

A Study of Impact of Climate Change on Livelihood of Farmers in Kumaon Himalaya

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Abstract

Climate change in the Kumaon Himalaya can significantly affect farmers in various ways. Shifts in temperature and precipitation patterns may impact crop yields, disrupt traditional farming practices, and lead to increased vulnerability. Changes in water availability and the melting of glaciers can affect irrigation, essential for agriculture in the region. Additionally, the altered climate may influence the prevalence of pests and diseases, posing further challenges to crop production. Overall, adapting to these changes is crucial for sustaining agricultural livelihoods in the Kumaon Himalaya. The present study is based on both primary and secondary data survey to highlight the impact on farmers livelihood pattern in the study area.

Keywords: Climate Changes, Livelihood, Agriculture

Introduction

Among the emerging issues in the world ‘climate change’ is at the top and it puts the attention of the whole world whether they are developing or developed economies. India is not an exception for this global issue and it is also facing the effects of this threat. Like other parts of the country, the

Indian Himalayan region is also affected by global warming. The Himalayan region is considered to be among the most vulnerable to climate change. The newly carved state Uttarakhand is among one of the hilly states in the Indian Himalayan region where the impact of climate change can be observed in different sectors of the economy.

However, climate change has a severe impact especially on the agricultural sector due to a rise in temperature, increased or reduced rainfall^[1] Cloud bursts, intense episodes of rainfall, less frequency of snowfall, etc.

In the hills of Uttarakhand, the livelihoods are almost totally based on natural resources^[2]. Agriculture in the mountainous state of Uttarakhand is dominated by marginal farmers^[3]. The state has a varied topography which makes it special by dividing the state into different agro-climatic zones from the south plains towards the trans-Himalayan region in the north. Under typical conditions, climate change has affected agriculture and horticulture production and productivity and also reduced animal husbandry practices due to scarcity of water and fodder. This has affected the daily life of the households in the region and they prefer to opt for migration from these regions due to no or fewer opportunities for livelihood. The Rural Development and Migration Commission of Uttarakhand released a report^[4] in September 2019, and according to this report, poor agricultural produce,

and the destruction of agricultural produce by wild animals were among the reasons responsible for outmigration from the state.

Literature Review

A number of studies in past years has been conducted for understanding the impact of climate change in the life of local residents specially in the hilly regions who lives in typical topography conditions. **Negi et. al (2012)** discussed the impact of climate change on the western Himalayan Mountain ecosystem and suggested to make attention on some important area^[5]. **Jethi et. Al. (2013)** studied the consequences of climate change on farm women of wills and concluded that climate change has certain. impact and is affecting the people of Uttarakhand particularly women folks, The impacts will be increasingly felt and will necessitate changes in people's livelihood and lifestyles in time to come, so they suggest that their issues should be addressed in research, development, disaster preparedness, and adaptation and mitigation strategies^[6]. **Rautela and Karki (2015)** discussed the impact of

climate change on life and livelihood in Higher Himalaya and found that changes in floral and faunal population and type together with changed animal behaviour was also observed. The changing climatic conditions resulting in less of livelihood capital, changing agro – livestock conditions and emergence of invasive species^[7]. **Rautela & Karki (2015)** in their study concluded. that both duration and amount of rainfall having changed significantly, most precipitation is received as rain rather than snow. The people at the same time are aware of various storage practices together with nutrient and medicinal value of plants available in their vicinity^[8]. **Datta et.al. (2022)** concluded in their study. the Indian farmers have perceived the temperature warming, decreased rainfall, delayed Onset monsoon and erratic rainfall patterns at climate change^[9]. **Mandwal and Gunwant (2023)** discussed the effect of climate change on farmers of Uttarakhand and came to conclusion that the farmers in state are fighting a difficult battle every day to save their hand and their livelihood^[10].

Research Methodology

a) Study area and Sample Size

The study is conducted in the Ramgarh development block of District Nainital in the Kumaon region of Uttarakhand. Ramgarh development block is totally hilly with scenic views. The total population of the block is 39830 and the block contains 7947 households living in 130 villages. 11932 people are engaged in full-time farming or cultivation and 2753 are marginal cultivators^[11]. Using purposive sampling method 50 households were selected for the study by random selection. The selected households are those families who have agriculture as their primary occupation and some members of the family have also migrated for livelihood.

b) Collection of Data

The study based on primary data collected their interview Schedule and primary survey method. For analysis of the data percentage is used. For secondary data various secondary sources has been used for the present study.

