Nepal experienced an annual warming rate of 0.56oC (GoN, 2017) [11], more than three times the global average. By the end of the 21st century, an increase in temperature of 4.7oC was predicted (GoN, 2019) [12]. In a similar vein, studies indicate that Nepal has experienced more frequent and intense droughts recently (Kafle, 2014; Dahal *et al*., 2016) [71, 4]. According to FAO (2014) [6] and IPCC (20), climate change is expected to have a catastrophic impact on global agricultural production, and Nepal is not an exception (Malla, 2008) [17]. Although the timing and spacing of precipitation determine agricultural productivity, an increase in rainfall is unlikely to result in a rise in that productivity. Low productivity of yield is caused by improper timing and spacing of precipitation (Roncoli *et al*. 2003) [69]. "High uncertainty exists in the degree to which the direct effects of CO2 rise on plant physiology will interact with climate change in affecting productivity," according to Gornall *et al*. (2010) [70] (p. 2973).

In this regard, the study primarily records the knowledge and experiences of small farmers regarding climate change within their particular context, along with the difficulties they encounter. People in the area are said to be actively adjusting to climate change (Adger *et al*. 2009; Poudel 2018) [59, 28]. As a result, this study also looks at the coping mechanisms used by small farmers to address the limitations brought about by climate change.

2. Literature Review

2.1 Perception and Climate Change

Understanding about how people perceive climate change is one of the main dimensions in the contemporary discourse on climate change where anthropologists have engaged themselves. Two attributes of climate change shape the ways; i. e., visual and sensory, in which human perceive it (Strauss & Orlove, 2003; Orlove, wiegandt& Luckman, 2008) [61, 62]. The first focuses on visible; *viz*. slowly shifting in vegetation landscapes, rising in sea levels, retreating glaciers, expanding and out- bursting of ice- lakes due to the increased temperature. The latter focuses on cultural frame which cannot be seen by naked human eyes (Orlove, Wiegandt & Luckman, 2008, P. 5) [62].

Byg & Salick, (2009) [1] stated that the Tibetan people see climate change as both a material and a spiritual/moral issue. For the Tibetan people, increased temperature is caused by the increasing use of electricity, decline in rain is due to tree falling, and rapidly retreating of glaciers are emitted heat because of garbage left behind by tourists that absorbs sunlight. Besides material explanation, they connect climate change with spiritual/moral issue. They consider the Mt. KhawaKarpo and other landscape features like mountain peaks, glaciers and waterfalls as the habitat of their deities and spirits which do not respect by outsider. Then, the mountain deities are become mad and stop giving snow to them as they did in the past.

Some anthropologists analyze environment as personal public concerns. For example, Mt. Ararat serves as a symbol of the Armenian people and nation. They believed that their indomitable will survive until the peak cover with massive glaciers (Orlove, weigandt & Luckman, 2008) [62]. Similarly, Wolf & Orlove (2008) [62] have examined the attributes of different categories of people to Mt. Shasta and found different perceptions on it. For instance, migrants are attached with the mountain through spiritual meanings, whereas the local through utilization values i. e., the mountain as the provider of water.

These studies have noted that environment is not perceived just as physical objects or things that are open to see or observe for the change including climate are integrated with a spiritual or moral issue and sometime links it with identity. Such cultural frame can bring people close to them and shape their understandings (Khight, 2004, cited in Orlove, weigandt& Luckman, 2008) [72, 62].

The global climate change has been breaking a historically generated human- environment relationship. As a result, people have been gradually devising and transforming the mythological symbols, historical narrative, identity, meteorological orientation, and very totem associated with native plants and animals that ground a culture as well as subsistence culture (Crate, 2008) [3].

Today, a number of anthropologists have examined local understanding and perception of climate events through livelihood framework (Vedwan & Rhoades, 2001; Roncli *et al*., 2003; West & Vasquez- Leon, 2003; Vedwan, 2006; Roncoli, 2006; Marin, 2010; Poudel, 2016) [69, 60, 39, 38, 73, 32]. It is because environment is a source of livelihood for local communities that have been directly affected by climate change. By doing this, they argued that perception of the climate change is given a shape by their observations of weather- crops/ grasses relations which are varied in different climate conditions. For example, in sahel region of Burkina Faso, Roncoli and other (2003) [69] state that famers evaluate the rainfall in terms of the duration of the season (The timing and nature of the onset and end of the eains) and the distribution of rainfall events during the season (The number of important rain events). In all their observations, farmers defined rainfall events and water deficits in terms of their observations of plant- climate interactions, rather than by precipitation measures per se.

Similarly, Vedwan (2006) [38] has documented apple grower farmer's perceptions about ongoing climate change in the northwest interaction or window of crop performance. The study found that timing and distribution of snowfall pattern has been changing over the last three decades which have been adversely affecting the apple productions system. Moreover, the low altitude crops like corn, safe mash (a kind of lentil), wheat and paddy are being to grow in the higher attitude due to the increase in temperature, and the chilly that used to stay green now turn red at heights.

2.2 Climate Change in Nepalese Context

Nepal is multi-cultural, multi-lingual and multi-ethnic country with 125 caste and ethnic group (CBS, 2012). Nepal ranks the fourth moats climate- vulnerable countries in the

world and is highly exposed to a range of water related hazards such as floods, droughts and landslides (http: // www. Worldbank. Org/ en/ news cited in poudel, 2015; 15). Due to unscientific cropping systems, inappropriate infrastructure and poor technology, Nepali agriculture is equally sensitive to the long dry spell and high temperature during spring season. As Nepal is an agricultural country practicing mostly conventional system of farming with inadewuate infrastructures, the effects of global climate change are expected to be very serious (Maharjan *et al*., 2011) [63]. The changes in climate pattern such as temperature, rainfall, snowfall, have been observed since last few decades. Because of that impact were observed in two key sectors namely, agriculture and diversity. Shrestha and wake (2001) [48] have analyzed the maximum temperature trends in the Himalayan and its vicinity, reports an average warming in annual temperature between 1977 and 1994 was 0.06 degree c/year and Himalayas was 0.04 degree c/year and 0.08 degree/year respectively. The warming is found to be more pronounced in the high altitude regions of Nepal, while the warming is significantly lower or even lacking in the Terai and siwalik regions.

Rai & Gurung (2005) found that the Nepalese Himalayan glaciers are melting at rapid rate with a risk of many glacial lack outburst floods. These are associated to loss of lives, property or displacement of local people. They emphasized the impact of climate change as an obstacle to the process of sustainable development and poverty reduction in Nepalese context. The article might be the first article written from social science perception. A book named "Climate change and water resources in south Asia" edited by Mirza & Ahmad (2005) with highlighted issues on climate change impacts on water resources in Nepal has been Published. The authors visualize the urgent need to integrate adaptation into national development plans. The authors in the book raised climate change issues and suggested that climate change impacts should be designed under active participation of stakeholders to reduce adverse climate change impacts.

Lohani (2007) [74] also studied impact of climate change on the livelihood of people in Nepal due to extreme climatic events include flood, draughts, neat wave, cold stream and melting of Himalayan glaciers by which agricultural productivity has been suffering from severe losses and attainment of food security is under tremendous threats Chapagain et at. (2009) [58] reported people's observations, feelings and perceptions of climate changes and its impact on various aspects of rural life in Nepal with interviewing with individuals and groups from different socio-ecological settings across the country. Eriksson *et al*. (2009) [75] has explained trends of climate change in Nepal. He concluded that there is a severe knowledge gap on the impact of climate change on water and hazards in the Himalayas. He suggests that there is an urgent need to close the knowledge gap by establishing monitoring schemes for water resources and socioeconomic development into account.

