Journal of Agricultural Extension
Vol. 30 (3) July, 2026
ISSN (e): 24086851; ISSN (Print): 1119944X
Website: https://www.journal.aesonnigeria.org; https://www.ajol.info/index.php/jae
Email: editorinchief@aesonnigeria.org; agricultural.extension.nigeria@gmail.com

Comparative Assessment of Livelihood Security among Diversified Farmers in Northern Bangladesh

https://dx.doi.org/10.4314/jae.v30i3.12

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Submitted: 3 February 2026
First Request for Revision: 2 April 2026
Revisions: 10, 22, 27, 30 April 2026 & 6 May 2026
Accepted: 6 May 2026
Published: 10 July 2026
Cite as: Rashid, M. M., Mondol, M. A .S., Rahman, M. S. and Jackson, T. (2026). Comparative assessment of livelihood security among diversified farmers in Northern Bangladesh. *Journal of Agricultural Extension, 30*(3), 120-130
Keywords: Livelihood security, agricultural situations, diversified farmers.
Conflict of interest: The authors hereby declare that there is no conflict of interest
Acknowledgements: The authors would like to express their heartfelt gratitude to all individuals who contributed to the successful completion of this research, particularly the enumerators involved in data collection.
Funding: This research was financially supported by the ACIAR-funded *Transforming Smallholder Food Systems in the Eastern Gangetic Plain (Rupantar) Project* (WAC/2020/148) under a PhD Fellowship.
Authors' contributions:
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RMS: Methodology; Investigation; Supervision; Writing – review & editing (15%)
JT: Writing – review & editing; Language editing (10%)

Abstract

This study assessed livelihood security among diversified farmers across three agricultural settings in northern Bangladesh. A total of 348 households was selected using a multi-stage sampling technique. Data were collected through structured interviews and analysed using means, frequencies, percentages, chi-square tests, and analysis of variance. Livelihood security was measured across seven components comprising 35 items, assessed on a three-point continuum. The results revealed notable regional variation in livelihood security. Upland farmers scored highest in terms of habitat ($\bar{x}$ = 8.67), education ($\bar{x}$ = 7.57), health ($\bar{x}$ = 7.98), and environmental security ($\bar{x}$ = 8.90); Charland farmers presented relatively greater financial ($\bar{x}$ = 7.56) and social security ($\bar{x}$ = 7.71); and Barind Tract farmers showed relatively higher food security ($\bar{x}$ = 8.64). Overall, most farmers (85%) exhibited low to moderate livelihood security. Results revealed a significant association (χ^2 = 10.74) between agricultural situations and livelihood security. It further showed a significant difference (F =*

4.334) in mean scores, with Upland farmers achieving the highest overall mean score (46.75). The study concludes that agricultural situations significantly influence livelihood security among diversified farmers. It recommends context-specific, targeted policy interventions to address region-specific needs and improve overall livelihood security in northern Bangladesh.*

Introduction

Agriculture remains the backbone of rural livelihoods in South Asia, where a substantial proportion of the rural population depends on farming for income, food security, and employment (Asian Development Bank [ADB], 2023). In Bangladesh, agriculture continues to play a central role in sustaining rural livelihoods despite ongoing structural transformations in the economy (Australian Centre for International Agricultural Research [ACIAR], 2025; International Food Policy Research Institute [IFPRI], 2024; Kaushik et al., 2023). However, agricultural livelihoods face increasing challenges from climate variability, land degradation, market volatility, and demographic pressures, which intensify exposure to production and income risks. Livelihood security, which encompasses income stability, food security, resilience to shocks, and overall well-being, remains a central concern in development policy and research (Majumder et al., 2024; Sultana et al., 2023).

In northern Bangladesh, agrarian livelihoods are shaped by diverse agro-ecological environments, notably the Upland areas, riverine Charlands, and the Barind Tract, each characterised by distinct natural resource endowments, cropping potentials, and climatic stressors (Rahman & Anik, 2020; United Nations Environment Programme [UNEP], 2022). Charland farmers are particularly vulnerable due to recurrent flooding, riverbank erosion, weak infrastructure, and limited access to extension services, contributing to unstable incomes and heightened exposure to shocks (Al Mamun et al., 2023; Khatun et al., 2021). Upland areas experience seasonal water scarcity, declining soil fertility, and reliance on low-input rainfed agriculture, which constrain crop diversification and income stability (Emran et al., 2022; Sunny et al., 2022). Farmers in the Barind Tract face chronic drought, poor soil quality, and costly groundwater irrigation, which limit productivity, reduce adaptive capacity, and exacerbate livelihood insecurity, particularly among smallholders (Afrin et al., 2024; Sultana et al., 2023).

