https://dx.doi.org/10.4314/dujopas.v10i3c.11
ISSN (Print): 2476-8316
ISSN (Online): 2635-3490
Dutse Journal of Pure and Applied Sciences (DUJOPAS), *Vol. 10 No. 3c September 2024*

Assessment of the extent of Community Preparedness to Flood Risk in Jigawa State, Nigeria

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Abstract

Jigawa State faces annual flood disasters that have resulted in significant loss of life and property, putting many communities at risk. This study aim to evaluate the preparedness for flood risk in Jigawa State, Nigeria. A sample of 666 respondents was selected for a self-administered questionnaire, with 601 fully completed. The collected data were analyzed descriptively to determine the preparedness index. (PI). From the result of the findings, a majority (77.7%) of the respondents agreed that the community is aware of flood risks. There was also a provision of a neighborhood directory (97.8%), local shelter (75.9%) and emergency contacts (55.4%) during floods. The PI (92.6%, 98.6% 84.1% and 85.1% respectively), are above the 65% threshold and hence considered 'prepared' in this regard; but, 'somewhat prepared' (PI of 61.7%) regarding awareness of flood disaster risk management strategies; 'and unprepared' (PI of 55.5%, 50.5%, 50.5%, 50.8% and 54.3% respectively) in terms of community organization of public education and training of flood risk reduction (66.6%); engagement on rehearsals/emergency drills (51.6%); good community-based warning system (51.4%); and a standalone system for property protection measures during floods (52.4%); as well as an active recovery plan (62.9%). It was recommended that proper embankment protection and water regulation outlets be established. Additionally, real-time flood forecasting and effective early warning systems should be developed. Communities should be assessed to identify flood risk zones before construction activities begin, or alternatively, resettlement to safer areas should be considered for those living in flood-prone regions.

Keywords: preparedness, flood risk, resettlement, early warning system, resilience

INTRODUCTION

Floods are one of the most common and devastating natural disasters worldwide, causing significant loss of life, property damage, and environmental degradation. They occur due to a variety of factors including excessive rainfall, river overflow, dam failures, and melting snow. The global impact of floods is profound, affecting millions of people each year.

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According to the World Bank (2020), floods account for approximately 44% of all disaster-related events and affect an estimated 2.3 billion people globally between 1995 and 2015.

Africa is particularly vulnerable to floods due to its diverse climate and topography. The continent experiences a range of flood types, from flash floods in arid regions to riverine floods in tropical zones. Climate change has exacerbated the frequency and intensity of floods in Africa, contributing to increased rainfall variability and sea level rise. The African Development Bank (2020) reports that floods in Africa have affected over 10 million people annually in recent years, with significant economic and social impacts. Vulnerable communities often suffer the most, with limited infrastructure and resources to mitigate and respond to flood events.

Nigeria, the most populous country in Africa, is no stranger to the devastating impacts of floods. The country's diverse geography, which includes rivers, lakes, and an extensive coastline, makes it particularly susceptible to flooding. Seasonal flooding is common, particularly during the rainy season from April to October. In 2012, Nigeria experienced one of its worst flood disasters, which affected 30 out of 36 states, displaced over 2 million people, and resulted in more than 300 deaths (NEMA, 2013). The Nigerian Meteorological Agency (NiMet) has indicated that climate change and urbanization are significant contributors to the increasing frequency and severity of floods in the country.

Jigawa State, located in the northwestern region of Nigeria, is particularly prone to flooding due to its geographical and climatic conditions. The state is intersected by the Hadejia River, which is a major tributary of the Komadugu-Yobe River Basin. During the rainy season, the river often overflows, leading to widespread flooding in the state. Jigawa's flat terrain and poorly drained soils exacerbate the situation, making it one of the most flood-prone areas in Nigeria.

The floods in Jigawa State have significant socio-economic impacts. Agriculture, which is the mainstay of the state's economy, is severely affected as farmlands are inundated, leading to crop losses and food insecurity. Additionally, infrastructure such as roads, bridges, and buildings are often damaged, disrupting transportation and access to essential services. In 2020, floods in Jigawa State displaced over 50,000 people and destroyed thousands of hectares of farmland (ReliefWeb, 2020).

The state government, in collaboration with national and international organizations, has been working on various flood mitigation measures. These include the construction of embankments, improvement of drainage systems, and implementation of early warning systems. However, the challenges are immense, and there is a need for more comprehensive and integrated approaches to manage and reduce the risk of floods in Jigawa State.

