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THE STUDY OF FLOOD EFFECTS ON THE ENVIRONMENT AND LIVELIHOODS IN GHANA

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ABSTRACT

Purpose: This study investigates the repercussions of flooding on the environment and the livelihoods within the *Haatso* community and its immediate surroundings, situated in the Ga East Municipality of the Greater Accra Region, Ghana.
Design/ Methodology/ Approach: We employed purposive sampling to conduct household-based interviews with 61 individuals across five residential areas. We used semi-structured questionnaires to collect their perspectives on the 2022 flooding situation within the *Haatso* communities. Descriptive statistics were used to analyze disaggregated data such as demographic characteristics and other relevant themes directly bearing on flooding and flood vulnerability.
Findings: The *Haatso* community and its immediate environs would continue to experience floods recurring annually due mainly to drain-related and unplanned infrastructure issues. Hence, the detrimental consequences of floods on infrastructure and businesses, resulting in hardships in the community are expected to persist.
Research Limitation/Implication: The approach utilized in this study can be adapted for similar endeavours aimed at mitigating the effects of flooding on both the environment and livelihoods within various communities and their immediate environs.
Practical Implication: The causes, rate of occurrence, and adaptive and coping mechanisms of floods ought to be known to provide additional knowledge on combatting floods.
Social Implication: Providing early warning alerts increases survival schemes and hence decreases the direct and indirect losses caused by annual floods on communities.
Originality/Value: This research submits a more pragmatic, holistic, and realistic survival strategy for the *Haatso* community and its immediate environs as compared to generalized studies, which did not consider directly local settings.
Keywords: *Environs. floods. Haatso. infrastructure. livelihoods.*

INTRODUCTION

Flooding is extensively recognized globally as one of the most common environmental or natural hazards, ranked second to diseases (Smith, 2009). Generally, floods are the most recurrent and destructive of all naturally triggered disasters and are considered the most damaging climate-related hazard in the world (UNDP, 2004; WMO, 2008; NRC, 2012). According to the UN-WDPAC (2010), 50% of all disasters and 84% of disaster-related deaths worldwide are attributed

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to floods with aftermaths leaving densely populated habitats with conditions suitable for the occurrence of diarrhoea and malaria. Based on evidence from various studies, flood-related fatalities can be categorized into two main groups: immediate causes of death, as discussed by Jonkman and Kelman (2005), and underlying factors, as identified by Yari et al. (2020). Immediate causes of death, as outlined by Jonkman and Kelman (2005), encompass incidents such as drowning, physical trauma, heart attacks, fires, electrocution, over-exertion, and shock. Conversely, Yari et al. (2020) categorized the underlying factors of flood-related deaths, which include hazard-related factors, as well as individual, environmental, socioeconomic, and managerial factors.

Others, such as Pereira et al. (2016) and Di et al. (2010), have emphasized that the degree of individual vulnerability, health status, victims' behavior, and their responses to floods are key underlying factors contributing to flood-related deaths. Statistically, the 2018 World Disasters Report, as highlighted by IFRC (2011), recorded 1,522 flood occurrences worldwide between 2008 and 2017, resulting in 50,312 fatalities. Although flood disasters are more prevalent in Asia, accounting for 41% of cases, Africa has also witnessed 17% of these disasters, primarily impacting people through shelter loss, socio-economic setbacks, and agricultural losses, as noted by Smith (2009). In a broader context, Carter et al. (2007) have suggested that the aftermath of disasters leads to an increase in poverty and deprivation within the affected regions. Regrettably, global warming has not only triggered but also exacerbated incidents like flooding, tsunamis, iceberg melting, shoreline erosion, and island submersion, as indicated by the Intergovernmental Panel on Climate Change (IPCC, 2007). Indeed, severe flooding is expected due to climatic changes and variability, population increase, and expansion of human settlements (Ahadzie & Proverbs, 2011; Okyere et al., 2013). Therefore, practically, when considering the adverse effects of flooding, especially deaths, the effectiveness of flood management policies ought to be critically examined to significantly reduce losses.

