



## ANALYSIS OF FLOOD VULNERABILITY AMONG LOWLAND RICE FARMERS IN KOGI STATE

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### ABSTRACT

The study analyzed the flood vulnerability among lowland rice farmers in Kogi State. A multistage sampling technique was employed to select 218 respondents across flood-prone communities. Data were collected using structured questionnaires and analyzed using descriptive statistics and Flood Vulnerability Index (FVI), respectively. The findings revealed that majority (82.6%) of the rice farmers were male, within the mean age of (40.88 years) economically active group, with low educational attainment and a high dependence on farming. The results indicated that majority (87.2% and 70.2%) of the rice farmers were exposed to flood and attested that floods is severe. Also 76.1% of the rice farmers reported that they experience flooding every year and 52.8% attributed the source of flooding to the river in the study area. The FVI results indicated a low level of vulnerability, characterized by high exposure in Kabawa (0.772), Okumi (0.755) and S/Noma (0.728) with sensitivity 0.560, 0.583 and 0.583 respectively, as well as high adaptive capacity. Additionally, farmers adopted coping mechanisms including livelihood diversification, use of early warnings, and reliance on communal and institutional support. The study concludes that lowland rice farmers in study area experience recurrent and severe flooding. It recommends the development of context-specific flood mitigation infrastructure, improved access to agricultural inputs and credit, and strengthened extension services to build resilience and reduce rural poverty.

**Keywords:** Flood, Vulnerability, Farming, Exposure, Sensitivity, Adaptive

### INTRODUCTION

Agriculture plays a critical role in Nigeria's economy, employing approximately 70% of the labour force and contributing over 21% to the nation's GDP (NBS, 2023). However, the sector faces increasing disruption from climate-related hazards, particularly flooding. Flood disasters in Nigeria and especially in Kogi State have become more frequent and severe, often resulting in the destruction of farmlands, displacement of populations, and loss of livelihoods (National Emergency Management Agency, 2018). Kogi State, being a riverine region bordered by the Niger and Benue rivers, is especially prone to seasonal and flash floods. In 2012 alone, over 344 communities in the state were devastated, with large areas of rice farmland submerged (Okpala-Okaka *et al.*, 2013). These recurrent flood events have been linked to multiple factors, including climate change, poor urban planning, and inadequate drainage infrastructure (Okafor, 2021). Flooding not only undermines agricultural productivity but also deepens existing vulnerabilities among farming communities. For lowland rice farmers, who are highly dependent on climatic stability and fertile plains, the risk is particularly acute. This study seeks to analyse the extent of flood vulnerability among these farmers, with a focus on exposure, sensitivity, and adaptive capacity, as a basis for effective risk reduction and resilience planning.

Flooding is an increasingly frequent and severe hazard in Nigeria, driven by climate change, rapid urbanization, and poor land-use planning (IPCC, 2018; UNDRR, 2021). In Kogi State, particularly along the floodplains of the Niger and Benue Rivers, lowland rice farmers are among the most affected. Recurrent floods have destroyed crops, displaced families, and caused extensive environmental and economic damage (Salau *et al.*, 2020). While the global and national literature emphasizes the growing impact of floods due to climate variability and anthropogenic activities (Munich Re, 2020; Bubeck *et al.*, 2015), there remains a significant gap in localized assessments of flood vulnerability at the community or farmer level, particularly in terms of their exposure,



sensitivity, and adaptive capacity. These factors directly affect farmers' ability to recover and adapt to flood-induced shocks (UNDRR, 2021). Several prior studies support this issue such as Nzeadibe & Igbokwe (2014) emphasized that smallholder farmers lack access to insurance, credit, and infrastructure, increasing their vulnerability. *Jega et al. (2024)* linked flood disasters in Kebbi State significantly reduced crop yields and household income among smallholder farmers, which amplified income insecurity and rural poverty. Similarly, *Kwari et al. (2017)* documented that the 2012 flood in Adamawa State led to devastation in agricultural livelihoods, leading to widespread losses in farm assets, diminished yields, and greater reliance on aid contributing directly to poverty among affected communities. Others studies were carried out such as *Jatau et al (2023)* assessment of flood vulnerability in Kogi State, *Osanaiye (2023)* Geospatial model for flood mitigation along the Niger River coastal settlements of Lokoja, Nigeria. Despite the severity of the issue, empirical studies on flood vulnerability specific to lowland rice farmers in Kogi State are scarce. Thus, a comprehensive vulnerability analysis is essential to understand the risk landscape and develop context-specific disaster mitigation strategies. The main aim of this study were to analyze the flood vulnerability of lowland rice farmers while the specific objectives include describe the socio-economic characteristics of lowland rice farmers, the nature and frequency of flood occurrence, the level of flood vulnerability and identify the coping strategies to mitigate the effect of flood among lowland rice farmers in the study area.

