Assessing Livelihood Coping Strategies Adopted by Small and Marginal Farmers of Climate-Vulnerable Assam State of India

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ABSTRACT

This study examined the livelihood diversifications of small and marginal farmers' households and determinants of livelihood diversification of Assam state of India under climate-vulnerable situations. A sample of 300 marginal and small rural households was obtained from three highly flood-affected districts. The sampling plan adopted some flexibility as the data collection process coincided with the late part of the COVID-19 pandemic. Data was collected through a structured questionnaire. The data were analysed using descriptive statistical tools, the non-parametric chi-square test, and the Simpson Diversification Index. The study indicates that most respondents tried diversifying their livelihood strategies for economic improvement. However, no dominant livelihood strategies were found among the adopted portfolios. Many respondents preferred livestock as a portfolio for livelihood diversification. The study found that respondents with a higher formal education or job card holders under the MGNREG-Act were identified as positive determinants for livelihood diversification. The study proposes increasing the allocation of Job Cards under the MGNREG-Act, given that Job Cards enable cash in hands or establish a consistent provision of substantial cash through different farming programmes. The study also emphasises the introduction of suitable livestock-based livelihood diversification.

Keywords: Assam; climate change; livelihood diversification; livelihood strategies; Simpson diversification index.

1. INTRODUCTION

Assam is a state highly vulnerable to the impacts of climate change within the Indian Himalayan Region (IHR), as stated by Goswami [1]. The New Indian Express [2] reported that fifteen of its districts are among the twenty-five most vulnerable to climate change districts in India. Sarma [3] mentioned that the temperature of Assam is predicted to increase by about 2° C by 2050, and extreme rainfall events are expected to increase by more than 35.00 per cent compared to the baseline period of 1971–2000.

Proper livelihood coping strategies play a crucial role in mitigating the risks of climate change for smallholder farmers in Assam. They depend on rainfed agriculture. They have less land, land primarily fragmented, fewer resources, and are more vulnerable to climate change. Under a changing climate, ensuring sustainable livelihoods is essential for their economic development. By adopting sustainable farming practices, smallholder farmers can reduce their exposure to climate change and strengthen their resilience [4]. According to Frost et al. [5], smallholder farmers can pursue climate-smart agriculture practices to adapt and mitigate climate change. Diversifying livelihood options can help smallholder farmers reduce dependence on a single crop or income source, thereby improving their family income. Farmers can spread their risks and improve their capacity for adaptation by diversifying their operations [6]. Supporting the livelihoods of small and marginal farmers in Assam is essential for increasing their income in the face of climate-related risks like floods.

The effectiveness of livelihood strategies in a rural household's vulnerability to food insecurity is essential [7]. Families that depend on agriculture-based livelihoods are more vulnerable to food insecurity than those who have diversified their livelihoods [8]. The livelihood diversification can contribute to household food security [9]. The choice of livelihood strategies can substantially affect rural households' food security [10]. According to their findings, diversified livelihood strategies are critical for ensuring food security. Understanding how livelihood strategies affect household food security is essential for sustainable development in subsistence-oriented or semi-subsistence farming systems [11,10]. Diversifying livelihoods can help increase rural income and reduce vulnerability to climate change.

Livelihood diversification may comprise on-farm and off-farm activities undertaken to produce extra income in addition to the main household agricultural activities [12,13]. It entails engaging in various income-generating activities to support agricultural production [14]. Producing supplementary goods and services in the agricultural and non-agricultural sectors, working as wage labour, working for self-employment in small businesses, and other risk-reduction techniques can all be included in this strategy [12].

The motivation behind livelihood strategies can vary widely. It may include factors such as accumulation for consumption and investment, risk spreading, coping with temporary crises, adapting to long-term declines in income or entitlements, and taking advantage of local resources, culture, and opportunities [13,15]. Diversification can help the state's overall economic development by lowering reliance on a single sector, paddy. Additionally, it can increase employment opportunities and raise standards of living [16].

The main natural disasters that Assamese farmers experience each year are floods and untimely drought. The annual flood, which also impacts people's spirits, frequently results in the loss of crops, livestock, homes, arable land, and human lives. Such yearly losses are reportedly in the millions of rupees [17]. Annually, 8000 hectares of land are lost to flooding in Assam [18]. According to the same report, the annual mean expenditure incurred due to flooding in Assam is estimated to be around Rs 200 crore.

