

Flooding in Freetown's urban coastal settlements: a community-based course of action

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Research Article

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Abstract

The Sierra Leone government and its partners have been working hard to find a solution to the devastating flooding in Portee and Rokupa. However, information for understanding community-based actions in flood containment is limited, particularly at the household and organisation levels of coastal slum settlements. Consequently, there is insufficient knowledge to implement projects to change the current condition. In light of these concerns, this paper aims to present current information on this subject using a mixed methodology, with purposive and snowballing sampling techniques, to investigate 204 slum households and 12 community-based organisations. The findings show that word-of-mouth is the primary source of flood information for most household respondents (53%). This method of disseminating flood news is inefficient and indicates the widespread lack of flood information in the study sites. In their situation, a majority (83.2%) of household respondents and community-based organisations (58%) do not get support for flood management. The author recommends the urgent implementation of a people-centred early warning system. Also, future statistical studies are advised to use correlation and other relevant tests to assess the relationships between household characteristics and the potential to take or not take a particular flood management action. Such studies should look into the relative advantages and disadvantages of these actions. A comparative analysis of flood response and management strategies among the country's various coastal slum settlements is also recommended. Further investigation is required into the feasibility, socio-ecological and economic costs, and opportunities for transforming these slum settlements into modern flood-resistant structures.

1.0 Introduction

Freetown is the capital city of Sierra Leone. It is home to the nation's legal, business, and diplomatic communities. Its cultural richness, historical landmarks, and bustling population make it arguably one of the most captivating destinations in West Africa. Despite these exciting features, the city is vulnerable to flood disasters (Freetown City Council, 2022).

Various flood events have destroyed lives, properties, and livelihoods. The residents in Freetown's coastal slums are more exposed to these flood events. The exposure to floods has been attributed to the low-lying geographical position of these communities. The lower elevation puts these communities as recipients of both urban and coastal floods, which often result in disasters (CARE International, 2012).

Flood in Freetown's coastal slums happens annually during the rainy season, with destabilising impacts on the communities. Some of these events include, for instance, the flooding on the 25th of August, 2020, leaving about 60 people homeless and one fatality (Politico-SL, 2020). The flood of September 2015 turned the roads of Portee and Rokupa into streams of fast-flowing water and affected about 27 houses, including nine that were extensively damaged and three that were completely demolished. Two recorded deaths and some minor injuries and fractures (Macarthy et al., 2017). The impacts of flooding in these communities were fatal during the outbreak of the COVID-19 pandemic, as inhabitants were finding it difficult to manage the two problems simultaneously (Turay, 2022).

Previous researchers have connected flood disasters in coastal settlements to extreme weather events caused by climate change, the expansion of slums with high population densities, poor waste management, lack of drainage systems and clogging of existing ones (CARE International, 2012; Reingold, 2019). Over 68 areas in Freetown, described as slums or informal settlements, have been identified (Oviedo et al., 2021). Despite the dangers and risks and the lack of the government's capacity to provide appreciable resettlement, the inhabitants in these places are unwilling to relocate from these areas due to the sociocultural connections and ties to livelihood activities (Reingold, 2019).

Unplanned urbanisation has been pointed out as the leading cause of people living in at-risk areas. The urban expansion of Freetown has persisted, partly due to increased emigration from the provinces. The rural-to-urban migrants primarily reside in dangerous areas where they may find affordable housing, often in locations that are prohibited from habitation in the urban environment (Ziervogel, 2021).

Finding solutions to the mentioned problems seems complicated as people seek greener pastures in urban areas but cannot plan to adapt to longer-term climate risks at the household and community levels. The difficulty of planning for long-term climate risks has been linked to unequal access to social amenities, the reality of living from hand to mouth, and the struggle to satisfy basic needs (Satterthwaite et al., 2020).

In previous research in this field, Macarthy and his colleagues used Amartya Sen's Capability Approach to examine the relationships between empowerment and humanitarian responses in Portee and Rokupa. They discovered that community-based humanitarian practices had been the most effective mechanism for increasing the empowerment assets of residents in Portee and Rokupa (Macarthy et al., 2017). Reingold evaluated the cases of Portee and Rokupa and noted that if community-based organisations could coordinate humanitarian efforts with local, national, and international government agencies and NGOs, they would be more capable of addressing biodiversity and livelihood issues (Reingold, 2019).

With all the advances made so far in the study areas, there is limited information on understanding how the community organised itself and act during flooding. Given this background, this study aims to understand how the locals get information, prepare, evacuate, and get humanitarian support and the role of community-based organisations in flood management.

Community-based action is conceptualised here as the activities performed solely by the local people or in which they control the decisions and influence the outcome of such activities to meet their needs.

2.0 Methodology

This study employed a mixed research design, drawing from quantitative and qualitative data and methods, following necessary procedures to record and interpret the data. Household heads and representatives of community-based organizations were the targeted respondents of the interviews.

2.1 Sample selection and sampling techniques

In 2020, Memon and his colleagues examined the choices made by various researchers and the generally accepted guidelines for choosing the sample size for survey research. They discovered that there is no single guideline for choosing sample sizes; instead, the sample selection's accuracy determines the sample's strength, not its size (Memon et al., 2020). With this in mind, the author selected a sample of 204 slum households to examine based on the research questions guided by previous literature.

The following shows the figures in the literature used to calculate the desired sample size:

The average household size in Freetown, including the study areas, is 5.2 (Statistics Sierra Leone, 2019). And the parts of Portee and Rokupa referred to as slums, are home to 6,059 people (Macarthy et al., 2017).