In Ghana, floods continue to be a serious and impactful disaster, significantly affecting both people and their livelihoods. According to the 2014 report on 'Disasters and Hazards in Ghana' by EM-DAT, floods rank as the second leading cause of death in the country. Similarly, at a national level in Ghana, flooding mirrors the global trend as the second most frequent disaster, occurring approximately 18 times each year and resulting in the loss of over 400 lives over the past decade, as documented by Sam (2009) and Asumadu-Sarkodie et al. (2015). Furthermore, Okyere et al. (2013) reported that between 1968 and 2011, numerous flood events occurred in Ghana, leading to the tragic loss of approximately 300 lives and adversely impacting the livelihoods of over 3 million people. Additional statistics cited by Asumadu-Sarkodie et al. (2015) reveal that from 1968 to 2014, around 3.9 million individuals were affected by flood events, with 409 individuals losing their lives directly. The prevalence of flooding in Ghana can be attributed to several factors, including the widespread distribution of rivers and their associated floodplains, low-lying coastal areas, and the rapid expansion of human settlements. The development of these settlements has led to the creation of impermeable surfaces, hindering water infiltration and resulting in overland

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flows. These conditions render urban areas highly susceptible to floods, particularly in instances where drainage networks are inadequate, as noted by Okyere et al. (2013).

Poor planning of towns and cities

Most urban areas such as Accra, Kumasi, and Takoradi, experience; seasonal rainfall variability and adverse urbanization-related difficulties such as; improper land use, poor drainage, dumping waste into waterways, and building on wetlands among others have intensified the incidence and impact of floods in Ghana (Chati et al., 2018). For example, estimates by Abraham et al. (2006) suggest that, within the capital city of Accra where the topography is naturally low-lying, about 60% of residents live in slums where floods are mostly experienced. The inability to implement and further enforce bylaws has encouraged the private development of diverse infrastructure in unauthorised zones in most cities (UN-WDPAC, 2010). The increasing trend in rural-urban migration and the unauthorized siting of infrastructure in many cases have created slum conditions which have resulted in flooding and the severity of its impact (Genovese, 2006). Indeed, a recent observation by Addei (2016) maintains that a major cause of flooding in most towns and cities in Ghana is the haphazard manner of infrastructure development.

These losses increase the susceptibility of impacted communities and households to future hazards (Afriyie et al., 2016 cited in Larbi, 2017). To illustrate, the 2015 floods in Accra, along with the ensuing fire outbreak, had repercussions for approximately 53,000 individuals. Remarkably, even after two years, nearly one-third of those affected had not yet fully recuperated from the consequences (Erman et al., 2018).

Severe soil erosion due to floods renders buildings weak, leading to their possible collapse whilst channels and gullies are also created on streets and roads, making them inaccessible (Addei, 2016). “Sustainable urban drainage systems” by cities have been argued to be the main long-term remedy to the annual occurrences of floods in Accra (Okyere, et al., 2013).

Hence, this investigation aimed to assess the effect of floods on both the environment and the livelihoods of the residents within the Haatso community and its immediate surroundings, situated in the Ga East Municipality of the Greater Accra Region, Ghana.

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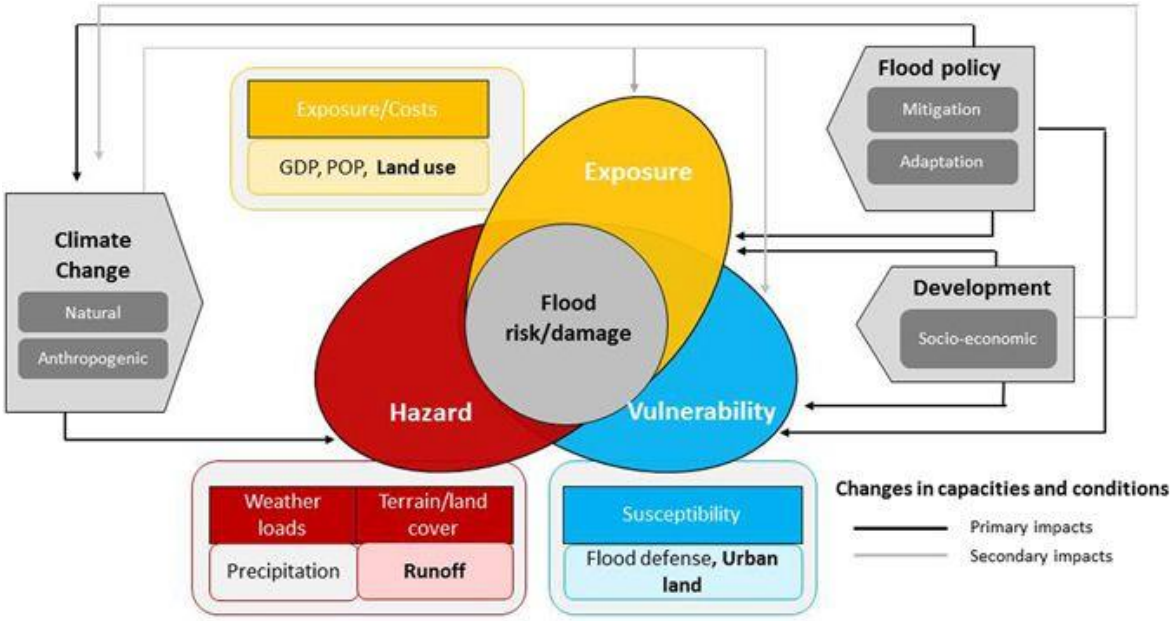