A thorough analysis of small and marginal farmers' livelihood strategies is necessary to determine their livelihood possibilities and perceived profitable agricultural activities in the future to develop a strategy to improve their livelihoods. So, the present study was conducted to assess the livelihood coping strategies of marginal and small farmers of Assam. Assessing the livelihood strategies pursued by small and marginal farmers in Assam is necessary in identifying new livelihood strategies that are more sustainable and resilient in the face of changing conditions.

2. METHODOLOGY

The study was proposed in 2019; however, the researchers encountered a data collection period with the COVID-19 pandemic. Following a proper sampling design during the pandemic was challenging for various reasons. Though there was some relaxation in movement in many places from the last part of 2020, sporadic restrictions hindered following the proper sampling plan for the study.

2.1 Selection of Study Location and Respondents

Therefore, it was decided to collect the data during the first part of 2021 in a flexible sampling plan. In Assam, there were no official records of farmers for each village, along with personal information like phone numbers, landholding size, and age in a proper way. So, it was challenging to select respondents properly. Therefore, after discussing with experts, a flexible sampling plan was followed by modifying the original one. In a podcast, a researcher of IFPRI also mentioned that they carried out survey works during the pandemic by changing their data collection procedure with a flexible sampling plan [19]. ILO also suggested some relaxation for the sampling plan to collect data from the field in the face-to-face interview method [20].

Though utmost care was taken in data collection from the respondents, respondents' responses might still reflect the impact of the COVID-19 pandemic period. The data collection was conducted under a broad study covering two years as a benchmark at ten-year intervals (2010 and 2020). In the present study, only some findings of 2020 were presented as it also provides some important results.

Finally, one agroclimatic zone of the state, namely Upper Brahmaputra Vally Zone, was selected, and three flood-prone districts of the zone, namely Majuli, Golaghat and Jorhat, were selected randomly for the study. All the selected districts are severely flood-affected, and Golaghat district is one of the 25 most climate-vulnerable districts in the country. At that time of data collection, offices were running with limited staff. The field-level extension staff, like Agricultural Development Officers (ADOs) and Agriculture Extension Assistants (AEAs), were also busy handling the impact of COVID-19 on agriculture. Still, District Agriculture Officers (DAOs) were able to discuss the matter of the selection of villages with some ADOs and AESs over the phone. In this way, a list of 10 villages suitable for the study from each district was collected from DAOs of the selected district. Finally, five villages were selected randomly from the lists of each district so that at least 20 respondents could be interviewed for the study. Advanced intimation to the selected farmers was impossible because there was no official list of farmers and their telephone numbers. Snowball sampling was followed to find potential respondents who could give valuable information [20].

At the time of data collection, those who were available and agreed to the interview were considered respondents. The process could not provide the requisite number of respondents of 100 from each district to make the total number

of respondents 300. Therefore, one more village from each district was added to fill the shortfall. Ultimately, six villages from each district were selected for the study.

This sampling approach has some limitations. Since the selection of villages was not based on a specific sampling plan, the sample may not represent the entire population. Considering the time, budget and endemic situation, the sample size was reduced to 271 by Cochran's equation based on the online source of Sample Size Calculator [21] with combinations of measure of confidence level as 90 per cent, a margin of error = 5%, a measure of variability at 0.5. However, finally, a total of 300 samples was considered by selecting 100 samples from each selected district. It is important to consider potential biases and limitations associated with this method.

2.2 Measurements of Livelihood Strategies and Extent of Livelihood Diversification

In the study, livelihood strategies were measured in terms of income-generating activities adopted by the respondents for livelihoods. The Simpson Diversification Index (SID) was adopted to determine the extent of respondents' livelihood diversification [22]. The analysis provided information about the means adopted by the farmers to sustain their lives. The index is easy to compute and interpret, as follows.

$$SID= 1 - \sum_{i=1}^{n} p_i^2$$

Where,

SID = Simpson Index of Diversification
n = Total number of income sources and
p_i = Income proportion of the ith income source

where SDI is the Simpson Diversification Index, N is the total number of revenue sources, and p_i is the proportion of revenue from i^{th} source. The value would vary from 0 to 1. The index value is zero when there is only one source of income. The value increases with more income sources and more evenly distributed income shares. The score reaches one as the level of diversification increases. When a lone source of income exists, $P_i = 1$, then SDI = 0.