From this information, Let's:

The number of slum households = 'Nshh.' The population of slum dwellers = 'Psd.' The average household size = 'Ahh.'

The number of slum households, Nshh, is therefore calculated using the formula $Nshh = \frac{Psd}{Ahh}$

Where: Psd = 6,059; Ahh = 5.2; Nshh = unknown

$Nshh = \frac{6,059}{5.2}$ Number of slum households (Nshh) = 1,165.2

The sample size (of 204) selected is 17.5 per cent of (1,165.2) the total slum households of Portee and Rokupa. The scope of the study conditioned this sample size.

A non-probabilistic sampling technique was used in this research because it is considered ideal in case study research designs. As with this work, the cases explored using a non-probabilistic technique tend to concentrate on small samples to explore a real-world phenomenon, necessitating a convincing justification for including particular cases or people over others (Taherdoost, 2016).

The author adopted a purposive non-probability sampling technique to conduct the household surveys. Purposive sampling is an approach in which specific contexts, people, or events are purposefully chosen to reveal important information that cannot be learned from other options (Sharma, 2017). Although the purposive sampling technique has been criticized for being subjective and not giving room for generalization (Taherdoost, 2016), the less time and low cost make it convenient for this work.

A snowball sampling technique was used to interview the community-based organization representative. Snowball sampling is also a non-probability sampling strategy in which current study participants guide the researcher or find new participants from their social networks. As the sample grows, sufficient information is gathered to be helpful for research (Sharma, 2017). This technique helped the author to get the responses of representatives of organizations that it would not have been possible to get using any other method.

2.2 Research instrument

Kobo toolbox/ kobocollect was used to collect field data for this work. Kobo toolbox is a free and open-source tool for collecting field data in humanitarian contexts and challenging environments.

The Kobo toolbox has drawn criticism for its strict requirements for Android phones or tablets, inexperienced users needing technical assistance to make the questionnaire in the application, and the need for proper training to handle the gadgets for entering the data into the application. However, the tool has also been praised for its ability to quickly and accurately collect data for various situations (Lakshminarasimhappa, 2021).

However, the growing use of the kobo toolbox by reputable institutions and researchers worldwide shows its worth. For instance, the United Nations Development Program used it to collect data for the "Fighting one of the world's biggest killers during a pandemic" study (UNDP, 2021). It was used to collect data to support girls' empowerment during COVID-19 in Sierra Leone (Purposeful and KoBo Inc, 2021). Chuang and his colleagues used the tool to assess community-based disaster response in Taiwan. In their research, they recognized the role of the instrument in disaster resilience by providing information for establishing community-based Emergency Operating Centers, humanitarian response, etc. (Chuang, Kuo-Yu slayer et al., 2019).

The author's expertise and personal experience with the tool proved the following advantages that make it the most convenient and suitable for use in this work: safeguard against data loss; internet connection security is provided by Secure Sockets Layer (SSL) standard technology; data is immediately available for analysis in contrast to other field data collection tools like paper-based questionnaires, Google forms, etc., the kobo toolbox

can record GPS coordinates in the field; is inbuilt with functions to perform descriptive statistics, data analysis and visualization; raw data can be exported into Excel, SPSS, or QGIS/ArcGIS for further analysis if necessary.

In preparing the tool for the field visit, the author created a free researcher's account on the kobo toolbox website. This type of account gives the user a free monthly storage space of 5 Gigabytes and hosts unlimited projects and 10,000 form submissions. Two KoBo projects, each with its questionnaire, were created in the author's account and deployed for this work. One of the projects was designed for household interviews, while the other was intended for interviewing community-based organizations' key representatives.

2.3 Data collection process

The data collection happened between April 07 and May 28, 2022. The places covered in Portee by the household data collection exercise are Kabba street, Limba wharf and Munjuru street. In Rokupa, the locations covered are Rokupa wharf, Wright Street, and the lower side of West Street. A total of 204 interviews were completed for the household questionnaire. In cases where the household heads were absent at the time of the visit, the author had to seek consent from an adult household representative on behalf of the household head. In cases where no one or an adult was present in a household, a revisit was done before the close of the day's work. These strategies were successful in most cases and helped reduce the fieldwork's cost and complexity. Following the sampling techniques employed and based on the research questions, only households fitting into the description of a slum household were visited. The interviewing of community-based organizations' key people yielded 12 respondents in the two communities in a relatively less complicated manner, using a snowballing technique described in the sampling techniques section. The support of a community-based expert was employed throughout the data collection process community-based.

This study does not involve experimentation with humans or any other life form. However, in conformity with professionalism, the author made sure that the people who participated in the research understood the purpose, aims, and methods of the study and freely consented to participate. A skip logic was created at the beginning of the form, giving respondents a choice to choose either "yes" or "no" to their consent to participate. A "no" ends the form, and a "yes" gives them access to the other questions. Skip logic is further created between questions, giving respondents the freedom to discontinue the interview at any time while preserving the questions they are willing to answer.

2.4 Data analysis and visualization

The field data for this study were analyzed using Microsoft Excel, 2019 version. The author performed the following descriptive statistics on the relevant fieldwork data: frequencies, means/ averages, and percentages. Accordingly, the data were visualized after the statistical analysis. Before analysis in Excel, the data was exported from the kobo toolbox in Excel format and cleaned. Map data used in the study areas were processed and visualized using QGIS desktop version 3.22.4.