Figure 1: Conceptual framework of flooding (Source: Zhou, et al, 2017)

Though floods are still recognized as a serious global issue in Ghana, research on their incidence and impact has not received adequate attention. This can be ascribed to the apparent shortage of essential financial resources and technical expertise required to mitigate its effects. The *Haatso* community in the Ga East Municipality of the Greater Accra Region of Ghana has constantly been suffering from the devastating impacts of annual floods.

MATERIALS AND METHODS

Profile of Study Area

Haatso is a locality situated within the Ga East Municipal District, located in the Greater Accra Region of Ghana. The community is located within longitude 5°39′56″N and latitude 0°12′07″W and forms part of the larger Dome-Kwabenya Constituency. It shares boundaries with other neighbourhoods such as North Legon, Madina, Legon, Dome, and Westland.

Climate and vegetation

The *Haatso* community is situated within the savannah ecological zone. The region experiences a bi-modal rainfall pattern, with the average annual temperature varying between 25.1°C in August and 28.4°C in February and March. Typically, February and March are the hottest months of the year. Within the community, two primary vegetation types prevail, consisting of shrublands and grasslands (Ghana Statistical Service, 2013).

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Relief and drainage

The terrain within this area is characterized by a gently sloping landscape, interspersed with plains to the west. Towards the western end, the Akwapim range rises sharply, reaching an elevation generally ranging from 375 to 420 meters north of Aburi in the Akuapim South District. As one moves southward into the Okaikwei North District, the elevation gradually decreases to around 300 meters. In this region, there are several rivers and seasonal streams, although many of them face threats from human activities. Notable watercourses include the Sesemi Stream at Sesemi and the Dakubi Stream at Ajako. Additionally, there are small ponds located at Abloradjei, Sesemi, and Old Ashongman. Moreover, there is a substantial presence of underground water sources, some of which have been harnessed to provide potable water for small towns and communities within the Municipality (Ghana Statistical Service, 2013).

Soil and agricultural land use

Large portions of the Accra plains primarily consist of Precambrian bedrock formations, specifically of the Dahomeyan type. These formations comprise alternating acidic and basic bands of massive crystalline gneisses, underlain by schists and migmatites. The acidic rock layers decompose to form slightly permeable calcareous clay, while the basic layers give rise to impermeable clay, often lateritic and prone to erosion (Sam, 2009). The soil composition within the community is characterized by very shallow and excessively well-drained soils, featuring pale-coloured sandy loam with small rock fragments, particularly on steep slopes. Additionally, these soils can be described as well-drained red sandy clay loam to clay, containing an abundance of rough stones and quartz gravel. These various soil types are conducive to the establishment of permanent forests (Ghana Statistical Service, 2013).

Figure 2: Study area (Source: Center for Remote Sensing & Geographic Information Systems (CERSGIS).

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Research Design

A research design outlines the specific strategy employed for collecting and analyzing data (Saunders, Lewis, & Thornhill, 2012; Sekaran & Bougie, 2013). Various types of research designs exist, but the selection typically hinges on the research's objectives (Burns and Bush, 2000). In this study, the researchers determined that the case study research design, coupled with a mixed-method (multi-strategy) approach (Creswell, 2009; Robson, 2011), was the most suitable choice. This decision stemmed from the need to integrate both qualitative and quantitative research methodologies. Given that the research participants are the individuals most directly affected, their firsthand experiences, perspectives, and opinions were deemed essential for achieving the study's objectives.