## METHODOLOGY

### Study Area and Sampling

Kogi state is an agrarian state with a large percentage of the population engaged in farming and agro allied activities as their primary economic activity. Kogi state has an area of 29,581.9 square kilometers with a population of 4.37 million in 2015 (Kogi Statement Government, 2007). The State has an average maximum temperature of 33.2°C and average minimum of 22.8°C. The State has two distinct seasons – dry season, which lasts from November to February and the raining season that lasts from March to October. Annual rainfall ranges from 1016mm- 1524 mm. The population for this study will comprised of Fadama farmers in some selected local government areas (LGAs) in Kogi State. “Fadama” a word already adopted by the World Bank refers to the low-lying swampy area consisting alluvial deposits and containing extensive exploitable aquifers. It also refers to as alluvial low lands formed by erosion and depositional actions of the rivers and streams possessing fine texture and less acid soils which make it rich agricultural soil. Fadama lands are especially suitable for crop irrigation and fishing, and traditionally provide feed resources and water for livestock. In Kogi State, rice production is encouraged in the flood plains of the rivers, with the river Niger drainage system acting as a major rice-growing environment and about 38000ha of rice cultivable area and yield of 79890 metric tons in 2004 for wet season rice production (ADP, 2005). According to Kogi State Ministry of Agriculture, the main rice producing areas in Kogi State are Ibaji, Idah, Lokoja and Bassa. As part of the drive to boost rice production, the State has established rice farms in Koto, Okumi, Galele and Sarkin Noma Irrigation Project sites. In terms of rice production, reports by *Horna et al. (2005)* indicated that Kogi State produced at least 5% of the total rice production in Nigeria.

A multi-stage sampling technique was employed for this study. The first stage involved purposive selection of Kogi state due on the predominance of lowland rice farmers affected by flood; and incidence of poverty rate, the second stage involved the purposive selection two (2) Local Government areas based on the predominance of flood activities and high poverty status. The third stage involved random selection of three (3) communities from the selected LGAs. The final stage involved selection of farmers based on the sampling frame of lowland rice farmers from the selected LGAs within the state. The report form the the reconnaissance survey reveals the sampling frame of the selected LGAs was 502 while the raosoft online calculator was used to arrive to sample size of 218.



**Table 1:** Sample Frame, Sample Size and Coverage Area

<i>LGAs</i>	<i>Communities</i>	<i>Sample Frame</i>	<i>Sample Size</i>
<i>Kogi</i>	Koton Karfe	78	36
	Egyehya	85	36
	Akpaku	86	36
<i>Lokoja</i>	Okumi	90	37
	Kabawa	84	37
	Sarkin Noma	79	36
<i>Total</i>		<b>502</b>	<b>218</b>

Sources: Preliminary Studies, 2023

### Data Collection Method and Analytical Technique

Primary data was used for this study. The data was collected using structured questionnaire which was administered by the researcher and trained enumerators. Socio-economic characteristics of lowland rice farmers was obtained. Data on the strategies to mitigate flooding activities and from lowland rice farmers in the study area. The data collected for this study was analyzed using descriptive and inferential statistics.

**Flood Vulnerability Index: FVI** was used in analyse the level of flood vulnerability in the study area. It is a combination of both biophysical and socioeconomic factors to describe flood vulnerability incidence of the study region. Indicators were adopted to assess the exposure, sensitivity, and adaptive capacity to flood of the respondents based on the definition of vulnerability given by the Intergovernmental Panel on Climate Change (IPCC) (2007) where vulnerability is defined as “a function of the character, magnitude and rate of climate variation which a system is exposed, its sensitivity, and its adaptive capacity”.

### Classification of Indicators

Indicators were grouped into three major vulnerability dimensions based on IPCC (2007) and related literature (Adger, 2006; Balica *et al.*, 2012)

**Exposure to flood:** This describes the degree to which a region that is the focus of an assessment falls within the scope of a hazardous event (Birkmann *et al* 2013). It refers to the possibility that flooding will have an effect on individuals, as well as possible tangible items (properties, buildings, cultural heritage, and agricultural land) because of their position (Balica *et al* 2010).