3.0 The Case Study Description

Freetown is divided into three administrative regions: Central (i, ii), East (i, ii, iii), and West (i, ii, iii). The Portee and Rokupa communities are found in the East iii administrative area of Freetown. Portee is bordered north by Grassfield, Kuntolor to the west, and Rokupa to the south. Rokupa is bounded on the north by Portee, on the west by Kuntolor, and the south by Conga Water I. The two communities are bounded by the Sierra Leone River, an estuary of the Atlantic Ocean to the east. A cliff-like feature stretches from the north to the south of the study areas and separates the coastal settlements from the upper part.

Figure 1 below shows the study areas.

The administrative regions in Freetown are further divided into wards. Wards are the smallest political administration units and are governed by ward councillors elected to the Freetown City Council (FCC). The FCC is the local government body headed by a mayor. The entire Portee and part of Rokupa fall into ward 409. Rokupa has its remaining part in ward 408 (NEC-SL, 2017). Portee and Rokupa are inhabited by 34,502 people, accounting for 3.4 per cent of the total population of Freetown City. This population lives in a congested area with a high poverty rate (NEC-SL, 2017; Statistics Sierra Leone, 2019).

The two communities coexisted as one settlement until 2004 when local governance and decentralization were reinstated in Sierra Leone. The communities were split formally in 2004 due to the border delineation for the first local elections (The Local Government Act, 2004).

The climate around the coast is hotter and more humid, whereas it is more temperate inland. The data from the World Bank (1990–2020) shows that June, July, and August have the highest monthly rainfalls, an average of 887.62 mm, making them the wettest months in Freetown. When there is a lot of rain, the Atlantic Ocean's water level rises and overflows, adding to the inland water overflowing from rivers, streams, and drainages that drain into coastal areas, increasing the risk of flood disasters. Rainfall is a significant climate determinant of flooding in Portee and Rokupa (World Bank, 2021).

Portee and Rokupa are inhabited on parts with elevations ranging from 2.6 to 58.8 meters above sea level (Fig. 2). The Elevation of the coastline (area demarcated in blue) which ranges from 2.6–10.6 meters is the area observed with the most deplorable slum conditions.

The slums' characteristics in the coastline and their identification by the World Bank, FCC, and the ONS as hotspots for flooding, justify and make these sites ideal to be selected for this work (GOPA-CES, 2014; The World Bank, 2017). Due to their background and similarities, this paper seeks to

understand the coastline of the two communities as one.

4.0 Results And Discussions

4.1 Households' characteristics

The author made a record of household sizes, age, marital status, the gender distribution of household heads, and length of residence to understand the characteristics of the households concerning this topic.

Of the 204 household representatives interviewed, 55 per cent of them are female, and 45 per cent of them are male. According to Terpstra and Lindell, gender indirectly influences the decision to respond to a hazard, and women are more likely than men to perceive risk and hazard-related characteristics (Terpstra & Lindell, 2013). Research from Serbia perceived men as being more prepared for flooding and appeared to have more confidence in their ability to handle it. Women, however, showed a greater understanding of flood events. Perhaps due to a deeper understanding, women displayed more attitudes toward taking care of the home (Cvetković et al., 2018). Contrary to earlier studies, the higher number of female heads does not have any noticeable positive impact on the flood response in the study areas. This outcome could be due to the existing socio-economic and gender inequality.

The mean age of respondents is 39.8 years. Previous literature shows that how old an individual is has a relationship with their physical capabilities, agility and activeness of response in case of an emergency. The older the age, the more the possibility of acquiring flood experience. The downsides, however, come as a result of the natural process of ageing, in which most people (mostly from 65 and above) physical activeness starts to drop, resulting to lower mobility and agility (HelpAge International, 2015).

In comparison, younger populations are active, but most lack the experience of the aged. According to a study on German citizens living near the Rhine and Danube rivers, households with older members had more trouble completing efficient emergency procedures than those with younger members (Thieken et al., 2007). The mean age of respondents can be considered to have a combination of experience and agility. However, this does not have any noticeable influence on flood response in the study areas.

Sixty per cent of respondents are married, 18 per cent are single, 16 per cent are widows/ widowers, 5 per cent are divorcees, and 1 per cent are separated. In a prior study conducted in Accra, Ghana, marital status was linked to acting in more protective ways than non-protective ways (Twerefou et al., 2020). In contrast to Accra, most household members in a marital union in Portee and Rokupa do not show evidence of flood protective behaviours.

The field result shows that most (44 per cent) households have four members, followed by households with six members, 37 per cent of households have five members, 10 per cent are single-member households, and 14 per cent have more than seven and above household members. A household with more members and inadequate resources can stress the available resources and increase household vulnerability. On the other hand, a larger household size with strong social networks and resources can improve the total household's ability to respond to flooding (John, 2020). Most (44 per cent) households with four members do not show any positive effect on households' capability in flood response. Observations show that 14 per cent of households with seven or more members live in dense household spaces and are therefore open to suffering more consequences from flooding, such as the faster transmission of water-borne sickness caused by flood-polluted water.

The field results revealed that most household members (70.59 per cent) have resided in their places for more than five years, while 8.82 per cent of households have lived there for between 3 to 4 years. The rest have been living in their households for less than three years. The length of stay of these people in flood-prone areas can be related to their experience with flooding and their incapability or unwillingness to leave these dangerous areas.

