Original Research Article

International Journal of Silkroad Institute of Research and Training (IJSIRT)

Vol-3. No. 2, Jul-Dec 2025 DOI: 10.3126/ijsirt.v3i2.87204 ISSN: 2990-7837 (Online & Print)

Climate Change and Its Impact on Agriculture Sector: Evidence from Western Nepal

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ABSTRACT

Background: Climate change has emerged as a major global challenge, disproportionately affecting agricultural communities in developing countries like Nepal. This study assessed farmers' knowledge and perceptions of climate change and its impact on agriculture in western Nepal.

Method: A cross-sectional survey was conducted among 1,046 respondents from eight wards of the Gandaki district using a structured questionnaire. Data were analysed using descriptive statistics in SPSS v26.

Result: The average age of respondents was 56.05 years, and 93.4% depended primarily on agriculture, although only 18.1% had received formal agricultural training. Educational attainment was low, with 21% being illiterate and 32.4% having only informal education. The majority of respondents (67.8%) had heard about climate change, with radio (65%) and television (53.6%) serving as the most common information sources. Farmers reported experiencing shifting climatic conditions, including irregular rainfall, rising temperatures, and decreased water availability, which they perceived as affecting crop yields, livestock productivity, and overall agricultural stability.

Conclusion: Overall, farmers are experiencing climatic changes but lack sufficient knowledge and adaptive strategies. The findings highlight the need for targeted climate education, strengthened agricultural extension services, and improved rural infrastructure to enhance resilience and support sustainable agricultural livelihoods in western Nepal.

Key words: climate change perception; farmers' knowledge; agricultural impacts; western Nepal.

Received: 8th May, 2025 Accepted: 1th December, 2025 Published: 9th December, 2025

INTRODUCTION

One of the most emerging factors that is a global challenge in this century is the climate change, which has very impactful consequences in ecosystem, livelihood and the economic condition of the nation. The most vulnerable aspects of climate change are the agricultural system, which is the major source of livelihood in developing nations such as Nepal. The majority of population of Nepal relies heavily on the farming which provides them food and income for survival. However, the consequences of climate change such as high temperature, droughts, heavy rainfall, extreme weathers and natural calamities have heavily affected agricultural system, productivity and food security. Despite these consequences, local people especially in rural areas have very limited knowledge of climate change and the idea for tackling its impact have not been ever documented.[1] These farmers are vulnerable to the effect of climate change and yet no alternatives for the adaptation against the climate change has been taught to the farmers. Farmers in this region are experiencing

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critical impacts of the changing climate patterns, but their perceptions, adaptation strategies, and the extent of agricultural impact have not been systematically documented or analysed. This lack of localized evidence poses challenges for developing targeted adaptation and mitigation policies. This study aims to explore the perceptions of farmers in Nepal regarding climate change and assess its observed and perceived impacts on agricultural practices and productivity.[2] It also seeks to understand how demographic factors influence awareness and response to climate risks in the farming community. By analysing field-level data, the research intends to provide a comprehensive understanding of how climate change is shaping agriculture in this region. Understanding these responses can help local governments, policy makers make better strategy, and plans in combating the climate change.[3]

The increasing impacts of climate change on agriculture have created an urgent need to understand how farming communities perceive and respond to these challenges, yet limited empirical evidence exists from western Nepal where livelihoods are highly climate-sensitive. Strengthening farmers' adaptive capacity requires context-specific strategies tailored to geographic and socio-economic conditions, but such strategies can only be developed when local perceptions and knowledge are clearly understood. This study therefore aims to explore households' understanding of climate change and its agricultural consequences, providing evidence that can guide policy interventions, development planning, and capacity-building programs to safeguard rural livelihoods. Specifically, the study assesses farmers' knowledge of climate change and examines their perception of its impacts on the agriculture sector, thereby contributing essential insights for building climate-resilient farming communities.

