People's Perception towards Variability of Climate Change and its Impact on Livestock in Kaski District

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Abstract

Climate change is one of the most important issues of the twenty-first century, and understanding climate change its sources, impacts, and potential amelioration is an inherent development concern. This study aims to analyze the people's perception towards variability of Climate Change and its impact on Livestock in Kaski District. For this purpose, Machhapuchhre Rural Municipality and Ward 19 as well as 20 of Pokhara Metropolitan City and Rupa Rural Municipality were selected for information collection. Information was collected by using a structured questionnaire from 260 respondents with age 45 years and above. A descriptive analysis was carried out for this study. The indicators of variability of climate change were measured in five-point Likert scale.

The majority of the respondents perceived the increment in the annual average maximum temperature, while the timing of rainfall, amount of rainfall and the cases of drought incidents have been increased but annual average rainfall has been decreased. The winter as well as the summer annual rainfall has been decreased. Incidence of new diseases in livestock has been increased. The growth of new noxious weed is the most perceived impact of climate change. Summer hotness has increased milk and meat production whereas winter coldness has decreased milk and meat production. There has been decrement in animal and birds' diversity. Morbidity of the livestock has been increased but the longevity of livestock has been decreased. These findings provide valuable insights into local perceptions, which can guide adaptation strategies and policy interventions.

Keywords: Climate change, perception, rainfall, temperature, variability

Introduction

Climate change is the global challenge of the century. It refers to the change in climatic conditions over time due to either anthropogenic or nature-induced causes, which remains for decades or longer and shows distinct variations in its mean (IPCC 2007). The global surface temperature has increased by 0.85°C over the period from 1880 to 2012 (IPCC, 2014). The latest report of inter-governmental Panel on climate change (IPCC-AR6, 2023) synthesis also reveals that the global surface temperature was 1.08°C [0.95 to 1.20]°C in 2011-2020. There are other numerous visible evidences that also confirm that the climate change has occurred globally (Adhikari & Mathema, 2022; Intergovernmental Panel on Climate Change (IPCC), 2023).

Nepal is one of the most vulnerable countries to climate change in the world. Climate change poses serious threats to livestock production. These impacts are difficult to quantify due to the sector's uncertain and complex interactions between agriculture, climate, the surrounding environment, and the economy. Increased temperatures, shifts in rainfall distribution, and increased frequency of extreme weather events are expected to adversely affect livestock production and productivity around the world. These adverse impacts can be

the direct result of increased heat stress and reduced water availability. Indirect impacts can result from the reduced quality and availability of feed and fodder, the emergence of livestock disease and greater competition for resources with other sectors (Thornton, 2010; Thornton and Gerber, 2010; FAO, 2009).

Agriculture is the backbone of country and main economic activity of majority of rural Nepalese people. Agriculture and forestry sector contribute 25.8% to the gross domestic product (GDP) and provide employment opportunity to 73.9% of a total employed population. Similarly, the livestock alone contributes 27% of Agriculture Gross Domestic Product and about 13% of national GDP (MOF, 2021; CBS, 2019; MALD, 2021).

Though, there are huge number of studies on climate change and its impact on agriculture sector, there are few studies on climate change and its impact on livestock in Nepal. In this context, this study aims to analyze the people's perception towards variability of Climate Change and its impact on Livestock in Kaski District.

Data and Methods

This study has adopted descriptive research design as it aims to assess the perception of people on variability of climate change in Kaski district. Further, this study has followed a multi-stage sampling technique in which Kaski District was chosen purposively at the first stage since there are maximum number of buffaloes in the district. At second stage, Machhapuchhre Rural Municipality, Pokhara -20, Pokhara-19 and Rupa Rural Municipality were selected purposively. There are 5512, 1027, 2610 and 762 households in these study sites. So, total population of this study is 9911. At third stage, ward 7 of Rupa Rural Municipality

& 3 and 4 wards of Machhapuchhre Rural Municipality are selected randomly. Out of 9,911 housholds, information was collected from 260 households (at 6% margin of error and 5% level of significance) which is proportionately distributed as 145, 27, 68 and 20 respectively in the selected areas. At final stage data was collected from the household head with age at least 45 years or any member of same age in the household as well as residing in that area since last 15 years or more. A descriptive analysis was carried out for this study. The statements on impacts of climate change were analysed in five levels i. e., "strongly agree (5), agree (4), same as before (3), disagree (2) and strongly disagree (1)". Similarly, the Likert scale test was used for analysis of perceptions of the respondents on the climate change.

