Progress in Disaster Science 25 (2025) 100399

Contents lists available at ScienceDirect

Progress in Disaster Science

journal homepage: www.elsevier.com/locate/pdisas

Women's knowledge and perception of flood disasters in Butaleja District, Uganda

Alice Nakiyemba *, Kinobe Zakaria, Kakungulu Mosses, Nyangoma Immeldah, Masaba Sowedi

Busitema University, Faculty of Natural Resources and Environmental Sciences, Uganda

ARTICLE INFO

Keywords:
Floods
Disaster
Knowledge
Perception
Women
Uganda

ABSTRACT

Globally, flood disasters have increased, adversely affecting women. The study assessed women's knowledge and perception of flood disasters in Butaleja district, Eastern Uganda, regarding the occurrence, severity, causes, and timely access to flood information among women flood victims. Evaluating women's knowledge and perception of flood disasters guides the design and implementation of risk-reduction initiatives and practices. We employed mixed methods, with primary data collected from 300 households, 16 focus group discussions, and 9 key informants. Data were analysed with R-software and Atlas ti 23. Results attributed the causes of flood disasters to heavy rainfall, poor farming methods, and encroachment on wetlands and riverbanks. Most women reported that floods were becoming more severe, and they lacked access to information sources regarding flood disasters. Women's awareness of flood disasters is significantly associated with the respondents' level of education and the primary source of livelihood. The study concludes that even when women flood victims were aware of flood disaster occurrence, severity, and causes, they exhibited inadequate knowledge, as they did not have access to information sources to alert them to flood disasters. The study recommends appropriate location of flood early warning systems and proper land use to enhance women's knowledge of flood disasters.

1. Introduction

Community knowledge and perceptions of disasters are crucial for effective risk reduction and comprehensive management of disaster effects. Women, in particular, play a significant role in this process. Globally, flood disasters have increased over the last two decades. Between 2001 and 2021, flood disasters increased by 37 %, accounting for more than half of the disaster events [1]. In 2021, floods accounted for 39 % of disaster-related deaths, 29 % of people affected and 29.5 % of disaster-related economic losses. Fidele, 2013 notes that the risk of flooding is increasing globally due partly to climate change, which enhances the number of weather extremes like excessive rainfalls or droughts. Flash flooding is a significant obstacle in China that highly affects social and economic development [2]. In Malaysia, floods affected more than half a million people, and the public infrastructure was damaged, with the cost losses estimated at RM 2.8 billion [3].

In Africa, most of the central and western parts of the continent are affected by floods. Between 2000 and 2019, floods accounted for 64 % of disaster events, 32 % of deaths and 16 % of people affected by disasters [4,5].

In Uganda, floods are a major disaster, accounting for 36 % of affected people and the leading cause of house destruction and damage. In Butaleja district, floods account for 61 % of disastrous events, 94 % of affected people and 70 % of houses destroyed and damaged [6,7]. Previous studies have demonstrated that the poorest and most marginalised people, who are mostly women, suffer more from disasters, which has resulted in exacerbating vulnerability, social inequalities and decreasing economic growth [8]. Similarly, Asaba [9] notes that women are more vulnerable to climate-related disasters and less able to adapt. Hao S. et al. [2] attribute this to women's weak self-rescue capability during flood disasters.

Further studies reveal that women have limited capacity to implement disaster mitigation and adaptation measures due to the persistent gender gaps with restrictive social norms, limited land ownership, limited access to gainful work opportunities, restricted access to credit, and a higher burden of caring for family members. These together reduce their coping capacity [10,11,12,13,14]. Previous studies such as that by [15] indicate that vulnerability to hazards and to gender is a multifaceted interaction between poverty and gender relations, in which women are likely to experience higher levels of vulnerability. It is found

* Corresponding author.
E-mail address: anakiyemba.nres@busitema.ac.ug (A. Nakiyemba).

https://doi.org/10.1016/j.pdisas.2024.100399
Received 12 August 2024; Received in revised form 13 December 2024; Accepted 15 December 2024
Available online 19 December 2024

that gender issues also exaggerate both self and social protection during disasters. However, women are not involved in emergency planning and preparedness decisions in the developing world [15]. [16] notes that little is known about the occurrence, frequency and severity of flood disasters among community members, especially women in flood-prone areas of Uganda.

Regarding this, findings by Faizatul., et al. [3] indicate that people's awareness about flood disasters must be raised to enhance and increase their knowledge and information on disasters. Faizatul further notes that if psychological and physical awareness and preparedness were practiced and learnt by the people who live around the flood-prone area, the awareness of people could minimise the damage caused by floods and reduce the difficulties of rescue work for the disaster risk management authorities. Thus, the losses from a disaster can be reduced by raising the awareness and preparedness of communities for disaster.

In Uganda, the Butaleja District hazard risk and vulnerability profile, 2016 indicates that in the Butaleja district, the probability of flood disaster occurrence is inevitable, with high severity of impacts and high relative risk. Thus, understanding the level of women's knowledge and perception of flood disasters will help identify awareness gaps to minimise the damage caused by floods, especially to women. In case of low awareness of flood disasters, an increase in women's awareness of flood disasters shall be a means to strengthen their flood rescue capabilities in flood-prone areas of Uganda, especially in the study area. Further, establishing knowledge and perceptions of flood disasters would benefit several risk-reduction initiatives and practices such as timely household relocation, flood water diversion channels, timely harvesting of food crops and raising river embankments. Awareness of the appropriate steps to follow before and during a disaster is one of the most important factors in survival, saving lives and reducing material damage [17].