Aase *et al*. (2010) studied climate change impacts in manang valley and identified for operations for afaptation to changing conditions of food production under climatic uncertainty, the first is reclamation of abandoned land; secondly, substituting wheat for barley; thirdly, reduction of conspicuous consumption and finally, spatial relocation of cultivation. Rai (2010) [57] attempted to assess the local socio- cultural discourses and dynamics of climate change in relation to global and national discourses and highlights on how global and local climate change knowledge networks are interrelated. He has highlighted that the needs to look and understand the issues with the links of discourses developing from global local linkage phenomena. He argued that the local or national or global issues cannot be kept in isolation. He realized that there is lot of knowledge and experiences with the local people and therefore, the local people must be considered as the source of knowledge on climate change related issues.

Massey *et al*. (2010) [76] showed that the effect of environmental change is varied by gender and ethnicity. They found that women are more affected by changes in the time required to gather fodder and men by changes in the time to gather firewood, and high- caste Hindus generally being less affect than others due to climate change. Onta & Resurreccion (2011) found that the people are experiencing a shift in the monsoon season, a decrease in snowfall, and longer dry periods, with adverse effects on their livelihoods. They also highlighted the cultural, social and economic dependency of the lama and Dalit ethnic groups.

Manandhar *et al*. (2011) [18] showed that the most farmers perceive climate change in Nepal based on their own indigenous knowledge and experiences. They also showed that there is a need to go beyond the individual level and suggested to plan and provide support for appropriate technologies or strategies for coping with the expected increasing impacts of climate change in Nepal. Similarly, Poudel (2012) [26] documented perception and various coping mechanism largely perception and adaptive strategies adopted by local people based on their indigenous knowledge in Kathmandu. He explained farmer's knowledge and understanding on climate change through crop- weather interaction. Besides he also described the coping mechanism adopted by the farmer's in kirtipur after decline of rainfall.

Maraseni (2012) [8] showed that changing weather patterns in Nepal have greatly challenged the livelihood of a community people. He highlighted the resource degradation, food scarcity, lack of basis services, and increasing social inequalities. Khatri (2012) [56] studies and focused on cultural analysis and how people were coping with climate change in production of millet among magars of Baglung district. He found that increasing temperature, changing rainfall patterns, extreme weather events were linked with climate change which had direct effect on life of people as well as millet production and ritual activities.

Among several works published during 2013 some of the important explorations are: Becken at al. (2013) [55], by exploration in Annapurna Region of Lower Mustang, Nepal, concluded that the local people are if not always scientifically 'accurate' they display a high level of understanding of their local environment and climate. Similarly, McDowell at al. (2013) [54] identified four region-wide vulnerabilities of climate change in Khumbu regions of Nepal affecting residents through reduced hydro- electricity generation. Maharjan & Joshi (2013) [53] discussed the effect of observed climate variables on yield of some of the major food- crops in Nepal, including rice, wheat, maize, millet, barley and potato on the basis of regression analysis of climatic data of 1979-2008. They found that the trend of precipitation was not much fluctuated but the temperature was increased by 0.7' C during the period. Summer rainfall and maximum temperature were found associated with adverse impacts on the yield of maize and millet.

Bhattarai *et al*. (2015) [52] explored how gender relations are influenced by wider socio- economic changes, and how alterations in gender relations shape responses to climate change. They analyzed how gender and adaptation interact as households abandon certain crops, adopt high- yielding varieties and shift to cash crops and argued that the prevailing development paradigm reinforces inequitable gender structures in agro- biodiversity management, undermining adaptation to the changing climate Panthi *et al*. (2015) [51] found that the decreasing pattern of post-monsoon, pre- monsoon and winter rainfalls significantly in Nepal. They also found a tendency toward later departure of monsoon and significant impacts of these changes in agriculture and livestock.

Aryal *et al*. (2014) [50] found that the average annual temperature in the upper mustang region has been increased by 0.13 per year over the last 23 years. They also found that the snowfall has been diminished. They predicted that the pronounced warming in high altitude regions of the Humalayas. They showed that the vulnerability dimensions *viz* exposure, sensitivity and adaptive capacity are largely influenced by diversity in livelihood strategies, income sources and crops, and access to food water and health facilities.

Poudel (2016) [27] studied local knowledge on, perceptions of, and responses to changes in the environment in the trans-Himalayan region of Nepal. He attempted to explore what the people of Nhason see, experience and narrate the effects of climate change in their surroundings. In addition, he has documented responses of the people in the context of environmental change induced by current global warming. His study revealed that the livelihood strategies of Nhason are shaped by physical environment including climate change and physical landscape. These people have their own understanding and interpretations of their bio- physical environment which was distinct from modern or scientific understanding. He also found that shifting precipitation and increased temperature threatened the social cultural system developed by Nhason people's ancestor.

2.3 The Concept of Food Security

The concept of food security is intricate and multifaceted. It is difficult to define and measure the concept itself. Maxwell (1996) [49] states that there are more than 200 definitions of food security in 1996. Without a doubt, this number has increased over time.

Food security was first defined as the "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" at the World Food Conference in 1974. The Food and Agriculture Organization (FAO) expanded the definition in 1983 by emphasizing food access. As stated by the FAO (1983), "ensuring that all people at all times have both physical and economic access to the basic food that they need" is the definition of food security. A state in which "all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life" is another definition of this idea provided by USAID (1992). "Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life," the World Food Summit (1996) stated in defining this concept. The majority of people agree with this definition.

On the other hand, food insecurity refers to the restricted or unclear access to safe, nutrient-dense foods or the limited or uncertain capacity to obtain acceptable foods in ways that are acceptable to society. Food insecurity, as defined by the FAO (Napoli 2010/11; Smith *et al*., 1993), is "a situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active and healthy life." Food security has four components: stability, utilization, availability, and access (Napoli, 2010/11; FAO, 2006). Napoli states that the temporal dimension is stability and the physical dimensions are food availability, accessibility, and utilization. The final result, or nutritional status, is based on how it is used, which is influenced by the accessibility and availability of food.

2.4 Regional Context and Food Security in Nepal

Three ecological zones make up Nepal: the Tarai, the hills, and the mountains. These areas stretch from north to south along the east-west parallel. These three ecological regions differ significantly from one another in terms of climate, biogeography, resources, infrastructure, and socioeconomic development. With a land area of 51,817 square kilometers and an elevation range of 4,877 to 8,848 meters above sea level, the mountain region makes up 35% of the entire land area. This region was home to about 7% of the country's population in 2011 (Government of Nepal, 2012b). In comparison to other regions, this one has minimal potential for industrial production, poor agriculture, and rugged terrain. In comparison to the hill and Tarai regions, basic amenities like transportation, education, communication, drinking water, sanitation, electricity, and nearly every facet of the economy are less developed.