4.2 How do households get information, prepare, and evacuate during floods?

Most (53 per cent) of the respondents get information about a flood event by word of mouth. Eighteen per cent stated that they get disaster information through radios, phone calls, SMS, etc. 15 per cent of respondents get flood information through social media communication channels, such as WhatsApp, Facebook, Twitter, etc. (Fig. 2A).

A previous study on the urban slum communities in the Indian Himalayan city of Dehradun shows that information limitations negatively affect how people respond to and cope with disasters (Pandey et al., 2018). In contrast to the study areas, household inhabitants in Mombasa's informal settlements rely primarily on the radio for information about potential flooding disasters (Okaka & Odhiambo, 2019). Most respondents getting flooding information by word of mouth in Portee and Rokupa shows a widespread lack of flood information, which gives inhabitants less time to prepare for flood events.

The fieldwork occurred during the rainy season, the period in which flood events mostly take place. Against this backdrop, respondents were asked whether they were prepared to evacuate to a safer place in case a flood occurs that poses a risk to the safety of their households. Sixty per cent reported that they were not prepared, 18 per cent said they were ready, and 23 per cent were unsure about their preparation status (Fig. 2B).

The majority not ready to evacuate to safety (even if the need arises) indicates the possibility of this set of people being trapped in catastrophic flood events.

Interviewees were further asked whether they had a safe place they could temporarily go to during a disastrous flood event (Fig. 5). Fifteen per cent of households confirmed that they have a temporary safe area, and 41 per cent reported that they do not have anywhere to go for safety in case the need arises. Most households not having a secure location to evacuate to during an emergency could be linked to other probable factors such as availability, distance and accessibility, as well as cultural or religious beliefs regarding a potential temporary evacuation place.

Households were also asked about the number of vulnerable persons they must worry about during evacuation (Fig. 6). The author refers to vulnerable persons during evacuation as persons at and above 65 and below ten years of age, persons with hearing or sight problems, pregnant women, persons with mental health problems, people with frequent episodes of seizures and the mobility impaired. Of the 204 households interviewed, 77 per cent reported having a vulnerable person(s) to worry about during an evacuation, while the remaining reported not having any. The average number of vulnerable household persons is 3.1.

4.3 Humanitarian aid

Humanitarian aid in times of distress is necessary to sustain life and keep the vital functions of a household running. The author inquired to know from where households can rely on support when in need.

The results show that the majority (83.2 per cent) of those interviewed do not consider themselves to have any reliable humanitarian aid source. A low number (0.5 per cent) considered community-based organizations reliable sources of aid, and no one stated the reliability of a relative within the community. 10.6 per cent considered government/ public institutions a reliable humanitarian aid source, while 4.8 per cent of households considered both local and international non-governmental organizations a reliable source of aid in the event of a flood disaster. The interviewees' responses were based on their past experiences of support received trust and feelings of reliability about the sources of support mentioned (Fig. 3).

In contrast to Portee and Rokupa, research in Da Es Salam reveals that 77 per cent of flood-prone urban slum households received support from various sources, while only 23 per cent received no support (John, 2020). Also, a study by Adelekan shows that 75.3 per cent of respondents who lived in impoverished coastal urban households in Nigeria get help from family and friends during flood disasters. While only 10.8 per cent of surveyed individuals said, they had received government support (Adelekan, 2010). Similarly to Adelekan's findings, 10.6 per cent of respondents in the study areas mentioned the government as a reliable aid source.

These findings indicate widespread low support from governments in coastal urban slum households, which implies hopelessness and abandonment of their fate. This issue can be linked to the limited capability of the responsible institutions to provide support, or the notion that additional assistance will make slum dwellers feel more at ease about continuing to live in such risky environments.

4.5 The role of community-based organizations in flood management

The communities' inhabitants organize themselves for local actions through community-based organizations (Table 1). The author took a record of the role of these organizations in flood response and management. All the 12 organizations interviewed stated they are clearing drainages, putting sandbags, and other flood barriers during flood disasters, and nine said they are engaged in community sensitization. Only 1 CBO stated that it is involved in identifying problems (Fig. 4A). Some of these organization's primary roles are not in flood management, but indicated that they have to take part in flood management to protect their communities.

Table 1
Community-based organizations and their roles in flood management.

Source: Fieldwork

CBO	Site	Position of interviewee	Clearing drainages, putting sandbags and other flood breakers	Organizing community people and resources during flood emergencies	Help people during evacuation	Provide humanitarian relief items	Help rebuild destroyed homes and common assets	Problem identification	Community Sensitization
Destiny sisters social club	Portee	Public relations officer	Yes	Yes	No	No	Yes	No	Yes
Solar city organization	Portee	Senior Member	Yes	No	No	No	No	No	Yes
Seaside rangers social club	Portee	Public relations officer	Yes	No	No	Yes	Yes	No	No
Young stars' social club	Portee	Secretary	Yes	Yes	No	No	Yes	No	No
Estate family social club	Portee	Senior Member	Yes	Yes	No	Yes	No	No	Yes
Community health workers' Organization	Portee	Director	Yes	Yes	No	Yes	No	Yes	Yes
Heaviest fashion social club	Rokupa	Chairman	Yes	Yes	No	No	No	No	Yes
Sabenti Organization	Rokupa	Secretary-General	Yes	Yes	No	No	No	No	Yes
Moyen organisation	Rokupa	Member	Yes	Yes	No	No	No	No	Yes
To me, to you Organization	Rokupa	Senior Member	Yes	No	No	No	Yes	No	No
One family organization	Rokupa	Chairlady	Yes	No	No	No	No	No	Yes
Fashion models' social club	Rokupa	Chairperson	Yes	No	No	No	Yes	No	Yes

A more significant number (58 per cent) of the organizations reported that they have never received support from the government, NGOs or INGOs. The number of organizations that confirm being supported by the government, NGOs/ INGOs, reported that they have been receiving funding, training, cleaning tools, and medical items support for their activities.