This forms the basis for flood risk reduction and effective management of flood disasters since women may represent a specific target audience for flood risk-reduction initiatives and practices. Henceforth, the current study seeks to answer whether women in the Butaleja district understand flood disasters, including awareness, occurrence, severity, causes, and timely access to flood disaster information. Calamitous disasters can be circumvented with preparedness and proper mitigation actions [18].

It is thus justified that despite the several initiatives and interventions put in place by the government, such as the establishment of river embankments, water channels, water reservoirs, and afforestation, coupled with community sensitisation, women in Butaleja district remain vulnerable and suffer the effects of flood disasters. This continued vulnerability can be attributed to the knowledge gap concerning flood disasters, where women cannot make timely and rational decisions before, during, and after a flood disaster. Understanding women's knowledge and perceptions will help to bridge the knowledge gap and further guide the design and implementation of practical and policy flood disaster risk-reduction initiatives in the study area.

2. Theoretical framework

The study uses the Bounded Rationality theory proposed by [19]. The theory states that people make judgements based on the amount of information available to them. Humans base their decisions on their limited knowledge and cognitive capacity. Directly linked to the study, women's choices and decisions when facing flood disasters depend on their knowledge, experience or perception. According to this theory, information restricts an individual's rationality, the cognitive limits of their minds, and the finite amount of time available to them in decision-making. For example, in times of disaster, the available information and time will determine the individual's decision to relocate to a safer place, harvest food crops on time, establish water diversion channels, and raise soil bands as embankments. Thus, according to the Bounded Rationality theory, the decision on when and what to adapt may be influenced by the individual's perception, knowledge, experience and available time. This relates very well to the study that, based on women's knowledge, perceptions, and experiences, when flood disaster information is received, women will make decisions that may help them survive or succumb to the flood disasters. In this regard, increasing knowledge is expected to impact how women perceive and respond to flood disasters. Lack of or inadequate acquisition of flood disaster information restricts the choice and implementation of risk-reduction initiatives, thus weakening women's flood-rescue capabilities. On the other hand, having sufficient knowledge and a good perception of flood disasters influences timely decision-making and choice of life-saving initiatives. Thus, assessing the level of knowledge and perceptions of flood disasters forms a basis for enhancing flood-rescue capabilities and flood risk reduction. The theory complements rationality as optimisation, which views decision-making as an entirely rational process of finding an optimal choice given the information present. Thus, Bounded rationality theory acknowledges that when trying to be rational, individuals are limited by imperfect knowledge, for example, knowledge of disasters [19]. The theory is suitable for this study since the study tries to assess Women's knowledge and perception of flood disasters.

3. Materials and methods

3.1. Materials

We conducted the study in Butaleja district (Fig. 1), one of the most flood-prone areas in Eastern Uganda, with almost all sub-counties being vulnerable. Statistics show that the low-lying areas of the Butaleja district are vulnerable to flood disasters. More recently, in December 2019, floods led to 4 deaths, and over 2000 people were displaced [20]. The study area is generally gently sloping and nearly flat, and the altitude ranges between 800 and 1000 m above sea level. The soils are largely plinthosols (Ferruginous tropical soils) with mottled clay materials. Several rivers drain the district, including Manafwa, Mpologoma, Namatala, Dumbu, and Nakwasi. Wetlands cover 22 % of the district. Butaleja district experiences a sub-humid climate. The temperature ranges between 16.2 °C and 28.7 °C. The rainfall follows a bimodal pattern, which peaks during May and October. The annual rainfall ranges between 1130 and 1720 mm. The district has a total population of 310,900 and 45,000 households. Currently, Butaleja district has ten (10) sub-counties and five (5) Town councils ([21,20,22,7]; UBOS, [23]).

3.2. Methods

A mixed methods approach drawing on quantitative and qualitative enhanced the validity of the findings through triangulation and complementarities. We collected data between January and June 2023. The Busitema University grants committee approved the study, funded by the Busitema University Innovation Fund(BURIF). Butaleja District Local Government, Office of the Chief Administrative Officer granted further permission to conduct the study. We identified and selected the study area purposively because it is prone to flood disasters following the Butaleja district disaster profile [22]. Two sub-counties, two parishes from each sub-county and two villages from each parish were purposively selected. To address the key research gap, we asked respondents to mention and discuss their experiences, how much they knew of flood disaster occurrences, severity and causes, and their opinions regarding flood disasters. Thus, we defined and measured women's knowledge of flood disasters based on their awareness of occurrences, severity, causes and access to information on flood disasters. Perceptions were determined as the ways in which individuals and groups assume, observe, and remark on flood disasters [24].

3.2.1. Quantitative methods

For the quantitative approach, we recruited a sample of 300 households (women flood victims) in the study area across eight villages