Study area

Jigawa State is located in the northwestern region of Nigeria, between latitudes 11°00'00" N and 13°00'00" N, and longitudes 8°00'00" E and 10°30'00" E. Its administrative capital is Dutse, and the state comprises 27 Local Government Areas (LGAs). Covering an area of approximately 24,742 km², Jigawa State had a population of around 5,828,200 people in 2016 (NBS, 2016). Wetlands (Fadama) account for about 14% of the state's total landmass (Yusuf et al., 2021). The vegetation in Jigawa State consists of Sudan Savannah and Sahel Savannah types, and the area experiences a tropical wet and dry climate with seasonal rainfall from May to October. This semi-arid climate features a long dry season and a short wet season from June to September. The average annual temperature is around 25°C, with monthly temperatures ranging from 21°C in the coolest month to 31°C in the hottest month. Annual rainfall ranges from 600mm to 762mm, with significant variations that can lead to severe and prolonged droughts in some years (Ogunkoya and Dami, 2007; Kaugama and Ahmed, 2014). The soils are relatively recent, generally sandy at the top and compact at depth, often with hard pans, and substantial aeolian deposits from the Sahara Desert contribute to the soil composition (Abubakar et al., 2016).

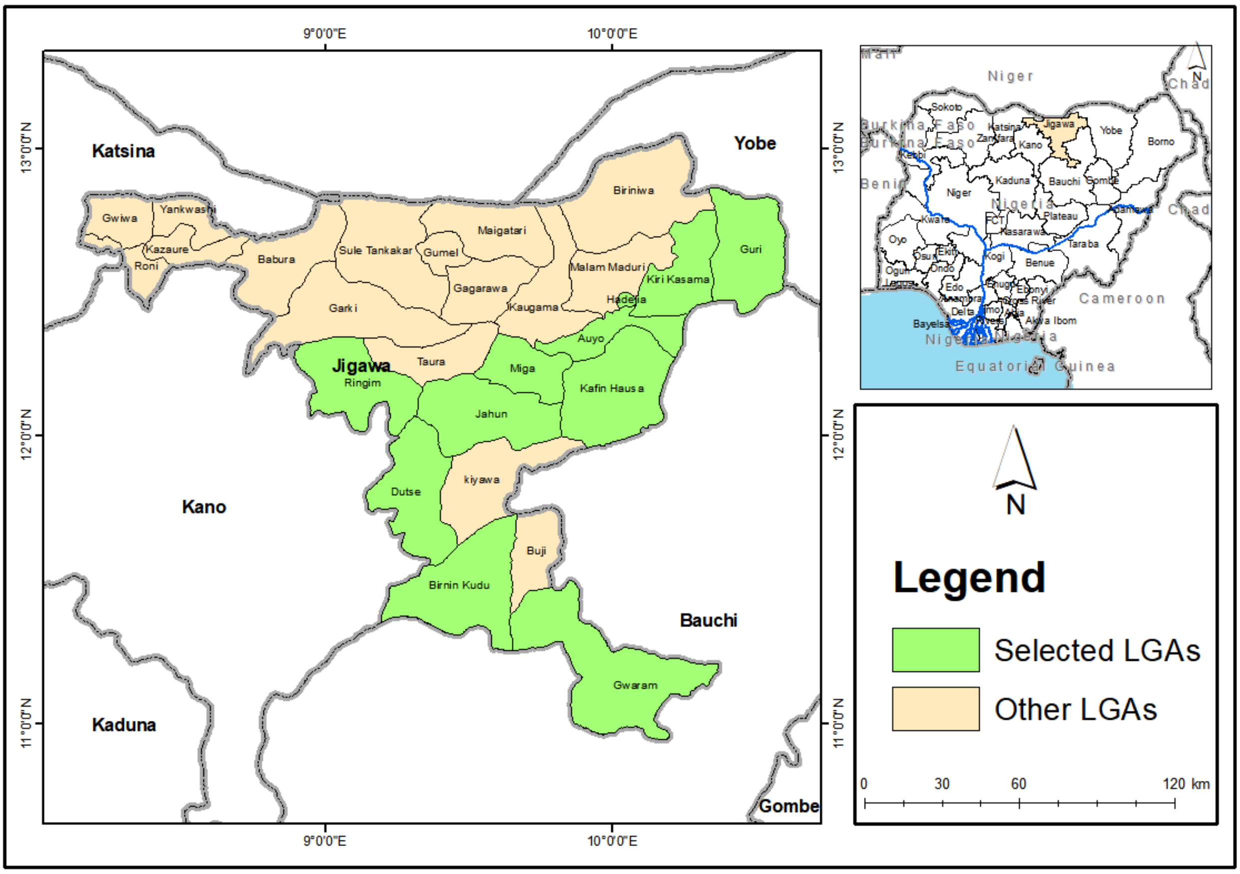

Fig 1: The Study Area
Source: Adapted from Administrative Map of Jigawa State.