c) Limitations of the study

The study is limited to the village of Ramgarh development block of District Nainital.

d) Objectives of the Study – The present study is conducted using following objectives -

- To study the perception of people towards climate change in study area.
- To study the economic impact of limit change on farmers of study area.
- To study the status of migration due to climate change.

e) Hypothesis of the Study

- Agriculture productivity perception due to climate change is not a cause of migration.
- Agricultural productivity due to climate change is not a cause of transformation of family occupation for livelihood.

f) Outcomes of the Study

The study will be useful for the policy makers to fill the gap between climate change and adaptation on Economy of farmers in the region. The study is focused on Kumaon region of Uttarakhand Himalaya and will be useful for researchers and policy makers in a sustainable way.

Result and Discussion

(1) Perception of people towards climate change

To know the perception of the respondents towards climate change in their region seven questions were asked in this regard and shown in table 1.0. When asked about the increase in forest fires in their area due to climate change 84 percent of respondents responded positively and described that the frequency of forest fires is high in the dry season whether it is summer or winter. According to them this forest fire evaporates the water from the land and is one of the reasons for scarcity of water in the region. 96 percent of respondents responded that they have observed phenological changes for the last few years that they have not experienced before like early flowering etc. 60 percent of respondents replied that there is a decrease in species diversity and some of the plant species have shifted to higher regions for their survival. All respondents feel that there is an increase in average temperature in all seasons as they feel it by their own estimate of experience by observations nearby them. The rainfall frequency and snowfall pattern have also been changed in the study area according to the respondents and all respondents agree with this type of change in the study area. Asking the

question about the availability of water from nearby resources, 70 percent of respondents accepted that they found a change in water availability to the sources nearby them. Most of the water resources

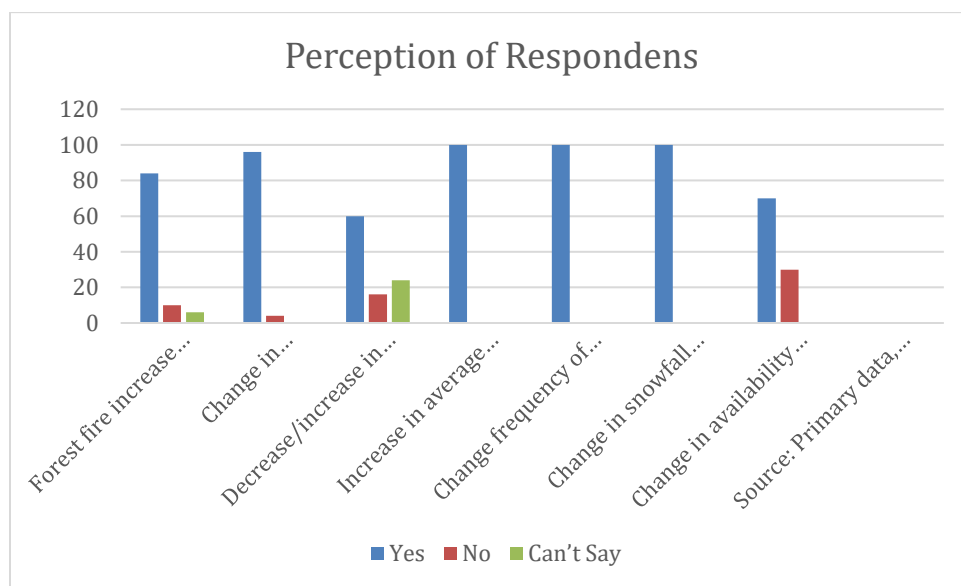
become dry after two or three months of post-monsoon as they were the source of water for a whole year before two or three decades.

Table 1.0

Perception of people towards climate change in study area

Perception for -	Yes	No	Can't Say
Forest fire increase due to climate change	84	10	6
Change in phenological behaviour	96	04	0
Decrease/increase in species diversity	60	16	24
Increase in average temperature in all season	100	0	0
Change frequency of rainfall	100	0	0
Change in snowfall pattern	100	0	0
Change in availability of water in nearby water resource	70	30	0
Source: Primary data, showed in percentage [N= 50]			

Figure 1.0



(2) Impact on Agriculture and allied activities

Table 1.1 elaborates on the impact of climate change on agriculture and allied activities. Climate change has a significant negative effect on agricultural productivity [12] as responded to by the respondents in the study area while asking questions. 90 percent of respondents accepted the change in their agricultural productivity. 60 percent of respondents accepted the increase in the use of fertilizers due to low productivity, 80 percent said yes when they were asked

about the increase in infestation in crops in their fields, all respondents responded for an increase in the problem of weeds, increase in the threat of wild animals and decrease in animal husbandry practices due to scarcity of water and fodder in nearby forest. 70 percent admitted that they had left agriculture practice in their most lands due to various reasons which also include climate change. 80 percent responded that there has been less fruit or vegetable production in recent years when comparing to the previous time.