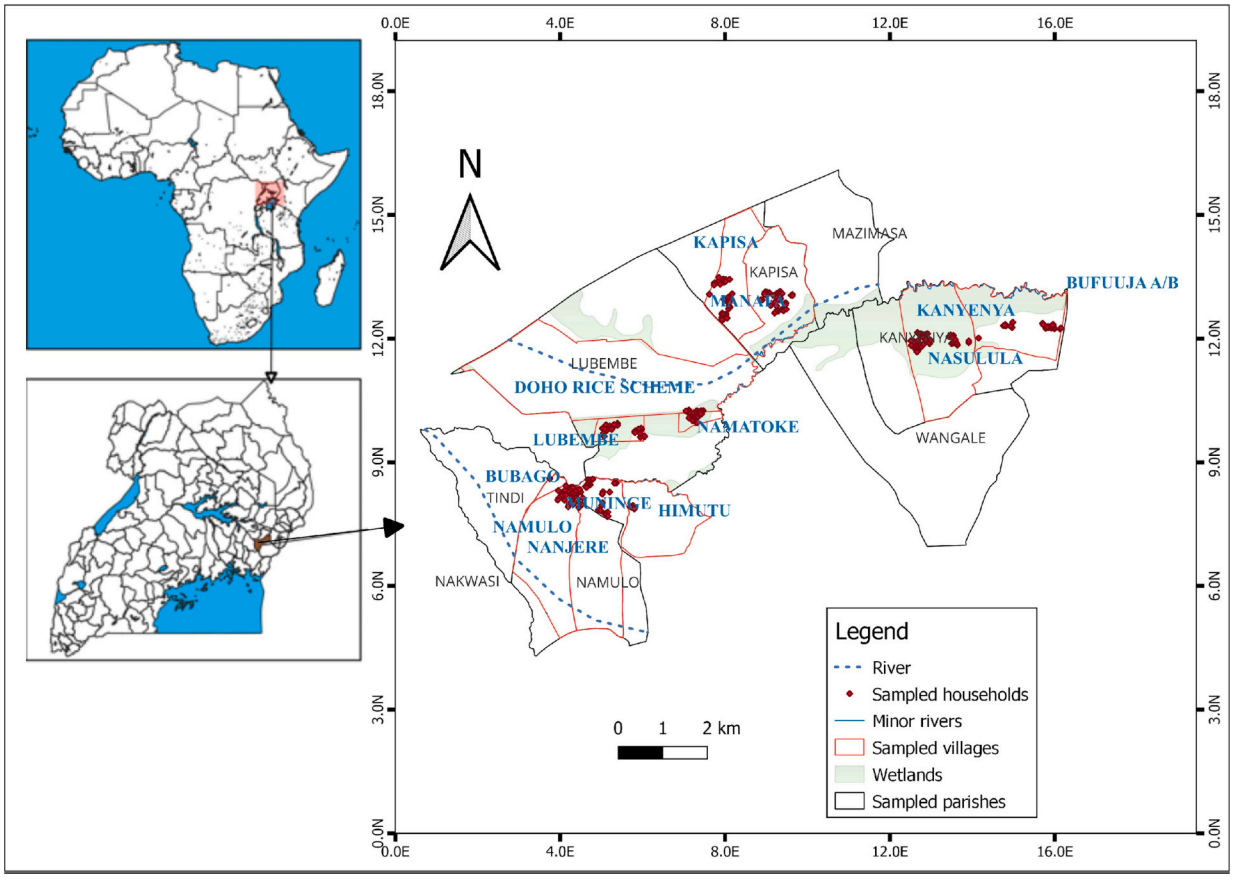

Fig. 1. Map of the study area.

comprising 38 women per village selected randomly using a systematic random sampling technique. Inclusion and exclusion criteria are based on the availability of evidence of the effects of flood disasters on the household and other sources of livelihood. This sample represented the total number of women flood victims in the study area. This was ensured following Slovin's equation for sample size determination. Women flood victims were selected using systematic random sampling. The sampling frame used was a list of the total number of households in local council 1. We collected survey data from households through interviews with the help of CSpro Entry application version 7.7.3, installed on tablets. During data collection, all respondents consented to the study verbally and were recorded. Data were analysed using R-statistical software version 4.1.2 to produce descriptive and inferential statistics. We adopted the Likert scale of measurement (Rensis, [25]).

3.2.2. *Qualitative methods*

The Qualitative approach involved focus group discussions and key informant interviews to understand women's knowledge and perception of flood disasters. As indicated in Table 2, we conducted 16 FGDs across eight (8) villages, two FGDs per village comprising 16 gender-differentiated FGDs with flood disaster victims between April and May 2023. We conducted the focus group discussions with the help of a focus group discussion guide. The discussions explored awareness of flood disasters in terms of occurrence, severity, causes and timely access to information on flood disasters. Verbal group consent was sought and recorded from group members. In addition, we conducted nine (9) key informant interviews using a structured interview guide. We purposively selected the key informants because of their experience, knowledge and opinions about flood disasters (Table 3). Recorded data was transcribed and manually cleaned. Then, we performed a thematic analysis to identify major themes, sub-themes, and emerging themes from the transcripts. The data coding with the help of Atlas ti, version 23, followed this.

4. Results

4.1. *Socio-demographic characteristics of the survey respondents*

All the survey respondents were female, and 27 % were household heads. Most respondents were married (87 %) and had not attained any formal education (48 %). The average age of the respondents was 40, and most depended on farming (99 %) as their primary source of livelihood (Table 1). The average household size was seven, and the average monthly household expenditure was 40 USD.

Table 1
Demographic characteristics of survey respondents.

Age group (years)	Highest education level	Marital status	Years spent in the area	Source of livelihood
17–30 (34.3 %)	No education (47.70 %)	Single (0.003 %)	Below 12 (39.4 %)	Farming (99 %)
31–60 (56.3 %)	Primary (42 %)	Married (86.7 %)	Above 12 (60.6 %)	Non-farming (0.3 %)
61–85 (9.3 %)	Secondary (10 %)	Divorced (4.33 %)		Formal employment (0.3 %)
	Tertiary (0.33 %)	Widowed (8.67 %)		Others (0.3 %)

Table 2
Focus group discussion (FGD) participants by gender.

Sub county	Parish	Village	Participant category	Men	Women	Total
Mazimasa	Kapisa	Manafa	Women	00	12	12
			Men	08	00	08
		Kapisa	Women	00	11	11
			Men	12	00	12
	Lubembe	Namatoke	Women	00	11	11
			Men	10	00	10
		Lubembe	Women	00	12	12
			Men	11	00	11
Himuntu	Kanyenya	Kanyenya	Women	00	12	12
			Men	11	00	11
		Masulula	Women	00	11	11
			Men	10	00	10
	Namulo	Muninge	Women	00	12	12
			Men	10	00	10
		Namulo	Women	00	12	12
			Men	10	00	10
Total:				82	93	175

Table 3
Key informants (KIs) interviewed.