Table 2
Summary of CBOs and their support from external sources.

Source: Fieldwork

CBOs	Supports received
One Family Organization	Funding
To me to you, Organization	Funding Cleaning tools
Moyen Organization	Funding Training
Community Health Workers Organization	Funding Training Medical items
Estate Family Social Club	Funding Training
Sea Side Rangers Social Club	Funding
Destiny Sisters Social Club	Training Funding

The Freetown City Council requires that all CBOs be registered to gain official recognition so that officers can monitor their activities to comply with the local government act. All the organizations interviewed reported that they are officially registered to perform their respective functions. The registration status of a CBO can influence whether a government or NGO/ INGO would wish to establish a relationship with it during operations.

Unlike the organizations interviewed in Portee and Rokupa that asserted to be fully registered, many of the community-based organizations in the informal coastal neighbourhood of Glefe in Accra were formed following floods and are not acknowledged by local authorities. They only speak up during and after significant flooding incidents or when they mobilize to interact with local officials (Amoako & Inkoom, 2018).

5.0 Conclusion

This study has revealed critical information on the role of the local community in containing floods. The research results show that the majority of the respondents get information about a potential or occurring flood by word of mouth. This means of information dissemination is inefficient because it often cannot reach all those in trouble in time for early preparation. This circumstance indicates the widespread lack of disaster information in the study areas and stands out as one of the leading causes of preventable flood disasters. What is worth noting is that most respondents do not have anyone to count on for support when floods happen.

Community-based organisations play vital roles in flood management; therefore, they should be incorporated along with the community disaster management committees into the planning and implementation of disaster risk management interventions.

Findings contained in this study can be incorporated into projects and nationally determined targets, such as goals 11 and 13 of the Sustainable Development Goals, the Sendai Framework on Disaster Risk Reduction, Transform Freetown and the Knowledge in Action for Urban Equality (KNOW) projects. The results will also be essential to preparing the fourth National Communication to the United Nations Framework Convention on Climate Change.

Most importantly, public institutions such as the National Disaster Management Agency, the Meteorological Agency, the Environment Protection Agency, the Ministry of the Environment, the Ministry of Housing and Infrastructure, and the Freetown City Council could be informed by this work in the development of their flood management interventions for the study areas and all other slum communities with similar socio-ecological, economic and geographical characteristics to the study sites.

Future statistical studies should use correlation and other relevant tests to assess the relationships between household characteristics and the potential to take or not take a particular flood management action. Such studies should examine the relative strengths and weaknesses of such activities.

A comparative analysis of the flood response, and management strategy among the different coastal slum settlements in the country is recommended. Such research should explore the possibility, socio-ecological and economic costs and opportunities for transforming these slum settlements into modern flood-resilient buildings.

Future researchers should also look at the local people's perception of their exposure and vulnerability to flood disasters and how to improve their condition. Research of such nature should consider individuals' preferences and needs to relocate permanently away from their present slum settlements.

The relevant government's authorities should urgently support the study areas with the implementation of early warning systems. The implemented early warning systems should be understandable and easily interpreted by the local people to facilitate early responses to floods.