In the present study, to examine the extent of livelihood diversification at the unit level, the sample households were classified based on the level of diversification into four categories: not

diversified (0), less diversified (>0 to <0.29), moderately diversified (0.29 to <0.59), highly diversified (0.59 to <1) and fully diversified (1). The value of SID ranges between 0 to 1. The first category had the lowest score (0), where only one source of portfolio was for income generation. So, the category was termed as 'not diversified'. Likewise, the highest ranked category was termed 'fully diversified' for those respondents whose SID score was 1. In between, three more categories were made with class intervals based on maximum and minimum scores obtained by the respondents. Here, the class interval was found to be 0.29. In the present study, the minimum score obtained by a respondent was '0' and the highest was '0.88'.

2.3 Selection of Determinants of Livelihood Diversification and Hypothesis

Among these determinants of livelihood diversification, educational level, family type, migration, procession of job card under Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), and market accessibility were hypothesised as statistically significant predictors of livelihood diversification.

2.4 Statistical Measurement Followed

Conclusions were reached using descriptive statistics for analysing livelihood coping strategies pursued by respondents. The Simpson Diversification Index was used to determine the extent of livelihood diversification. The non-parametric chi-square test and cross-tabulations were used to determine the association between selected variables and livelihood diversification. IBM SPSS V20 was used for data analysis.

3. RESULTS AND DISCUSSION

3.1 Livelihood Coping Strategies Pursued by Respondents

Table 1 shows that 300 respondents adopted 17 livelihood coping strategies. The table depicted that most smallholder farmers followed a combination of 'paddy+ vegetables + piggery' as livelihood activities in the study areas. As paddy is Assam's main crop, farmers as much as possible to cultivate paddy in their fields. Among livestock, farmers wanted to incorporate piggery, which increased their income. Piggery is a popular and profitable livelihood option for farmers in Assam [23]. It was commonly practised by some tribes and communities [24]

but has the potential to spread among other communities. The Government of Assam has also started a Pig Development Project to help pig farming in the state [23]. From that perspective, the findings will help the project to identify potential farmers from the study areas. The table reflected that most livelihood activities were combined with paddy, pig farming, vegetable cultivation, dairy (indigenous), poultry (backyard), fishery, weaving, etc.

Table 1 indicates that no dominant livelihood strategies were observed among the respondents. It indicates that no existing livelihood strategy provided sustainable livelihood to the respondents. The farmers in Assam have been incorporating the livestock sector in livelihood activities to increase their livelihood [25], (Livestock Census, 2023). It also reported that in Assam, smallholders with indigenous species mainly do livestock production activities. Thus, more improved animals, fodder/feed technology, and livestock services are needed to help small and marginal farmers access reliable markets and earn more. However, few households (4.33%) solely depended on remittance, indicating that they had no other source of livelihood. The result shows that people of rural Assam already incorporated remittance as a livelihood portfolio. Dey and Laskar [26] also mentioned that in Assam, remittance impacted improved poverty. It is evident from Table 1 that the respondents engaged in a variety of activities to maintain their livelihood. However, there is a need to identify an effective portfolio for livelihood diversification for small and marginal farmers and adopt such practices to enhance income levels and improve overall livelihoods.

3.2 Extent of Livelihood Diversification

The livelihood diversification among the respondents was depicted in Table 2, that most respondents (71.70%) were moderately diversified, indicating that they adopted some sources and depended on almost all the income sources. On the other hand, 12.30 per cent of the respondents were less diverse. Again, it was indicated that 11.70 per cent of respondents were highly diversified, i.e., they had adopted different income sources and depended on all the sources for livelihood. Only 4.33 per cent of respondents depended solely on one source for livelihood. The results from the study pointed out that, for income generation, the respondents mostly adopted different livelihood activities. The findings support the report of Sharma et al. [27], who reported that most households in India have two or even more livelihood options.

3.3 Association between Selected Variables and Livelihood Diversification

A chi-square test was done for some selected variables to determine the variables influencing livelihood diversification, measured through SID.