Categories of key informant	Male	Female	Total
Civil society Organization (Red cross-Uganda)	0	1	1
Sub County Chiefs	2	0	2
Sub County Community Development Officers (CDOs)	1	1	2
District Production Officer (DPO)	1	0	1
District Community Development Officers (DCDO)	1	0	1
Chief Administrative Officer (CAO)	1	0	1
District Forestry Officer (DFO)	1	0	1
Total:	07	02	09

4.2. Awareness and causes of flood disasters

The survey findings show that most respondents (94 %) were aware of flood disasters in their community. Most of the respondents attributed the causes of floods to climate change, which brings about heavy and erratic rainfall (47.5 %), poor farming methods (19.3 %), encroachment on wetlands and riverbanks (11.4 %), deforestation (9.4 %) and silting of the rivers (7.4 %), (Fig. 2).

Quantitative findings agree that women were aware of flood disasters and attributed the increase in flood disasters to encroachment on wetlands, cultivation along riverbanks and climate change. Community members were reported to cultivate in wetlands and along riverbanks during the dry season. It was further mentioned that these areas offered moist soils and a cool environment required for crop growth and animal grazing, ultimately destroying the vegetation around the riverbanks and the silting of rivers. According to the results, the vegetation around the riverbanks and wetlands would help to reserve floodwaters. Results further show that during the rainy season, floodwaters would find the rivers silted and the wetlands degraded, which occasionally resulted in the bursting of the rivers and the overflow of wetlands. Members of the focus group discussions had this to say:

> "Flood disasters occur due to the destruction of forests and cultivation on and along riverbanks, and nowadays, riverbanks have also turned into rivers. We cultivate and leave the river open. This means the vegetation that could hold water was all removed, so the river remained bare. By the time we grew up, riverbanks could not be cultivated. We could leave some good distance from the riverbank. That is what I see is bringing about flood disasters more often nowadays."
>
> (FGD women respondent from Kapisa village)

> "Butaleja is a low-lying area with poor agricultural practices along the river banks. Due to population pressure, there has been mismanagement of river banks whereby people have gone ahead to encroach on the river banks; they have now left the river banks open so that when it rains, the soils are washed back into the river, resulting in silting. Due to vegetation removal, there will be reduced water infiltration into the soil, increased soil erosion and silting so, whenever it rains, it will just flood everywhere".
>
> (District et al. District)

4.2.1. Community myths about the perception of the causes of flood disasters

We explored community beliefs and perceptions about awareness and causes of flood disasters. Findings indicate a strong belief in myths; for example, some women and men participants in FGDs perceived that the increase in flood disasters was due to the decline in the offering of traditional sacrifices made to the gods by the community members. It was perceived that because of this, the gods got annoyed and increased the rate of flood disasters to penalise the community members. It was also perceived that since the community members went ahead to destroy the vegetation around the rivers, which were dwelling avenues for the gods, these gods got annoyed and increased the severity of flood disasters. It was also mentioned that the traditional rainmakers in the community had the power to either increase or decrease the rate of flooding by regulating the amount of rainfall received. While this was featured in the qualitative results, it was not in the quantitative results. Some FGD respondents mentioned this:

> "When we grew up around 1975, people who could perform rituals at the river like sacrificing a chicken, speaking to it, and dancing, but all those traditional things collapsed. Also, introducing the Doho rice scheme changed the river accordingly because all the vegetation along the river was removed, which could act as residences for the traditional gods. That is why these spirits come over to cause floods. It seems the river got annoyed, and when it got annoyed, it closed up, bringing sand into the river. So, the river became narrow and so when water comes it just floods."
>
> (FGD women respondent from Manafwa village)

Table 4
Associations between socio-economic groups and the respondents' perceptions of flood disaster occurrence and severity.

Parameter	Flood disaster occurrence				Flood disaster severity			
	Pearson	df	r	*p*-value	Pearson	df	R	*p*-value
Age	15.04597	14	0.158356	0.375019	21.4678	14	0.189155	0.090231
Disability	0.567589	2	0.043497	0.752921	1.750617	2	0.07639	0.416733
Time_area	4.054579	16	0.082205	0.998806	11.01808	16	0.135512	0.808368
Education	53.07649	6	0.297424	1.13E-09	27.73437	6	0.214998	0.000105**
Marital status	3.170103	6	0.072688	0.787214	4.495371	6	0.086558	0.609957
Religion	1.201754	6	0.044754	0.976798	2.822378	6	0.068585	0.830787
Gender	5.94235	2	0.14074	0.051243	3.716713	2	0.111306	0.155929
Livelihood	49.21379	6	0.286397	6.76E-09	29.05628	6	0.220062	5.94E-05**

Significant differences are indicated with ***$p < 0.01$, **$p < 0.05$ or *$p < 0.1$.