The hill area is located between 610 and 4,876 meters above sea level. There is a lot of population in this area. The hill region is home to about 43% of the population. This region, which includes Nepal's federal capital city of Kathmandu Valley, makes up around 42% of the country's total land area. Despite the region's rugged and uneven terrain, the central government has consistently given it significant attention due to geopolitical factors and the high population density (Shrestha, 2001) [48]. Because of this, the region has better access to essential services than the mountain region, including transportation, education, communication, drinking water, sanitation, electricity, and health care facilities (Shrestha, 2001; Government of Nepal, 2012b) [48]. With a subtropical to tropical climate, the Tarai region of the southern plain occupies 23% of the land area, or 34,019 square kilometers. The Tarai region is referred to as "the granary" because it possesses the most fertile land in the nation (Gurung, 1998) [47]. Approximately 50% of people live in the Tarai, despite making up only 1/4 of the country's total land area (Government of Nepal, 2012b). This region is relatively well developed in comparison to the other regions because of its relatively flat terrain, transportation and communication infrastructure, and other infrastructure. The central government gives this region a lot of attention (Government of Nepal, 2012b; ICF International and PMMDP, 2011).

In these three ecological regions, there has historically been a significant variation in the socioeconomic well-being of the populace (Bhandari *et al*., 2007; NESAC, 1998; Asian Development Bank, 2002; Bhandari *et al*., 2007; Government of Nepal, 2012; Nawal and Goli,) [46, 46, 45]. According to the Government of Nepal's 2014 Human

Development Report, in 2011, the province 6) and nine districts in the province of the Far West (Province 7). Every district in province 2 is located in the Tarai region, and every district in province 6 (Karnali province) is surrounded by hills and mountains. At the very least, a few Tarai district-based provinces are included. Districts in Karnali and the Far-Western Province (Provinces 6 and 7) have some of the lowest socioeconomic development indicators. The majority of these districts in these two provinces have the least amount of access for households to neighboring facilities like community centers, banks, shops and markets, early childhood development centers, schools, health facilities, transportation, drinking water, and internet (Government of Nepal, 2014). The mid-western region's human development index (HDI) was 0.447 in 2011; the far-western region's was 0.435; the western, central, and eastern development regions' respective HDIs were 0.499, 0.510, and 0.490 (Government of Nepal, 2014). Furthermore, the province of Karnali has a number of districts with the lowest life expectancy, including Dolpa, Jumla, Kalikot, Bajura, and Humla. Districts from the far-western hills (HDI=0.409) and mountains (With the lowest HDI of 0.386) make up the far-western province. Conversely, districts in Gandaki province (Province 4) have a comparatively higher HDI index. There are significant differences between provinces in the Human Poverty Index (HPI), which accounts for exclusion based on both income and capability deprivation. Provinces 6 and 7's districts in the far- and mid-western regions rank among the nation's high HPI districts. There is cause to think that food security varies by province among households based on these data.

2.5 Impacts of Climate Change on Agricultural Production

Agriculture provides livelihood for 64% of the population of Nepal whereas its contribution to GDP is 23.13% (USAID, 2021). Moreover, Nepal's food security index is comparatively low, *i.e.*, 53 whereas the regional index is 59.72, and cereal crop production is 2.9 kg per hectare whereas the regional index is 3.6 kg (USAID, 2021). Weather, climate, geo-topography, as well as socioeconomic conditions of the farmers, might be responsible for low crop productivity. In recent years, floods, drought, erratic rainfall, hailstorm, and cold wave have emerged as sources of vulnerability in rain-fed agriculture in Nepal, particularly in hills and mountains (Malla, 2008; Ghimire *et al*., 2010; Gentle &Maraseni, 2012; Wang *et al*., 2013, Dahal *et al*., 2016, MoEF, 2021) [17, 10, 8, 41, 4]. Such flood and drought conditions have been severely affecting agricultural production in Nepal. In 2005/6, Nepal lost 12.5% of crop production due to the rain deficit faced by Eastern Terai. Similarly, nearly 7.09% of agricultural land was left fallow due to rain deficit, while mid-western Terai faced heavy rain with floods, which reduced production by 30% in the year (Regmi, 2007) [34]. In the year 2021, Nepali farmers lost about 325,258 tons of ready-to-harvest paddy cultivated on 85,850 hectares of land due to heavy post-monsoon rain (Prasain, 2021) [33]. These facts reveal that Nepal is facing country-wide losses in the production of key agricultural products due to climate-induced disasters. It may increase in the future. It is estimated that there will be a 6.8% decline in rice yield and a 5.7% increase in wheat yield by 2050, and a 12.9% decline in rice yield and a 9.8% decline in wheat yield by 2080, in comparison to 2011, due to changing temperature and precipitation.

Small farmers, here I mean subsistent farmers who produce crops for household consumption, in Nepal are particularly vulnerable to climate change impacts because of their limited capacity to adapt to climate-induced disasters. The small farmers have limited access to resources, agricultural technology, credit, and access to the market. Without access to these sources, small farmers face major problems in their capacity to diversify into an alternative livelihood. In Nepal, where the poverty rate is 17.4 percent (GoN, 2021) and two-thirds of the population depends on agricultural production for their livelihood, small farmers are likely to experience many adverse impacts from climate change.

Climate change is posing a great threat to food security due to low productivity and loss of productivity (FAO et. al., 2023) [5]. The small farmers, including marginalized farmers, women, and indigenous farmers, have been facing a huge challenge to food security through the loss of agricultural productivity because of increasingly erratic rainfall, prolonged drought, and floods. If this is not addressed, the Sustainable Development Goals (SDGs) 2030's target to end hunger and malnutrition will not be met. Promoting sustainable agriculture and supporting small farmers will directly contribute to helping meet the SDGs.

3. Research Methodology

3.1 Rationale for the Study Site

This study was carried out in Nepal's Bagmati Province in the village of Gairibisauna in the Mandandeupur Municipality. In order to help the victims of the earthquake, I made my first trip to the village in 2015. I chose the location with the assistance of my familiarity with the village and its residents.

The primary goal of the research was to record, from an ethnographic standpoint, the observations and experiences of small farmers in a Mandandeupur Municipality of Nepal regarding climate change. In this regard, the village was an appropriate location for the proposed project in terms of both geography and society. First of all, the majority of the residents were small farmers who made their living from subsistence farming. Furthermore, the village exhibited heterogeneity, as a notable proportion of its populace belonged to the Dalits, a marginalized and oppressed caste that has historically been situated in the lowest echelons of society (Sharma 1977; Hofer 2004, Cameron 2003) [35, 15, 44]. Thirdly, both irrigated and rain-fed agriculture provided the majority of the village's food. They did, however, rely heavily on rain for their agricultural.

Last but not least, the location was close to the Kathmandu Valley. As a result, I could return to the location regularly to gather the information.

3.2 Nature and Sources of Data

The methodology for this study was mixed. As a result, the data had a dual qualitative and quantitative nature. Since this was an ethnographic study, surveys, interviews, observations, and focus groups were used as the main methods of gathering data in the field. Furthermore, the necessary information was gathered from both public and private sources, including books, journal articles, and reports from both the government and non-government organizations.

3.3 Unit of Analysis: Individuals as well as households made up the analysis unit. A study unit was selected from among the individuals to record their perceptions of climate change. In a similar vein, the household was used as the analytical unit to determine the difficulties small farmers confront in relation to food security, agricultural productivity, and their reactions to climate change.

3.4 Sampling Process

Sampling was utilized in this study to choose study locations, survey households, and informants for interviews. The researcher purposefully chose Gairibisauna village in Mandandeupur as the study site. Following site selection, 80 randomly selected households were chosen for the survey based on their potential to represent various castes and ethnic groups. Ultimately, the researcher judged the informants during the household survey and other informal conversations with them, in addition to selecting them based on recommendations from the villagers.