Likert Scale Test

Index(I) for each scale of a statement =

Number of responses x weight for each column

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total number of responsibilities

Five responses (strongly disagree, disagree, neutral, agree, strongly agree) for each indicator were rephrased and their index was calculated. For example, the number of responses who strongly agreed for all the climatic indicators were calculated separately for each term. It was multiplied by the weight of each column, which we had selected (1, 2, 3, 4 and 5) and then divided by the total number of respondents. The obtained index value for each column were added and finally calculated the weighted mean.

Weighted mean= $\sum I_I$

For peoples' perception towards the impact of climate change on livestock, mean score was directly calculated and rank was given to all the indicators of impact.

Result and Discussions

Based on the information collected from 260 respondents, this study has the following result and discussions:

Characteristics of Respondents

The socio-economic and demographic information consists of statistical or numerical data of the respondents. It presents the analysis of the background characteristics of the respondents interviewed. It includes sex, age, marital status, religion, caste/ethnicity, level of education, Profession other than agriculture and livestock farming, family type, household size, household annual income, household annual expenditure, food availability and distance of shade from road (Table 1).

Table 2
Distribution of Respondents by Background Characteristics

Characteristics	Number	Percent
Sex		
Male	165	63.5
Female	95	36.5
Age (Years)		
Minimum Value=45 years, Average Value= 54.25 years and Maximum Value= 84 years		
Marital Status		
Unmarried	7	2.7
Married	244	93.8
Separated	1	0.4
Widower/Widow	8	3.1
Religion		
Hindu	250	96.2
Buddhist	10	3.8
Caste/Ethnicity		
Brahmin	170	65.4
Chhetri	36	13.8
Janajati	26	10.0
Dalit	21	8.1
Others (……………)	7	2.7
Level of Education		
Illiterate	24	9.2
Literate (Informal Education)	106	40.8
Basic Level (1-8)	62	23.8
Secondary Level(9-12)	50	19.2

Higher education (Bachelors and Above)	18	6.9
Profession other than agriculture and livestock farming		
No other job	150	57.7
Government Job	25	9.6
Non-governmental Job	6	2.3
Business	9	3.5
Others	70	26.9
Household Size		
Minimum Value=1, Mean= 5.05 and Maximum Value=20, SD = 2.39		
Family Type		
Nuclear Family	115	44.2
Joint Family	145	55.8
Household Annual Income (in NRS)		
Minimum Value= 25000, Mean= 343450 and Maximum Value= 1800000		
Household Annual Expenditure (in NRS)		
Minimum Value= 25000, Mean=308603.85 and Maximum Value= 1800000		
Food Availability (in months)		
Minimum Value=1, Mean= 8.28 and Maximum Value= 25; SD = 3.89		
Distance of Shade to the road (in meter)		
Minimum Value= 2, Mean= 40.40 and Maximum Value= 500, SD = 75.75		

Source: Field Survey, 2023

Majority of the respondents (63.5%) were male. The minimum age was 45 years whereas the maximum age was 84 years with average 54.25 years. Majority of the respondents were married (93.8%). Most of the respondents stated that they were Hindus (96.2%) and Brahmin (65.4%). Majority of the respondents (40.8%) were literate (informal education) followed by basic level (23.8%), secondary education (19.2%), illiterate (9.2%) and higher education (6.9%) respectively. Majority of the respondents (57.7%) stated that they did not have other jobs than agriculture. The minimum household size was 1 whereas the maximum household size was 20 and the average was 5.05. More than half of the respondents (55.8%) belonged to joint family.