**Sensitivity to flood:** defines the propensity of elements at risk (social and ecological) to suffer harm as a result of the level of settlement volatility, unfavourable conditions, and relative weaknesses (Birkmann *et al* 2013, Kablan *et al* 2017).

**Adaptive capacity to flood** is the capability of a system to endure any disturbance while maintaining fundamental efficiencies in its social, economic, and physical environmental dimensions.

This framework is expressed conceptually as:

$$FVI = \frac{E + S + A}{3} \dots\dots\dots(1)$$

Where: E = Exposure Index; S = Sensitivity Index; A = Adaptive Capacity Index

### Data Normalization

Since the indicators are measured in diverse units, **Min-Max normalization** was applied to scale all values to a range of **0 to 1**. For positively oriented indicators (higher value = higher vulnerability), the normalization formula is:

$$X_{ij}^* = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)} \dots\dots\dots(2)$$

While for negatively oriented indicators (higher value = lower vulnerability, e.g., income and farm size), the reverse normalization is applied:

$$X_{ij}^* = \frac{\max X_j - X_{ij}}{\max X_j - \min X_j} \dots\dots\dots(2b)$$

Where:

$X_{ij}$  is the value of the  $j^{\text{th}}$  indicator for the  $i^{\text{th}}$  respondent

$X_{ij}^*$  is the normalized score

$\text{Min}(X_j)$  and  $\text{max}(X_j)$  are the minimum and maximum values of the indicator  $j$

### Construction of Sub-Indices

After the normalization operation, **sub-indices** for each dimension were computed by taking the arithmetic mean of the respective normalized indicators:

$$E_i = \frac{1}{n_E} \sum_{j=1}^{n_E} X_{ij}^* \dots\dots\dots (3)$$

$$S_i = \frac{1}{n_S} \sum_{j=1}^{n_S} X_{ij}^* \dots\dots\dots (4)$$

$$A_i = \frac{1}{n_A} \sum_{j=1}^{n_A} X_{ij}^* \dots\dots\dots (5)$$

Where:

$E_i, S_i, A_i$  are the Exposure, Sensitivity, and Adaptive Capacity scores for respondent  $i$

$n_E, n_S, n_A$  are the number of indicators in each dimension

The overall **FVI** was computed as a combination of the three sub-indices:

$$FVI_i = \frac{E_i + S_i + A_i}{3} \dots\dots\dots (1)$$

A higher FVI value indicates **greater vulnerability**, while a lower value implies **lower vulnerability**.

### Vulnerability Levels Classification

In order to facilitate interpretations, computed **Flood Vulnerability Index (FVI)** values were classified into three ordinal categories: **Low, Medium, and High vulnerability**. This classification was based on the **Equal Interval Method**, a widely accepted approach in index-based assessments (Cutter *et al.*, 2003; Balica *et al.*, 2012). The equal interval method divides the possible range of index values **from 0 (minimum vulnerability) to 1 (maximum vulnerability)** into three equal parts of 0.33 units each.

$$\text{Interval Width} = \frac{\text{Max value} - \text{Min value}}{\text{Number of classes}}$$

**Table 2:** Classification of Vulnerability Levels

<b>FVI Score Range</b>	<b>Vulnerability Level</b>	<b>Interpretation</b>
<b>0.00 – 0.33</b>	Low	Households with strong resilience or minimal exposure
<b>0.34 – 0.66</b>	Medium	Households with moderate vulnerability
<b>0.67 – 1.00</b>	High	Households with significant exposure and weak adaptive capacity

## RESULTS AND DISCUSSION

### Socio-Economic Characteristics

The result as presented in Table 3 revealed that 31% of the rice farmers were between the ages 30-39 while 6% were between ages of 60-69 with the mean age of 41 years. This implies that majority of the farmers were young and highly productive and were within their economic viable age. However, they are also potentially more vulnerable to physical demands of farming and the economic strain due to recurrent flooding. This is in line with Henry *et al.*, (2023) who conducted a study on analysis of poverty status among farming households in central zone of plateau state, Nigeria and found out the mean age of 40 years, indicating that majority of the respondents were in their active ages of production in agriculture. The result further showed that 42.7% of the farmers in the study



area had between 10-17 years of farming experience, 33.3% had between 1-9 years of experience, 18.3% had between 18-26 years of experience the mean farming experience of the farmers 4.1% had between 27-35 years of experience and 1.4% had between 36-43 years of experience. The mean years of experience was 13 years which indicated that farmers in the study area suggests that a significant portion of these farmers have substantial experience managing agricultural risks and practices. This is also in line with Henry *et al*, (2023).