Table 1. Livelihood coping strategies pursued by small and marginal farmers in the study area (n=300)

S.N	Livelihood strategies	Frequency	Percentage
1.	Paddy+ Vegetables + Piggery (improved)	52	17.33
2.	Fruit crops + Dairy (indigenous)	12	4.00
3.	Vegetables + Piggery (improved)	47	15.67
4.	Nursery + Fruit crops + Paddy	10	3.33
5.	Poultry (backyard) + Weaving	23	7.67
6.	Duckery (indigenous) + Plantation crop	31	10.33
7.	Dairy (indigenous) +Fishery + Paddy	38	12.67
8.	Piggery (improved) + Service + Kitchen Garden	14	4.67
9.	Gotary (indigenous) + Piggery (improved) + Paddy	11	3.67
10.	Plantation crop + fishery	8	2.67
11.	Remittance	13	4.33
12.	Bamboo + Small business + Poultry (backyard)	9	3.00
13.	Fishery +Small business	10	3.33
14.	Weaving + Kitchen Garden	5	1.67
15.	Service + piggery (improved) + Duckery (indigenous)	7	2.33
16.	Small business + paddy	6	2.00
17.	Remittance + weaving	4	1.33
	Total	300	100.00%

Table 2. Extent of livelihood diversification of the respondents

Status of diversification	SID value range	Percentage of respondents
Not diversified	0* (Possible minimum score)	4.33
Less diversified	>0 to < 0.29	12.30
Moderately diversified	0.29 to <0.59	71.70
Highly diversified	0.59 to <1	11.70
Fully diversified	1**(Possible Maximum score)	0

*Minimum possible scale value=0 & **Maximum possible scale value=1
Actual minimum score obtained=0 and maximum score obtained=0.88
Class interval=0.29

3.3.1 Association between education and livelihood diversification

In the case of the association between education and livelihood diversification, Table 3 asserted that most of the respondents had above the primary level of education and moderately diversified their farms. This group represents 51.00 per cent of total respondents. The table reported a significant association between education and livelihood diversification. The chi-square value was X^2 (3, N=300) =12.576, p=.006*, indicating that respondents with higher education had more livelihood diversification. Some studies also found that education was a determinant in the adoption process of livelihood diversification strategies [28,22].

3.3.2 Association between family type and livelihood diversification (SID)

The association of family type and livelihood diversification is presented in Table 4. It describes that most joint families were moderately diversified, with 36.67 per cent of the total respondents. The chi-square test found no significant association between family type and livelihood diversification, indicating no difference in livelihood diversification whether families were nuclear or joint. Generally, in joint families, more family labourers are available in rural areas [29]. That was also not reflected in the study. In India, joint families are still prevalent, especially in rural areas. In the study, the proportion of joint families was the same as that of nuclear families. The findings were contradictory to the report given by Shaikh [30].

3.3.3 Association between migration and livelihood diversification

Table 5 depicted that 89.33 per cent of respondents had not adopted migration as a source of livelihood. The chi-square test confirmed no association between migration and livelihood diversification. However, Table 1 reflects 13 respondents dependent on remittance. The findings contradict the studies of Bouapao [31] and Hussein and Nelson [13], who reported that remittance is now considered an important portfolio for livelihood diversification.

3.3.4 Association between job card of MGNREGA and livelihood diversification

In the case of the association of job cards and livelihood diversification, it was explored from the study that most job card holder respondents were moderately diversified. The MGNREGA provides job cards to rural households to ensure one hundred days of guaranteed unskilled work for which they get wages in bank accounts. From the chi-square test (Table 6), it was also found that there was a significant association between job cards and livelihood diversification. So, it indicated that the higher the job card, the higher the rate of livelihood diversification, so the null hypothesis was rejected. Job cards provided 100 days' wages in cash, which might help the respondents to diversify. The findings also indicate that cash in hands is essential for smallholder farmers to diversify their livelihood. So, the job card was an important determinant that can improve their annual income. It indicates that cash flow was important for livelihood diversification.

