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Sustainable rural livelihoods of farmers in chronically flood prone areas of north bank plains zone of Assam

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Abstract
The present study was carried out to assess the Sustainable Rural Livelihoods of farmers in chronically flood prone areas. The study was conducted in the North Bank Plains Zone of Assam. In order to measure the sustainable rural livelihoods, Sustainable Rural Livelihoods index developed by Directorate of Rice Research, Govt. of India (2012) was used. The findings revealed that majority (82.79%) of the respondents belonged to the age category of 36 - 59 years. Majority of the respondents (31.97%) had formal education up to middle school level and there was no illiterate respondent in the study area. Majority of the respondents (79.51%) belonged to the nuclear family type and majority of respondents (70.49%) had small families (up to 4 members). Among the respondents, marginal farmers made up the majority (46.72%), followed by small farmers (45.90%) and no respondents were found in the medium and big land holding category. Majority of the respondents (76.23%) had medium net annual farm income (Rs.26,313 to Rs.61,851). Majority of the farmer respondents (81.15%) had 'only cultivation' as occupation. Findings revealed that that majority of the respondents had medium level of Human Capital asset (59.84%), Physical Capital asset (63.11%), Natural Capital asset (57.38%) and Social Capital asset (68.03%). The average Human Capital Index (HCI) score was 57.60, which was by and large of moderate strength and the average Physical Capital Index (PCI), Natural Capital Index (NCI) and Social Capital Index (SCI) score was 36.27, 20.36 and 30.75, respectively, which were by and large of lower strength, which contribute to their overall poor Sustainable Rural Livelihood Index (36.25) strength.

Keywords: Sustainable rural livelihood, flood prone areas, North bank plains zone, farmers, Assam

Introduction
In India, flooding has historically been a common occurrence. In some regions of the country almost every year, floods of varied magnitudes occur. Due to the country's varied climates and rainfall patterns, some areas may simultaneously experience severe floods and drought conditions. In India, flooding was responsible for the 3rd deadliest event of the year 2020, costing 1,922 lives and caused US$ 7.5 billion in economic losses (Anonymous, 2021) [2]. Assam is one of the states of the country with the greatest risk of hazards. The most common water-induced hazards in the state are floods, flash floods, and river bank erosion. Lakhimpur and Dhemaji are highly flood affected districts of North Bank Plains Zone (NBPZ) of Assam, which cause adverse effect on livelihood of farmers. Crop production, which contributes significantly to the livelihood of the agricultural community in these areas due to poor productivity and small per capita land holding, has significant challenges. Large areas of the district's farmers have been left with few options for coping with the negative impacts of floods. A thorough assessment of the livelihood of the flood affected farmers is essential for improving their living conditions. Different forms of livelihood capital, such as human capital, physical capital, natural capital, social capital, and financial capital, would be more important to achieve sustainable rural livelihoods because they can help people deal with shocks and stresses, recover from them, and maintain or improve their capabilities and assets both now and in the future without destroying the natural resource base. Considering these issues, the present study was conducted to assess the sustainable rural livelihood of farmers in chronically flood prone areas of Lakhimpur and Dhemaji district of Assam along with associated personal and socio-economic aspects.

Methodology
The study was carried out in the Indian state of Assam, which is located between 24^0 and $28^018'$ north latitude and $89^050'$ to $97^04'$ east longitude. The state has an area of 78,523 sq. km

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(78,523,000 ha) with a total population above 311 lakh (as per 2011 census). Based on rainfall, terrain and soil characteristics, Assam has been broadly delineated into six Agro-Climatic zones, *viz*., North Bank Plains Zone, Upper Brahmaputra Valley Zone, Lower Brahmaputra Valley Zone, Central Brahmaputra Valley Zone, Barak Valley Zone and Hill Zone. The state of Assam is divided into 33 Administrative Districts. Out of these 33 districts, the study was carried out in the Lakhimpur and Dhemaji district of Assam, which is a part of the North Bank Plains Zone. The dependent variable for the present study was Sustainable Rural Livelihoods which was measured using the Sustainable Rural livelihood Index developed by Directorate of Rice Research. North Lakhimpur agricultural sub-division has thirteen Agriculture Development Officer (ADO) circles and Dhemaji agricultural sub-division has seven Agriculture Development Officer (ADO) circles. Out of these, two ADO circle were selected purposively based on highest number of chronically flood affected villages. The two ADO circles were Lakhimpur and Butikur respectively. From each of the selected ADO circles, two AEA (Agricultural Extension Assistant) *elekas* were selected purposively. Thus, from two ADO circles, four AEA *elekas* were selected purposively. From each of the selected AEA elekas *viz*., Naharani, Gharmara, Batgharia, Somorajan, two chronically flood affected villages were selected randomly. Thereby, a total of eight villages were included under the present study from the four selected AEA elekas. A list of the flood affected farmers of each of the selected villages was prepared with the help of the concerned AEAs of the selected AEA elekas. Then from each of the selected villages, 20 per cent of total flood affected farmers were selected by using simple random sampling technique and hence total number of farmer respondents became 122. The statistical techniques and tests used for analysis and interpretation of data included frequency, percentage, mean, standard deviation, coefficient of variation, correlation, multiple regression analysis and "t" test.

