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Understanding farmers' perception about climate change in Barpeta district of Assam, India

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Abstract

The present investigation was carried out in the undivided Barpeta district of Assam to study farmers' perceptions regarding climate change. An ex post facto research design was adopted, and a total of 120 respondents were chosen through random sampling from four villages of Barpeta district, comprising 30 farmers from each village. Data were collected through a structured schedule covering changes in rainfall, temperature, flood and drought occurrence, and agricultural impacts. The results revealed that a large proportion of farmers perceived significant changes in climatic patterns over the past years, including reduced rainy days, erratic rainfall distribution, increased dry spells, and rising temperatures. Notably, all respondents reported experiencing more intense heat and scorching sunshine, while 98% also perceived change in the onset timings of rainfall.

In terms of agricultural impacts, the majority of farmers observed increased costs of cultivation, reduced crop yields, and heightened incidence of weeds, pests, and diseases. All farmers agreed that climate change has led to a rise in the occurrence of extreme weather phenomena like floods and droughts. Correlation analysis indicated that farmers' characteristics such as age (r = 0.318**), farming experience (r = 0.226*), and socio-political participation (r = 0.333**) had a positive and significant association with their perception of climate change. These findings suggest that awareness, experience, and active involvement in the community enhance farmers' ability to recognize and respond to climate variability. The study underscores the need for timely dissemination of climate information, location-specific technological interventions, and integration of indigenous knowledge with scientific practices to strengthen farmers' resilience to climate challenges.

Keywords: Farmers' perception, climate change, rainfall pattern

Introduction

Climate change has emerged as a major global concern for humanity in the 21st century. It is demanding immediate and united action from people all around the world to mitigate its impacts and safeguard our planet for future generations. "Climate change is defined as a change in the state of the climate that can be identified by changes in the mean and the variability of its properties and that persists for an extended period, typically decades or longer" (IPCC, 2001) [8]. United nations framework convention on climate change (UNFCC) stated that "climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (Grubb, 2019) [7]. The variations in different climatic parameters, such as cloud cover, rainfall and temperature, along with the increased emission of greenhouse gases (GHGs) due to human activities, are causing these changes. The intensity of rainfall, change in rainfall pattern, pollution, more dry spells, increase in scorching heat etc. are the causes of climate change.

The rise in atmospheric temperature has been identified as the key driver behind the recent dramatic shifts in climate. The World Meteorological Organization (WMO) in its provisional state of global climate report published in 2023 has concluded that the global average temperature has increased by 1.19℃ (1.19℃±0.12℃) in the last ten years (2014-2023) above the year 1850-1900 average temperature. Therefore, the last ten years was the warmest 10-year period on record. Earth's rising temperature is mainly due to greenhouse gases such as carbon dioxide, carbon monoxide, methane, and nitrous oxide. These gases retain heat by preventing it from escaping through the atmosphere. In 2022, the measured levels of carbon dioxide, methane, and nitrous oxide reached unprecedented highs. World

Meteorological Organization reported that Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O) have seen increases of 150%, 262% and 123% respectively (Abrahao *et al.*, 2023) [1].

Global agriculture is being significantly impacted by climate change, mainly because of alterations in rainfall patterns and the increased frequency of dry spells. These changes disrupt the delicate balance necessary for crop growth and food production. Unpredictable rainfall leads to periods of both excessive moisture and prolonged droughts, each presenting unique challenges for farmers. Excessive rainfall can result in flood condition, waterlogged soils, increased runoff, and erosion, all of which harm crop health and yield. On the other hand, extended dry spells and stress water condition have made irrigation increasingly necessary. This dual threat reduces the reliability of crop production, leading to lower yields and higher susceptibility to pest and disease outbreaks.

Objective

To assess farmers' perception about climate change

Research Methodology

The study was conducted in the undivided Barpeta district of Assam, following an "Ex post facto" research design. A random sampling technique was adopted to select 120 respondents from four villages, with 30 farmers chosen from each village. To assess the farmers' perception of climate change over the past 30 years, a structured schedule was developed containing statements related to different aspects such as rainfall, temperature, drought and flood situations, and the impact of climate change on agriculture. The rainfall aspect included factors like the number of rainy days, amount of rainfall, dry spells, and changes in crop growth. The temperature aspect covered increase in temperature, experienced scorching sunshine, summer getting warmer. The drought and flood situations considered changes in timing of rains, changes in flood occurrence. Aspects of impact of climate change on agriculture considered as decrease in crop yield, income from agriculture is adversely affected due to climate, more weed infestation, more pest and disease incidence. For measurement of farmers perception about climate change has been assigned as "1" for disagree, "2" for undecided, "3" for agree. To determine the relationship between farmers' perception and selected personal characteristics, the Pearson correlation coefficient was employed and calculated using the standard formula.