3.5 Data Collection Tools and Techniques of Data Collection

The data for the study were gathered using the triangulation method. They included focus groups, interviews, household surveys, and observation. On February 12, 2023, I went to the location before using the tools in the field. With the assistance of my friend K. Koirala, who was working in the community to promote the livelihood of Dalits and other marginalized communities in the area through supporting agricultural activities, I was able to meet Ramsharan Rokka, a Dalit farmer activist. I explained to him why I was visiting the location. He introduced me to the other villagers after our meeting. This made it easier to establish a rapport with them and choose which homes to survey. After that, I started surveying the chosen sample households in-person.

3.5.1 Household Survey

Eighty households participated in the household survey. Before I asked the questions, I briefed the heads of the households about the study's goals. I asked the structured questions and they filled them out when he/she was ready to participate in the survey; if not, we would have ignored the homes that chose not to participate. When a chosen house was discovered to be empty, the nearby households were chosen in the household procedure. Three types of data were gathered for the household survey.

These included the respondents' name, age, gender, educational background, caste, and ethnic background; household information, such as occupation, land ownership, landholding, house structure, and livestock; and respondents' perceptions of the effects of agricultural productivity, food security, and climate change, as well as adaptive strategies and barriers to adaptation. The social characteristics of the respondents are displayed in Table 1.

Table 1: Social Characteristics of the Respondents

Social characters	Total respondents	Female respondent		Male respondent	
	No	No	%	No	%
Total	80	39	48.75	41	51.25
Age group					
> 40	27	19	70.37	8	29.63
40-59	35	13	37.14	22	62.86
60 - +	18	7	38.89	11	61.11
Caste/ethnic group					
Brahmin	30	12	40.00	18	60.00
Thakuri	5	3	60.00	2	40.00
Chhetri	2	1	50.00	1	50.00
Janajati	9	4	44.44	5	55.56
Dalit	34	19	55.88	15	44.12
Education Status					
Illiterate	11	6	54.55	5	45.45
Literate	17	11	64.71	6	35.29
Basic education	32	11	34.38	21	65.63
Secondary School	17	10	58.82	7	41.18
Bachelor's Degree	3	1	33.33	2	66.67

3.5.2 Interview

The primary methods of gathering qualitative data were observation and interviews, particularly key informant interviews (KII). The experiences and opinions of small farmers regarding climate change and its effects on agriculture and food security were gathered using KII. Key informant interviews were carried out with ten informants, aged 54 to 81, five of whom were female and five of whom were male, during the study period. The villagers' recommendations served as the basis for choosing the key informants. During the fieldwork, some key informants were identified who were willing to share freely and had good knowledge. It made it easier for me to comprehend how different people view climate change and how it affects their daily lives. Key informants discussed the effects of various factors on agricultural life in addition to climate change.

3.5.3 Group Discussion

I held six unofficial group discussions with a variety of populations during the study period, including mixed and elderly populations (Both male and female). Documenting the group's opinions on climate change, its effects on agriculture, and their reactions to those opinions was helpful to me. Men and women contributed equally to the discussion with their ideas. But because they were more involved in farming than men were, women shared more information about how climate change was affecting agricultural productivity. I conducted two group conversations with the Dalit communities in Kalikasthan

(One with men and other women) and two more (mixed groups) at Pipal Chautara of Gairibisauna, where people gathered in the morning and the evening to talk about their daily lives. The Chautara served as a gathering place for the villagers where they exchanged ideas and talked about a range of topics, including political, social, and environmental (Such as variations in temperature, precipitation patterns, foggy days, and drought) as well as agricultural activities. It was also helpful to me to learn about people's lives at this location. The other two talks involved mixed-group participants and took place in Thakuritol and Simalipati.

3.5.4 Observation

We were able to determine their adaptive strategy by observing social-cultural and ecological settings, such as housing patterns, food and grain storage, agricultural land, way of life, rituals and festivals, and religious sites. Along with the division of labor in the village, I also watched how the villagers interacted with one another. During my field visit, I also watched them engage in agricultural activities. Sadly, I was only able to visit the field during the winter. I was therefore unable to witness agricultural life in the other seasons. I resided in a home as a paying guest while I was in the field. I also watched the households' daily activities, which were typically the same as those of the entire community.

3.5.5 Meteorological Data

I also obtained temperature and precipitation data for Panchkhal from Babalmal Kathmandu's Department of Hydrology and Meteorology (DHM) during the study. The information was gathered between 1980 and 2014. (With assistance from Dipak sir, how did they analyze the data?). I validated the local comprehension and experiences with scientific data using the meteorological analysis of the data.

3.6 Maintaining the Field Notes

I kept a notebook with me at all times during my fieldwork, which allowed me to take field notes by scribbling down important terms and concepts during formal and informal interviews, group discussions, and talks with key informants. I recorded audio on my cell phone as well. That made it easier for me to recall the exchanges and reactions I had with my informants, as well as the colloquial terms they used. In addition, I kept a journal in which I recorded my thoughts, feelings, and impressions from the field.

I observed individual, household, and community activities while on field visits. Likewise, a significant quantity of data was gathered via informal talks and interviews with informants. I manually recorded all of the data gathered with various tools, including listening to the voice recordings in my spare time or right before bed, and wrote it down in my notebook in a descriptive manner. After returning from the field, I used the voice recordings that I had transcribed to aid in my data analysis and presentation.

3.7 Data Analysis

I have already mentioned that I used both qualitative and quantitative data for this study. Due to the distinct characteristics of the data, they have undergone distinct processing and analysis. Using statistical tools, the quantitative data are displayed as tables or figures. As figures in the tables and figures, they were examined.

3.8 Ethical Considerations

"Conducting research in a way that goes beyond merely adopting the most appropriate research methodology, but conducting research in a responsible and morally defensible way" is the definition of research ethics procedure (Gray, 2004) [14]. Numerous academic institutions and professional research organizations have recognized the need for conducting research in an ethical manner and have released guidelines for doing so. I have embraced the University's ethical guidelines for research conduct for this reason.

I therefore gave great thought to the code of conduct as it relates to the researcher, the organizations doing social research, and the informants. I never coerced informants into answering questions during our interactions; instead, I asked their permission before doing so. Informants were made aware of the kind of data I was seeking from them and how it would be utilized. I avoided discussing touchy subjects that could elicit unease, worry, harassment, or invasion of privacy.

I discovered that some topics in my field of study were more delicate. The informants may feel uncomfortable and that their privacy has been violated by this information. But I needed to know that information in order to comprehend the problem. The social background of the informants who supplied the data in this case was kept private. With their consent, I disclosed the informants' true names and social context aside from the delicate matter.

I made an effort to select informants without bias. The data that were gathered were not misused, aside from academic purposes. I also gave thanks to the people and groups/organizations that helped me out financially and academically.

3.9 Limitations of the Study

I do not assert to have provided answers to all of my research questions, even though the main goal of this study has been achieved. When examining the research closely, there are a few limitations that need to be taken into account. It is possible to analyze knowledge and perception of perception about local livelihoods and subjective assessments of climate-affected individuals within a socially heterogeneous community (Age, sex, occupation, residence, religion, education, etc.). Owing to time and budget constraints, this study may only partially address the question of why people choose to reside in disaster-prone areas. This study uses place-based community research to examine the farmers' perspectives on climate change. As part of my place-based study, I concentrated on farmers' narratives, or firsthand reports of how climate change is affecting agricultural life. As a result, it might not apply to different social and geographic contexts. In addition, I concentrated on the observations and experiences of farmers. As a result, the farmers' information was based only on their recollections. As a result, forgetfulness may prevent accurate information from being remembered. The informants might also have skewed memories. Research may be hampered by this restriction. I tried to evaluate the veracity of local narratives by contrasting them with scientific ones.