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Figures

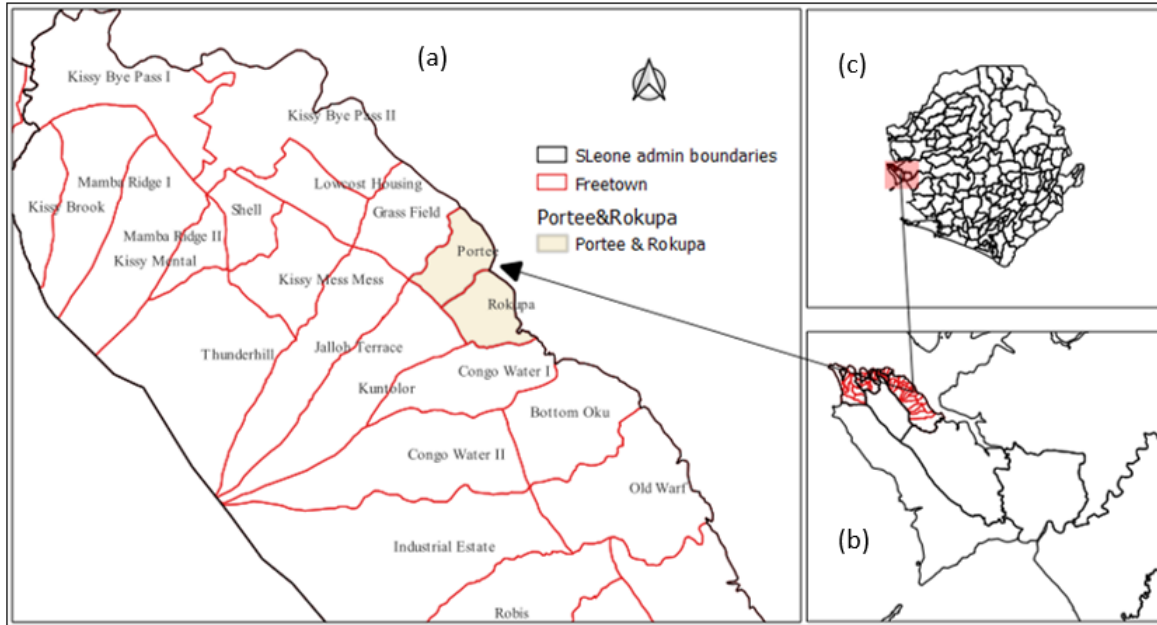


Figure 1

The study sites, a); Freetown, b); and Sierra Leone, c) overviews. Data source: <https://data.humdata.org/dataset/cod-ab-sle>. Drawn: Author



Figure 2

Elevation of the study sites. Boundary shapefile, <https://data.humdata.org/dataset/cod-ab-sle>; elevation and imagery layers, google earth pro and google hybrid. Drawn: Author