3.3.5 Association between access to market and livelihood diversification (SID)

The result (Table 7) of the association between access to market and livelihood diversification affirmed that 58.33 per cent of the respondents had access to the market to sell their farm produce with moderate diversification. However, there was no association between the access to market and livelihood diversification, which was shown through the chi-square value, *i.e.*, 0.713 with *p*-value of .870. Therefore, the null hypothesis was accepted. The findings indicate

Table 3. Frequency and percentage distribution of respondents according to the association between education and livelihood diversification (SID)

Category	Response	Livelihood diversification based on SID value				Total (%)
		Not diversified (%)	Less diversified (%)	Moderately diversified (%)	Highly diversified (%)	
Education	Below HSLC passed	6(2.00%)	10 (3.33)	62 (20.67)	20 (6.67)	98(32.67)
	HSLC passed & above	7 (2.33)	27 (9.00)	153 (17.67)	15 (5.67)	202(67.33)
Total		13(4.33%)	37(12.33%)	215(71.67%)	35(11.67%)	300(100.00%)

Note: Pearson chi-square, X^2=12.576, df =3, p =.006*

Table 4. Frequency and percentage distribution of respondents according to the association between family type and livelihood diversification (SID)

Category	Response	Livelihood diversification based on SID value				Total (%)
		Not diversified (%)	Less diversified (%)	Moderately diversified (%)	Highly diversified (%)	
Family type	Nuclear	10 (3.33)	14 (4.67)	105 (35.00)	17 (5.67)	146(48.67)
	Joint	3 (1.00)	23 (7.67)	110 (36.67)	18 (6.00)	154(51.33)
Total		13(4.33%)	37(12.33%)	215(71.67%)	35(11.67%)	300(100.00%)

Note: X^2=5.894, df=3, p=.117

Table 5. Frequency and percentage distribution of respondents according to the association between migration and livelihood diversification (SID)

Category	Response	Livelihood diversification based on SID value				Total (%)
		Not diversified (%)	Less diversified (%)	Moderately diversified (%)	Highly diversified (%)	
Migration	Yes	0(0.00)	3 (1.00)	28 (9.33)	1 (0.33)	32(10.67)
	No	13 (4.33)	34 (11.33)	187 (62.33)	34 (11.33)	268(89.33)
Total		13(4.33%)	37(12.33%)	215(71.67%)	35(11.67%)	300(100.00%)

Note: X^2=5.300, df=3, p=.151

Table 6. Frequency and percentage distribution of respondents according to the association between job card and livelihood diversification

Category	Response	Livelihood diversification based on SID value				Total
		Not diversified (%)	Less diversified (%)	Moderately diversified (%)	Highly Diversified (%)	(%)
Holding	Yes	6 (2.00%)	17 (5.67)	146 (48.67)	24 (8.00)	193(64.33 %)
of job card of MGNREGA	No	7 (2.33%)	20 (6.67%)	69 (23.00)	11 (3.67)	107(35.67%)
Total		13(4.33%)	37(12.33%)	215(71.67%)	35(11.67%)	300(100.00%)

Note: X^2=8.795, df=3, p= .032***

Table 7. Frequency and percentage distribution of respondents according to the access to market and livelihood diversification (SID)

Category	Response	Livelihood diversification based on SID value				Total
		Not diversified (%)	Less Diversified (%)	Moderately Diversified (%)	Highly Diversified (%)	(%)
Access to	Yes	11 (3.67)	32 (10.67)	175 (58.33)	28 (9.33)	246(82.00)
market	No	2 (0.67)	5 (1.67)	40 (13.33)	7 (2.33)	54(18.00)
Total		13(4.33%)	37(12.33%)	215(71.67%)	35(11.67%)	300(100.00%)

Note: X^2=0.713, df=3, p=.870

Table 8. Frequency and percentage distribution of respondents according to alternate livelihood options based on existing livelihood diversification

Category	Response	Not diversified (%)	Less Diversified (%)	Moderately Diversified (%)	Highly Diversified (%)	Total (%)
Alternate	Yes	9 (3.00%)	10 (3.33%)	126 (42.00%)	22 (7.33%)	167(55.67%)
Livelihood option	No	4 (1.33%)	27 (9.00%)	89 (29.67%)	13 (4.33%)	133(44.33%)
Total		13(4.33%)	37(12.33%)	215(71.67%)	35(11.67%)	300(100.00%)

X^2=14.752, df=3, p=.002***

that for livelihood diversification, market accessibility was not considered by them. They may produce a negligible portion as marketable surplus since they were smallholder farmers.