The average annual household income was Rs. 343450 and the average annual household expenditure was Rs. 308603.85. The maximum food availability period was 25 months whereas the minimum food availability was one month. Furthermore, the average food availability was 8.28 months. Similarly, average distance of shed from the road access was 40.40 meter.

People's Perception on variability of Climate Change

All of the respondents agreed to the statement related to the perception on variability of climate change (compared

within last 15 years). Table 2 shows that almost two fifth of the respondents (37.7%) agreed to the statement that annual average maximum temperature has been increased followed by Neutral (20.8%), Strongly Agree (15%), Strongly Disagree (13.8%) and Disagree (12.7%). More than half of the respondents agreed (50.8%) that summer average maximum temperature has been increased. Almost half of the respondents agreed (49.6%) to the fact that winter average maximum temperature has been increased followed by Neutral (28.8%), Strongly Agree (11.5%), Disagree (8.5%) and Strongly Disagree (1.5%). Majority of the respondents agreed (65.4%) to the statement that timing of rainfall has been changed followed by respondents who strongly agreed (14.2%), neutral (14.2%), disagreed (5%) and strongly disagreed (1.2%) respectively. More than three fifth respondents (64.2%) agreed to the statement that amount of rainfall has been changed whereas there only few respondents who strongly disagreed (0.4%) to this statement. When it comes to summer average rainfall has been decreased, majority of the respondents (59.6%) agreed to this statement while only few respondents (0.4%) strongly disagreed to this statement. Almost three fifth of the respondents agreed (56.2%) to the winter average rainfall

has been decreased whereas only few respondents (0.8%) disagreed with this statement. Almost half of the respondents (48.5%) agreed to the statement that number of drought incidents has been increased followed by respondents who remained neutral (30.4%), strongly agree (14.6%), disagree (5%) and strongly disagree (1.5%). Two fifth of the respondents (40%) agreed to the statement that number of flood incidents has been increased while only few respondents (6.3%) strongly disagreed to this statement. Majority of the respondents (51.5%) agreed to the statement that water availability has been decreased followed by respondents who remained neutral (20%), strongly agreed (19.2%), disagreed (6.9%) and strongly disagreed (2.3%) respectively. Regarding the incidence of diseases has been increased in agricultural sector, three fifth of the respondents agreed to this statement while only few respondents (0.4%) strongly disagreed with this statement. Majority of the respondents (63.5%) agreed to the statement followed by respondents who remained neutral (16.9%), strongly agreed (15.8%), disagreed (3.1%) and strongly disagreed (0.8%) respectively. The past studies conducted in Gandaki province also confirmed the findings of this study (Paudel et al. 2022; Paudel, et al. 2019; Dhakal et al. 2016).

Table 2

Peoples' Perception towards Climate Change

Variables	SDA	DA	Neutral	A	S	Wt.Mean	Rank
Annual average maximum temperature has been increased	0.138	0.254	0.623	1.508	0.750	3.273	VIII
Summer average maximum temperature has been increased	0.031	0.223	0.635	2.031	0.692	3.612	VII
Winter average maximum temperature has been increased	0.015	0.169	0.865	1.985	0.577	3.612	VII

Table 2
Peoples' Perception towards Climate Change

Variables	SDA	DA	Neutral	A	SA	Wt. Mean	Rank
Timing of rainfall has been changed	0.012	0.100	0.427	2.615	0.712	3.865	III
Amount of rainfall has been changed	0.004	0.023	0.496	2.569	0.885	3.977	I
Annual average rainfall has been decreased	0.008	0.092	0.473	2.554	0.750	3.877	II
Summer average rainfall has been decreased	0.004	0.115	0.554	2.385	0.788	3.846	IV
Winter average rainfall has been decreased	0.008	0.108	0.646	2.246	0.808	3.815	V
Number of drought incidents has been increased	0.015	0.100	0.912	1.938	0.731	3.696	VI

Peoples' Perception Towards the Impact of Climate Change on Livestock

Majority of the respondents agreed to statement of decreasing in availability of food, grass, livestock production and weight of livestock, decrement in quality of food, milk, meat as well as, reduction in quality of grass as well as the indigenous grass and water.