Additionally, larger households may have more diverse sources of income or assistance, as multiple family members may engage in off-farm work as well. This is in line with Ameh *et al* (2021), who conducted a study on gender dimension of poverty among rice farmers in Kogi state, Nigeria and found out mean number of persons per household was 8 persons. The result also showed that 59.5% of the rice farmers had annual income between ₦80,000-₦256,000 while 13.4% 10.6%, 10.2% and 9.7% of the total respondent had annual income between ₦784,004-₦960,004 while ₦256,001-₦432,001, ₦432,002-₦608,002 and ₦608,003-₦784,003 respectively, with a mean income ₦342,734 per annum. This implies that most of the respondents are average income earners and had little resources at their disposal annually to meet up with their family demands. This also limits their ability to cushion the effects of floods and adopt the necessary control measures. This is in line with Ameh *et al* (2021).

**Table 3:** Quantitative Socio-economics Characteristics

Variable	F	%	Min	Max	Mean	SD
<b>Age (years)</b>						
20-29	28	12.8	20	69	40.8899	10.61
30-39	77	35.3				
40-49	69	31.7				
50-59	31	14.2				
60-69	13	6.0				
<b>Farming Experience (Years)</b>						
1-9	73	33.5	1	43	12.8398	7.70
10-17	93	42.7				
18-26	40	18.3				
27-35	9	4.1				
36-43	3	1.4				
<b>Household size (number)</b>						
1-3	38	17.4	1	15	6.8761	3.38
4-6	66	30.3				
7-9	65	29.8				
10-12	36	16.5				
13-15	13	6.0				
<b>Farm size (hectares)</b>						
0.4-1.0	90	41.3	0.4	3.61	1.7050	0.84
1.1-1.72	15	6.9				
1.73-2.35	65	29.8				
2.36-2.98	40	18.3				
2.99-3.61	8	3.7				
<b>Income</b>						
80,000-256,000	128	59.3	80,000	960,004	342,734	261,591
256,001- 432,001	23	10.6				
432,002 - 608,002	22	10.2				
608,003 -784,003	21	9.7				
784,004 - 960,004	29	13.4				

**Source:** Field Survey, (2024)

From table 5 above shows that majority 82.6% were males while 17.4% were females. This gender distribution suggests that men are more likely to be involved in rice farming, possibly due to cultural, social, or economic factors that influence access to land, resources, and decision-making





power. Male farmers, who are typically the primary breadwinners in many households, might have more access to the resources needed to respond to flood risks, such as capital for flood mitigation technologies, better market access, and higher levels of agricultural knowledge. This is in line with Omotesho *et al* (2021) who conducted a study on an analysis of the capacity building needs of rice farmers in Kwara State, Nigeria found out that majority of the farmers in their study area were male. The result from table 5 shows that most of the farmers 79.4% were married 16.1% were single while 3.2%, 1.4% were divorced and widowed respectfully. The high proportion of married farmers shows that family structures play a significant role in rice farming. Married farmers may have more labor resources available to them, as spouses and children often contribute to agricultural work. Additionally, married farmers are more likely to have established household support systems, which can be crucial in times of economic hardship, such as following a flood disaster. This is in line with Ozigbu *et al* (2022), who studied Implications of flooding on the Socio-Economic Status of residents in flood prone Areas in Bayelsa State, Nigeria who found out that 54.2% of the respondents were married.

Most of the farmers had secondary school education 45.4%, while amongst the rest of the farmers 29.8% attended primary schools, 19.7% had non-formal education and 5% had university degrees. The relatively medium educational standard among rice farmers in the study area suggest that they could at least read and write. This could serve as added advantage for the respondents to quickly comprehend and understand modern ways of adapting to flood incidence. This is in line with Enwa *et al* (2023) from their study on impact of flooding disaster on economic returns of fish farmers in Rivers State Nigeria found out that fish farmers in the study area had a high level of literacy. Since education gives farmers access to strategies and technologies that would help them lessen the devastating impact of floods on their fish farms and is viewed as an important tool during the period of flooding and other climate change disasters.

The result reveals that majority of the respondents 68.3% had contact with extension agents, while 31.7% of the respondents had no extension contacts. This implies that there is an adequate extension activity which directly helps farmers to improve their level of productivity, the farmers also had the opportunities to access knowledge and information on how to cope with the effects of flood. This is in agreement with Oladapo (2021) in his study on Incidence of Flooding and Coping Strategies Among Rice Farmers in Selected Local Government Areas, Kwara State, Nigeria described the frequency of extension agent to the on the respondent's farms to be occasional.

