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Household Level Assessment of Climate Change Vulnerability of North Bank Plains Zone Farmers of Assam

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ABSTRACT

The study was carried out to assess the vulnerability of farmers to climate change in north bank plains zone of Assam. For this 2 districts were selected randomly from the north bank plains zone of Assam i.e., Sonitpur and Udalguri. A household level survey was carried out with the selected farmers to obtain the primary data. For this, total 120 farmers were selected from 6 different villages through proportionate random sampling. Vulnerability index was worked out by considering 10 different indicators. Findings revealed that 69.17 per cent of farmers belonged to medium vulnerability category followed by 16.67 per cent and 14.17 per cent in high and low vulnerability category respectively. The mean vulnerability score was 0.455 indicating that, on an average, respondents had medium vulnerability to climate change. Most of the respondents are belonged to medium category.

INTRODUCTION

The impacts of climate change are likely to be a great extent in tropical regions. Developing countries are generally more vulnerable to the effects of climate change than the more developed countries, mainly due to their low capacity to adapt to the climate induced changes. Among the developing countries, India may be the most vulnerable to climate variability and change. High levels of vulnerability and low adaptive capacity in India have been linked to factors such as a high reliance on natural resources mainly agriculture, inability to adapt financially and institutionally, low per capita GDP and extreme poverty. In developing countries like India, climate change would represent an additional stress on ecological, cultural, political and socio-economic systems that are already facing tremendous pressures due to rapid urbanization, industrialization, privatization, globalization and economic development. Agricultural activities are among those sectors which are very sensitive to climate and weather conditions. Most interestingly climate change affects the agriculture sectors to a great extent and in turn it contributes to climate change. So, there is a reciprocal relationship between them. Further this climate change induced effects would accelerate the existing stresses due to non-climate factors, such as changes in land use pattern and the unsustainable use of natural resources. Climate change has the potential to affect everyone, but one particular vulnerable group is farmers. India is more vulnerable in view of the large population depending on agricultural as well as natural resources. In India, significant negative impacts have been implied with medium-term (2010-2039) climate change, predicted to reduce yield by 4.5 to 9.0 per cent, depending on the magnitude and distribution of warming. IPCC (2001) defined vulnerability to climate change as “the extent to which a natural or social system is susceptible to sustaining damage from climate change, and is a function of the magnitude of climate change, the sensitivity of the system to changes in climate and the ability to adapt the system to changes in climate”. Although many useful steps have been taken in the direction of ensuring adequate adaptation to climate change in developing countries, much work still remains to fully understand the need for future adaptation (Brar et al., 2020). Understanding the importance of farmers’ perception towards changing climate is extremely important in developing

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adaptation strategies to overcome the increasing effect of climate change and variability (Dupdal et al., 2021). In this background, the study aimed to assess the vulnerability to climate change among the farmers of north bank plains zone of Assam.

METHODOLOGY

The study was conducted in purposively in North Bank Plains Zone of Assam as it is the highly flood affected and drought prone areas of Assam. The study was carried out in 2 randomly selected districts form this zone i.e., Sonitpur and Udalguri. Total 120 farmers were selected from 6 different villages of these 2 districts through proportionate random sampling. The primary data were collected using a structured interview schedule during the period from February to March, 2019. Drawing from the approaches of TERI (2003) and UNDP (2002), a composite vulnerability index was worked out. A total of ten indicators were considered in this study to work out the vulnerability index. The ten indicators were awareness about the consequences of climate change, perception towards climate change, attitude towards climate change, fatalism, egalitarianism, perceived knowledge of adaptation practices, ownership of physical resources and assets, livelihood diversification, access to climate information and social participation. Different scales developed by the researchers Trivedi and Pareek (1964), Leiserowitz (2006) and Thornton (2009) were used to measure the indicators. The formula for working out the vulnerability index for each respondent was:

$$VI = \sum_{i=1}^{n} (I_i \times W_i)$$

VI = Vulnerability Index, I_i = Value of i^{th} sub index, W_i = Weight of the i^{th} sub index, i= 1 to n, n = No. of sub index

All indicators were standardized following the UNDP (2002) procedure of standardizing indicators for life expectancy index. Appropriate weights were assigned to the indicators based on the judgement survey conducted among the experts. An unequal weighting system, based on relative importance attached to each indicator by a sample of 35 progressive farmers, 5 extension functionaries and 45 agricultural scientists was used, where they were asked to rank the five most important indicators that they considered to have biggest impact on farmer's vulnerability to climate change. The number of times a particular indicator was cited was used to generate the weights of indicator. Data were analyzed using frequency, percentage, mean, standard deviation, coefficient of variation and Pearson correlation coefficient.