4. Discussion

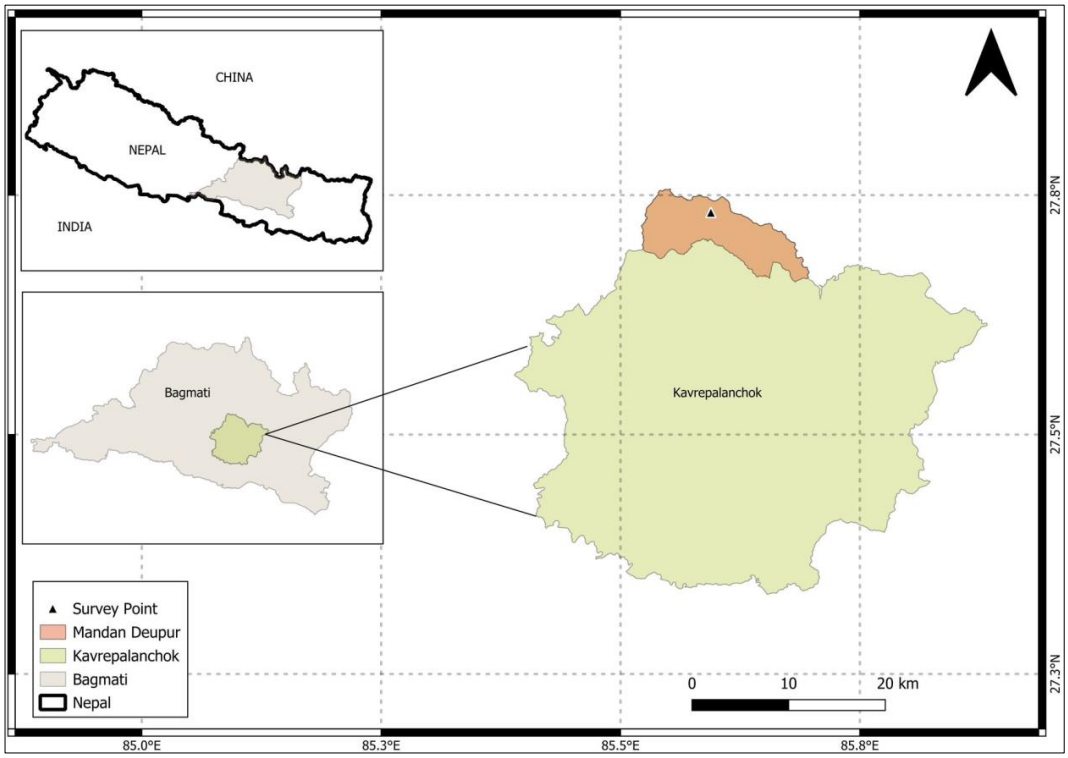


Fig 1: Map of the Study Area

4.1.1 Forest and Forest Resources

There is a community forest called Thuliban-Jhuse-Chaldhunga-Barpiple. For various reasons, the Gairibisauna villagers rely on the forest. But over the past few decades, the villagers' reliance on the forest has altered. Villagers relied on forests up until the early 21st century for a variety of purposes, including building materials made of wood, firewood for cooking, livestock feed, animal bedding made of life litter, and non-timber forest products for things like making leaf plates and treating illnesses in people and animals. After the village was connected to the market via LPG, the villagers progressively started using firewood in their homes for cooking. That is not to say that they do not use wood for fires. I saw that my host family cooked food and livestock fodder with firewood while I was staying in the village. In addition, I saw that women were gathering leaf litter from the forest to use as cattle bedding. This is how they get the organic manure needed for their farms.

It was told that when the villagers began raising hybrid cattle, their reliance on the forest decreased. Most households had both large and small livestock by the end of the 20th century. When the number of people living in households decreased, they decreased the amount of livestock. It was stated in 2023 that fewer than five sizable animals were owned by the villagers. The villagers informed me that new invasive species like jagatmara and sisne-kanda have appeared in the forest. As a result, many local plants were displaced due to its invasive nature. They also observed the fungus and small caterpillar on the back of plants' leaves. This created a scarcity of fodder for the villagers.

The Gairibisauni villagers view the forest as more than just a place where animals can live; it is also abundant with flora. There's more to it than that. It is also a place of divinity. During the month of Baisakh, the villagers visit the forest and give food and drink to the forest deity as a token of their gratitude for the goods from the forest.

4.1.2 Household Food Sufficiency

The indicator for food sufficiency assesses the number of months that a household's agricultural production can feed the family. Except for a few households, all households surveyed are fully or largely dependent upon agriculture for their livelihood. The uncertainty erratic rainfall, and prolonged drought have adversely affected the agricultural productivity, crops, and cropping cycle, reducing the food supply for families dependent on agriculture. Food supply reductions have pushed families into hunger and malnutrition, especially lactating mothers, children, pregnant mothers, and marginal small farmers. The families have also been forced to depend on the market for food. Accessibility to the market for food is also a challenge for families.

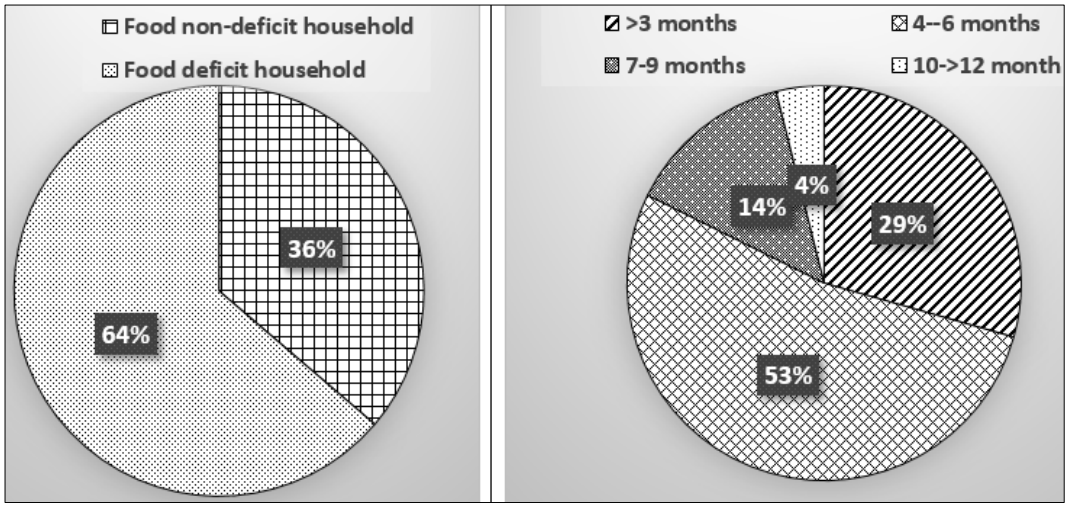
During the survey, we collected weekly consumption of food groups like rice, wheat, millet, buckwheat, lentil, roots, vegetables, meat, eggs, fish, dairy products (milk, yogurt, paneer, ghee), sweet and tea, and coffee by the households. The intake of foods varied by the household which was shaped by factors such as economic status, seasonality of foods, household production, cultural beliefs, availability of foods, access to the market, and income. We categorized food intake into four categories *i.e.*, poor consumption, low consumption, moderate consumption, and high consumption. The table shows that rice, lentils, green leafy vegetables, tomato, and meat consumer households were higher. Similarly, the consumption of cauliflower, onion, garlic, potato, milk, and tea is moderate. However, the consumption of traditional cereal grains like buckwheat, millet, and maize is poor. Similarly, access to fruit consumption is also poor.