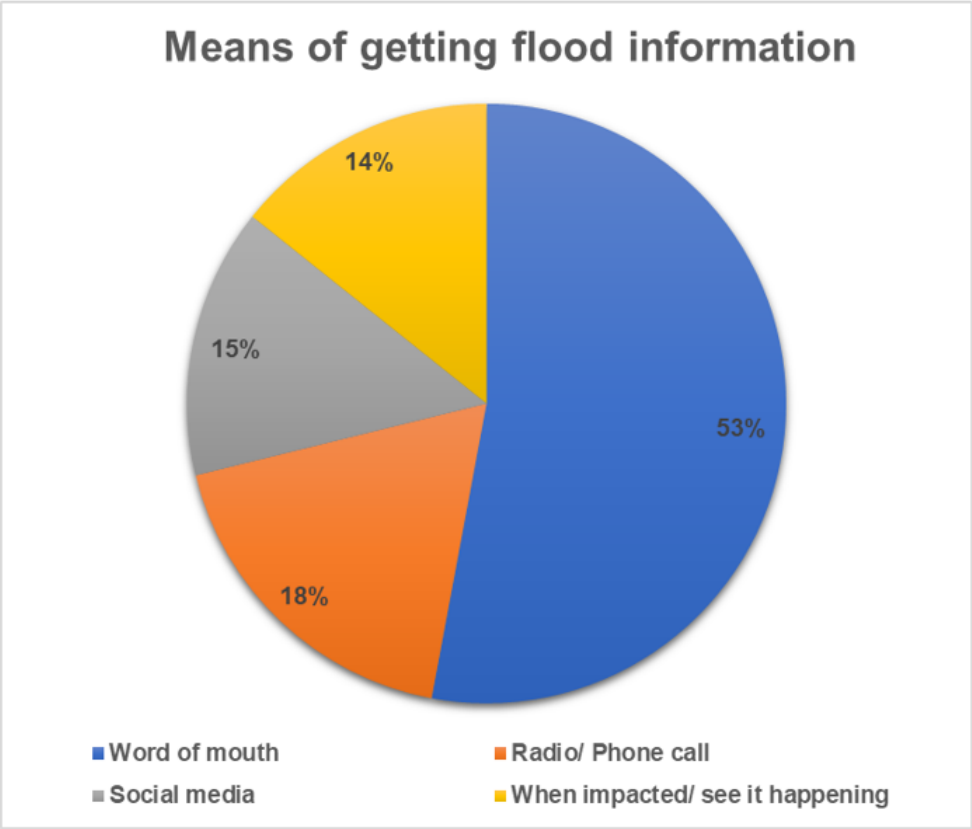


Figure 3
 Flood information. Source: Author

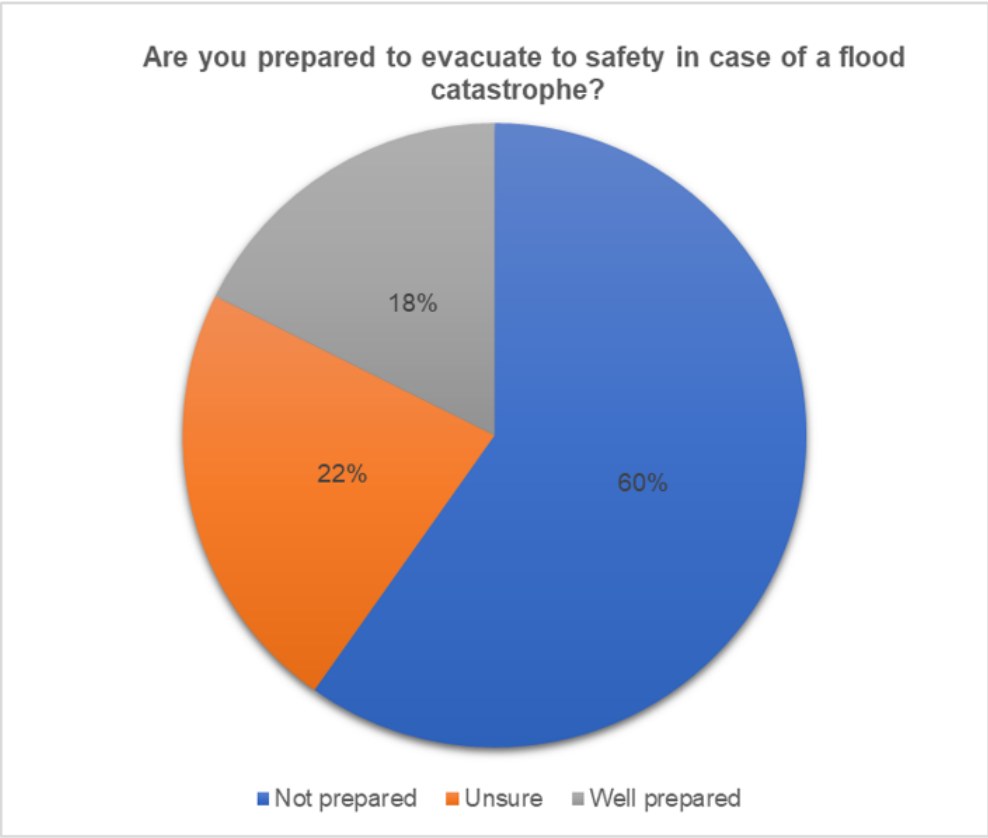


Figure 4

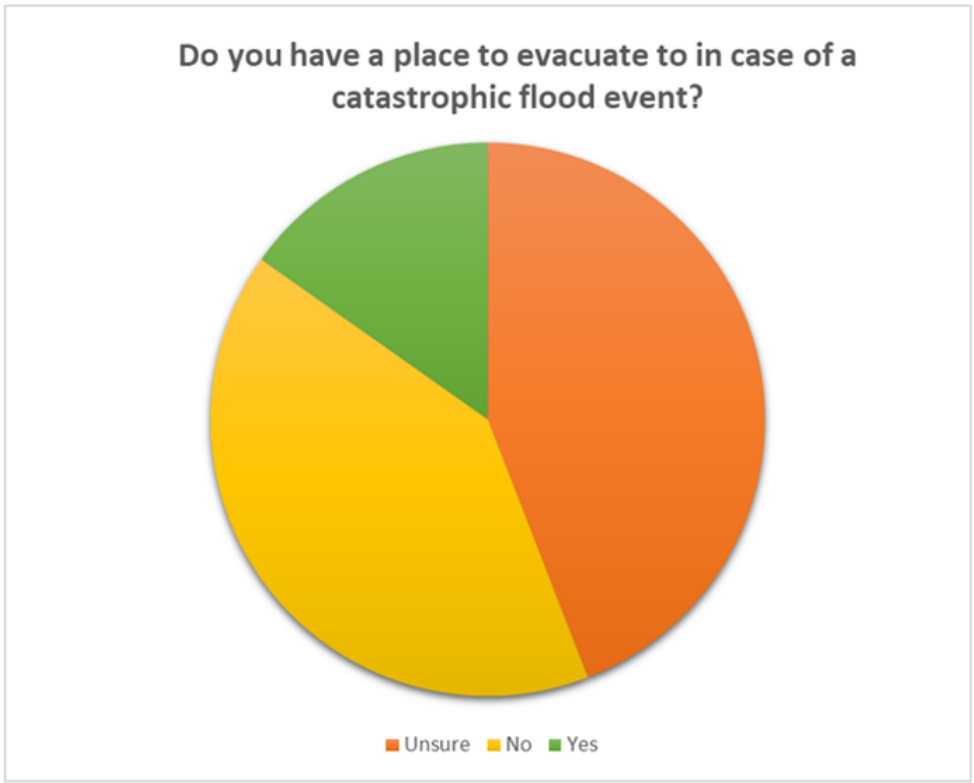


Figure 5

Whether there is a safe place to seek safety in a catastrophic flood event. Source: Fieldwork