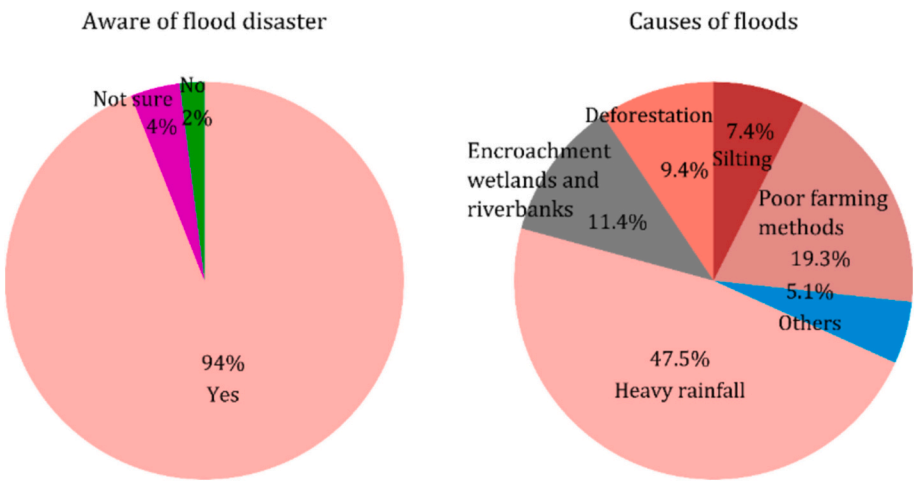

Fig. 2. Awareness and causes of flood disasters.

4.3. Perception of flood disaster occurrence and severity

Survey findings indicated that flood disasters increased, were unpredictable, and occurred twice a year, especially during April and November (70 %), and were increasing (82.7 %). Most respondents reported having experienced the 2022 flood disaster (Fig. 3). This agrees with the qualitative findings from focus group discussions and key informant interviews, which revealed increased flood disaster occurrence and severity, especially in April, May, October and November. To support this, some FGD respondents mentioned that;

> "Sometimes we experience floods once or twice depending on how heavy the rains can be. We normally receive floods between April and May and then between October and November, but of course, due to climate change, nowadays, it is tough to predict. There are times when we do not expect floods, then they happen, and then there are times when we expect them and do not happen. During the previous years, floods could strike mostly in March because rains could start early."
>
> (FGD women respondent from Kapisa village)

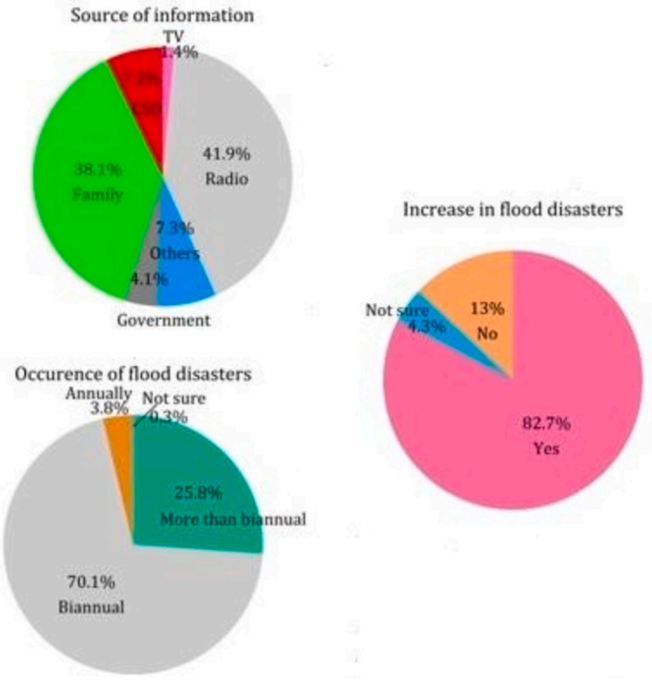

Fig. 3. Occurrence, severity and sources of information about flood disasters.

We associated socio-economic groups and the respondents' perceptions of the occurrence and severity of flood disasters. Respondents' perceptions of the occurrence and severity of flood disasters were influenced by factors including Source of livelihood, Gender of the household head, Religion of the respondent, marital status of the respondent, Education level of the respondent, duration of time spent at home, Disability and age of the respondent. At a significant level of 5 %, only the education level ($p = 0.000105$) and the primary source of livelihood of the respondents ($p = 5.94E\text{-}05$) were significantly associated with the perceptions on the occurrence and severity of flood disasters (Table 4).

4.4. Women's access to sources of information about flood disasters

Survey findings showed that the majority of the respondents received information about flood disasters over radios (41.9 %) and family members (38.1 %) (Fig. 3). In consensus, a few FGD respondents, especially men and some key informants, mentioned receiving information about flood disasters over radios and telephones. In addition, further information from key informant interviews and FGDs indicated that information regarding flood disasters is sometimes disseminated through the local council 1(one) chairperson in every village and the flood early warning systems installed in some selected trading centres. Accordingly, it was revealed that the installed flood early warning systems were vandalised and not functional during data collection. Respondents in FGDs had this to say;

> "During the previous years, we could know about flood disasters because we could predict the rain seasons, but currently, we just see floods occurring. Some time back, they installed an early warning system, which could alert us about flood disasters, but it got damaged, and now we cannot know. So, we just come to see flood disasters occurring."
>
> (FGD women respondent from Kanyenya village)

Following the vandalisation of the installed flood early warning systems, most key informants and focus group discussion participants agreed that most flood victims could not receive any flood alerts.

4.5. Women's perception of flood disaster risks

Most survey respondents (88 %) perceived flood disasters as an essential issue for discussion in their community. Most respondents (81 %) indicated that floods were becoming more severe and that a flood disaster was likely (84 %) to occur in their community in the next six

months (84 %), and they feared flood disasters (84 %) (Fig. 4).

5. Discussion

This study assessed women's knowledge and perception of flood disasters and answered the research question of whether women in Butaleja district understand and how they perceive flood disasters. Both qualitative and quantitative findings concur that women were aware of flood disaster severity, occurrence and causes but lacked adequate information concerning flood on-set. This answers the research question that women lack adequate knowledge of flood disasters. Education and major sources of livelihood were significantly associated with awareness of flood disasters.