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{n}}{\sqrt{\left[\sum X^2 - \frac{(\sum X)^2}{n}\right]\left[\sum Y^2 - \frac{(\sum Y)^2}{n}\right]}}$$

Where,

r = Correlation coefficient

ΣXY = Sum of product of X and Y variable

ΣX = Sum of X variable

ΣY = Sum of Y variable

ΣX^2 = Sum of square of X variable

ΣY^2 = Sum of square of Y variable

n = Total number of respondents

For data analysis and interpretation, statistical tools such as frequency, percentage, mean, weighted mean, and standard deviation were applied.

Results and Discussion

Profile of sample respondents: The majority of the respondents (75.83%) belong to age range 35 to 59 years with mean age of 47.03. About 68.33 percentage of the respondents had medium size family (4-6 members). The study indicated that half of the respondents (50.00%) had farming experience of 26 to 45 years. The most of the respondents (57.50%) had operational land holding upto 1 ha which indicates that they are marginal farmers. It was noticed that 55 percent of the respondents were involved in community work followed by 17.50 percent were without any official position in socio politics organization. This may be due to increasing number of NGO, FPO/FPC/Cooperatives in the study area and different government incentives provided to them. About half (50.83%) of the respondents had low training exposure. About 90.83 percent of the respondents use mobile phones as source of weather forecast followed by television (21.67%). About 69.17 percent of the respondents had medium level of mass media exposure. Mean uses of mass media exposure is 3.58. The study revealed that majority 95.83 percent of the respondents had medium level of information seeking behaviour with mean value of 2.46. The contact with extension agency indicates that KVK personnel were the most widely contacted extension agent and comes in the rank I with a mean score 1.84. The farmers attended an average of 1.65 days of training, indicating a very low level of training exposure.

Farmers' perception about climate change on changes in precipitation: Findings of the study indicated that 84.16% of respondents perceived a reduction in the number of rainy days within the district. Govindbhai (2023) [6], Prakash (2020) [13] and Brar (2016) [4] reported similar findings in their study. Findings indicated that 74.16% of respondents perceived a lower amount of rainfall, whereas 98.33% experienced alterations in the onset period of rainfall. All (100%) respondents agreed that there is more dry spells and 99.16 percent perceived that there was changes in the rainfall during crop growth period (Table 1). Suryawanshi (2022) [15], Chandrashekhar (2019) [5] and Parganiha (2016) [12] reported similar findings in their study. This reveals that farmers with good perception about changes in precipitation were likely more observant due to their direct dependence on rainfall for agriculture and years of experience recognizing climatic variation.

Table 1: Distribution of respondents statement wise according to the farmers' perception about climate change on changes in precipitation (n=120)

Sl. no.	Statements	Frequency and Percentage		
		Agree	Undecided	Disagree
1.	Number of rainy day (>2.5mm) were more	4 (3.33)	15 (12.50)	101 (84.16)
2.	Amount of rainfall was more	5 (4.16)	26 (21.67)	89 (74.16)
3.	There was change in the onset timing of rainfall	118 (98.33)	2 (1.67)	0
4.	More dry spells	120 (100.00)	0 ()	0
5.	There was change in the rainfall during crop growth period (July-October)	119 (99.16)	1 (0.84)	0
6.	There was no change in the rainfall pattern	1 (0.84)	0	119 (99.16)

Perception of farmers on changes in temperature: The Table 2 reveals that all the respondents believed that there was increase in temperature and experiencing scorching sunshine. 70 percent of the respondents perceived that winter was getting warmer. This might be due to personal experience faced by the respondents with noticeable temperature change in the study area in the recent years. Shankara (2010) [14] and Joshi (2016) [9] observed similar findings in their study.

Table 2: Distribution of respondents statement wise according to the perception of farmers on changes in temperature (n=120)

Sl. no.	Statements	Frequency and Percentage		
		Agree	Undecided	Disagree
1.	There was increase in the temperature	120 (100.00)	0 ()	0 ()
2.	Experienced more extreme temperature	120 (100.00)	0 ()	0 ()
3.	Experienced less extreme temperature	0	0	120 (100.00)
4.	Experienced scorching sunshine	120 (100.00)	0	0
5.	Summer was getting warmer	120 (100.00)	0	0
6.	Winter was getting warmer	84 (70.00)	15 (12.50)	21 (17.50)
7.	There was no changes in the temperature	2 (1.67)	0	118 (98.33)

Perception of farmers about impact of climate change on Agriculture: The Table 3 reveals that out of all the respondents 98.33 percent perceived that cost of cultivation has increased due to climate change, 60.83 percent agreed that there is decrease in the crop yield due to climate change and 88. 33 percent perceived that income from agriculture is adversely affected due to climate. Shankara (2010) [14] and Kharumnuid (2011) [10] reported similar findings in their study. All the respondents were agreed that there is more weed and pest infestation due to climate change. This clearly indicates that the majority of farmers in the district had perceived noticeable climatic changes. Suryawanshi (2022) [15], Laxman (2016) [11] and Parganiha (2016) [12] reported similar findings in their study.