The starting point of the livelihood framework was the Sustainable Livelihood Framework (SLF) comprising 5 livelihood assets *viz*., natural (e.g., land, trees), human (e.g., nutrition, health), physical (e.g., infrastructure, transport), social (e.g., networks and connections) and financial assets (e.g., savings, income) (Carney, (1998) and DFID, (2001)). According to this framework, the people with more natural, human, physical, social and financial assets have a better livelihood. Therefore, the dependent variable of the study, i.e., Sustainable Rural livelihoods, was analyzed in terms of capital assets. Out of the five capital assets, the Sustainable Rural Livelihood Index was measured using four capital assets *viz*., Human Capital, Physical Capital, Natural Capital, and Social Capital. Due to unavailability of real data and lack of response from the respondents, Financial Capital was omitted for the present study. The dependent variable was measured using the Sustainable Rural livelihood Index developed by Directorate of Rice Research.

Results and Discussion

Personal and Socio-economic attributes of the respondents

Findings revealed that the majority of respondents (82.79%) belonged to the middle-aged group followed by the young age group (13.11%). Majority of the respondents (31.97%) had formal education up to middle school level. There was no illiterate respondent in the study area. Majority of the respondents (79.51%) belonged to the nuclear family type, while 20.49 per cent belonged to the joint family type. The majority of respondents (70.49%) had small families, followed by those with medium-sized families (22.95%). Only 6.56 per cent of the respondents had large size of family. Among the respondents, marginal farmers made up the majority (46.72%), followed by small farmers (45.90%). Semi-medium land holdings were represented in 7.38 per cent of the respondents. The findings highlighted that no respondents were found in the medium and big land holding category. 76.23 per cent of the respondents had medium net annual farm income in the range of 26,313-61,851, followed by 13.93 per cent with low net annual farm income in the range of 15,000 -26,313. 9.84 per cent of the respondents had high net annual farm income. Majority of the farmer respondents (81.15%) had 'only cultivation' as occupation followed by 10.66 per cent respondents having 'cultivation + skilled labour' and 5.74 per cent of respondents having 'cultivation + business' type of occupation. Only 2.46 per cent of the respondents had 'cultivation + service' type of occupation.

Table 1: Personal and Socio-economic attributes of the respondents

Sl. No.	Socio-economic Characteristics	Category	Frequency	Percentage
1	Age	Young aged	16	13.11
		Middle aged	101	82.79
		Old aged	5	4.10
2	Educational level	Illiterate	0	0.00
		Can read only	4	3.28
		Primary school passed	11	9.02
		Middle school passed	39	31.97
		HSCL passed	36	29.51
		HS/P.U. passed	24	19.67
		Graduate/diploma & above	8	6.56
3	Family type	Nuclear family	97	79.51
		Joint family	25	20.49
4	Family size	Small family	86	70.49
		Medium family	28	22.95
		Large family	8	6.56
5	Size of land holding	Marginal	57	46.72
		Small	56	45.90
		Semi-medium	9	7.38
		Medium	0	0.00
		Big	0	0.00
6	Annual net farm income	Low annual income	17	13.93
		Medium annual income	93	76.23
		High annual income	12	9.84
7	Occupational status	Only cultivation	99	81.15
		Cultivation + skilled labour	13	10.66
		Cultivation + business	7	5.74
		Cultivation + service	3	2.46

Sustainable Rural Livelihoods of the respondents

The dependent variable of the study, i.e., Sustainable Rural livelihoods, was analyzed in terms of four livelihood capital assets *viz*., Human Capital, Physical Capital, Natural Capital, and Social Capital. The Sustainable Rural Livelihoods Index for each respondent was determined by taking into

consideration the Human, Physical, Natural and Social capital indices.

Human Capital as a livelihood asset
Findings presented in Table 2 revealed that the majority of the respondents (59.84%) had medium level of Human Capital asset followed by 22.13 per cent respondents with low level of Human Capital asset and 18.03 per cent respondents with high level of Human Capital asset. The mean value of Human Capital asset was 57.60 with standard deviation of 7.14.

Table 2: Distribution of respondents according to Human Capital asset

Category	Score Range	Frequency	Percentage	Mean	SD	C.V
Low Human Capital asset	20.00-50.46	27	22.13			
Medium Human Capital asset	50.47-64.74	73	59.84	57.60	7.14	12.39
High Human Capital asset	64.75-100.00	22	18.03			
Total		122	100			

Physical Capital as a livelihood asset
Data presented in Table 3 and Figure revealed that the majority of the respondents (63.11%) had medium level of Physical Capital asset followed by 22.95 per cent respondents with high level of Physical Capital asset and 13.93 per cent respondents with low level of Physical Capital asset. The mean value of Physical Capital asset was 36.27 with standard deviation of 13.43.