Survey chi-square results indicate that education and source of livelihood were significantly associated with knowledge of flood disasters (Table 4 above). This means educated women perceive and understand flood disasters quite well compared to uneducated ones. This can be attributed to the fact that educated women are in a position to access, read and interpret information about the flood disasters than uneducated women. Also, educated women could have had an opportunity to study about flood disasters while in school, thus attaining much knowledge. On the other hand, source of livelihood is significantly associated with knowledge and perception of flood disasters because people with gainful sources of livelihood are, in most cases, more mobile and probably educated and can have access to information sources on floods and can read and interpret information regarding flood disasters. This is probably why most of the population may not be well knowledgeable about flood disasters and only come to understand flood disasters at the time of occurrence, as revealed by the current study. This agrees with the results in Table 1, which indicate that most respondents (47.7 %) had no formal education, while 99 % of the women flood victims depended on agriculture, which is not a formal gainful source of livelihood in Uganda. Hence, the majority of the women flood victims lack adequate knowledge of flood disasters since they are not in a position to access, read and interpret flood disaster information. Hence, they are at more risk of flood disasters. This agrees with results by Birkholz S., 2014 that little is known about the occurrence, frequency and severity of flood disasters among community members, especially women in flood-prone areas of Uganda. Thus, there is a need to increase awareness of flood disasters, as earlier revealed by Faizatul et al. [3]. People's awareness of flood disasters must be raised to enhance and increase knowledge and information on disasters.

Both qualitative and quantitative findings agree that women flood disaster victims were aware of flood disasters in their community and attributed the causes to climate change, which brings about heavy and erratic rainfall, poor farming methods, encroachment on wetlands and riverbanks and deforestation. This is in consensus with results by Fidele [26], who state that the risk of flooding is increasing globally due partly to climate change, which enhances the number of weather extremes like excessive rainfalls or droughts. In the same vein, Faizatul et al., [3] notes that flood disasters are caused by natural phenomena, but their occurrences and impacts have been intensified through human actions and inactions.

We also encountered misconceptions of some FGD respondents who believed that flood disasters were caused and influenced by traditional "gods". This is linked to the levels of education, where the study indicates that about 48 % of the survey respondents (Table 1) had no formal education. This can create more disaster for the country. In addition, this has implications for the interventions implemented to minimise the effects of flood disasters since many community members may ignore or fail to participate in the designed interventions as a response. This requires serious government, community, and civil society to work together to cause mindset change before implementing the designed flood-risk reduction interventions.

Both qualitative and quantitative studies concur that the increase in flood severity is due to the location of the Butaleja district. This low-lying flat area is located downstream of Mount Elgon and predominantly surrounded by two wetland ecosystems, Doho-Namatala and Mpologoma, which expose it to flood disasters. Therefore, the district's location makes it a drainage area for the Elgon region, rendering it susceptible to floods [22]. The study findings further indicate inconsistencies in flood disaster occurrence and severity. This is in line with [27,28], who also found that the frequency of flood events appears to rise, primarily in Africa and Asia, where most developing countries are located. Recent research links specific flooding events to the effects of rising greenhouse gas levels and global climate change [29]. This seriously affects the households regarding food security because April is a planting season, and November is a harvesting season. The floods destroy crops, which are either not ready for harvesting or are prepared for harvesting.

Qualitative results show a need for more information sources concerning flood disaster occurrence, especially for women, where the community learns about flood disasters at the time of flood occurrence. It was revealed that men at least access information through cell phones and radios. This is typical of African rural settings where only men own assets like radios and cell phones. This could essentially be due to patriarchal norms, traditional beliefs, and stereotypes, among others, that together limit women's ownership and control of livelihood assets, including radios, telephones and televisions, which could avail information regarding flood disasters readily. This has implications mainly for vulnerable groups such as women and children who remain in their households all the time when these flood disasters occur. Previous studies support our findings. For example, Asaba, 2014 found that women and other vulnerable individuals are less mobile and spend much of their time at home, which limits their access to flood disaster information. Relying on physical observation limits community preparedness for disasters, especially for women. These findings further agree with the results of Asaba (2014), who noted that women generally rely primarily on traditional early warning signs, where indigenous knowledge plays a significant role. Availing of information concerning flood disasters in the community through the chairpersons of local council 1(one) would be important since the early warning systems are inadequate. In most cases, flood alerts come when the disasters have occurred. In Uganda, early warning systems are placed in trading

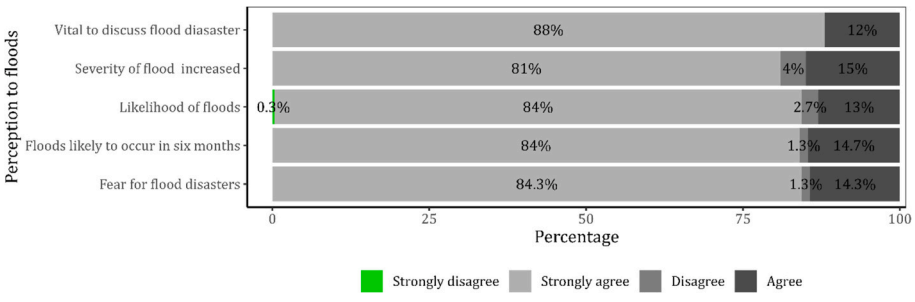

Fig. 4. Women's perception of flood disaster risks.

centres, which limits women's access, and, in most cases, they are not functional. Installing flood early warning systems in the trading centres mainly benefits men more than women. This is because men usually move to the trading centres where the systems are installed. In contrast, generally, women remain at home to look after the children and the entire family, look for firewood, food, and water, and hardly access these early warnings. This is supported by previous studies such as by [10,11,12,13,14], who revealed that women have limited capacity to implement disaster mitigation and adaptation measures due to the persistent gender gaps with restrictive social norms which reduce their coping capacity. Similarly, studies by [15] indicate that women are likely to experience higher levels of vulnerability where gender issues exaggerate both self and social protection during disasters. However, women are not involved in emergency planning and preparedness decisions in the developing world. This could be the primary reason women cannot implement flood risk-reduction initiatives and suffer more of the effects of flood disasters. This is further supported by previous studies such as that by Hao S. et al., 2022 who showed that women have weak flood rescue capability, possibly due to limited knowledge of flood disasters.