Further majority of the respondents perceived that summer hotness has increased meat production where it has decreased the milk production. Similarly, winter coldness has decreased meat production. Majority of the respondents agreed that incidence of new disease in livestock, morbidity of livestock as well as growth in new noxious weed has been increased whereas longevity of livestock and diversity of birds as well as animals has been decreased. Mean score for all the indicators except for the number of livestock is decreased is greater than 3 which means people perceived impact of climate change on livestock. The rank for each indicator shows that growth in new noxious weed, diversity of birds as well as animals has been increased are the most perceived impact and Winter coldness has decreased meat production as well as milk production are the least perceived impact of climate change on livestock.

Table 3
Perception of People towards Impact of Climate Change on Livestock

Variables	SDA	D	N	A	SA	Mean Score	Rank
Growth in new noxious weed	0.8	2.7	12.7	64.6	19.2	3.99	I
Diversity of birds has decreased.	2.7	2.7	13.1	64.2	17.3	3.91	II
Diversity of animals has decreased.	2.7	3.5	16.9	62.7	14.2	3.82	III
Reduced availability of Indigenous Grass	2.7	4.2	15.8	68.5	8.8	3.77	IV
Decreased in Quality of Food	3.8	7.7	15	60	13.5	3.72	V
Incidence of new diseases in livestock has been increased.	2.3	2.3	29.6	55.4	10.4	3.69	VI
Decreased in Quality of Water	3.1	10.8	16.2	60.4	9.6	3.63	VII
Decreased in Availability of Food	5.8	7.7	17.3	58.8	10.4	3.6	VIII
Decreased in availability of grass	4.6	10	16.9	59.2	9.2	3.58	IX
Reduced in quality of grass	4.2	11.2	17.3	58.5	8.8	3.57	X
Quality of milk has decreased.	11.2	7.7	10	63.1	8.1	3.49	XI
Summer hotness has increased milk production.	3.1	3.8	43.5	45	4.8	3.44	XII
Longevity of livestock has decreased.	5.8	12.7	24.2	48.8	8.5	3.42	XIII
Quality of meat has decreased.	12.3	7.3	15.4	57.7	7.3	3.4	XIV
Morbidity of livestock has increased.	5.8	11.9	33.8	35	13.5	3.38	XV
Weight of livestock has decreased	4.6	7.3	16.9	56.5	4.6	3.29	XVI
Summer hotness has increased meat production.	2.7	5	55.8	33.5	3.1	3.29	XVII
Livestock production has decreased	17.3	6.2	13.8	59.6	3.1	3.25	XVIII
Winter coldness has decreased meat production.	4.6	15.4	49.6	26.2	4.2	3.1	XIX
Winter coldness has decreased milk production.	4.6	16.2	50	27.3	1.9	3.06	XX
Decreased in number of Livestock	32.7	11.5	13.1	33.5	9.2	2.75	XXI

Source: Field Survey, 2023

Discussion

The findings of this study highlight a growing consensus among respondents regarding the perceived variability of climate change over the past 15 years. The majority of participants observed an increase in annual average maximum temperature. This aligns with global trends of rising temperatures due to anthropogenic climate change, as reported by the Intergovernmental Panel on Climate Change (IPCC, 2021). Additionally, more than half of the respondents agreed that summer average maximum temperature has increased, while 49.6% noted a rise in winter average maximum temperature. These perceptions are consistent with empirical climatic data indicating seasonal temperature shifts worldwide (Hansen et al., 2010). Changes

in precipitation patterns were also widely acknowledged by respondents. The majority agreed that the timing of rainfall has changed, and perceived a shift in the total amount of rainfall. These observations are supported by studies indicating altered precipitation patterns due to climate change (Kumar et al., 2019). A significant proportion of respondents believed that summer average rainfall has decreased, while more than half observed a decline in winter average rainfall. Similar trends have been noted in regional climate assessments, suggesting that erratic rainfall could contribute to increased drought frequency (Paudel et al., 2022).