Therefore, identifying livelihood strategies that enhance resilience and reduce vulnerability has become a global priority. Agricultural diversification has emerged as a key strategy for improving livelihood outcomes among smallholder farmers, involving the allocation of household resources across crops, livestock, fisheries, and non-farm activities rather than specialising in a single enterprise. Although agricultural diversification in Bangladesh has shown a gradual but positive trend over recent decades, its adoption in northern Bangladesh remains moderate and uneven, varying considerably by location and farmers' capacity (Nahar et al., 2025; Rashid et al., 2026). Farmers in the region often cultivate multiple crops annually; however, some remain reliant on monocropping due to agro-ecological constraints and limited resources (Brown et al., 2023; Islam et al., 2024; Nahar et al., 2024). Evidence from Bangladesh and comparable contexts suggests that diversification enhances household income, food security, and resilience to climatic and economic shocks (Alam et al., 2023; Nahar et al., 2024; Siddika et al., 2023). Similarly, studies in Nigeria indicate improvements in income stability, food security, and households' capacity to cope with climate and economic shocks (Belonwu et al., 2024; Olayeriju & Akinnagbe, 2025). Moreover, access to livelihood information through ICTs and

social networks further supports well-being, although infrastructural and connectivity limitations may constrain these benefits (Adeniyi & Yekinni, 2023).

Despite the benefits of diversification, livelihood outcomes vary across Charland, Upland, and Barind agro-ecological regions due to their distinct environmental and socio-economic constraints (Afrin et al., 2024; Islam et al., 2024). Farmers adopt diverse strategies, including drought-tolerant and market-oriented crops, to sustain production, manage risk, and improve well-being (Kaushik et al., 2023; Siddika et al., 2023). Livelihood security depends on access to natural, financial, physical, human, and social capital (Al Mamun et al., 2023; Saba et al., 2022), and limited access to these assets increases household vulnerability to shocks and stresses.

Although previous studies in Bangladesh have explored food security, crop diversification, and climate adaptation (Afrin et al., 2024; Al Mamun et al., 2023; Alam et al., 2023; Islam et al., 2024; Majumder et al., 2024; Nahar et al., 2024; Sultana et al., 2023), most focus on single sectors or dimensions of welfare. Comparative analyses of livelihood security across different agro-ecological contexts remain limited, constraining the understanding of how diversification interacts with local conditions. To address this gap, this study conducts a comparative assessment of livelihood security among diversified farmers across three distinct agricultural situations—Charland, Upland, and Barind Tract—in northern Bangladesh. In line with this direction, the study was undertaken with the following objectives:

I. to assess the level of livelihood security among diversified farmers in Charland, Upland, and Barind Tract agricultural situations in northern Bangladesh; and
II. to compare the level of livelihood security across Charland, Upland, and Barind Tract agricultural situations.

Methodology

The study was conducted in the Rangpur Division of Northern Bangladesh, which comprises eight districts and is characterised by agro-ecologically disadvantaged regions, namely the Upland, Charland, and Barind Tract areas, located between 25°44′24″–25°51′00″ N latitude and 88°56′24″–89°15′00″ E longitude. This study focused on the Kurigram, Thakurgaon, and Dinajpur districts, which represent the three primary agricultural situations respectively: Charland, Upland, and Barind Tract.

The study population comprised 2,720 farm households from the six selected villages, all of whom had more than three years of farming experience and were engaged in diverse farming activities. The sample size was determined using Yamane's (1967) formula, which is a commonly adopted method in recent research studies. The formula is represented as follows:

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{2720}{1 + 2720(0.05)^2} = 348$$

Where *n* represents the sample size, *N* denotes the population size, *e* indicates the margin of error set at 0.05, and 1 is a constant. The number of farm households from each village and upazila was determined using Borku et al.'s (2024) Population Proportional Sampling Methods (PPSM).

A multi-stage sampling technique was employed to select the sample in line with the research objectives. In the first stage, the three districts (Kurigram, Thakurgaon, and Dinajpur) were purposively selected. In the second stage, one upazila (sub-district) from each selected district was also chosen purposively to capture agro-ecological variation. In the third stage, one union was randomly selected from each chosen upazila (Hakimpur: 3 unions; Thakurgaon Sadar: 19 unions; Kurigram Sadar: 8 unions), followed by the random selection of two villages from each selected union from a total of 10–15 villages per union to identify farm households. Data were collected via structured in-person interviews conducted by local enumerators from August to December 2024.