METHODS

A cross sectional survey was conducted on the house of each ward of western Nepal to study the perception of farmers on the impact of climate change in agriculture. A minimum sample size of 1000 individuals were surveyed from the western Gandaki of Nepal. A structured questionnaire was used to assess the demographic information and the perceptions on climate change. The collected data were stored in Excel for basic statistical analysis and data visualization. SPSS version 26 (Statistical Package for the Social Sciences) was used for the analysis and visualization of the findings. The results of the survey were tabulated according to the answers from the survey takers. The tables consist of the different variables, which are the questions and the frequency and percentage of each answer selected by the survey taker. Descriptive statistics was used to summarize the demographic characteristics.

RESULTS

A total of 1,046 individuals from eight wards of Gandaki district participated in the survey aimed at assessing farmers' knowledge and perceptions of climate change and its impact on agriculture. Of the respondents, 61.7% were male and 38.3% female, with an average age of 56.05 years. The average household size was nearly six members, and the average annual household income was NPR 556,416.67, ranging from NPR 30,000 to NPR 5,000,000. Respondents had been living in their communities for an average of 42.35 years and had an average of 31.26 years of farming experience, indicating long-standing engagement with agriculture. The average landholding for farming was 11.47 ropani, and the

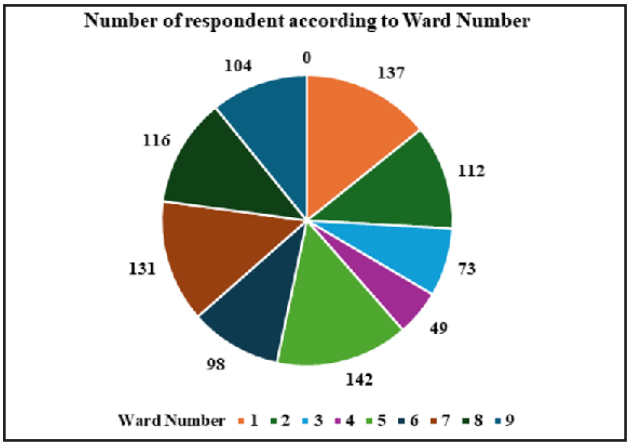

Figure 1. Number of respondent according to ward number.

average distance from farming land to the nearest water source was 614 meters.

In terms of household heads, 47.2% were male and only 8.8% were female, highlighting a gender imbalance in agricultural decision-making roles. Education levels among respondents were relatively low, with only 2% having higher education, 12.1% secondary education, 33.5% basic education, 32.4% informal education, and 21% being illiterate. Most respondents were married (92.4%), and family structure data showed that 59.6% lived in joint families, while 40.4% lived in nuclear families. Ethnically, the majority (55%) belonged to Janajati communities, followed by Brahmin (23%), Dalit (9.9%), Chhetri (7.9%), and others. The dominant religion was Hinduism (80.5%), with Buddhists making up 15.6%, Christians 1.2%, and the rest following other religions.

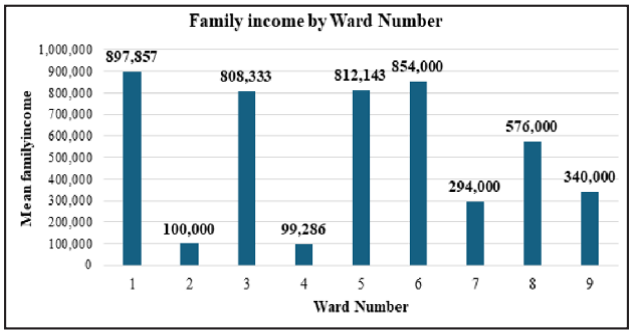

Figure 2. Family income by ward number.

Agriculture was the main occupation for 93.4% of respondents, while a small percentage were involved in government service (2.3%), private jobs (0.9%), or business (1.5%). Despite their heavy involvement in farming, only 18.1% of respondents had formal agricultural training or skills, while the remaining 81.9% did not. This indicates a significant gap in agricultural capacity building. Additional income sources included government jobs (average NPR 506,300 annually), daily wages (NPR 130,738.10), private employment (NPR 350,125), foreign employment (NPR 280,652.17), remittances (NPR 469,724.49), pensions (NPR 413,454.55), and other sources (NPR 186,250.09).