This relates to the Bounded rationality theory, which states that people make decisions based on the information available to them. Suppose these women have access to adequate information on flood disasters. In that case, they can make good decisions, for example, timely relocation to safer places, timely harvesting of food crops, and establishment of water diversion channels, which are quite affordable to them. However, societal norms and increased gender roles limit women's decision-making, which may affect their ability to implement such initiatives. This further limits women's cognitive and rational abilities in addition to inadequate information regarding flood disasters. Henceforth, women remain less knowledgeable, with limited ability to exercise their cognitive and rational abilities. This is further supported by the Bounded rationality framework which states that information restricts an individual's rationality, the cognitive limits of their minds, and the finite amount of time available to them in decision-making regarding risk-reduction initiatives.

Most survey respondents perceived that flood disasters were essential for discussion in their community, were becoming more severe and had increased occurrence and that a disaster was likely to occur in the next six months, which increased their fear. The reasons for increased fear can be attributed to the effects of flood disasters on human lives and the sources of livelihood upon which the community depends for survival. This is in agreement with reports which indicate that floods are a major disaster in Uganda, accounting for 36 % of affected people and the leading cause of house destruction and damage. For example, in Butaleja district, floods account for 61 % of disastrous events, 94 % of affected people and 70 % of houses destroyed and damaged [6,7]. If the community members perceive flood disasters as a vital issue in their community, this could have promising implications on the planned interventions since there will be easy adoption of the efforts to minimise the risk of flood disasters.

6. Conclusions

The study assessed women's knowledge and perception of flood disasters in Butaleja district, Uganda, where flood disasters pose significant challenges to various communities. The issue of flooding, if not handled, will bring a lot of damage and destruction to the physical, socio-economic and environmental components. Study results indicate that women are aware of flood disasters in terms of frequency, severity and causes but lack information about flood disasters on set. This reveals that women suffer flood disasters due to inadequate knowledge and poor perception. This is coupled with women's weak flood-rescue capabilities, as revealed by earlier studies. Access to information is critical as far as management of climate-induced disasters like floods is concerned. Timely access to information enhances early preparedness, response and recovery mechanisms from disaster effects. Climate change, coupled with poor farming practices and encroachment on river banks, works as catalysis for flood disasters. Inadequate acquisition of flood disaster information restricts the choice and implementation of risk-reduction initiatives, thus weakening women's flood-rescue capabilities. On the other hand, having sufficient knowledge and a good perception of flood disasters would influence timely decision-making and choice of life-saving initiatives. Uganda, as a country faced with the challenge of flood disasters, should put measures in place to increase information sources targeting women who are perceived to be more vulnerable. Henceforth, the responsible authorities, such as the prime minister's office, should take policy action as soon as possible.

Therefore, we provide some practical and policy recommendations such as;

Installation of efficient flood early warning systems in all flood risk areas, implementation of regular and localised flood risk assessments, dissemination of awareness information through mechanisms such as community meetings by opinion leaders, radios, and cell phone alerts to complement the information from the installed flood early warning systems, and regular maintenance of damaged early warning systems.

When designing interventions to increase information sources for communities affected by flood disasters, the needs of women who stay home during these events must be considered. Blending flood early warning information with flood risk reduction and management interventions is needed to help enhance flood rescue capabilities for the vulnerable, primarily women. There is a need for more effort to reduce the effect of stringent patriarchal norms, traditional beliefs, and stereotypes typical of African rural settings, which limit women's ownership and access to information sources. This can be achieved through awareness creation and mindset change programs.

Promoting community education and sensitisation and designing programs and interventions that increase women's emancipation are necessary to increase the community's knowledge and awareness of flood disasters.

There is an urgent need to reduce development in flood-prone areas and designate open spaces and routes for recovery and response. This can be achieved through proper land use and city planning. The local community should also be mobilised on the benefits of proper land use practices that can mitigate flood risks in the river basin. If the benefits of proper land use practices are shown, local communities and their leaders can take the necessary steps towards a safer future.

7. Limitation of the study and future research

Although the study emphasised women's knowledge and perception of flood disasters, some limitations prevent the generalisation of the findings. The first limitation is the survey; although the qualitative interviews provided both men's and women's insights, the quantitative study focused solely on women's flood disaster victims. Thus, the study did not consider men's knowledge and perceptions to produce disaggregated data based on gender. Therefore, future studies should focus on both men and women to produce disaggregated data regarding gender.

CRediT authorship contribution statement

Alice Nakiyemba: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Kinobe Zakaria:** Writing – original draft, Visualization, Software, Investigation, Formal analysis. **Kakungulu Mosses:** Writing – original draft, Visualization, Software, Formal analysis. **Nyangoma Immeldah:** Writing – original draft, Visualization, Software, Formal analysis. **Masaba Sowedi:** Writing – original draft, Supervision, Project administration, Methodology, Investigation, Formal analysis, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgements

The authors acknowledge the Busitema University Research Innovation Fund (BURIF) for funding this research. Special thanks also go to the Busitema University Grants Committee for awarding us the grant which enabled us to conduct the research and write the report.