Sources of Data

In this study, a combination of primary and secondary data was employed. Primary data constitutes information obtained directly from individuals or the situation being investigated, while secondary data encompasses previously reported accounts by other studies (Creswell, 2012). For this research, primary data primarily involved conducting interviews with respondents. Interviews, as described by Boyce and Neale (2006), entail in-depth individual questioning of a limited number of respondents to explore their perspectives on a specific concept, program, or situation. Additionally, secondary data sources, such as pertinent literature, land policy documents, records of rainfall patterns from meteorological sources, the Ga East Municipal District master plan, and other relevant materials, were utilized to gather information about the topic of flooding.

Population of the Study

The study encompassed a population that comprised the Manbunaa, Niibu, Ecomog, Madam Block Factory, and Video Club areas, all located within a 5 km radius of the central *Haatso* community.

i. Manbunaa: Is a highly populated residential area, however, with low economic activities and poor school facilities.
ii. Niibu: Is a highly populated area with vibrant economic activities and good schools.
iii. Ecomog: Is a highly populated settlement with high economic activities and good schools.
iv. Madam Block Factory: This is a highly populated settlement with vibrant economic activities and good schools.
v. Video Club: A densely populated area characterized by robust economic activity and the presence of reputable schools. Typically, these localities fall into the category of informal settlements, encompassing a variety of rental arrangements, squatting, and informal land use designations. More than 90% of communities prone to flooding consist of informal settlements whose residents often live in extremely impoverished and precarious physical and socio-economic circumstances (Amoako and Boamah, 2014)."

Sampling and Sample

Data collection was conducted on a household basis in five residential areas using the purposive sampling technique, as advocated by Thurstone (1959). This method was chosen to involve

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individuals who can provide comprehensive information, a concept referred to as being 'information rich' by Patton (1990) and Creswell (2002).

The snowball sampling technique, as described by Goodman (1961), was employed, wherein participants were encouraged to recommend potential interviewees. Furthermore, precautions were diligently taken to ensure that all respondents were aged 18 years or older. In total, 61 individuals participated in the interviews, responding to a semi-structured questionnaire designed to elicit their perspectives on the flooding situation within the *Haatso* communities.

Approach to Interviews

Respondents were assured that their responses were solely intended for academic purposes. Consequently, their input remained anonymous, and their participation was entirely voluntary. The questions were subsequently presented in an organized manner, and participants' responses were carefully documented. The questionnaire design avoided leading questions, as such inquiries could potentially bias responses by prompting participants to overly emphasize certain facts or ideas at the expense of other significant information, as cautioned by Proctor and Van Zandt (2008).

Data Collection

The interview sessions were initially piloted with a lesser number of participants in the study area to ensure that, questions and responses were appropriate and also compatible with the objectives of the study. Semi-structured questions were adopted for the collection of the primary data from respondents. Practically, a semi-structured interview structure allows for open and closed-ended questions which provides an opportunity for deeper probing and understanding of issues (Bryman and Bell, 2011). The questions were centered on the demographic characteristics of respondents, views, and perceptions of flooding which include causes, impacts, and the adaptive strategies used to cope with floods.

Interviews with Key Informants (KI) were in-depth, exploratory, and intended to provide a broader perspective on the issue under study and also provide for the assessment of the role of state and non-state stakeholder institutions in the prevention/mitigation of floods and their impacts. At the beginning of each survey, every participant was informed about the ethical and confidential issues of the research in line with the ethical considerations. Each questionnaire was assigned a unique serial number (ID) for ease of identification and subsequent referral.

The primary and secondary data sources were augmented with direct observations (DO) by the researcher during field visits and in the course of interviewing to provide personal evidence to some of the issues raised by the respondents and or secondary sources. In addition, a handheld Global Positioning System (GPS) device was employed to gather the geographical coordinates of respondents and infrastructure, including buildings susceptible to flooding or situated within flood-prone areas.

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Data Analysis and Presentation

The quantitative data from the interviews were coded and entered into a Statistical Package for Social Sciences (SPSS), currently referred to as the Statistical Products and Services, version 20. Descriptive statistics were used to analyze disaggregated data such as demographic characteristics and other factors with a bearing on flooding and flood vulnerability. The qualitative content analysis technique was used in analyzing the qualitative data after manual disassembling and text coding for the identification and analysis of the relevant themes.