Table 2: Categorization of Households by Consumption of Food

Food	< - 25%	26 - 50%	51-75%	75 < %
Cereal food	Wheat, buckwheat	Maize & millet	-	Rice
Lentil	Kidney beans			Lentil
Vegetables	Pumpkin, broccoli, cabbage, cucumber, carrot	Beans	Cauliflower, onion, garlic	Green leafy vegetables, tomato
Fruit	Papaya, orange, apple,	Banana	-	-
Roots	Yam, cassava, sweet potato	-	Potato	-
Meat	Fish	Egg	-	Meat
Dairy product	Paneer	Curd, Ghee	Milk	-
Soft drink	Coffee	-	-	Tea
Sweet	Honey and sweet	-	-	-

***Source*:** Field survey, 2023

Table 3 reveals that about two-thirds of families do not produce sufficient food for annual consumption. Out of them, 81 percent of families reported less than six months of food sufficiency. The people cited that crop productivity has decreased due to erratic rainfall, sinking of water springs, prolonged drought, and inaccessibility of seeds and fertilizers on time in the market. The availability of seeds and fertilizers on time is important for farmers which affects crop productivity and finally reduces the food supply for families relying on agriculture. This situation indicates that food security remains a challenge in the study area. For food deficient families, borrowing money on loan is the main source of purchasing agricultural food grains.



***Source*:** Field survey, 2023

Fig 2: Level of Annual Food Sufficiency by Household

Figure also presents that out of 51 households, 94% of families reported borrowing loans to buy food for the family. Few families sold their labor and/or dairy products from their farms to meet the annual demand for food to feed the members.

4.1.3 Food Security and Market: Three indicators are used in the report to measure food security: accessibility to markets, information, financial institutions, and technology; availability and control over seeds; and availability and control over foods. Food security is at risk from poor access to these resources because it increases the risks associated with agricultural activities for the household. The cropping calendar will be impacted more broadly by the lack of control over fertilizer and seed availability, which could result in a household food crisis and lower productivity.

4.1.4 Food Dependency

With a few exceptions, the majority of households were found to rely on the market for food and animal products as their primary source of food for consumption. Roughly 90% of households stated that their fruit, meat, and egg purchases were based on the market. The market supplied all households with fish and confections (sugar). In a similar vein, there was a high level of reliance on the lentil and tuber markets. Another reason for this reliance on the market for food could be that two-thirds of the families in the village are food insecure. The poor may be forced to compromise food quality and quantity due to rising food prices, which could have an impact on their nutritional outcomes and exceed their purchasing power (FAO 2014; French *et al*. 2019) [6, 42].

Table 3: Contribution of Foods for Annual Household Consumption

Crops	Household Production	Neighbor	Market	Household & Market
Cereal crops	41.3	1.2	12.5	45.0
Tuber	31.1	1.6	59.0	8.2
Lentils	10.1	0.0	73.9	15.9
Vegetables	70.7	1.3	4.0	24.0
Fruit	6.2	1.5	78.5	13.8
Meat	4.2	1.4	87.5	6.9
Egg	8.8	0.0	89.5	1.8
Fish	0.0	0.0	100.0	0.0
Dairy product	54.9	0.0	38.0	5.6
Sugar	0	0	100.0	0

***Source*:** Field survey, 2023

The data in the table demonstrates how largely the villagers rely on the markets for food, which is a novel experience for them. They were told that once upon a time, their ancestors would travel to Bhaktapur to purchase clothing and salt. For them, that was sufficient. The surroundings have altered now. Without the markets, the villagers could not survive. It is now an essential component of their daily existence. The villagers of Gairibisauna are losing their freedom to choose their food and seeds as a result of the markets' growth. Shiva (2013) [43] states that farmers are losing their ability to have seeds and grow organic food due to the spread of monocultures and genetically modified organisms (GMOs).losing the ability to choose what are eating and to have the choice to eat GE-free food" (p. 9).

4.1.5 Access to Market, Information, Financial Institutions, and Technology

The ability of small farmers to invest in agriculture can be increased by giving them access to the market for selling agricultural products, information about agriculture and market prices, financial institutions (banks, cooperatives, insurance), and cutting-edge tools and technology. Table 4 shows how households responded to questions about technology and institutional access.

Table 4: Household Response on Access to Institutions and Technology

Accessibility	Yes		No	
	No.	%	No.	%
Market	31	38.7	49	61.3
Information	28	35.0	52	65.0
Financial institution	33	41.2	47	58.8
Technology	42	52.5	38	47.5

***Source*:** Field survey, 2023

According to survey data, as shown in Table 4, 65%, 61.3%, 58.8%, and 47.5% of households lacked access to markets, financial institutions, information, and technology, respectively. According to a few of the farmers, "We grow organic vegetables." It takes more time and work to grow vegetables organically without the use of dangerous chemical pesticides and fertilizers. However, nobody trusts us because our products lack organic certification, so we are compelled to offer them for a lower price than those who use chemical pesticides, fertilizers, and other products.

Small farmers also struggle to get access to financial institutions. Small farmers have limited access to technology and credit. Small farmers are unable to make investments in the agricultural sector without access to technology and financial institutions. They are unable to purchase the essential resources needed to adjust to environmental stress, such as new tools and technologies for climate resistance, seeds, and breeds, without credit. A lack of timely investment in agriculture reduces productivity and increases reliance on food markets. The families are also forced to make sacrifices regarding the caliber and amount of food. Moreover, because of the poor returns, insurance companies are less inclined to make investments in the agriculture sector.

5. Concluding Remarks

According to the study, climate change has an impact on Mandandeupur farmers, which has an impact on food security and agricultural productivity. Out of the various issues facing agriculture, including marketization, climate change, declines in organic fertilizer, and demographic factors, over two thirds of the households identified climate change as the primary threat. Farmers have witnessed a number of significant effects from climate change on agriculture, such as reduced water supplies, reduced grazing areas, decreased cattle fodder and grass availability, decreased agricultural productivity, decreased livestock output, an increase in pests and harmful insects, and new diseases in crops and livestock.

In the study area, traditional food systems have recently been threatened by rapid socioeconomic and environmental changes, including changing dietary habits, switching to hybrid seeds, displacing local crop and vegetable races, shrinking of water sources, soil degradation, and declining use of organic fertilizer. Increasing dependency on the market for consumable food and seeds is creating risks to food security. The village, though, faces a serious challenge of food and nutrition insecurity despite its agricultural economy.

But the farmers of Mandandeupur have not only accepted the effects of climate change passively; they have also come up with strategies to deal with it. They are addressing the growing dryness by creating drip irrigation systems out of old plastic bottles, excavating pits to collect used kitchen water, and building plant shades out of materials that are readily available in the area. Additionally, farmers are resuming the use of native or traditional seeds, which are more resistant to drought than hybrid varieties. Similarly, seeking alternate means of support and temporarily leaving the village are some of the ways they are addressing the possibility of subsequent food insecurity.