Regarding agricultural practices, rice was the most commonly consumed grain, followed by maize and wheat. Wards 2 and 3 had the highest rice consumption,

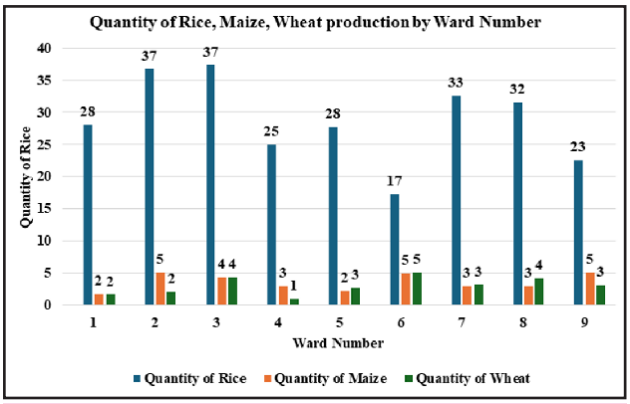

Figure 3. Quantity of rice, maize, wheat production by ward number.

whereas Ward 6 had the lowest. Maize and wheat consumption were highest in Wards 2 and 9. In terms of livestock, goats were the most commonly farmed animals, followed by chickens, buffaloes, and pigs. Ward 5 had the highest number of goats, Ward 6 had the highest number of cows and buffaloes, Ward 4 had the most pigs, and Ward 8 led in chicken farming.

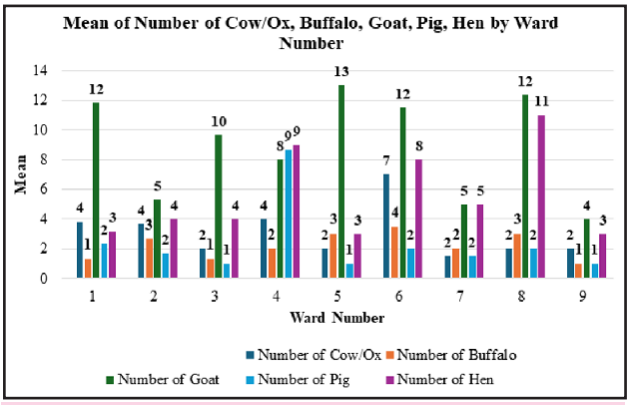

Figure 4. Mean of number of cow/ox, buffalo, goat, pig, hen by ward number.

Regarding agricultural practices, rice was the most commonly consumed grain, followed by maize and wheat. Wards 2 and 3 had the highest rice consumption, whereas Ward 6 had the lowest. Maize and wheat consumption were highest in Wards 2 and 9. In terms of livestock, goats were the most commonly farmed animals, followed by chickens, buffaloes, and pigs. Ward 5 had the highest number of goats, Ward 6 had the highest number of cows and buffaloes, Ward 4 had the most pigs, and Ward 8 led in chicken farming.

On climate change knowledge the core objective of the survey 67.8% of farmers reported having

Average Income from each sources

	N	Minimum	Maximum	Mean	Std. Deviation
Income from Government Job	20	50000	2800000	506300.00	688899.741
Income from daily wages	42	25000	500000	130738.10	92368.314
Income from Private Job	16	50000	3200000	350125.00	771400.620
Income from Foreign employment	23	15000	1200000	280652.17	288193.055
Q11_Remitance	98	10000	5000000	469724.49	547869.74
Q11_penson	11	110000	2000000	413454.55	533763.312
Income from Others	32	1	800000	186250.09	168785.881
Valid N (listwise)	0				

Figure 5. Average income from each sources.

heard about climate change, while 32.2% had not. Among those who had heard of climate change, the primary source of information was radio (65%), followed by television (53.6%). Only 6.7% received information from newspapers and peer groups, and 14.4% mentioned other sources. This suggests that mass media, particularly radio and television, plays a vital role in spreading climate awareness among rural farmers, while interpersonal communication and print media have limited reach.