Table 1: Sampling frame

Situation	District	Upazila	Union	Village	Population	Sample
Charland	Kurigram	Sadar	Jatrapur	Char Jatrapur	564	72
				Garuhara	490	63
Upland	Thakurgaon	Sadar	Nargun	Uttar Bochapukur	410	52
				Purbo Nargun	468	60
Barind Tract	Dinajpur	Hakimpur	Alihat	Alihat	476	61
				Koktara	312	40
				Total	2720	348

To measure the livelihood security of diversified farmers, the index developed by Mary and Karthikeyan (2013) was used, with modifications to ensure uniform scoring. This index has also been applied in previous studies by Abhishek (2023) and Shivaji et al. (2024). It comprises seven components—food, financial, habitat, educational, health, social, and environmental security—each containing five items, for a total of 35 items that represent the overall construct. Responses were measured on a three-point continuum ('High', 'Low', and 'No') with corresponding scores of 2, 1, and 0, respectively. Accordingly, each component score ranged from 0 to 10, while the total livelihood security score was obtained by summing all items, yielding a possible range of 0 to 70. The internal consistency of the scale was assessed using Cronbach's alpha, which yielded 0.86, indicating good reliability. Reliability was also examined for each individual dimension, with Cronbach's alpha values ranging from 0.70 to 0.85, all within the acceptable range of internal consistency. Based on the cumulative scores, respondents were categorized into three groups—poor, average, and better livelihood security—using the mean ± standard deviation approach, following Chaithrashree and Shivalingaiah (2022). The collected data were coded, tabulated, and analysed using frequency, percentage, mean, standard deviation, rank order, Chi-square tests and analysis of variance (ANOVA).

Results and Discussion

Level of Livelihood Security of Diversified Farmers

The component-wise analysis of livelihood security among diversified farmers (Table 2) reveals notable variation across the three agricultural situations. Environmental security ranked highest in the Charland ($\bar{x}$ = 7.84) and Upland ($\bar{x}$ = 8.90) areas and third in the Barind Tract ($\bar{x}$ = 7.35), while food security ranked highest in the Barind Tract ($\bar{x}$ = 8.64) but was relatively lower in the Upland ($\bar{x}$ = 7.71) and Charland ($\bar{x}$ =

7.31) areas. Habitat security ranked second in both Charland ($\bar{x}$ = 7.76) and Upland ($\bar{x}$ = 8.67) areas and fourth in the Barind Tract ($\bar{x}$ = 6.94). Educational security ranked seventh in Charland ($\bar{x}$ = 6.96), fifth in Upland ($\bar{x}$ = 7.57), and second in the Barind Tract ($\bar{x}$ = 7.47), while health security ranked sixth in Charland ($\bar{x}$ = 7.30), third in Upland ($\bar{x}$ = 7.98), and fifth in the Barind Tract ($\bar{x}$ = 6.67). Social security ranked relatively higher in Charland ($\bar{x}$ = 7.71; third) but was lowest in Upland ($\bar{x}$ = 7.05; seventh) and the Barind Tract ($\bar{x}$ = 6.44; seventh), whereas financial security ranked moderately across all situations (Charland: $\bar{x}$ = 7.56; Upland: $\bar{x}$ = 7.54; Barind Tract: $\bar{x}$ = 6.50). In the pooled analysis, environmental security ranked first ($\bar{x}$ = 8.04), followed by food security ($\bar{x}$ = 7.82) and habitat security ($\bar{x}$ = 7.82) (tied for second), health security ($\bar{x}$ = 7.34), educational security ($\bar{x}$ = 7.30), financial security ($\bar{x}$ = 7.25), and social security ($\bar{x}$ = 7.13).

These differences are largely influenced by variations in agro-ecological conditions, which affect food availability, income opportunities, and access to services. In Charland areas, frequent flooding and riverbank erosion disrupt agricultural production and reduce income stability. In contrast, Upland areas generally experience more stable environmental conditions and better access to markets, contributing to relatively higher livelihood security. The Barind Tract, however, faces challenges such as water scarcity and poor soil quality, which limit agricultural productivity and opportunities for income diversification. Similar patterns have also been reported in India (Abhishek, 2023; Shivaji et al., 2024), indicating that livelihood outcomes are shaped by the combined effects of environmental and socio-economic factors.