MATERIAL AND METHODS

Sample Size and Sampling Technique

A multi-stage sampling procedure was adopted in the sample selection. In the first stage, Local Government Areas (LGAs) with high reported cases of flooding in Jigawa states were identified. In the second stage, some communities with high reported cases of flooding were purposively selected from each of the LGA.

Areas with a history of flooding or identified as high-risk zones through preliminary analysis were targeted for data collection.

Key informants, such as government officials, community leaders, and experts, were selected purposively due to their expertise and participation in flood management activities. Lastly, individual households were selected at random from each of the selected communities in proportion to the number of households in the community. The total population of each ward determine the proportion of respondents sampled for the questionnaire administered.

A purposive sampling technique was adopted to select the local governments for this study thus out of twenty-seven local governments areas in the state eleven local governments were purposively selected these wards are chosen for the study are Kafin-Hausa (Kafin-hausa, Balangu, Maizan, Sarawale), Kiri-kasamma (Kirikasamma, Marma, Fandom, Baturiya), Guri (Guri, Kadira, Dawa), Hadejia (Yayari, Yankoli, Dubantu), Jahun (Harbo sabuwa, Harbo tsohuwa, Gunka, Kale), Ringim (Dabi, Yandutse, Sankara), Gwaram (Gwaram, Basirka, Maruta, Dingaya, Tsangarwa, Farin-Dutse), Birnin-Kudu (Birnin-kudu, Kangire, Kwangwara, Lafiya), Auyo (Auyo, Ayama, Gatafa, Unik), Miga (Harbo, Miga, San-sani), and Dutse (Karnaya) this is based on the information from NEMA, SEMA, Media reports and NIMET and the researcher's knowledge being predominantly experiencing seasonal flood almost every year. A purposive sampling technique was adopted to select the study wards for questionnaire administration. Some wards or communities within each LGA are selected solely based on the researcher's awareness that these areas are primarily located within river basins and experience significant seasonal flooding. (Table 1). To determine the sample size of the study, the Ken (2004) sample size formula was used (equation 1). Therefore, using the projected population of the study area (2,937,591,75), a sample size of 665.5 was obtained; as such 666 samples were selected. Additionally, given the provision of population data at the ward level, the chosen wards were drawn from the 1991 estimated census figures for Auyo, Hadejia, Guri, Jahun, Kafin-Hausa, Gwaram, Kiri-kasamma, Birnin-Kudu, Ringim, Dutse, and Miga, with their populations projected to 2023 using Equation 2 (Table 1). To calculate the proportion of respondents sampled, Yamene’s (1976) formula was applied using Equation 3 for respondents’ selection.