DISCUSSION

This study was conducted to understand the farmer's knowledge on climate change and to assess the farmers' perception on climate change impact on agriculture sector. For this study, total of 1,046 individuals from eight wards of Gandaki district was surveyed with the premade questionnaire. The first part of the questionnaire consists of the study of demographic representation and its relatedness with farming. The majority of the respondents were around the age of 50 which is middle aged. Similarly, the majority of these individuals were farmers with high level of farming experiences. They were also the long living residence of this place with very stable and knowledgeable farming experiences. However, the house head of each family consisting of female representation was very low as compared with the male representation. This finding shows a minor gender disparity, which affects the decision-making in family and the access to climate change impacts and the information.[4]

The findings of this research showed that the low education attainment of the farmers and residents may affect the knowledge in climate change adaptation. The higher number of farmers were illiterate and some had only basic level of education, which affects their ability to understand and comprehend the information related to science of climate change. Not only that, it will limit their ability to cope up with the current trends on tackling the climate change through different agricultural practices. These issues should be immediately addressed by the local government and the best solution to improve the literacy rate should be acquired.[5] The interesting fact about these native peoples were, despite lacking formal skills, majority of them had strong dependance on agriculture with knowledge and experiences matching with higher educated individuals.[6] The 93.4% of respondents solely relied on agricultural occupation such as farming of crops and rearing of animals, only 18.1% had higher level education and training regarding agriculture and farming. This finding highlights a critical need of improved agricultural extension programs such as formal training and basic education. It was found that the culture and ethnicity was diverse and should be considered in outreach. Due to this diversity, each ethnic group may have different perception on the climate change knowledge. Most of the ethnic group and religious affiliation suggest that climate adaptation programs should align with their cultural practices to maximize the effectiveness and the acceptance of these programs.

The media plays a major role in spreading the information between publics. The most common means of media are radio and television programs, which are also the main sources of information on climate change. Other media such as newspaper may have very minimal impacts.[7] However, new form of media which socialize peoples such as Facebook and YouTube have the major impact on the flow of information about the climate change in every corner of the country. This shows that awareness campaign should prioritize radio and televisions but also acknowledge the presence of social media, which has very high rural outreach. Even though

their high outreach of social media, the awareness on the climate change was very limited. Despite being highly affected by climate change in their day-to-day activities, nearly one third of farmers had never heard of climate change. This gap in information highlights the need of targeted education related to climate change and its adaptation in rural areas.[8] Even though some of them knew about the climate change, the real picture about the impact of climate change was not in their perception. This survey definitely measured the awareness and general farming practices and also the detailed information on how farmers perceive specific impacts of climate change such as, flood, heavy rainfall, drought, excessive heat, crop loss, uncontrolled pests in crops were not reported. This presents an opportunity for deeper qualitative follow-up.

The study also found that most of the households relies on agriculture with no other source of income for sustaining their livelihood. This gap in source of income could cause economic vulnerability and could increase their exposure to climate change impacts, which can be countered with changing the livelihood styles. There was slight variation in crop and livestock preferences among the wards of Gandaki which suggest that awareness about the climate changes could be different in each ward due to the differences in farming practice and resources.[9] Similarly, the average distance to the nearest drinking water sources was 614 meter which could be a major vulnerable factor for climate change impact as it may cause stress due to loss of water sources. This scarcity of infrastructural challenges should be addressed for better water accessibility and for better future planning against climate change.[10]

CONCLUSIONS

In conclusion, while farmers in the Gandaki district demonstrate resilience through their long-term experience and reliance on agriculture, urgent attention is needed to improve climate literacy, promote inclusive agricultural training, and ensure targeted and culturally appropriate adaptation strategies. Strengthening rural infrastructure and diversifying livelihoods will also be essential to enhance community resilience and sustainability in the face of future climate challenges.

Conflict of Interest: None

Funding: None

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Citation: Koirala S, Khatiwada K, Karki S, Ghimire D. Climate Change and Its Impact on Agriculture Sector: Evidence from Western Nepal. IJSIRT. 2025; 3(2):132-137.