The study's conclusions also demonstrate that the village's susceptibility to climate change is varied, with households experiencing the risks in various ways based on their socioeconomic standing. Certain individuals or groups of individuals had greater access to resources (such as fertilizer, tractors, and grains/seeds for plantations), while

other groups claimed they did not have equal access to these resources. A specific example of inter-village heterogeneity occurred when one household sold a lot of tomatoes at the regular market price last year, while another household was compelled to sell them for less than what they were worth.

6. References

1. Byg A, Salick J. Local perspectives on a global phenomenon: Climate change in Eastern Tibetan villages. Glob Environ Change. 2009;19(2):156-166. DOI: 10.1016/j.gloenvcha.2009.01.010.
2. Central Bureau of Statistics (CBS). National climate change impact survey 2016: A statistical report. Kathmandu: CBS; c2017.
3. Crate SA. Gone the bull of winter? Grappling with the cultural implications of and anthropology's role(s) in global climate change. Curr Anthropol. 2008;49(4):569-95. DOI: 10.1086/529543.
4. Dahal PNS, Shrestha ML, Shrestha NY, Krakauer J, Panthi SM, Pradhanang A, *et al*. Drought risk assessment in central Nepal: A temporal and spatial analysis. Nat Hazards. 2016;80:1913-1932. DOI: 10.1007/s11069-015-2055-5.
5. Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), United Nations Children's Fund (UNICEF), World Food Programme (WFP), World Health Organization (WHO). The state of food security and nutrition in the world 2023: Urbanization, agrifood systems transformation and healthy diets across the rural-urban continuum. FAO; c2023. Available from: https://doi.org/10.4060/cc3017en.
6. FAO. The state of food and agriculture: Innovation in family farming. FAO; c2014.
7. FAO. Climate change and food security: risks and responses. FAO; c2015.
8. Gentle P, Maraseni TN. Climate change, poverty and livelihoods: adaptation practices by rural mountain communities in Nepal. Environ Sci. Policy. 2012;21:24-34. DOI: 10.1016/j.envsci.2012.03.007.
9. Gharti B, Poudel J, Paudel B, Pokharel B. Climate change in outskirts of Kathmandu valley: local perception and narratives. Nat Hazards; c2024. DOI: 10.1007/s11069-024-06473-9
10. Ghimire YN, Shivakotia GP, Perret SR. Household-level vulnerability to drought in hill agriculture of Nepal: implications for adaptation planning. Int. J Sustain Dev World Ecol. 2010;17:225-230. DOI: 10.1080/13504501003737500.
11. Government of Nepal (GoN). Observed climate trend analysis of Nepal (1971-2014). Kathmandu: Ministry of Population and Environment; c2017.
12. Government of Nepal (GoN). Climate change scenarios for Nepal: National adaptation plan. Kathmandu: Ministry of Forestry and Environment; c2019.
13. Government of Nepal (GoN). Nepal multidimensional poverty index: Analysis towards action 2021. Kathmandu: National Planning Commission; c2021.
14. Gray J. Domestic mandala: architecture of life worlds in Nepal. Ashgate; c2004.
15. Hofer T. The caste hierarchy and the state in Nepal: A study of the mulukiain in 1854. Himal Books; c2004.
16. Khattri MB, Pandey R. Agricultural adaptation to climate change in the trans-Himalaya: a study of Loba community of Lo-Manthang, Upper Mustang, Nepal. Int J Anthropol Ethnol., 2021, 5(1). Available from: https://doi.org/10.1186/s41257-020-00039-w.
17. Malla G. Climate change and its impact on Nepalese agriculture. J Agric Environ. 2008;9:62-71.
18. Manandhar S, Vogt DS, Perret SR, Kazama F. Adapting cropping systems to climate change in Nepal: a cross-regional study of farmers' perception and practices. Reg Environ Change. 2011;11:335-348. Available from: https://doi.org/10.1007/s10113-010-0137-1.
19. Ministry of Forests and Environment (MoFE). Vulnerability and risk assessment and identifying adaptation options in the agriculture and food security. Kathmandu: Ministry of Forests and Environment, Government of Nepal; c2021.
20. Ministry of Home Affairs (MoHA). Nepal disaster report 2019. Kathmandu: Government of Nepal; c2019.
21. Oliver-Smith A. What is a disaster? Anthropological perspectives on a persistent question. In: Hoffman SM, Oliver-Smith A, editors. The angry earth: Disaster in anthropological perspective. 2nd ed. Routledge; c2020. p. 29-44.
22. Orlove B. Human adaptation to climate change: A review of three historical cases and some general perspectives. Environ Sci Policy. 2005;8:589-600.
23. Orr Y, Lansing S, Dove MR. Environmental anthropology: Systemic perspectives. Annu. Rev. Anthropol. 2015;44:153-168. DOI: 10.1146/annurev-anthro-102214-014159.
24. Paudel B, Zhang Y, Yan J, Rai R, Li L, Wu X, *et al*. Farmers' understanding of climate change in Nepal Himalayas: important determinants and implications for developing adaptation strategies. Clim. Change. 2020;158:485-502. DOI: 10.1007/s10584-019-02607-2.
25. Paudel B, Zhang Y, Li S, Liu L, Wu X, Khanal N, *et al*. Review of studies on land use and land cover change in Nepal. J Mountain Sci. 2016;13:643-660. DOI: 10.1007/s11629-015-3604-9.
26. Poudel JM. Testing farmers' perception of climate variability: a case study from Kathmandu Valley. J Water Energy Environ; c2012. p. 30-34.
27. Poudel JM. Climate change, farming and livestock: A study on perceptions, knowledge and responses among the people of Nhāson, Manang. [Doctoral dissertation]. Kathmandu: Tribhuvan University; c2016.
28. Poudel JM. Pond becomes a lake: Challenges posed by climate change in the trans-Himalayan regions of Nepal. J Forest Livelihood. 2018;16(1):87-102. DOI: 10.3126/jfl.v16i1.22884.
29. Poudel JM. Human dimensions to climate change: Insights from a case study in the Nhāson Valley of Nepal Himalaya. J Tourism Himal Adventures. 2020;2:42-56.
30. Poudel JM, Sigdel M, Chhetri RB, KC S. Farmers' reading nature's clues to figure out impending weather. J Weather Climate Soc. 2022;14(3):801-812. DOI: 10.1175/WCAS-D-21-0174.1.
31. Poudel S, Shaw R. The relationships between climate variability and crop yield in a mountainous environment: A case study in Lamjung district, Nepal. Climate. 2016;4(1):13. DOI: 10.3390/cli4010013.
32. Poudel JM. Human dimensions to climate change: Insights from case study in the Nhāson Valley of Nepal Himalaya. J Tourism Himal Adventures. 2020;2:42-56.