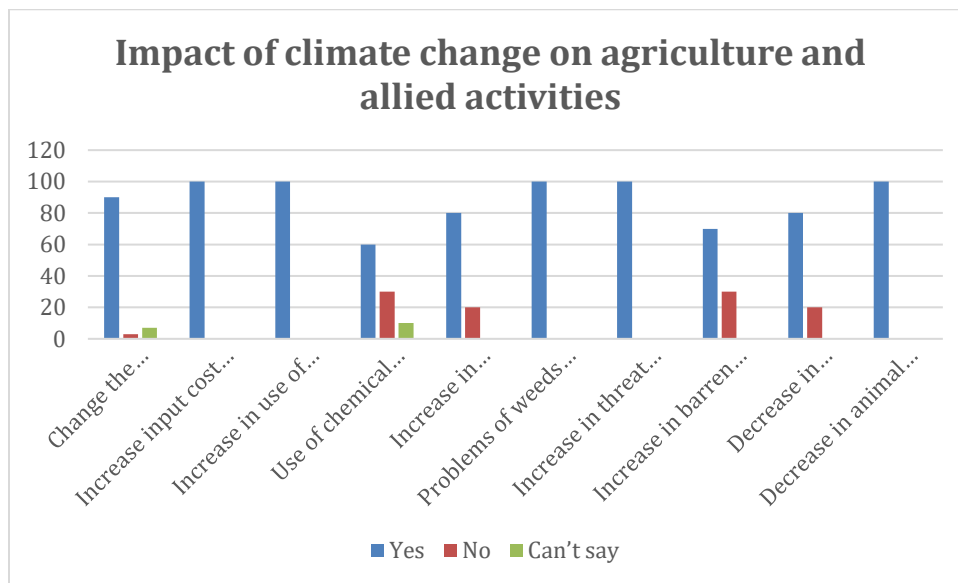
Table 1.1

Impact of climate change on agriculture and allied activities in study area

Impact on -	Yes	No	Can't say
Change the agriculture productivity	90	3	7
Increase input cost for agriculture	100	0	0
Increase in use of pesticides	100	0	0
Use of chemical fertilizers (increase)	60	30	10
Increase in infestation in crops	80	20	0
Problems of weeds in farmland (increase)	100	0	0
Increase in threat of wild animals to agriculture	100	0	0
Increase in barren land (left by the farmer due to various reason due to climate change)	70	30	0
Decrease in productivity of horticulture produce	80	20	0

Decrease in animal husbandry practices due to scarcity of water, fodder etc.	100	0	0
Source: Primary data, showed in percentage [N= 50]			

Figure 1.1



(3) Impact on Livelihood and Migration

Climate change has affected the lives of people in hilly, regions where there is agriculture is the main occupation of people, and have fewer opportunities in other sectors of the economy. Lack of infrastructure and other facilities while joining hands with typical topography makes life so hard in these regions. To find the impact of climate change on livelihood and how this forced people to migrate some questions were asked to the respondents

and Table 1.2 discusses the respondent's responses to these questions. When asked about the decrease in agricultural land per household as climate change is one of the reasons (70% responded 'yes' in the answer), 80% admitted that their interest has declined in agriculture and allied activities and they wish to transform their work and all respondents responded positively that decline in agriculture productivity affected their economic status. About three-fourths of the state's

population is rural and virtually all depend on agriculture ^[13]. Migration is a perennial problem ^[14] in Uttarakhand at least one person migrating for employment from their household ^[15]. When asked to the respondents that is there any migration from that family due to a decline in agriculture and inability to diversify their livelihood in the study area, 80% percent respondents responded positively. Among other questions regarding, the transformation of family occupation due to climate change and the increase in