Table 1 List of Wards and the sampled size in the study area

S/N	Names of Ward	Population					
		Male	Female	1991	2023	Sample size	Percentage of sample
1	KAFIN HAUSA	9451	8818	18269	47044	23	3.4
2	BALANGU	5529	5770	11299	29096	14	2.1
3	MAIZAN	7609	12385	19994	51486	25	3.8
4	SARAWALE	4439	4690	9129	23508	11	1.7
5	KIRI KASAMMA	4286	3299	7585	19532	10	1.4
6.	DOLERI	3285	3551	6836	17603	9	1.3
7	FANTUM	9452	9685	19137	49279	24	3.6
8	MARWA	3235	3178	6413	16514	8	1.2
9	BATURIYA	3697	4436	8133	20943	10	1.5
10	KAJIRA	7870	7051	14921	38423	19	2.8
11	DAWA	3029	3292	6321	16277	8	1.2
12	GURI	5057	4836	9893	25475	12	1.9
13	YAYARI	5098	5048	10146	26127	13	1.9
14	DUBATU	3517	2976	6493	16720	8	1.2
15	YAN KOLI	1320	1112	2432	6263	3	0.5
16	HARBO SABUWA	9517	9571	19088	49153	24	3.6
17	GUNKA	6821	7231	14052	36185	18	2.6
18	KALE	4627	4791	9418	24252	12	1.8
19	RINGIM	20578	16664	37242	95901	47	7.0
20	DABI	3425	3593	7018	18072	9	1.3
21	SANKARA	5675	3977	9652	24855	12	1.8
22	YAN DUTSE	6906	7201	14107	36327	18	2.7
23	BASIRKA	8760	6816	15576	40109	20	2.9
24	MARUFA	13454	10049	23503	60522	29	4.4
25	GWARAM	16168	12385	28553	73526	36	5.4
26	DINGAYA	4723	4690	9413	24239	12	1.8
27	TSANGARWA	5038	3528	8566	22058	11	1.6
28	FARIN DUTSE	5653	5192	10845	27927	14	2.0
29	BIRNIN KUDU	16347	15533	31880	82094	40	6.0
30	KANGIRE	10727	10714	21441	55212	27	4.0
31	KWANGWARA	11952	12473	24425	62896	31	4.6
32	AUYO	13428	12694	26122	67266	33	4.9
33	AKMA	2562	3102	5664	14585	7	1.1
34	GAFAKA	4032	4113	8145	20974	10	1.5
35	UNIK	4628	3517	8145	20974	10	1.5
36	MIGA	3715	3678	7393	19038	9	1.4
37	HARBO	7472	7480	14952	38503	19	2.8
38	SANSANI	5190	3906	9096	23423	11	1.7
39	KARNAYA	5060	5365	10425	26845	13	2.0
	TOTAL	273,332	258,390	531,722	1,369,228	666	100

Source: Author's Computation

Table 1 presents the names of the wards, and their population distribution based on 1991 estimated and 2023 projected population figures. It also shows the sample size drawn for the study and the percentage of samples.

$$N = \frac{\frac{[z^2 \text{ x } p\,(1-p)]}{e^2}}{1+ \frac{[z^2 \text{ x } p\,(1+p)]}{e^2 \text{ x n}}}$$ ……………………………..equation 1

Where: N= sample size

n= population size

e= error margin (set at 5% = 0.05)

p= standard deviation (set at 50% = 0.5)

z= confidence level (set at 99% = 2.58)

$Po = P1\,(1+r)^{n}$ ……………………………………... equation 2

Where Po= projected population,

P1= Initial population,

r= Growth rate=3% =0.03

n= Number of years projected

$Pp. = \frac{n \times 666}{N}$ ………………………………………..equation 3

Where: Pp. = proportion of respondents

n=Population of each ward

N=Total population figure

Households were selected at random and administered a questionnaire. Two trained research assistants were recruited from each ward who assist in the administration questionnaire. For respondents who did not understand the language used (English), the researcher team interpreted the questions for them. Only fully completed questionnaires were retrieved and used for study.

RESULTS AND DISCUSSION

Socio-demographic Characteristics of Respondents

The socio-demographic characteristics taken into account include gender, age, marital status, educational background, occupation, and length of residence of the respondents (Table 2). By analyzing these characteristics, we can generate data that translates into meaningful insights for use for proper understanding of flood risk and mitigation efforts in the study area. Thus, the distinct traits of communities and households affect their perceived risk or susceptibility to hazards. Generally, households and population groups possess varying disaster preparedness strategies due to observed differences in their socio-demographic profiles (Akpalu and Codjoe, 2013). Results are summarized and presented in Table 2. According to Table 2, males made up 70.38% of the respondents, representing the majority, while females comprised 29.62%. The age range was from 15 to 55 and older, with the largest group (32.11%) falling within the 35-44 age bracket and the smallest group (14.80%) in the 15-24 age range. Most respondents (56.90%) are married, while the smallest proportion (12.14%) are divorced.

Table 2: Respondents' Socio-demographic Characteristics

Gender	Frequency (Frq.)	Percentage (%)
Male	423	70.38
Female	178	29.62
Total	601	100
Age		
15-24	91	15.14
25-34	111	18.46
35-44	193	32.11
45-54	117	19.46
55 and above	89	14.80
Total	601	100
Marital status		
Single	103	17.13
Married	342	56.90
Divorced	73	12.14
Widowed	83	13.81
Total	601	100
Highest educational qualification		
Primary	93	15.47
Secondary	194	32.27
Tertiary	139	23.12

Informal Education	96	15.97
No education	79	13.14
Total	601	100
Occupation		
Farming	231	38.43
Trading	189	31.44
Civil Service	118	19.63
Self Employed	63	10.48
Total	601	100
Period of Residence in the Community		
0-5 years	203	33.77
6-10 years	308	51.24
11-15 years	58	9.65
16-20 years	22	3.66
21 years and above	10	1.66
Total	601	100