RESULTS AND DISCUSSION

Vulnerability to climate change

The results revealed (Table 1) that majority of the respondents (69.17%) belonged to medium vulnerability category. The findings are in line with Maiti et al., (2014) who revealed that majority of the livestock rearers of coastal Odisha were in medium vulnerability category. The findings are also in conformity with Raghuvanshi and Ansari (2020). Aparna et al., (2017) conducted a similar study in Karnataka and reported that majority of the dairy farmers of Sagara region were in medium vulnerability category. Majority of dairy farmers in Thirthahalli region and Bhadravathi region were in low and high vulnerability category respectively. The mean vulnerability score was 0.455 indicating that, on an average, respondents had medium vulnerability to climate change. The co-efficient of variation (23.60%) indicated that the respondents were relatively homogeneous with respect to their vulnerability.

The distribution of respondents on different indicators of vulnerability (Table 2) revealed that on most of the indicators like awareness, risk perception, favorable attitude, fatalism, egalitarianism, perceived knowledge of adaptation practices, ownership of physical resources and assets, livelihood diversification and access to climate information, majority of the respondents were in medium category. This might be the reason that majority of the respondents belonged to medium vulnerability category. The distribution of respondents based on their awareness revealed that majority of the respondents (70.00%) belonged to medium awareness category. The mean awareness score was 21.16. The medium vulnerability of most of the respondents can be attributed to their awareness level (Adebayo et al., 2012). With respect to risk perception, the majority of the respondents (62.50%) belonged to medium perception category. The mean risk perception score was 23.19 indicating that, on an average, respondents had medium risk perception which in turn affected their vulnerability as observed by Lee (2018). The risk perception translate into responses that achieve short term gains only rather than contributing in reducing long term vulnerabilities (Rühlemann and Jordan, 2021).

Regarding the attitude towards climate change, majority of the respondents (65.00%) had moderately favourable attitude. The mean attitude score was 63.19 indicating that, on an average, respondents had moderately favourable attitude toward climate change. With respect to fatalism, it can be observed that majority of the respondents (60.00%) belonged to moderately fatalistic category. The mean fatalism score was 15.92 indicating that, on an average, respondents were moderately fatalistic. For the egalitarianism, majority of the respondents (70.00%) belonged to medium egalitarianism category. The mean egalitarianism score was 25.33. For perceived knowledge of adaptation practices, majority of the respondents (63.33%) belonged to medium perceived knowledge category. The mean perceived knowledge score was 11.01 indicating that, on an average, respondents had medium perceived knowledge on adaptation practices. These findings are in line with Zarafshani et al., (2020).

Table 1. Distribution of respondents according to their vulnerability to climate change

Category	Range	Number (%)	Mean score	SD	CV
Low vulnerability	0.126-0.348	17 (14.17)			
Medium vulnerability	0.349-0.562	83 (69.17)	0.455	0.107	23.60
High vulnerability	0.563 -0.647	20 (16.67)			

Table 2. Distribution of respondents according to different indicators of vulnerability

Category		Score range	Number (n=120)	Percentage	Mean	S.D.	CV
1. Awareness	Low	14.00-17.75	17	14.17	21.16	3.41	16.09
	Medium	17.76-24.57	84	70.00			
	High	24.58-29.00	19	15.83			
2. Risk Perception	Low	17.00-20.44	18	15.00	23.19	2.75	11.88
	Medium	20.45-25.94	75	62.50			
	High	25.95-29.00	27	22.50			
3. Favourable Attitude	Low	47.00-56.81	18	15.00	63.19	6.38	10.09
	Medium	56.82-69.57	78	65.00			
	High	69.58-77.00	24	20.00			
4. Fatalism	Low	8.00-11.99	18	15.00	15.92	3.93	24.71
	Medium	12.00-19.85	72	60.00			
	High	19.86-24.00	30	25.00			
5. Egalitarianism	Low	18-22.34	19	15.83	25.33	2.99	11.82
	Medium	22.35-28.32	84	70.00			
	High	28.33-33	17	14.17			
6. Perceived knowledge of adaptation practices	Low	6.00-8.37	22	18.33	11.01	2.64	23.98
	Medium	8.38-13.65	76	63.33			
	High	13.66-17.00	22	18.33			
7. Ownership of physical resources and assets	Low	8.00-10.44	52	43.33	13.09	2.65	20.22
	Medium	10.45-15.74	62	51.67			
	High	15.75-20.00	6	5.00			
8. Livelihood diversification	Low	1.00-1.49	19	15.83	2.70	1.21	44.68
	Medium	1.50-3.91	70	58.33			
	High	3.92-5.00	31	25.83			
9. Access to climate information	Low	5.00-7.80	16	13.33	10.68	2.88	27.00
	Medium	7.81-13.56	81	67.50			
	High	13.57-18.00	23	19.17			
10. Social participation	No membership	0	50	41.67	0.82	0.87	106.47
	One organization member	1	50	41.67			
	More than 1 organization member	2	12	10.00			
	Office bearers	3	8	6.67			