Ethical Considerations

To uphold the emotional, cultural, and social rights of the respondents, the study adhered to the ethical standards in social research, as advocated by Babbie (2005). Consequently, several ethical considerations were implemented in this research, including voluntary participation, avoidance of harm to participants, and ensuring anonymity and confidentiality. Furthermore, prior to conducting interviews, informed consent was obtained from all interviewees. The study also adhered to ethical codes concerning research design accuracy, data collection and processing, and proper source attribution. Participants were informed of their rights, which included the ability to modify responses, decline to answer specific questions or withdraw entirely from the research. Consent forms were used to obtain permission from each volunteer participant.

RESULTS AND DISCUSSION

Demographic Information of Respondents

Data was collected from five main areas of the *Haatso* community; Manbunaa, Niibu, Ecomog, Madam Block Factory and Video Club areas. Data was collected on 7 socio-demographic characteristics that influence social stratification and with the potential to affect flood occurrence and impact. These characteristics include; gender, age, education, occupation, duration of stay in the community, number of household members, and ownership of residential or commercial premises.

Table 1 shows that the majority of respondents (55.7%) were female and between 40 to 59 (50.8%) years of age. Most respondents were entrepreneurs, (31.2%). 27% of the respondents had completed Technical/Vocational education.

While more than half of respondents (59.02%) have stayed in the community. Just over half (57.4%) are Tenants with up to 5 as members of a household. The demographic information depicts that the respondents are capable of giving informed responses that will improve the quality of data needed.

Furthermore, these attributes align with the findings of Shabanikiya et al. (2014), who, in addition to perceptual factors, emphasized that characteristics such as age, gender, marital status, education level, and attitude can influence a victim's willingness to accept risk and engage in risky behaviours during floods. According to Fatti and Patel (2013), demographic characteristics are very relevant

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as local assemblies have to engage residents in policy implementation in dealing with urban flooding.

Table 1: Demographic Characteristics of Respondents

Description	Frequency (N)	Percentage (%)
Gender		
Male	27	44.30
Female	34	55.70
Total	61	100
Age		
18-39	28	45.90
40-59	31	50.80
60-79	2	3.30
Above 80	0	0.00
Total	61	100
Occupation		
Artisan	11	18.03
Entrepreneur	19	31.20
Public Servant	9	14.80
Student	5	8.20
Trader	10	16.39
Unemployed	7	11.46
	61	100.00
Qualification		
Primary	3	4.92
JHS	6	9.84
Secondary	19	31.10
Technical/Vocational	17	27.90
Tertiary	10	16.40
None	6	9.84
Total	61	100
Years of Stay in Community		
1-10	36	59.02
11-20	2	3.28
21-30	3	4.92
Above 30	20	32.80
Total	61	100

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Members of a household		
1-5	36	59.00
6-10	20	32.80
11-15	2	4.90
Above 16	3	3.30
Total	61	100
Residential Status		
Landlord	26	42.60
Tenant	35	57.40
Total	61	100.0

Source: Field Survey Data, 2020.

Flood Occurrence, Frequency and Impact

Almost all respondents 60 (98.36%) experienced the 2019 flooding episode. The duration of these flooding events varies among respective respondents (Figure 3), persisting for a period of 5 hours (11.48% cumulative), a day (22.95%), and over a day (65.57%).