Extreme weather events such as droughts and floods were also a major concern among respondents. Almost half of the respondents agreed that drought incidents have increased, while two fifth acknowledged an increase in flood occurrences. These findings are supported by past research indicating the intensification of extreme weather events due to climate change (Dhakal et al., 2016). Furthermore, a majority of respondents perceived a decline in water availability, reinforcing concerns about climate-induced water scarcity (Paudel et al., 2019).

In the agricultural sector, climate variability has led to an increase in disease incidence, as noted by three-fifths of respondents. This finding is in line with research suggesting that climate change exacerbates the spread of plant pathogens and pests, affecting crop yields and food security (Chakraborty & Newton, 2011). These concerns highlight the urgent need for adaptive strategies in agricultural and water resource management to mitigate the adverse impacts of climate change.

Overall, the study's findings corroborate previous research conducted in Gandaki Province (Paudel et al., 2022; Paudel et al., 2019; Dhakal et al., 2016), confirming that climate variability is a pressing issue recognized by the local population. These perceptions underscore the necessity for policymakers to implement adaptive and mitigation measures to address climate-induced challenges effectively.

Further, the findings of this study highlight the significant impact of climate change on livestock, as perceived by the respondents. The majority of respondents reported a decrease in the availability of food, grass, livestock production, and the weight of livestock. This aligns with previous studies indicating that climate change adversely affects pasture growth, forage quality, and overall livestock productivity (Thornton et al., 2021; Ahmed et al., 2020). Temperature variations, particularly extreme weather conditions, significantly impact animal physiology, leading to lower milk yield and reduced meat quality (Nardone et al., 2019). A considerable number of respondents perceived an increase in summer temperatures to be associated with increased meat production, while milk production declined. In contrast, winter coldness was linked to decreased meat production. These perceptions are supported by studies showing that heat stress during summer leads to physiological changes in animals, influencing metabolic rates and altering productivity levels (Hooda & Singh, 2022). Additionally, cold stress in winter has been found to negatively affect feed intake and digestion efficiency, resulting in reduced meat yield (Rojas-Downing et al., 2017).

Another key observation from the study was the increasing incidence of new diseases, livestock morbidity, and the growth of noxious weeds. These findings corroborate research indicating that climate change fosters the emergence and spread of

dynamics and vector distribution (Altizer et al., 2019). Increased weed proliferation, particularly invasive species, negatively affects pasture availability and nutritional quality, further exacerbating the challenges faced by livestock farmers (Shikuku et al., 2020). The study also revealed that respondents perceived a decline in livestock longevity and a reduction in the diversity of birds and animals. Climate-induced habitat changes and resource scarcity are key drivers of biodiversity loss, with cascading effects on both domesticated and wild animal populations (Pachauri & Meyer, 2014). A decline in indigenous grass quality further supports existing literature on how climate change affects the nutritional content of available forage, ultimately influencing livestock health and productivity (Henry et al., 2018).

Mean scores for most indicators exceeded the threshold of 3, indicating that a significant proportion of the respondents acknowledged the impact of climate change on livestock. Ranking analysis showed that the most perceived impacts were the growth of new noxious weeds and reduced biodiversity, while the least perceived impacts were associated with winter coldness decreasing meat and milk production. These rankings provide valuable insights into local perceptions, which can guide adaptation strategies and policy interventions.

Conclusion

The majority of the respondents perceived the increment in the annual, winter and summer average maximum temperature while the timing of rainfall and amount of rainfall have been increased. But annual average rainfall has been decreased. The winter as well as the summer annual rainfall has also been decreased. Growth in new noxious weed, diversity of birds as well

as animals has been increased are the most perceived impact and Winter coldness has decreased meat production as well as milk production are the least perceived impact of climate change on livestock.

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