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LIVELIHOOD VULNERABILITY AND CONSTRAINTS FACED BY THE GUAVA GROWERS

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ABSTRACT

The present study investigated the livelihood vulnerability index and constraints encountered by guava growers in the Prayagraj district of Uttar Pradesh. The livelihood vulnerability index (LVI) comprises (the exposure index, sensitivity index, and adaptive capacity index) by using the IPCC- vulnerability approach, to evaluate the livelihood vulnerability of 120 guava growers selected by simple random sampling, and the data was collected with the help of a pre-tested interview schedule. The study revealed that the guava growers are greatly exposed (0.81) to climate change, and sensitivity indices underscore the high sensitivity (0.55), in contrast, the adaptive capacity indices (0.34) indicate a comparatively lower adaptive capacity among the surveyed respondents when juxtaposed with the exposure and sensitivity indices. For the constraints, a list of 19 constraints was prepared and grouped into 5 major dimensions. Addressing these challenges has the potential to improve the overall welfare and livelihood vulnerability of guava growers in the study area.

Keywords: *adaptive capacity index, constraints, exposure index, guava grower, livelihood vulnerability index, sensitivity index*

INTRODUCTION

Indian agriculture is highly vulnerable to risk and farmers are most vulnerable to the effects of climatic variability (Sudha *et al.*, 2015; Vinaya et al., 2022). The extreme weather uncertainties and exploitation of natural resources further aggravate farmers' vulnerability (Singh *et al.*, 2019). Various studies found that climate change will intensify and smallholding farmers (>80%) will be the most affected, as they entirely depend upon climate-sensitive livelihoods (agriculture) and have low adaptive capacity (Chingala *et al.*, 2017; Karthika *et al.*, 2017; Chuadhari et al., 2022; Mohanty, and Singh, 2022)). Thus, under the current situation of climate change, there is a need to adapt risk management strategies that could help farm households enhance their productivity and livelihood security.

Livelihood vulnerability is a multidimensional subject for climate change research. It consists of three main components, viz., exposure, sensitivity, and adaptive capacity. Exposure refers to stresses caused by changes in frequency, intensity, magnitude, duration, and the real extent of the hazard and nature of climate stress (Nazari *et al.*, 2015). Sensitivity measures the ability of a system to respond to the climate impacts found by both socio-economic and ecological situations and identifies the level at which a group will be influenced by environmental stresses. Adaptive capacity refers to the power of a system to take advantage of opportunities or deal with the consequences. As climate change continues to exert its influence on agricultural landscapes, understanding and addressing the specific vulnerabilities of guava growers is imperative for fostering sustainable agricultural practices and securing the well-being of communities dependent on guava cultivation in Prayagraj.

This research delves into the urgent requirement for targeted climate change risk management strategies, focusing on bolstering the adaptive capacity of smallholder farmers. By addressing the intricate interplay of exposure, sensitivity, and adaptive capacity, the study aims to provide insights that can inform policy and practical interventions geared toward enhancing the resilience of Indian agriculture in the face of evolving climatic challenges.

OBJECTIVE

To know the livelihood vulnerability and constraints faced by the guava growers

METHODOLOGY

The study was conducted in Prayagraj district of Uttar Pradesh. Prayagraj has 23 blocks out of which, kaurihar block was selected purposively due to the maximum production in the area. Random selection of 10 villages and from each village, 12 guava growers were selected randomly thus making a total of 120 guava growers. A pre-tested semi-structured interview schedule was used to collect the data through in-person interviews. The present study uses the data of farmers' perception of climate change as indicators to calculate an exposure index, (temperature, rainfall drought, and erosion as indicators) to develop a sensitivity index (agriculture as an indicator) to develop an adaptive capacity index (water availability, sanitation, information source, credit support, and provisions for materials as indicators) using Eq. (1, 2 and 3) as follows.