The findings further shows that majority, 73.4% of the respondents were members of associations while only 26.6% of the respondents do not belong to any associations. This implies that most of the respondents in the study area had access to advice, information and credit facilities from the associations they belong to which will aid the farmers in recovering from the effect of flood. This is contrary to the findings of Oluwafemi *et al* (2018) who in their study on Determinants of Poverty among Rice Farming Households in Nigeria.



**Table 4:** Qualitative Socio-economic Characteristics of Rice Farmers

Variables	Frequency	Percentage (%)
<b>Gender</b>		
Male	180	82.6
Female	38	17.4
<b>Marital status</b>		
Single	35	16.1
Married	173	79.4
Divorced	7	3.2
Widowed	3	1.4
<b>Educational level</b>		
non-formal	43	19.7
primary	65	29.8
secondary	99	45.4
tertiary	11	5.0
<b>Contact with extension agents</b>		
Contact	149	68.3
No contact	69	31.7
<b>Membership of Association</b>		
Member	160	73.4
Non-member	58	26.6

**Source:** Field Survey, (2024)

#### Nature and Frequency of Flood Occurrence

Key findings from Table 5 showed that majority (87.2%) of the respondents experienced flood on their farms while 12.8% had never experienced flood on their farms. This implies that a large number of the farmers have been affected by flood in the past and they are qualified to give an accurate description of its effects on the farm productivity. The study also revealed that majority (70.1%) of the farmers describe the effects of the recent flood experienced by them to be severe while 22% reported it to be moderate and 7.8% as mild. This implies that the farmers had suffered significantly due to loss in farm produce, properties and community infrastructures thereby contributing in further impoverishment of the farmers. This is consistent with Musa *et al* (2024) who in their study of Effects of Flood Risk on Agricultural Farmlands in Kofar Kona Zaria, Kaduna State, Nigeria expressed that majority of the respondent farmers agreed that flooding had a direct impact of agricultural farmland and had contributed greatly to farmland loss. The result further shows that 76.1% of the farmers attributed the occurrence of flood to be frequent i.e. on a yearly basis, while 13.8% slated the frequency of flood occurrence to be occasional between 2-4 years, 6.4% stated seasonal occurrence during specific months and 3.7% claimed flood occurs rarely around every 5 years. This implied that rice farmers in the study area are in a constant struggle to combat the effects of flood. This agrees with Adeleke *et al* (2024)

The result further revealed that 53.8% of the farmers experienced flood depth up to the waist level, 26.6% was at knee deep, 14.2% was at the ankle or lower and 6.4% was chest deep or higher. This means that the depth of the flood was life threatening especially for children and people who could not swim resulting not only in the loss of properties but lives as well. The study also shows that a large percentage of farmers (52.8%) attributed the main source of the flooding to be from the surrounding river while 45% attributed it to heavy rainfall and 2.3% to coastal flooding. This is in line with Komolafe *et al* (2015) who found out that the two natural causes of flood are heavy downpour and river storms. Also, Nnodim and Ezekiel (2020) examined the perceived impact of perennial flooding on livelihood activities of rural dwellers of Orashi Region of Rivers State. Their findings revealed that the causes of flooding in rural areas of Orashi region were prolonged rainfall, overflow of rivers, continued release of excess water from artificial reservoirs, climate change amongst others. The result further shows that 68.8% of rice farmers in the study area suffered severe damages to their properties, 21.8% incurred moderate losses while 9.6% suffered mild loss. This is in line with Ani *et*



*al.*, (2020) who found out that flood affects the economic lives of people, the environment as well as animals and people.