Table 2: Component-wise livelihood security of diversified farmers

Components	**Level of livelihood security across agricultural situations**			**Pooled situation**
	Charland Mean score ($\bar{x}$)	**Upland Mean score ($\bar{x}$)**	**Barind Tract Mean score ($\bar{x}$)**	**Mean score ($\bar{x}$)**
Food security	7.31	7.71	8.64	7.82
Financial security	7.56	7.54	6.50	7.25
Habitat security	7.76	8.67	6.94	7.82
Educational security	6.96	7.57	7.47	7.30
Health security	7.30	7.98	6.67	7.34
Social security	7.71	7.05	6.44	7.13
Environmental security	7.84	8.90	7.35	8.04

Source: Field survey, 2024.

Figure 1 indicates that households in the Barind Tract had the highest mean food security score (8.64) compared with those in Upland (7.71) and Charland (7.31), indicating better year-round access to balanced food. This is likely linked to farmers' diversified crop production, including vegetables and fruits alongside cereals, which is consistent with evidence that greater agricultural diversification enhances

household food security in the Barind Tract (Haque, 2024; Nahar et al., 2024). In Charland, the financial security score (7.56) was slightly higher than that in Upland (7.54) and Barind Tract (6.50), which may reflect area-specific savings behavior and greater engagement in off-farm income diversification strategies that enhance financial resilience (Noman, 2020; Saba et al., 2022). Habitat security was highest in Upland (8.67), compared to Charland (7.76) and Barind Tract (6.94), indicating comparatively better housing conditions and related facilities in Upland. Education security was higher in Upland (7.57) than in Barind Tract (7.47) and Charland (6.96), while health security was higher in Upland (7.98) than in Charland (7.30) and Barind Tract (6.67), reflecting spatial disparities in access to basic services across agro-ecological regions (Islam et al., 2023; Noman, 2020).