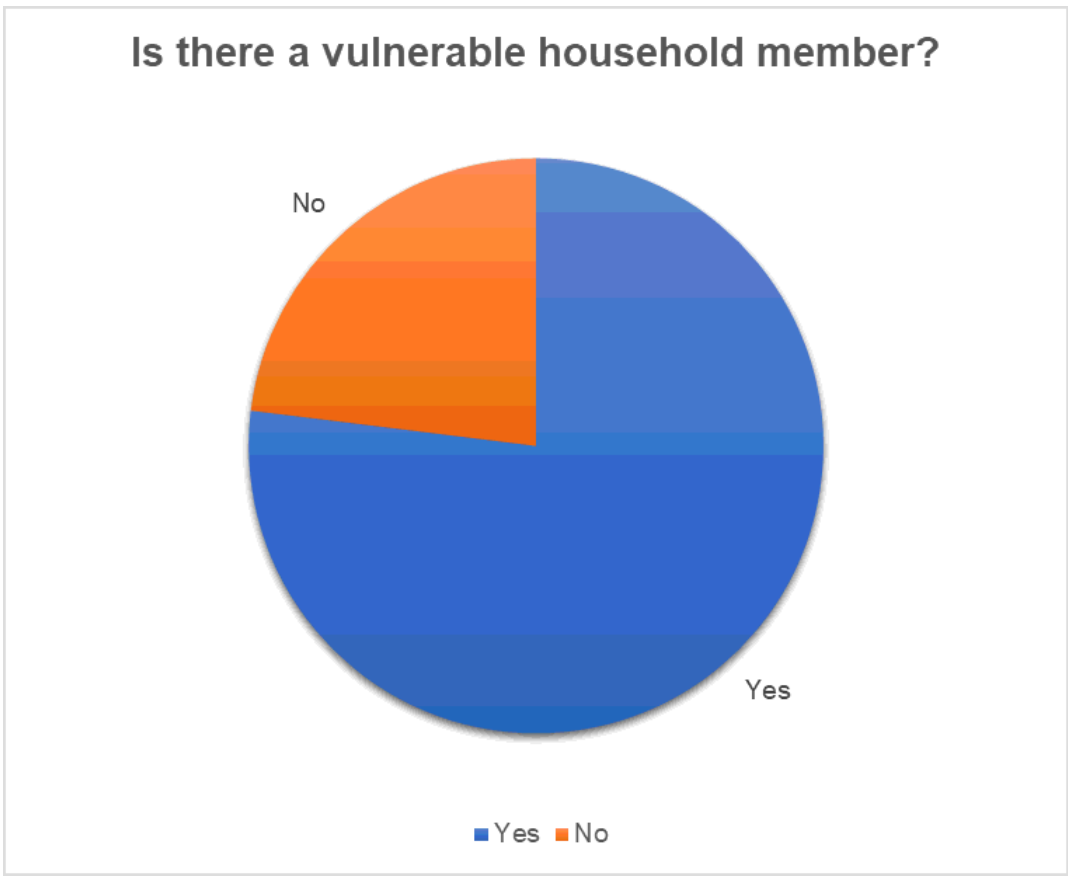


Figure 6

Fig 7: Vulnerable persons in households. Source: Fieldwork

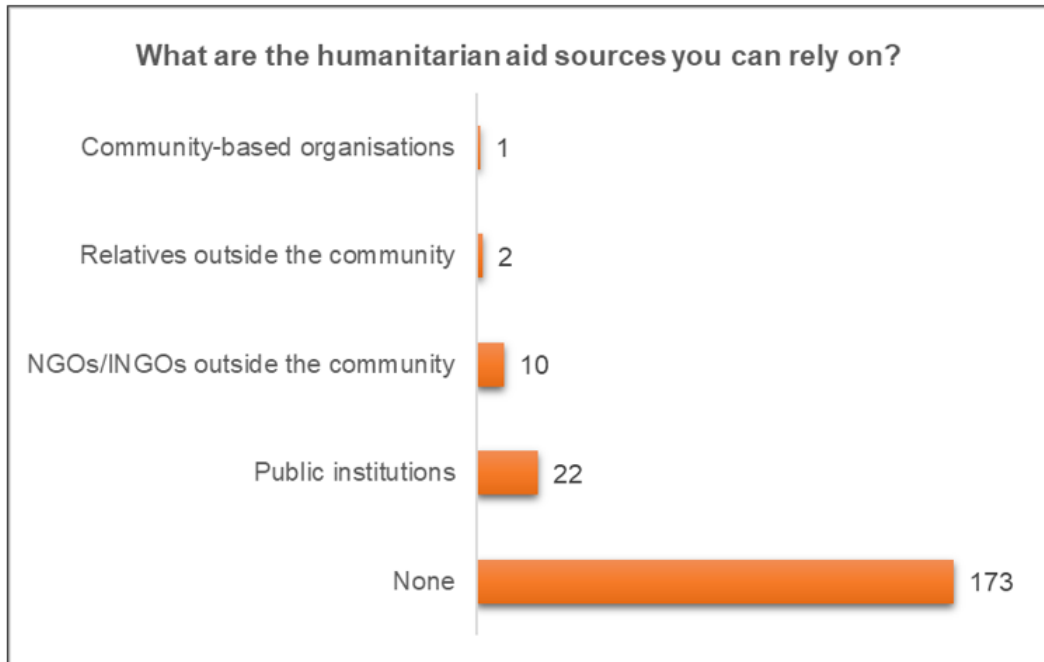


Figure 7

Fig 8: Reliability of aid sources. Source: Author

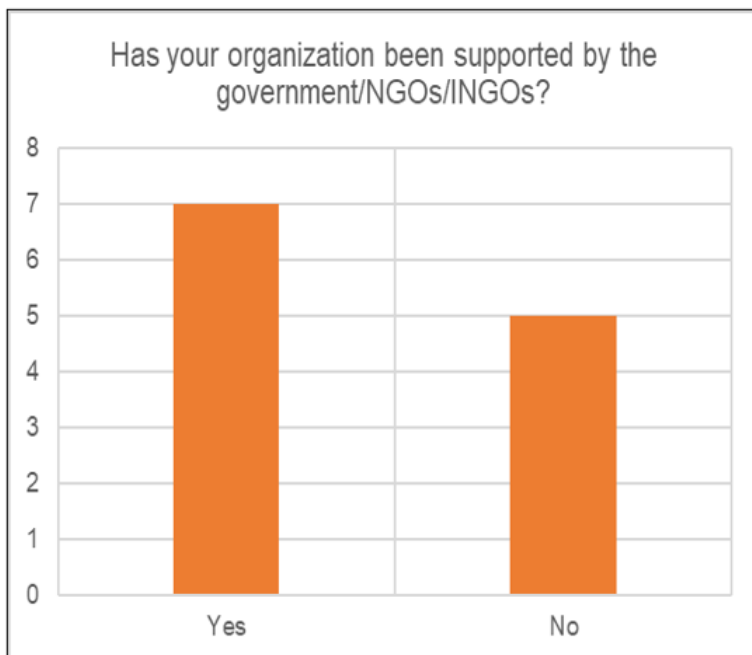


Figure 8

Fig 8: Whether external supports have been received. Source: Fieldwork.