References

[1] UNDRR. Global natural disaster assessment report. Retrieved from, https://www.preventionweb.net/media/84163/dowload; 2022.
[2] Hao S, Wang W, Ma Q, Li C, Wen L, Tian J, et al. Analysis on the disaster mechanism of "8.12" flash flood in Liulin River basin. Water 2022. https://doi.org/10.3390/w14132017. Retrieved from.
[3] Faizatul Akmar Abdul Nifa, Lin Chong Khai, Rani Wan Nurul Mardiah Wan Mohd, Wei Ooi Jun. A study on awareness of disaster risk reduction (DRR) among university students: the case of PETRONAS residential hall students. AIP Conf Proc 2018;2016:020005. https://doi.org/10.1063/1.5055407.
[4] CRED. Disasters in Africa: 20 year review (2000–2019). Retrieved from, https://www.emdat.be/publications; 2019.
[5] CRED. Disasters in numbers. Retrieved from, https://cred.be/sites/default/files/2021_EMDAT_report.pdf; 2021.
[6] DesInventar. Retrieved from, https://training.desinventar.net/DesInventar/profiletab.jsp; 2020.
[7] The World Bank. Disaster risk profile. 2019. Uganda.
[8] Alvina Erman, Robbé Sophie Anne De Vries, Thies Stephan Fabian, Kabir Kayenat, Maruo Mirai. Gender-dimensions-of-disaster-risk-and-resilience-existing-evidence.pdf. Retrieved from, https://wrd.unwomen.org/sites/default/files/2021-11; 2021.
[9] Asaba. Gender and Vulnerability to Disasters and Disaster/Climate Risk Management in Uganda: a participatory characterisation. 2014. Available at, https://www.necoc.opm.go.ug.
[10] Anugwa IQ, Agwu AE, Suvedi M, Babu S. Gender-specific livelihood strategies for coping with climate change-induced food insecurity. 2020. p. 1065–84. https://doi.org/10.1007/s12571-020-01042-x.
[11] Bukhari SIA, Rizvi SH. Impact of floods on women: With special reference to flooding experience of 2010 flood in Pakistan. J Geogr Nat Disast 2015. https://doi.org/10.4172/2167-0587.1000140.
[12] Chitiga-Mabugu M, Henseler M, Maisonnave H, Mabugu R. Climate change and women – impacts and adaptation. Int Rev Environ Resour Econ 2023;17(1). Retrieved from, https://hal.science/hal-04072199.
[13] Fruttero A, Halim D, Broccolini C, Coelho B, Gninafon H, Muller N. Gendered impacts of climate change evidence from weather shocks. In: Policy research working paper 10442; 2023.
[14] Akter S. Gendered impacts of climate change, environmental degradation and disaster risk within Asia and the Pacific. 2022.
[15] Mirza Ali Ashraf, Azad Md Abul Kalam. Environment and ecology research, gender issues in disaster: understanding the relationships of vulnerability, preparedness and capacity. Environ Ecol Res 2020;3(5):136–42. https://doi.org/10.13189/eer.2015.030504.
[16] Birkholz S, Muro M, Jeffrey P, Smith HM. Rethinking the relationship between flood risk perception and flood management. Sci Total Environ 2014;478(0048-9697):12–20. https://doi.org/10.1016/j.scitotenv.2014.01.061.
[17] Jadouane Abderrahmane, Azzeddine Chaouki. Perception and knowledge of disaster risks and preparedness: The case of the presented at the 4th international electronic conference on geosciences. Morocco: City of Mohammedia; 2022. Retrieved from, https://sciforum.net/event/IECG2022.
[18] Kurata YB, Ong AKS, Ang RYB, Angeles JKF, Bornilla BDC, Fabia JLP. Factors affecting flood disaster preparedness and mitigation in flood-prone areas in the Philippines: an integration of protection motivation theory of planned behavior. Sustainability 2023, March 17;15:6657. Retrieved from, https://doi.org/10.3390/su15086657.
[19] Simon HA. The concept and the rationality: boundaries and procedures. Rev Econ Polit 1957;30. https://doi.org/10.1590/S0101-31572010000300006.
[20] Erima G, Kabenge I, Gidudu A, Bamutaze Y, Egeru A. Differentiated spatial-temporal flood vulnerability and risk assessment in lowland plains in eastern Uganda. Hydrology 2022;9(11):201. https://doi.org/10.3390/h.
[21] Cecinati F. Precipitation analysis for a flood early warning system in the Manafwa River Basin, Uganda. A Thesis submitted to Massachusetts Institute of Technology. 2013.
[22] Office of the Prime Minister. Butaleja district hazard, risk and vulnerability profile. 2016.
[23] Uganda Bureau of Statistics. Statistical Abstract. 2023. Available at, https://www.ubos.org/wp-content/uploads/publications/2023-Statistical-Abstract.pdf.
[24] Pazzi V, Morelli S, Bonati S. Disaster risk perception knowledge base - a consolidated understanding of disaster risk perception in social media and crowdsourcing. 2020. Deliverable 2.2 of LINKS: Strengthening links between technologies and societies.
[25] Likert R. A technique for the measurement of attitudes. Archives of Psychology 1932;22(140):55. Available at, https://psycnet.apa.org/record/1933-01885-001.
[26] Fidele. A quantitative analysis of the impact of land use changes on floods in the Manafwa River Basin. 2013. Available at, http://hdl.handle.net/1721.1/82338.
[27] Adikari Y, Yoshitani J. Global trends in water-related disasters: An insight for policymakers. Retrieved from, https://www.unwater.org/downloads/181793E.pdf; 2009.
[28] Schanze J. Flood risk management – a basic framework. 2006. https://doi.org/10.1007/978-1-4020-4598-1_1.
[29] Schiermeier Q. Inecreased flood risk linked to global warming. 2011. https://doi.org/10.1038/470316a.