Source: Field Survey, 2024

The representation of both males and females among the sampled respondents might have helped to accommodate the possible variation of opinion on issues explored in the study. Nonetheless, the dominance of male respondents is attributed to the function of questionnaire administration as informed by the Hausa-Fulani cultural setting of the study area, in which more males were found and reached. However, regarding gender-specific capacities, it is believed that local women have the ability to influence their community by employing adaptive strategies in vulnerable areas. (United Nations Development Programme-UNDP, 2010), as they adjust to new circumstances and strive to manage climate change and other types of disasters. For example, studies have found that female respondents tend to perceive the risk of floods more acutely than their male counterparts and thus, may represent a specific target audience for risk reduction strategies (Ho, Shaw, Lin and Chiu, 2008; Lindell and Hwang, 2008). Hence, the fair representation of females in this study.

Studies have also demonstrated that gender and age are known to influence human vulnerability to natural hazards, more especially floods. (Ashley and Ashley, 2008, FitzGerald, Du, Jamal, Clark and Hou, 2010), It can therefore be deduced from the result obtained that, being in their middle and active age brackets (both male and females), the majority of the respondents might be not only in a better position to provide reliable responses to the issues addressed, but also the group may have an overall tendency towards certain physical, psychological, social and economic conditions which may maximize their ability to overcome floods.

The educational attainment of respondents as shown in Table 2 reveals that Secondary education represented the largest share (32.11%), whereas those with no education made up the smallest proportion (13.48%). Additionally, Table 2 indicates that the majority of respondents are involved in farming (38.27%) and trading (31.61%), while the smallest group is self-employed (10.32%). This implies that the majority of those interviewed have participated in some form of formal education. In this regard, UNDP (2010), stressed that the effectiveness of efforts to mitigate flood impacts, particularly the success of flood warning systems, heavily relies on the inhabitants' and users' understanding of local flood hazards and their awareness of recommended behaviors before and during floods. Therefore, respondents would probably demonstrate positive attitudes and motivation towards flood warning systems and disaster preparedness efforts.

Livelihood resilience in the face of recurring floods is also found to correlate with exposure to flood risk in various studies (Akuro *et al.,* 2013; Abubakar *et al.,* 2016; Umar *et al.,* 2019). Therefore, the access to and use of livelihood resources—such as the size of farmlands, availability of farm equipment, credit access, and the ability to receive support from social networks—are crucial factors in determining household resilience to floods. Consequently, the prevalent farming activities in the study area may significantly influence how communities perceive risks and their overall resilience to flood preparedness.

Table 2 also reveals that the majority of respondents, 51.58%, have lived in their communities for six to ten years. This is closely followed by 31% of the respondents who lived for a period of zero to five (0-5) years, those who have lived in the area for twenty-one years or more make up the smallest proportion (1.66%) of the respondents. This indicates that the respondents have resided in the area long enough to provide relevant information regarding floods.

The extent of Community Preparedness for Flood Risk
The role of the community in flood risk prevention can never be over-emphasized. Essential components of disaster emergency plans require permanent public involvement. Table 3 presents the extent of peoples' preparedness in the study area.

Table 3 Community Level of Preparedness on Flood in the Study Area

	A		D		U		Total		PI	RMK
Score Range	3		2		1					
	F	%	F	%	F	%	F	%	%	
The community is aware of flood risks	467	77.7	134	22.3	0	0	601	100	92.6	Prepared
The community is aware of flood disaster risk management strategies	224	37.3	63	10.5	314	52.3	601	100	61.7	Somewhat Prepared
The community organizes public education and training in flood risk reduction	0	0	400	66.6	201	33.4	601	100	55.5	Unprepared
The community engages in rehearsals/emergency drills	0	0	310	51.6	291	48.4	601	100	50.5	Unprepared
There is a good community-based warning system	0	0	309	51.4	292	48.6	601	100	50.5	Unprepared
There is provision of a neighborhood directory	588	97.8	0	0	13	2.16	601	100	98.6	Prepared
There is a community system for property protection measures during floods	0	0	315	52.4	286	47.6	601	100	50.8	Unprepared
There is availability of local shelter	456	75.9	4	0.7	141	23.5	601	100	84.1	Prepared
Individuals have emergency contacts	333	55.4	268	44.6	0	0	601	100	85.1	Prepared
The community has an active recovery plan	0	0	378	62.9	223	37.1	601	100	54.3	Unprepared