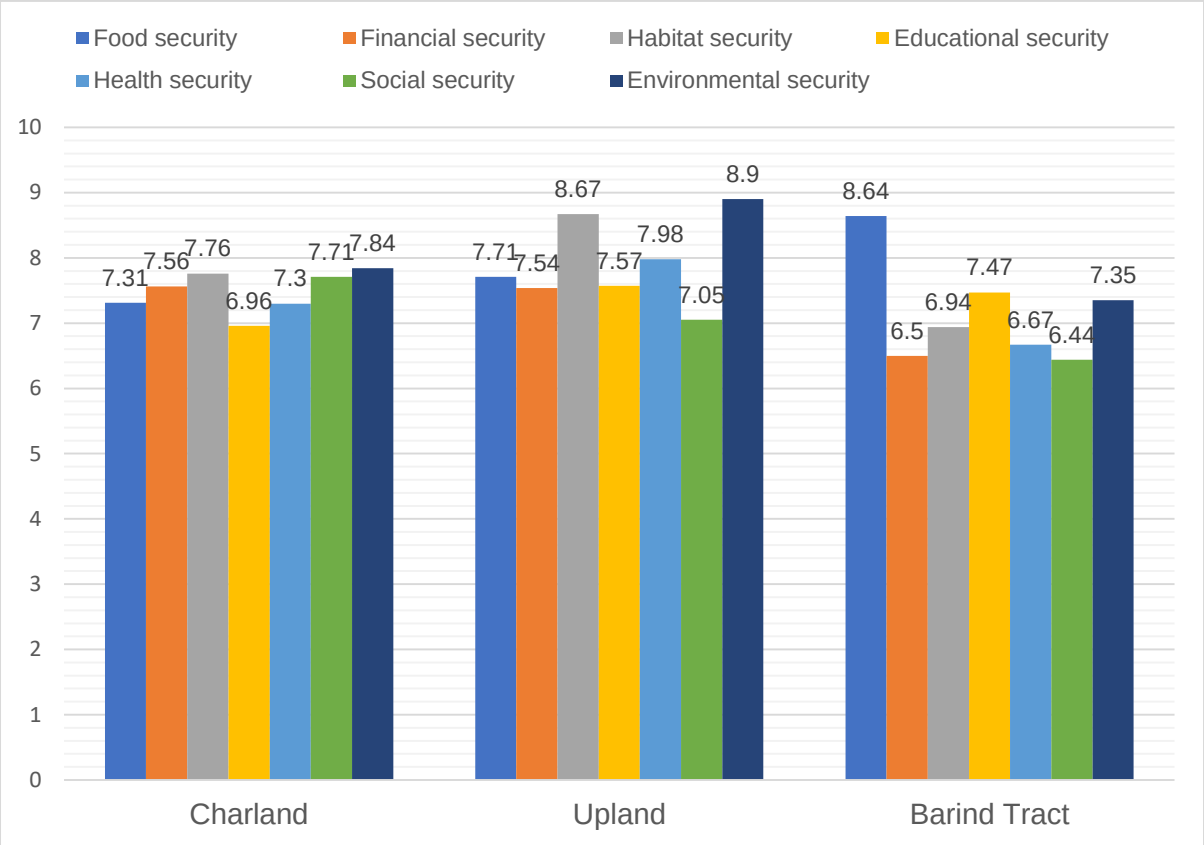

Figure 1: Component-wise livelihood security scores in study areas.
Source: Field survey, 2024.

In terms of social security, Charland farmers exhibited relatively stronger community engagement and participation in local decision-making, which is consistent with findings that social capital and cooperative networks are key determinants of rural livelihood resilience in Bangladesh (Kamal et al., 2021). Environmental security was highest in Upland (mean score = 8.90), followed by Charland (7.84) and Barind Tract (7.35), indicating relatively better access to water sources, natural resources, and eco-friendly practices in Upland locations (Sunny et al., 2022; Sultana et al., 2023). Overall, the farmers in Upland exhibited the highest mean scores across four security components (habitat, education, health, and environmental); Charland farmers scored highest in financial and social security; and Barind Tract farmers showed the highest mean food security scores.

The overall livelihood security scores ranged from 25 to 68 (out of a possible range of 0–70), with a mean of 44.88 and a standard deviation of 9.25. Using the mean ± standard deviation, farmers were classified into three categories: 'Poor' (≤36), 'Average' (37-54), and 'Better' (>54), as illustrated in Figure 2. The results show that the majority of farmers across all three agro-ecological regions had average livelihood security. Poor households were more common in the Barind Tract and Charland, while Upland had the highest proportion of better-off households. Overall, approximately 85% of farmers experienced low to moderate livelihood security, reflecting limited agricultural diversification and non-farm income opportunities, which is consistent with recent evidence that rural households in Bangladesh remain predominantly agriculture-dependent with uneven access to non-farm income diversification strategies (Saba et al., 2022; Salam & Bauer, 2022).