Regarding ownership of physical resources and assets, majority of the respondents (51.67%) belonged to medium level. With respect to livelihood diversification, majority of the respondents (58.33%) had medium livelihood diversification. These findings are in line with Devi et al., (2021) who revealed that high level of livelihood diversification leads to the low level of vulnerability. Further, regarding the access to climate information, majority (67.50%) of the respondents had medium level of accessibility to climate information. About social participation, an equal number of respondents (41.67%) were non-members of any organization as well as same number of respondents were members of one organization. The value of co-efficient of variation of all the indicators indicated that the respondents were homogeneous with respect to their awareness, risk perception, attitude, fatalism, egalitarianism, perceived knowledge of adaptation practices, ownership of physical resources and assets, livelihood diversification and access to climate information except social participation.

Table 3. Correlation analysis between different factors and vulnerability of farmers to climate change

S.No.	Independent Variables	Correlation coefficient (r)
1	Age	0.111^{NS}
2	Education level	-0.484**
3	Family type	-0.008^{NS}
4	Family size	0.032^{NS}
5	Size of operational land holding	-0.610**
6	Occupation	-0.115^{NS}
7	Farming experience	-0.095^{NS}
8	Gross annual income	-0.647**
9	Farm mechanization	-0.404**
10	Credit seeking behaviour	-0.469**
11	Degree of information exposure	-0.452**
12	Scientific orientation	-0.713**
13	Risk orientation	-0.551**
14	Economic motivation	-0.497**
15	Innovativeness	-0.558**
16	Adaptability to climate change	-0.508**

** Significant at 0.01 level of significance

Pearson's correlation analysis

The results revealed that (Table 3) educational level, size of operational land holding, gross annual income, farm mechanization, credit seeking behavior, degree of information exposure, scientific orientation, risk orientation, economic motivation, innovativeness and adaptability have significant and negative relationship with the vulnerability of farmers to climate change at 0.01 level of significance. The findings are in line with Doswald & Osti (2011) who believed that low-income areas are the most vulnerable to future climate change. The variables age, family type, family size, occupation and farming experience had no significant relationship

with the vulnerability of farmers to climate change. As the education level increases farmers will have better knowledge regarding the climate change and the ways to cope up with that which reduces their vulnerability. As the land holding and annual income increases, the farmers becomes more equipped to adopt the mitigation practices hence shows less vulnerability. The factors like credit seeking behavior, degree of information exposure, scientific orientation, risk orientation, economic motivation and innovativeness are desirable as they reduces the risk of being more vulnerable.

CONCLUSION

The results showed that majority of the farmers from north bank plains zone of Assam, had medium vulnerability to climate change. It calls for adequate measures for their preparedness and adaptation to climate change. The variables like farmer's educational level, size of operational land holding, annual income, farm mechanization, credit seeking behavior, degree of information exposure, scientific orientation, risk orientation, economic motivation, innovativeness and adaptability showed significant relationship with the vulnerability of farmers. Hence there is a possibility for the extension agencies to improve these crucial factors in order to reduce the vulnerability of farmers to climate change and these factors should be considered while preparing the adaptation strategies. The extension and advisory services should focus on providing scientific knowledge which helps the farmers to cope with the changing climate conditions. Findings implied that the extension functionaries and agricultural scientists should promote some agricultural management practices among the farmers to enable them to cope with changing climate conditions like use of organic manure, summer deep ploughing, conservation tillage, bunds and change in variety etc.

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