Table 3: Distribution of respondents statement wise according to the perception of farmers about impact of climate change on Agriculture (n=120)

Sl. no.	Statements	Frequency and Percentage		
		Agree	Undecided	Disagree
1.	Cost of cultivation has increased due to changes in the climate	118 (98.33)	2 (1.67)	0
2.	There is an increase in the crop yield due to climate change	22 (18.34)	31 (25.83)	67 (55.83)
3.	There is decrease in the crop yield due to climate change	73 (60.83)	29 (24.16)	18 (15.00)
4.	There is no changes in the crop yield due to climate change	5 (4.16)	32 (26.67)	83 (69.16)
5.	Income from agriculture is adversely effected due to climate	106 (88.33)	10 (8.33)	4 (3.33)
6.	There is soil nutrient loss due to climate change	81 (67.50)	31 (25.83)	8 (6.67)
7.	There is more weed infestation due to climate change	120 (100.00)	0	0
8.	There is more pest and disease incidence due to climate change	120 (100.00)	0	0

Perception of farmers about occurrence of flood and drought situation: The study reveals that 84.16 percent of respondents agreed that chances of heavy rains and flood increases, 98.33 percent perceived that chances of frequent and intense droughts increases, 96.67 percent believed that timing of rain occurrence had changed and 98.33 percent believed that flood occurrence timing had changed. Barman (2016) [3] and Kharumnuid (2011) [10] reported similar result in their study. So majority of the respondents perceived that there was changes in the flood and drought situation. Also, all the respondents (100%) agreed that there is increase in duration of dry spells during rainy season.

Table 4: Distribution of respondents statement wise according to the perception of farmers about occurrence of flood and drought situation (n=120)

Sl. no.	Statements	Frequency and Percentage		
		Agree	Undecided	Disagree
1.	Increase chances of heavy rains and floods	101 (84.16)	10 (8.34)	9 (7.50)
2.	Increase chances of frequent and intense droughts	118 (98.33)	2 (1.67)	0
3.	Change in the timing of rains (earlier/later/erratic)	116 (96.67)	4 (3.33)	0
4.	Changes in flood occurrence	118 (98.33)	2 (1.67)	0
5.	Increase duration of dry spells during rainy season	120 (100.00)	0	0

Relationship between profile of the respondents and farmers' perception about climate change: It is revealed from Table 4 that farmers' characteristics such as age (r = 0.318**), farming experience (r = 0.226*), and socio-political participation (r = 0.333**) have shown a positive and statistically significant correlation with their perception level on climate variability. This indicates that as the age of the farmers increases, their ability to perceive changes in climate becomes more accurate. Similarly, those with more years of farming experience tend to have a better understanding of climate variability. Moreover, higher involvement in socio-political activities significantly enhances farmers' awareness and perception of climate-related issues, as evidenced by the observed data.

Table 4: Relationship between profile of the respondents and farmers' perception about climate change

Sr. No.	Independent variable	r value
1	Age	0.318**
2	Family size	-0.095^{NS}
3	Farming Experience	0.226*
4	Socio politico participation	0.333**
5	Training exposure	-0.036 ^{NS}
6	Source of weather forecast	0.012 ^{NS}
7	Mass media exposure	-0.083 ^{NS}
8	Information seeking behaviour	-0.129 ^{NS}
9	Contact with extension agency	-0.169 ^{NS}
10	Decision making ability	-0.014 ^{NS}
11	Scientific orientation	0.059 ^{NS}

Conclusion

To build a resilient farming community capable of adapting to climate variability, it is essential to organize regular awareness programs and comprehensive training sessions at the community level. These should focus on key areas such as improved cultivation techniques, soil and water conservation, and integrated pest and disease management, all adapted to the realities of changing climatic conditions. Extension agencies must play a proactive role in ensuring timely access to climate intelligence by leveraging mass media and modern information and communication technologies (ICTs).

In parallel, the research system should prioritize the development of location-specific, cost-effective, and environmentally sustainable technologies. Integrating traditional indigenous coping strategies with modern scientific knowledge can create more robust and practical solutions. Additionally, the promotion and adoption of climate-resilient crop varieties such as those tolerant to heat, drought, flood, and resistant to pests and diseases is crucial for sustaining agricultural productivity under climatic stress. Ultimately, timely access to accurate weather and climate information is essential for enabling farmers to make informed decisions and prepare adequately. Therefore, coordinated efforts from extension and allied agencies are vital to support farmers in adapting effectively to the challenges posed by climate variability.

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