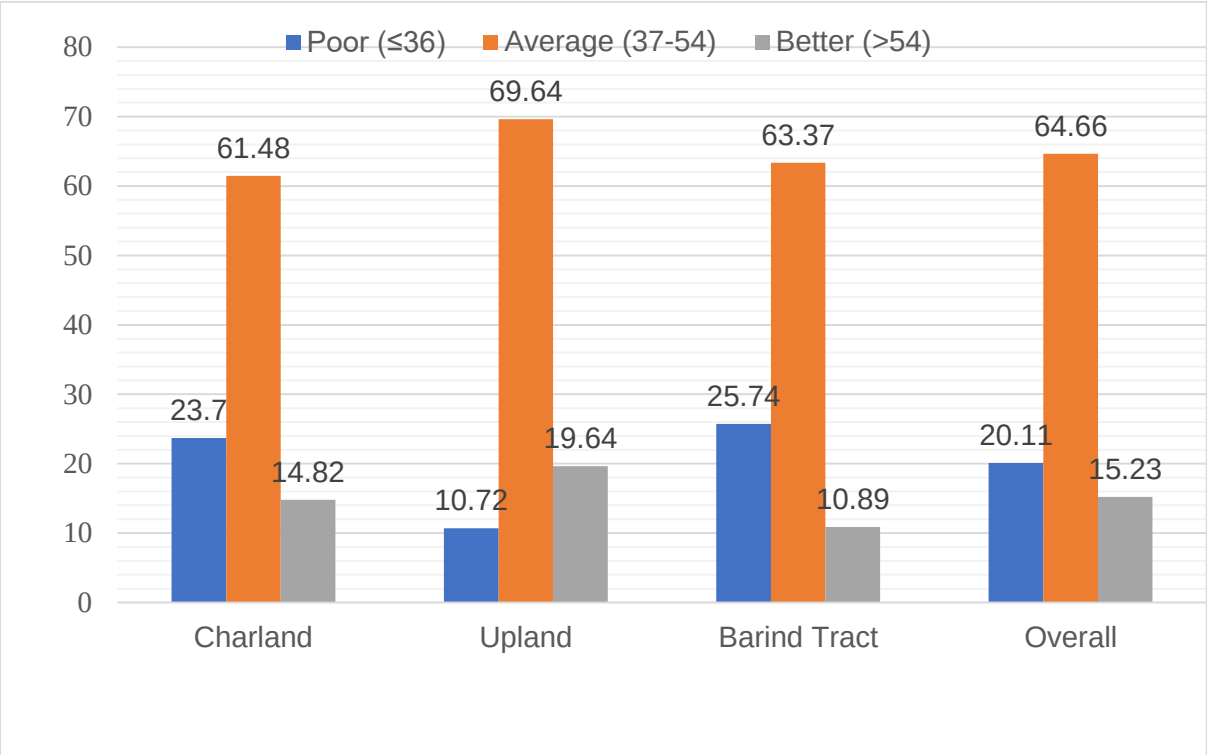

Figure 2: Livelihood security level.
Source: Field survey, 2024.

Comparison of Livelihood Security of Diversified Farmers across Agricultural Situations

Association between the different agricultural situations and the overall livelihood security level of diversified farmers revealed a statistically significant association between the agricultural situations and the livelihood security level ($\chi^2 = 10.74$, $p < 0.05$), indicating that the distribution of livelihood security levels differs across agricultural situations (Table 3).

Table 3: Variation in livelihood security across agricultural situations

Livelihood security level	Charland (n_1=135)	Upland (n_2=112)	Barind Tract (n_3=101)	χ^2
	%	%	%	
Poor (≤36)	23.70	10.72	25.74	10.74*
Average (37-54)	61.48	69.64	63.37	

Better (>54)	14.82	19.64	10.89
Total	100.00	100.00	100.00

Source: Field survey, 2024. *P≤ 0.05.

Livelihood Security across Agricultural Situations

Table 4 shows a statistically significant difference in mean livelihood security scores across agricultural situations (F = 4.334), indicating that farmers' livelihood outcomes are strongly influenced by agro-ecological conditions. The relatively higher scores in Upland areas and lower scores in the Barind Tract reflect differences in resource availability, environmental stress, and production opportunities. This suggests that uniform extension and development interventions may be ineffective across contexts. Therefore, agricultural extension services and policymakers should emphasize location-specific strategies, promoting climate-resilient and resource-appropriate practices to enhance livelihood security in diverse agro-ecological settings.

Table 4: Livelihood security across agricultural situations

Situations	Sample size	Mean ($\bar{x}$)	SD	'F' Value
Charland	135	44.68	9.50	4.334*
Upland	112	46.75	8.57	
Barind Tract	101	43.06	9.33	
Overall	348	44.88	9.25	

Source: Field survey, 2024.
*P≤ 0.05.

Similar findings have been reported in South Asia, where significant spatial variation in livelihood outcomes exists across ecological settings (Jackson et al., 2025; Mohammad et al., 2023). Evidence from African rural contexts also supports this pattern, showing differences in livelihood vulnerability and composite livelihood indices across agro-ecological zones (Albore, 2024; Belay & Lebeza, 2024). These findings collectively reinforce that livelihood outcomes are highly context-dependent, shaped by ecological, geographic, and socio-economic factors.

Conclusion and Recommendations

The study reveals significant variation in livelihood security among diversified farmers across agricultural situations in northern Bangladesh. Upland farmers achieved the highest scores in habitat, education, health, and environmental security, while Charland farmers performed better in financial and social security, and Barind Tract farmers exhibited relatively higher food security. Despite these differences, most farmers across all regions experienced a moderate level of overall livelihood security. Statistical analyses confirmed a significant association between agricultural situations and livelihood security, with Upland farmers attaining the highest mean overall scores.

These findings underscore the importance for policymakers, agricultural extension agencies, and development organizations in Bangladesh to design situation-specific agricultural policies and interventions rather than uniform livelihood strategies. Enhancing livelihood security requires an integrated approach that combines

agricultural diversification with improved institutional support and greater access to resources. Therefore, relevant government institutions (e.g., the Ministry of Agriculture and the Department of Agricultural Extension) should prioritise targeted support to strengthen context-specific livelihood dimensions and promote climate-resilient, market-oriented diversification. Future research should adopt longitudinal, mixed-methods approaches to better capture dynamic livelihood processes across diverse agricultural situations and examine the causal effects of agricultural diversification on livelihood security in northern Bangladesh.

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