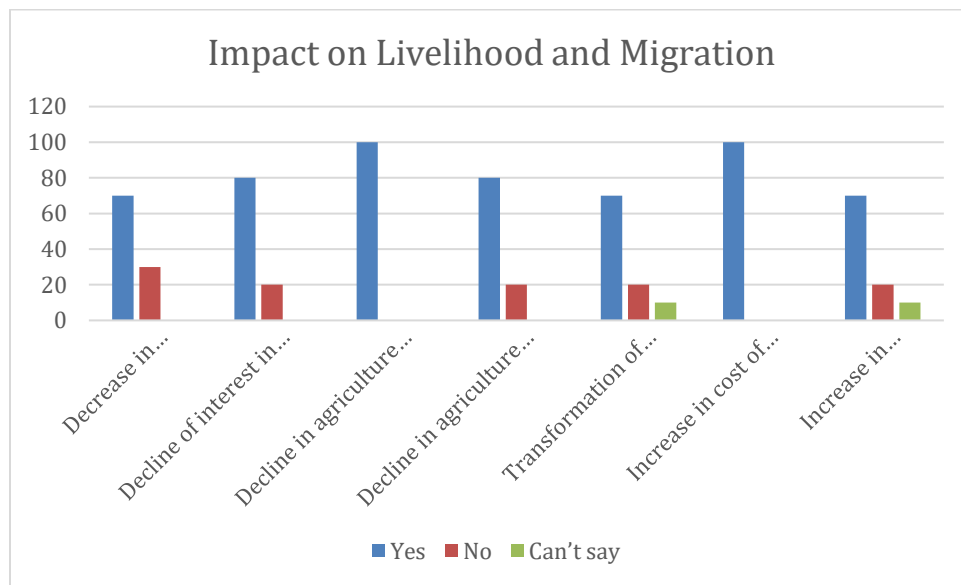
dependency on income other than agriculture and allied activities, 70 percent of respondents responded positively. The productivity of the traditional subsistence farming systems that cultivate mainly cereals is not sufficient to cover the food demand of the local population ^[16]. All respondents admitted the increase in their cost of living due to one important effect of climate change they have less produce in their land and generally must buy from the market in some months of the year and this increases in their cost of living.

Table 1.2

Impact of climate change on livelihood and migration in study area

Impact -	Yes	No	Can't say
Decrease in agricultural land as climate change is one reason	70	30	0
Decline of interest in agriculture and allied activities for livelihood	80	20	0
Decline in agriculture productivity which affected the economic status of respondent households	100	0	0
Decline in agriculture productivity and inability to diversify livelihood, push for migration	80	20	0
Transformation of family occupation	70	20	10
Increase in cost of living of respondent households	100	0	0
Increase in dependency on income other than agriculture and allied work	70	20	10
Source: Primary data, showed in percentage [N= 50]			

Figure 1.1



H_0 : Agriculture productivity perception due to climate change is not a cause of migration. A Chi-square test is performed for the same and the results shows that at .05 level of significance the Chi-square static is 6.8402 at degrees of freedom 4, where the P value is 0.144576. Since the p-value (0.1446) $>$ α (0.05) (One tailed test), we cannot reject the null hypothesis [17].

H_0 : Agricultural productivity due to climate change is not a cause of transformation of family occupation for livelihood. A Chi-square test is performed for the same and the results shows that at .05 level of

significance the Chi-square static is 3.4851 at degrees of freedom 4, where the P value is 0.4802. Since the p-value (0.4802) $>$ α (0.05) (One tailed test), we cannot reject the null hypothesis [18].

Conclusion and Suggestions:

The present study shows that climate change has negatively affected the lives of residents in the study area as they responded. It affected the natural resources, especially the water resource, which is necessary for agriculture practices. Change in agricultural productivity, increase of threats in agriculture, increase in input cost for agriculture, increased use of pesticides,

infestation, weeds, etc. were some of the effects that the respondent farmers felt for the last few years that this was happening due to the change in climate. As agriculture is mostly subsidiary in the region, the respondents feel that the change in climate reduced agriculture productivity, and day by day, the increasing cost of living forced the members of the family to migrate to other parts to earn bread.

Climate change is a global phenomenon that cannot be solved by efforts in a particular region, but it can be reduced by reducing its adverse effects on the livelihood of the respondents. Rural Non-Farm Enterprise (RNFE) activities, cultivation of specific types of crops that need less water and input costs, crops with low input of water can promote agro-tourism & organic farming, and entrepreneurship through microfinance with the help of self-help groups are some alternate sources of livelihood that can be suggested as remedial for the survival of livelihood in the region and not to migrate from the hills. Environmental awareness and literacy are needed to protect it by understanding and adopting the traditional techniques used by ancients to protect our

environment, natural resources, and species on earth.

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