Source: Field Survey, 2024
Key: A=Agreed. D=Disagreed, Undecided, PI=Preparedness Index, RMK=Remark

From Table 3, a majority (77.7%) of the respondents agreed that the community is aware of flood risks. There was also a provision for a neighborhood directory as attested by the majority (97.8). Many (75.9%) voted for the availability of local shelter and emergency contacts (55.4%)

during floods. The preparedness indices stood at 92.6%, 98.6% 84.1% and 85.1% respectively, which are above the 65% threshold based on DILG (2012) standards. Therefore, the community can be said to be 'prepared' in these regards. Whether the community is aware of flood disaster risk management strategies, a majority (52.3%) of the respondents voted for 'undecided'. However, some (37.3%) of the respondents agreed to be aware. With a PI of 61.7%, which is slightly within the threshold 60-65%, the respondents were considered in this case, 'somewhat' prepared (Table 3).

Also majority of the respondents disagreed that community organization of public education and training on flood risk reduction (66.6%); engagement in rehearsals/emergency drills (51.6%); good community-based warning system (51.4%); and a standalone system for property protection measures during floods (52.4%); as well as an active recovery plan (62.9%) are put on place. The preparedness indices for these, fell below the threshold 60 % (55.5%, 50.5%, 50.5%, 50.8% and 54.3% respectively), and hence were considered 'unprepared'based on these indices (Table 3).

Generally, respondents interviewed, showed high training needs in the entire preventive methods of flood risks. Despite awareness of flood risk, neighborhood coalition and local shelter provision, occupants in the area have remained with no professional skills to ensure physical and personal safety during times of extensive physical damage or significant disruption caused by a flood. Probably those who voluntarily organised themselves within the community to educate and learn about such measures might have in turn paid less attention due to low turnout and participation of local authorities, government and non-governmental organizations. However, the views about what can be possible in managing flood risk may vary widely among those who have not received official training. Those involved in various types of work are best described by the skills they have or the fields they pursue in their livelihood activities. These roles can include essential community or national functions such as farming, fishing, trading, transportation, manufacturing, construction, and teaching. It is rare for individuals to connect their everyday work experiences to "disaster management" and even more rarely to "reducing disaster risks" (Meludu, 2011).

From this study, it can be inferred that residents within the area under study are doing little to prepare against floods. The situation can be best understood through the 'cultural theory of risk, 'protection motivation theory'. And the 'rational theory method', Thus, it was of the view that: risk perception largely influences risk management and therefore determines whether risk management is successful in reducing vulnerability. Since risk is perceived differently by people, risk management approaches are influenced by what people perceive as 'risky'. If within the study area flood hazard is perceived as a potential risk, the respective actors may take action to manage it. Often preparedness in the face of a threat would influence the degree of risk perceived. For instance, the higher the preparedness, the lower the perceived risk. In essence, the understanding of risk and the perceived probability of adverse extreme events occurring; the social and cultural interpretations of risks as well as experiences and traditional strategies may result in improved management.

CONCLUSION

Flooding in the study area has been increasing. While uncontrollable factors like heavy rains, rainstorms, river and stream overflow, and prolonged rainfall contribute to this, issues such as deforestation, lack of flood embankments, poor waste disposal and drainage systems, and infrastructure development in flood-prone areas exacerbate the problem. The resulting damage, often attributed to mystical beliefs, is likely to continue rising. This trend persists despite the fact that residents in the affected areas, who have lived there long enough to gain significant experience and awareness of local flood hazards, have a good understanding of appropriate behaviors before and during floods. However, the primary and indigenous actions taken before floods are usually limited to renovating old mud houses and constructing new drainage systems, ditches, or embankments when needed. Notably, early warning systems, which could significantly boost motivation to prepare for floods, are largely absent in the study area, leaving much to be desired in terms of flood preparedness.

The dependency syndrome and its negative impact on community resilience due to reliance on aid may have reduced the ability to cope and contributed to livelihood insecurity in the area. The frequency, severity, and trend of floods, along with inadequate training on flood risk prevention and weak institutional capacities to implement risk reduction measures through public early warning systems, highlight the area's risk context. Vulnerability is further complicated by increasing exposure to risks. If the flooding issue in the study area continues to be neglected, the risk of exposure will increase, leading to more displaced economic activities and property loss.

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