**Table 5:** Nature and Frequency of Flood Occurrence

Variables	Frequency	Percentage (%)
<b>Rice farm Flood Experience</b>		
Experienced flood	190	87.2
No experience	28	12.8
<b>Description of Recent Flood Experience</b>		
Mild	17	7.8
Moderate	48	2
Severe	153	70.2
<b>Frequency of Flood Occurrence</b>		
Rarely (5 years)	8	3.7
Occasionally (2-4 years)	30	13.8
Frequently (every year)	166	76.1
Seasonal (during specific months)	14	6.4
<b>Depth of Flood Experienced</b>		
Less Than Ankle	31	14.2
Knee Deep	58	26.6
Waist Deep	115	52.8
Chest deep/Higher	14	6.4
<b>Main Sources of Flood</b>		
heavy rainfall	98	45
riverine flooding	115	52.8
coastal flooding	5	2.3
<b>Damages caused in terms of Properties</b>		
mild	21	9.6
moderate	47	21.6
severe	150	68.8

**Source:** Field Survey, (2024)

### The Level of Flood Vulnerability among Rice Farmers

Flood vulnerability among lowland rice farmers in Kogi State was assessed based on three core factors: exposure to flood, sensitivity to flood, and the farmers' adaptive capacity to cope with such events. The following section presents findings on indicators used to describe how these dimensions impact the level of flood among rice farmers in the study area.

Table 6 presents a detailed analysis of the Flood Vulnerability Index (FVI) among rice-farming communities. The FVI is decomposed into three core dimensions: Exposure, Sensitivity, and Adaptive Capacity. The result for exposure index in table 4 above reflects how frequently farmers are exposed to floods and the severity of the physical impacts. It was found that Akpaku had an exposure index of 0.449, egyhya 0.586, kabawa 0.772, koton karfe 0.539, okumi 0.755, S/noma 0.728. This indicates that kabawa, okumi and S/Noma showed high exposure indicating frequent and severe flood events. This is likely due to geographic proximity to flood-prone zones such as rivers banks, low-lying areas etc thereby resulting in loss in terms of human life, crop, livestock properties. This is in line with the findings of Ntajal *et al* (2016) who found that factors such as proximity to water bodies, longer flood duration, and the location of field crops in flood zones contribute to an increase in exposure of communities, thereby leading to negative impacts on humans and ecological systems. The sensitivity index which measures how susceptible a community is to harm based on economic and demographic factors in the communities in the study area was found to be; 0.608 for Akpaku, egyhya 0.588, kabawa 0.560, koton karfe 0.561, Okumi 0.583 while S/noma was found to be 0.583. This implies a high level of sensitivity to floods amongst farmers in the study area due to income constraints, predominance of small farm sizes owned by farmers, as well as presence of larger household sizes and dependence on flood-sensitive livelihoods (e.g., rain-fed agriculture). This





collaborates with Rafiq *et al* (2012) who in his study disaster risk and vulnerability in Pakistan at a District Level, reported that flooding usually has negative consequences on individuals engaging in agriculture-related activities who use agricultural lands as a source of their livelihoods. Adaptive capacity assesses the ability of communities to cope with or recover from flood impacts. The table reflects an index of 1.281 for Akpaku, Egyhya 1.259, Kabawa 1.093, Koton karfe, 1.233, Okumi 1.483 and S/Noma 1.37. This indicates a high adaptive score. This is contrary to the findings of Oyedele *et al* (2022) who noticed a lack of resilience in his study area due to households' lack of evacuation and flood management measures, low levels of flood education, high percentage of flood experience, low literacy rate, lack of access to flood warning facilities, and weak household economic capacity.

**Table 6:** Level of Flood Vulnerability

Community	Exposure Index	Sensitivity Index	Adaptive Capacity Index	FVI	Vulnerability level
Akpaku	0.449	0.608	1.281	-0.075	Low
Egyhya	0.586	0.588	1.259	-0.028	Low
Kabawa	0.772	0.56	1.093	0.08	Low
Koton karfe	0.539	0.561	1.233	-0.045	Low
Okumi	0.755	0.583	1.483	-0.048	Low
S/Noma	0.728	0.583	1.37	-0.02	Low

**Source:** Field Survey, (2024)

## CONCLUSION AND RECOMMENDATION

The study concluded that lowland rice farmers in the study area experience recurrent and severe flooding. The nature of the floods depth from **knee- to chest-deep water levels** often resulting in significant losses to farmlands and livelihoods. The frequency of flooding was reported **as almost yearly**. Despite their high exposure and sensitivity, the communities demonstrated relatively **low flood vulnerability**, which was attributed to their **strong adaptive capacity**. Farmers have adopted several coping strategies, including **adjusting planting calendars, temporary migration, livelihood diversification, and engagement with extension services**. Strengthen community-based adaptation strategies such as flood education, early warning systems, and access to financial aid, encourage infrastructure development, particularly drainage systems and flood-tolerant rice varieties, enhance policy support and promote collaborative efforts between government and local organizations to improve resilience and support farmers' cooperative membership and extension contact to improve disaster preparedness and recovery capacity.

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