$$\text{Exposure index (EI)} = T + R + D + E / 4 \quad (1)$$

$$\text{Sensitivity index (SI)} = CF + IF + GW + PC + CD / 5 \quad (2)$$

$$\text{Adoptive capacity index (ACI)} = CW + SF + IS + CF + MHF / 5 \quad (3)$$

After calculating the data of the exposure, sensitivity, and adaptive capacity index all three contributors were combined to obtain the livelihood vulnerability index (LVI) by using the equation (Hahn *et al*., 2009).

$$LVI = (EI- AI) \times SI$$

Where, LVI is the livelihood vulnerability index score (obtained using the IPCC vulnerability framework, 2007), EI is the calculated exposure score, ACI is the adaptive capacity score and SI is the sensitivity score. The LVI is based on the results obtained from the vulnerability index score, i.e., 1 (least vulnerable) to -1 (most vulnerable).

For the constraints, a list of 19 constraints was prepared in consultation with experts and past literature. The constraints were grouped into 5 major dimensions *viz.,* input, financial, technical, marketing, and storage constraints. The responses from the respondents were collected on a multiple-answer basis as to how many constraints they face in the production of guava. The collected data was analyzed using frequency and percentage and then the constraints were given rank order as perceived by the farmers.

RESULTS AND DISCUSSION

Table 1 : Exposure index (indicators and indices)

(n=120)

Sr. No.	Exposure indicators	Percentage
1	Rise in temperature during summer days in recent years (T)	0.88
2	Declined in rainfall in recent years (R)	0.75
3	Drought frequency has increased in recent years (D)	0.77
4	Soil erosion has increased in recent years (E)	0.83
Exposure index		**0.81**

In Table 1, the presented data indicates a significant impact of climatic factors on the livelihoods of farmers. A substantial majority, 0.88 of farmers, reported experiencing hotter summer seasons, while 0.75 perceived a reduction in rainfall. Additionally, 0.77 of farmers noted an increased frequency of drought, and 0.83 observed soil erosion. These climatic challenges collectively expose the vulnerability of farmers' livelihoods. The calculated exposure index, at 0.81, underscores the extent to which climatic factors have influenced and exposed the agricultural practices and livelihoods of the farmers, highlighting the pressing need for adaptive measures in response to these changing environmental conditions.

Table 2. Sensitivity index (indicators and indices)

(n=120)

Sr. No.	Sensitivity indicators	Percentage
1	Frequent crop failure due to uncertainties (CF)	0.53
2	Lack of irrigation facilities (IF)	0.49
3	Reduction in ground-water level (GW)	0.55
4	Low productivity of crops (PC)	0.60
5	Less crop diversification (CD)	0.57
Sensitivity index		**0.55**

In Table 2, the computed sensitivity indices revealed a significant vulnerability among guava growers in Prayagraj to the impacts of climate change. The data indicates that a substantial portion, 0.60 of the respondents, faced challenges such as low crop productivity. Additionally, over 0.50 of

farmers encountered recurring issues such as frequent crop failure, a reduction in groundwater levels, and limited crop diversification. Furthermore, 0.49 of farmers grappled with the absence of adequate irrigation facilities. The combination of factors such as insufficient irrigation and declining groundwater levels imposes a considerable burden on farmers, while frequent crop failure and limited crop diversification contribute significantly to the overall sensitivity of the system. The resulting sensitivity index is calculated at 0.55, underscoring the high sensitivity and vulnerability of guava growers in Prayagraj towards climate change.

Table 3 : Adaptive capacity index (indicators and indices)

(n=120)

Sr. No.	Adaptive capacity indicators	Percentage
1	Availability of clean drinking water (CW)	0.32
2	Availability of sanitation facilities (SF)	0.38
3	Easy access to information sources (IS)	0.38
4	Availability of credit facilities (CF)	0.33
5	Accessibility of materials for house and farm (MHF)	0.30
Adaptive capacity index		**0.34**

In Table 3, the computed adaptive capacity indices shed light on specific factors such as the availability of drinking water 0.32, sanitation facilities 0.38, easy access to information sources 0.38, availability of credit facilities 0.33, and provision of materials for houses and farms. With an overall adaptive capacity index value of 0.34, the assessment indicates that the adaptive capacity of guava growers is comparatively lower. These findings underscore challenges in the ability of guava growers to respond effectively to changing conditions, signaling a need for targeted interventions and support to enhance their adaptive capacities.