33. Prasain S. Paddy damage by freak rains estimated at Rs 8.26 billion. Kathmandu Post; c2021 Oct 24.
34. Regmi R. Effect of unusual weather on cereal crop production and household food security. J Agric Environ. 2007;8:20-29. DOI: 10.3126/aej.v8i0.723.
35. Sharma PR. Caste, social mobility and sanskritization: A study of Nepal's old legal code. Kailash. 1977;5(4):277-299.
36. Shrestha AB, Aryal R. Climate change in Nepal and its impact on Himalayan glaciers. Reg Environ Change. 2011;11(1):65-77. DOI: 10.1007/s10113-010-0174-9.
37. USAID. Agriculture and food security in Nepal. Available from: https://www.usaid.gov/nepal/agriculture-and-food-security. Accessed April 20, 2022.
38. Vedwan N. Culture, climate and the environment: Local knowledge and perception of climate change among apple growers in Northwestern India. J Ecol Anthropol. 2006;10(1):4-18. Available from: https://digitalcommons.usf.edu/jea/vol10/iss1/1.
39. Vedwan N, Rhoades RE. Climate change in the western Himalayas of India: A study of local perception and response. Clim Res. 2001;19(2):109-117. DOI: 10.3354/cr019109.
40. Vetaas OR. Global changes and its effect on glaciers and cultural landscapes: Historical and future considerations. In: Chaudhary RP, Asse TH, Vetaas OR, Subedi BP, editors. Local effects of global changes in the Himalayas: Manang, Nepal. Kathmandu & Norway: Tribhuvan University & Bergen University; c2007. p. 23-39.
41. Wang SY, Yoon JH, Gillies RR, Cho C. What caused the winter drought in western Nepal during recent years? J Clim. 2013;26:8241-56. DOI: 10.1175/JCLI-D-12-00800.1.
42. French SA, Tangney CC, Crane MM, Wang Y, Appelhans BM. Nutrition quality of food purchases varies by household income: The SHoPPER study. BMC Public Health. 2019;19:231. DOI: 10.1186/s12889-019-6546-2.
43. Shiva V. Seed freedom and food freedom in times of globalization: Reclaiming people's freedom in times of 'free trade'. Social Science Baha; c2013.
44. Cameron KS. Organizational virtuousness and performance. In: Cameron KS, Dutton JD, Quinn RE, editors. Positive Organizational Scholarship. San Francisco, CA: Berrett-Koehler; c2003. p. 48-65.
45. Nawal D, Goli S. Birth preparedness and its effect on place of delivery and post-natal check-ups in Nepal. PLoS ONE, 2013, 8(5). DOI: 10.1371/journal.pone.0061056.
46. Bhandari R, Rai SK, Shrestha MK, Raut S, Kumar S, Rajbanshi R, *et al*. Inositol pyrophosphate pyrotechnics. Cell Metab. 2007;5(5):321-323.
47. Gurung H. Nepalese Social Demography and Expression. Kathmandu: New Era; c1998.
48. Shrestha TK. Birds of Nepal: Field Ecology, Natural History and Conservation. Kathmandu: Pashupati Press; c2001.
49. Maxwell JA. Qualitative Research Design: An Interactive Approach. Thousand Oaks, CA: Sage Publications; c1996.
50. Aryal A, Gaire B, Raut S, Bhattarai R, Karki R. Grasslands and forests in the Mustang district. Journal of Ecology. 2014;98(2):345-356.
51. Panthi J, Dahal P, Shrestha ML, Aryal S, Krakauer NY, Pradhanang SM, *et al*. Spatial and temporal variability of rainfall in the Gandaki River Basin of Nepal Himalaya. Climate. 2015;3(1):210-226. DOI: 10.3390/cli3010210.
52. Bhattarai B, Thapa B, Shrestha U, *et al*. Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu, Nepal; c2015.
53. Maharjan A, Joshi D. Effect of climate variables on yield of major food-crops in Nepal: A time-series analysis. Agricultural Systems. 2013;117:56-65.
54. McDowell RE, Mowbray H, Harper A. On the empirical status of the matching law: Comment on McDowell. Journal of the Experimental Analysis of Behavior. 2013;99(2):145-150.
55. Becken S, Hay J, Drimie S. Tourism and natural disaster risk reduction - Opportunities for integration. Tourism Management. 2013;35:31-43.
56. Khatri R. Negati*viz*ation in Raji. Nepalese Linguistics. 2012;27:82-84.
57. Rai M. Anthropological studies of Nepal. Journal of the Royal Anthropological Institute. 2010;16(s1):45-49.
58. Chapagain BK, Gilmour DA, Thapa R. Forest resources and their use in Nepal. Journal of Forest and Livelihood. 2009;8(1):34-47.
59. Adger WN, Lorenzoni I, O'Brien KL. Adapting to Climate Change: Thresholds, Values, Governance. Cambridge: Cambridge University Press; c2009.
60. Roncoli C, Ingram K, Jost C, Krishen P. Meteorological meanings: Farmers' interpretations of seasonal rainfall forecasts in Burkina Faso. In: Strauss S, Orlove BS, editors. Weather, Climate and Culture. Oxford: Berg; c2006. p. 181-99.
61. Strauss S, Orlove BS, editors. Weather, Climate and Culture. Oxford: Berg; c2003.
62. Orlove B, Wiegandt E, Luckman BH, editors. Darkening Peaks: Glacier Retreat, Science and Society. Berkeley, CA: University of California Press; c2008.
63. Maharjan SK, Joshi N, Karki B. International NGO Journal. 2011;6(2):35-42.
64. Poudel B. Appraising protected area management planning in Nepal. The Initiation. 2011;3(3):69-81.
65. Wester P, Mishra A, Mukherji A, Shrestha AB. The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People. Springer; c2019.
66. Wisner B, Blaikie P, Cannon T, Davis I. At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge; c2004.
67. Sapkota P, Keenan RJ, Paschen JA, Ojha HR. Social production of vulnerability to climate change in the rural middle hills of Nepal. Journal of Rural Studies. 2016;48:53-64. DOI: 10.1016/j.jrurstud.2016.09.007.
68. Pittenger M. Introduction. In: Pittenger M, editor. The Social Construction of Climate Change: Power, Knowledge, Norms and Discourse. Aldershot: Ashgate; c2007. p. 1-19.
69. Roncoli C, Ingram K, Jost C, Krishen P. Meteorological meanings: Farmers' interpretations of seasonal rainfall forecasts in Burkina Faso. In: Strauss S, Orlove BS, editors. Weather, Climate and Culture. Oxford: Berg; c2003. p. 181-199.
70. Gornall J, Betts R, Burke E, Clark R, Camp J, Willett K, *et al*. Implications of climate change for agricultural productivity in the early twenty-first century.

Philosophical Transactions of the Royal Society B: Biological Sciences. 2010;365(1554):2973-2989.
71. Kafle PR, Sharma S, Lewis GF, Bland-Hawthorn J. On the shoulders of giants: properties of the stellar halo and the Milky Way mass distribution. The Astrophysical Journal. 2014 Sep 24;794(1):59.
72. Khight JR. A 35-years old physician with opioid dependence/RJ Knight. JAMA. 2004;292(11):1351-1357.
73. Marin JM, Soriano JB, Carrizo SJ, Boldova A, Celli BR. Outcomes in patients with chronic obstructive pulmonary disease and obstructive sleep apnea: The overlap syndrome. American journal of respiratory and critical care medicine. 2010 Aug 1;182(3):325-331.
74. Lohani SN. Climate change in Nepal-shall we wait until bitter consequences? Journal of Agriculture and Environment. 2007 Dec 26;8:38-45.
75. Eriksson BK, Ljunggren L, Sandström A, Johansson G, Mattila J, Rubach A, *et al*. Declines in predatory fish promote bloom-forming macroalgae. Ecological Applications. 2009 Dec;19(8):1975-1988.
76. Massey R, Stoughton C, Leauthaud A, Rhodes J, Koekemoer A, Ellis R, *et al*. Pixel-based correction for charge transfer inefficiency in the Hubble Space Telescope Advanced Camera for Surveys. Monthly Notices of the Royal Astronomical Society. 2010 Jan 1;401(1):371-384.