Table 3: Distribution of respondents according to Physical Capital asset

Category	Score Range	Frequency	Percentage	Mean	SD	C.V
Low Physical Capital asset	9.52-22.84	17	13.93			
Medium Physical Capital asset	22.85-49.70	77	63.11	36.27	13.43	37.03
High Physical Capital asset	49.71-100.00	28	22.95			
Total		122	100			

Natural Capital as a livelihood asset
Table 4 highlight the fact that the majority of the respondents (57.38%) had medium level of Natural Capital asset followed by 22.13 per cent respondents with low level of Natural Capital asset and 20.49 per cent respondents with high level of Natural Capital asset. The mean value of Natural Capital asset was 20.36 with standard deviation of 5.80.

Table 4: Distribution of respondents according to Natural Capital asset

Category	Score Range	Frequency	Percentage	Mean	SD	C.V
Low Natural Capital asset	9.38 – 14.56	27	22.13			
Medium Natural Capital asset	14.57 – 26.16	70	57.38	20.36	5.80	28.51
High Natural Capital asset	26.17 – 100.00	25	20.49			
Total		122	100			

Social Capital as a livelihood asset
Findings shown in Table 5 revealed that the majority of the respondents (68.03%) had medium level of Social Capital asset followed by 22.95 per cent respondents with high level of Social Capital asset and 9.02 per cent respondents with low level of Social Capital asset. The mean value of Social Capital asset was 30.75 with standard deviation of 7.35.

Table 5: Distribution of respondents according to Social Capital asset

Category	Score Range	Frequency	Percentage	Mean	SD	C.V
Low Social Capital asset	8.00 – 23.40	11	09.02			
Medium Social Capital asset	23.41 – 38.10	83	68.03	30.75	7.35	23.89
High Social Capital asset	38.11 – 100.00	28	22.95			
Total		122	100			

Distribution of respondents according to Sustainable Rural Livelihoods
Data presented in Table 6 revealed that the majority of the respondents (72.14%) had medium level of Sustainable Rural Livelihoods followed by 14.75 per cent respondents with low level of Sustainable Rural Livelihoods and 13.11 per cent respondents with high level of Sustainable Rural Livelihoods. The mean value of Sustainable Rural Livelihood was 36.25 with standard deviation of 5.31.

Table 6: Distribution of respondents according to Sustainable Rural Livelihoods

Category	Score Range	Frequency	Percentage	Mean	SD	C.V
Low SRL	11.62 – 30.94	18	14.75			
Medium SRL	30.95 – 41.56	88	72.14	36.25	5.31	14.65
High SRL	41.57 – 100.00	16	13.11			
Total		122	100			

Mean of capital index score
Mean capital index score for each capital asset was worked out for the sample. The findings are presented in Table 7.

Table 7: Mean capital index scores of the sample of respondents

Livelihood capital asset	Mean capital index score
Human Capital Index (HCI)	57.60
Physical Capital Index (PCI)	36.27
Natural Capital Index (NCI)	20.36
Social Capital Index (SCI)	30.75

Conclusion
In terms of farm productivity, physical capital stock, and human capital stock, natural disasters can have devastating long-term effects on rural people's livelihoods. They can also lead to significant economic, social, political, and cultural vulnerabilities in developing nations. Assam's enormous river network makes it susceptible to erosion and other natural disasters, which affects the state's overall growth. The Brahmaputra and Barak River, which are fed by more than 50 tributaries, each year, generate devastating floods during the monsoon season. One of the most severely hazard-prone areas in the nation is the Brahmaputra valley in Assam, which has approximately 40% of its land surface susceptible to flood

damage (Das, 2005) [5]. The flood-prone districts of Assam are devastated by three to four waves of flooding almost every year. Large sections of fertile land and property are destroyed, and the farming community is most negatively impacted by these floods (Das *et al*., 2009) [8]. Crop production, which contributes significantly to the livelihood of the agricultural community in these areas due to poor productivity and small per capita land holding, has significant challenges. Large areas of the district's farmers have been left with few options for coping with the negative impacts of floods. A thorough assessment of the livelihood of the flood affected farmers is essential for improving their living conditions. Concerned department should ensure better health facilities, proper training programmes, establishment of village information centre; benefits of flagship social welfare programmes such as Pradhan Mantri Awas Yojana, Pradhan Mantri Gram Sadak Yojana, Pradhan Mantri Ujjwala Yojana, National Rural Drinking Water Programme etc. should be made available along with improving the soil quality and integrating support in the form of SHGs/FIGs/FPOs for uplifting the overall sustainable livelihood of the people.

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