Table 4 : Exposure, sensitivity, adaptive capacity, and livelihood vulnerability indices.

(n=120)

Sr. No.	Determinants of vulnerability	Percentage
1	Exposure index	0.81
2	Sensitivity index	0.55
3	Adaptive capacity index	0.34
Livelihood vulnerability index		**0.26**

Table 4 reveals that the calculated exposure indices were notably elevated, reaching 0.81. Sensitivity indices underscore the high sensitivity of the surveyed respondents, with a value of 0.55. In contrast, the adaptive capacity indices, registering at 0.34, indicate a comparatively lower adaptive capacity among the surveyed respondents when juxtaposed with the exposure and sensitivity indices. This unequivocally indicates the vulnerability of guava growers' livelihoods to the impacts of climate change.

Table 5 : Correlation for the vulnerability indices with socio-personal characteristics (n=120)

Sr. No.	Variables	Exposure		Sensitivity		Adaptive capacity	
		'r' value	'p' value	'r' value	'p' value	'r' value	'p' value
X_1	**Age**	0.203*	0.026	-0.324**	0.000	-0.572**	0.000
X_2	**Education**	-0.193*	0.035	0.267**	0.003	0.782**	0.000
X_3	**Landholding**	0.073	0.431	0.262**	0.004	0.128	0.163
X_4	**Annual income**	0.047	0.608	-0.086	0.348	0.089	0.332
X_5	**Extension contact**	0.002	0.982	0.126	0.169	0.644**	0.000
X_6	**Source of information**	0.011	0.905	0.388**	0.000	0.064	0.491
X_7	**Progressiveness**	-0.078	0.397	0.272**	0.003	0.358**	0.000
X_8	**Risk bearing capacity**	0.062	0.502	0.120	0.192	0.298**	0.001

In Table 5 the analysis revealed key correlations between demographic factors and vulnerability indices. Exposure showed a positive and significant correlation with age (r =0.203, p =0.026). Sensitivity showed a positive and significant correlation with education (r = 0.267, p =0.003), land holding (r =0.262, p =0.004), source of information (r = 0.388, p = 0.000), and progressiveness (r =0.272, p = 0.003). Further, adaptive capacity had a positive and significant correlation with education (r = 0.782, p = 0.000), extension contact (r = 0.644, p = 0.00), progressiveness (r = 0.358, p = 0.00), and risk-bearing capacity (r = 0.298, p = 0.001).

Table 6 : Constraints faced by the guava growers (n=120)

Sr. No.	Constraints	Frequency	Percentage	Rank
Input Constraints				
1	Unavailability of good quality planting materials.	64	53.33	III
2	Lack of irrigation facility	77	64.17	I
3	Unavailability of organic manure, fertilizers, and pesticides	73	60.83	II
Financial Constraints				
1	High cost of labour and planting materials	62	51.67	III
2	High cost of fertilizers and chemicals	95	79.17	I
3	Non-availability of credit facilities at a marginal rate of interest in time	82	68.33	II
Technical Constraints				
1	Lack of knowledge about training and pruning	49	40.83	IV
2	Lack of knowledge about HYV and plant density	61	50.83	III
3	Lack of knowledge about doses of chemicals and fertilizers	80	66.67	I
4	Lack of knowledge about irrigation management practices	74	61.67	II
Marketing Constraints				
1	Lack of storage and transportation facilities	51	42.50	IV
2	Lack of knowledge about market intelligence and incorrect measures of weight	55	45.83	III
3	Low price of good quality produce in the Market	111	92.50	I
4	The minimum support price is not fixed	82	68.33	II
Storage Constraints				
1	Unavailability of proper place of storage	104	86.67	I
2	Inaccessibility of fumigants for storage	65	54.17	IV
3	Lack of technical know-how about post-harvest treatments	81	67.50	III
4	Problem with storing guava for a long duration	89	74.17	II

Table 6 provided a comprehensive overview of the diverse constraints faced by guava growers, categorized into five distinct areas: input, financial, technical, marketing, and storage constraints. Within the realm of input constraints, the majority of farmers identified the lack of irrigation facilities as the most prominent challenge (64.17%), closely followed by issues such as the unavailability of organic manure, fertilizers, and pesticides (60.83%), and the absence of good quality planting materials (53.33%).