3.4 Alternate Livelihood Options Based on Existing Livelihood Diversification

Table 8 stated that more than half of the respondents (55.67%) had opted for an alternate livelihood option. Thus, according to the data in the table, more than half the respondents would alter their current means of subsistence if viable alternatives were available.

4. CONCLUSION

The study found that education levels and the possession of a job card influence livelihood diversification in climate-vulnerable areas. The study suggests that development agencies, governments, and non-governmental organisations (NGOs) should prioritise education and job cards under MGNREGA access to all needy people. Based on the study, it is suggested that the government should provide cash for farming to needy farmers, which will help small and marginal farmers for livelihood diversification. Though there were no suitable portfolios to add to sustainable livelihood strategies, many small and marginal farmers tried livestock like pigs, poultry, and dairy. The study suggests that the government should emphasise systematically developing the livestock sector to assist Assam's small and marginal farmers develop proper livelihood strategies.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Goswami R. Assam most vulnerable to climate change in Indian Himalayan Region, says study; 2018, December 25.
   Available:https://www.telegraphindia.com
   Available:https://www.telegraphindia.com
2. The New Indian Express. Climate change: Assam has 15 of India's 25 most vulnerable districts. The New Indian Express;2022, September 16.
   Available:https://www.newindianexpress.com
3. Sarma C. The Assam Tribune. The Assam Tribune; 2017.
   Available:https://assamtribune.com/assam/climate-change-and-its-impact-on-assam-1476570; 2023.
4. United Nations Development Programme [UNDP]. Zimbabwe human development report 2017: Climate Change and Human Development: Towards Building a Climate Resilient Nation [Internet]. United Nations Development Programme; 2018.
   Available:https://www.undp.org/zimbabwe/publications/2017-zimbabwe-human-development-report
5. Frost C, Jayaram K, Pais G. What climate-smart agriculture means for smallholder farmers. McKinsey & Company; 2023.
   Available:https://www.mckinsey.com/industries/agriculture/our-insights/what-climate-smart-agriculture-means-for-smallholder-farmers
6. Beltrán-Tolosa LM, Cruz-García GS, Ocampo J, Pradhan P, Quintero M. Rural livelihood diversification is associated with lower vulnerability to climate change in the Andean-Amazon foothills. PLOS Climate. 2022;1(11):e0000051.
   Available:https://doi.org/10.1371/journal.pclm.0000051
7. Tefera TL, Perret S, Kirsten JF. Diversity in livelihoods and farmers' strategies in the Hararghe highlands, eastern Ethiopia. International Journal of Agricultural Sustainability. 2004;2(2):133–146.
   Available:https://doi.org/10.1080/14735903.2004.9684573
8. Giannini A, Nébié EKI, Ba D, Ndiaye O. Livelihood strategies shape vulnerability of households' food security to climate in Senegal. Frontiers in Climate. 2021; 3.
   Available:https://doi.org/10.3389/fclim.2021.731036
9. Nyathi D, Ndlovu J. Livelihood diversification and household food security in selected agrarian settings of Western Zimbabwe. In Springer eBooks. 2022;349–359.
   Available:https://doi.org/10.1007/978-3-030-98617-9_20
10. Manlosa AO, Hanspach J, Schultner J, Dorresteijn I, Fischer J. Livelihood strategies, capital assets, and food security in rural Southwest Ethiopia. Food Security. 2019;11(1):167–181.
    Available:https://doi.org/10.1007/s12571-018-00883-x

11. Wichern J, Van Wijk MT, Descheemaeker K, Frelat R, Van Asten PJ, Giller KE. Food availability and livelihood strategies among rural households across Uganda. Food Security. 2017;9(6):1385–1403.
Available:https://doi.org/10.1007/s12571-017-0732-9

12. Israr M, Khan H, Jan D, Ahmad N. Livelihood Diversification: A streatagy for rural income enhancement. Journal of Finance and Economics. 2014;2(5):194–198.
Available:https://doi.org/10.12691/jfe-2-5-10

13. Hussein K, Nelson J. Sustainable Livelihoods and Livelihood Diversification (IDS working paper 69) [Internet]. Institute of Development Studies and the Poverty Research Unit at the University of Sussex; 1998.
Available:https://www.ids.ac.uk/download.php?file=files/Wp69.pdf