Turning to the financial constraints category, a significant proportion of farmers highlighted the high cost of fertilizers and chemicals as their primary concern (79.17%). Subsequently, challenges related to the non-availability of credit facilities at a marginal rate of interest on time (68.33%), and the elevated costs associated with labor and planting materials (51.67%) were also prominently noted.

Within the technical constraints category, farmers emphasized their struggle with a lack of knowledge about the proper doses of chemicals and fertilizers (66.67%). This was closely followed by challenges related to insufficient understanding of irrigation management practices (61.67%), a lack of knowledge about high-yielding varieties (HYV) and plant density (50.83%), and insufficient knowledge about training and pruning techniques (40.83%).

In the marketing constraints category, a considerable percentage of farmers expressed concerns about the low prices of good quality products in the market (92.50%). Other significant challenges included the absence of a minimum support price (68.33%), inadequate awareness about market intelligence, and discrepancies in weight measurements (45.83%), along with issues related to storage and transportation facilities (42.50%).

Lastly, in the storage constraints category, the unavailability of a suitable storage facility emerged as a major challenge (86.67%). Additional concerns included difficulties in storing guava for extended durations (74.17%), a lack of technical expertise regarding post-harvest treatments (67.50%), and challenges related to accessing fumigants for storage (54.17%).

This comprehensive analysis of constraints provides insights for policymakers, and researchers, to develop targeted interventions and support systems that address the multifaceted challenges encountered by the guava growers, ultimately contributing to the sustainability and prosperity of guava cultivation practices.

CONCLUSION

In conclusion, this research article delves into the intricate dynamics of livelihood vulnerability and the multifaceted constraints faced by guava growers. The findings, derived from comprehensive analyses of exposure, sensitivity, and adaptive capacity indices, paint a vivid picture of the challenges confronting these agricultural practitioners in Prayagraj. The calculated exposure indices, notably high at 0.81, underscore the profound impact of climatic factors on guava growers. The discernible sensitivity indices, particularly the prevalence of low crop productivity, frequent crop failure, diminishing groundwater levels, and limited crop diversification, reveal the vulnerability of guava growers to climate change. Furthermore, the adaptive capacity indices, with a calculated value of 0.34, indicate a relatively lower capacity among guava growers to adapt to changing conditions. Specific challenges in adaptive capacity, such as limited access to credit facilities, underscore the need for targeted interventions to enhance the resilience of guava growers in the face of evolving environmental conditions. The study uncovered important connections between socio-personal characteristics and vulnerability indices. Age correlates positively with exposure. Education, landholding, source of information, and progressiveness correlate with sensitivity. Education, extension contact, progressiveness, and risk-bearing capacity are positively associated with adaptive capacity.

This research serves as a valuable foundation for policymakers, researchers, and practitioners to formulate context-specific strategies that address the identified challenges and fortify the livelihoods of guava growers in Prayagraj. As climate change continues to exert its influence on agricultural practices, proactive measures informed by this research can contribute significantly to building the adaptive capacity of guava growers, fostering sustainable livelihoods, and ensuring the resilience of agricultural communities in the region.

IMPLICATIONS

The study underscores the potential implications for the livelihoods of individuals engaged in guava cultivation. The findings of this study may shed light on the challenges and vulnerabilities experienced by guava growers, informing policymakers, agricultural practitioners, and relevant stakeholders about the necessary interventions and support systems required to enhance the resilience and sustainability of guava farming. The identification of constraints within the guava cultivation sector can serve as a foundation for targeted strategies aimed at improving the livelihoods of guava growers, fostering economic stability, and promoting the overall well-being of the communities involved in this agricultural practice.

CONFLICT OF INTEREST

This is to declare that there is “No conflict of interest”.

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