14. Biswas B, Mallick. Livelihood diversification as key to long-term non-migration: Evidence from coastal Bangladesh. Environment, Development and Sustainability. 2020;23(6):8924–8948.
Available:https://doi.org/10.1007/s10668-020-01005-4

15. Tanner T, Lewis D, Wrathall D, Bronen R, Cradock-Henry NA, Huq S, et al. Livelihood resilience in the face of climate change. Nature Climate Change. 2015; 5(1):23–26.
Available:https://doi.org/10.1038/nclimate2431

16. Agriculture – Status of environment related issues: Assam ENVIS Centre, Ministry of Environment and Forests, Govt. of India; 2015.
Available:https://asmenvis.nic.in/Database/Agriculture_839.aspx

17. Bhuyan S. The agricultural sector in Assam: Its importance; 1998.
Available:https://assam.org/node/2371

18. Ground Report. Assam losing 8000 hectares land every year due to floods. Ground Report; 2022, July 22.
Available:https://groundreport.in

19. Gupta S. Research talks with IFPRI (J. Weingart, Ed.; episode Episode 12). IFPRI; 2020.
Available:https://soundcloud.com/ifpri-researchtalks/episode-12-the-challenges-of-phone-surveys-with-women-in-india-during-covid

20. ILO, Department of Statistics. COVID-19: Guidance for labour statistics data collection: Guidance to data producers to maintain labour force survey data collection. [E Book]. ILO; 2020.
Available:https://ilo.org/wcmsp5/groups/public/---dgreports/---stat/documents/publication/wcms_743156.pdf

21. Sample Size Calculator. (n.d.).
Available:https://www.socscistatistics.com/tests/samplesize/default.aspx

22. Khatun D, Roy BC. Rural livelihood diversification in West Bengal: Determinants and constraints. ResearchGate; 2012.
Available:https://www.researchgate.net/publication/254385749_Rural_Livelihood_Diversification_in_West_Bengal_Determinants_and_Constraints

23. Animal Husbandry and Veterinary Department, Assam. Strategy Paper on Piggery Sector, Assam: Targets and goals for 2019-2024 [Internet]. Animal Husbandry and Veterinary Department, Assam, Guwahati-781003; 2018.
Available:https://animalhusbandry.assam.gov.in/sites/default/files/swf_utility_folder/departments/ahvetdept_webcomindia_org_oid_3/portlet/level_1/files/piggery.pdf

24. Shyam J, Tripathi H, Balaraju B. Economic contribution of backyard piggery in the livelihood security of tribal families of Assam. International Journal of Livestock Research; 2017.
Available:https://doi.org/10.5455/ijlr.20170208124713

25. Livelihoods Tracking System | Assam State Rural Livelihoods Mission (ASRLM). (n.d.).
Available:https://assamlivelihoods.in/livestock.aspx

26. Dey S, Laskar HA. Internal Remittances, Household Welfare, Spending Patterns and Labour Supply: A Study from Rural Areas of Hailakhandi District of South Assam. The Indian Journal of Labour Economics. 2022;65(1): 161–184.
Available:https://doi.org/10.1007/s41027-022-00361-1

27. Sharma HR, Malik SH, Bhatia A. Effects and determinants of diversification of livelihood options amongst agricultural households in India: A state level analysis. Indian Journal of Agricultural Economics. 2022;77(1):145–162.

Available:https://isaeindia.org/wp-content/uploads/2022/04/08-Article-HR-Sharma.pdf

28. Habib N, Ariyawardana A, Aziz AA. The influence and impact of livelihood capitals on livelihood diversification strategies in developing countries: A systematic literature review. Environmental Science and Pollution Research. 2023;30(27): 69882–69898.
    Available:https://doi.org/10.1007/s11356-023-27638

29. Biswas BS. Why Indians continue to live in joint families. BBC News. 2020;2020.

Available:https://www.bbc.com/news/world-asia-india-54053091

30. Shaikh Z. Rural India starts to go nuclear, urban families grow in shrinking space. The Indian Express; 2017.
    Available:https://indianexpress.com/article/india/rural-india-starts-to-go-nuclear-urban-families-grow-in-shrinking-space-4737882/

31. Bouapao L. Livelihoods and migration. In Springer eBooks. 2013;143–178.
    Available:https://doi.org/10.1007/978-1-4614-6120-3_5