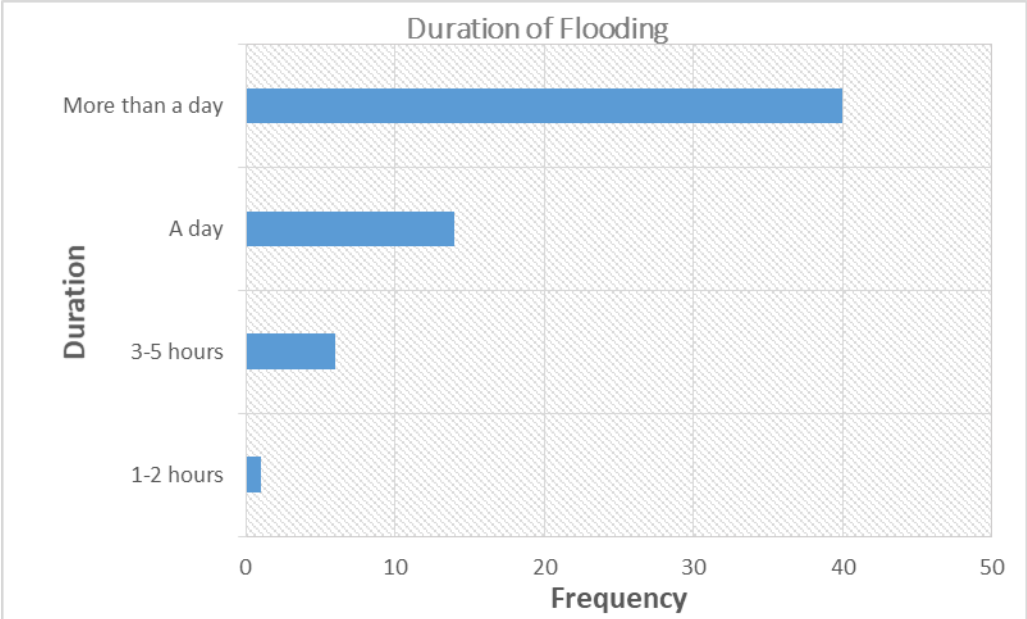

Figure 3: Duration of flood events

Flood Incidence, Frequency and Impact

Almost all respondents 60 (98.36%) experienced the most extensive recent flooding episode in the year 2019, hence attesting to the frequent and annual incidence of flooding. The duration of these

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flood events varies across various respondents, indeed lasting at various durations ranging from up to 5 hours (11.48% cumulative), a day (22.95%), and more than a day (65.57%) (figure 3). Again, this research confirms the observation that, the annual floods are mostly experienced in June, which has been noted generally as the month with the most intense rainfall and storm events (Adank *et. al.*, 2011; Rain *et. al.*, 2011). Though June has been identified as the month with the most intense rainfalls and storms, what is critically needed, according to Ahadzie and Proverbs (2011) is to have a well-developed flood risk management plan to predict and warn of potential floods.

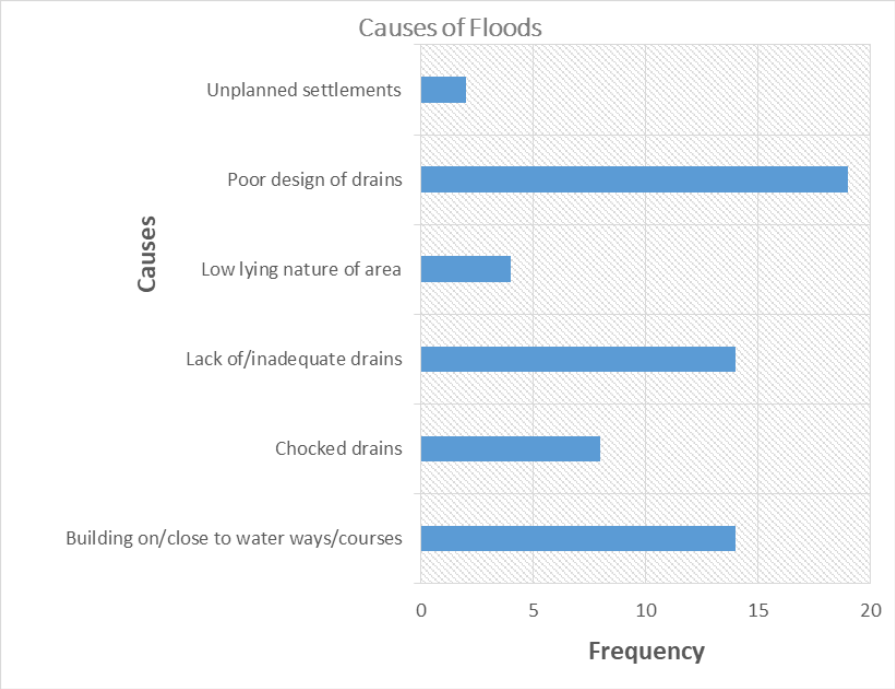

Figure 4: Causes of flooding in the communities

As indicated by various studies (Songsore *et al*, 2006; Sam, 2009; UNWDPAC, 2010), the major causes of floods being mostly connected to drains and building on wetlands among others have also been confirmed by this research (figure 4). On the other hand, the views of Darteh and Adank (2011) that the capacities of the existing drains are limited by their size and also by the fact that they are sometimes silted or choked with refuse were also confirmed by this study. This study is of the view that, aside from exposure and vulnerability being determinants of flood impact as identified by Genovese (2006), the magnitude of damage depends on flood characteristics such as; duration, flood depth, and velocity, as well as sediment load should be carefully categorized. This study, therefore deemed it appropriate to categorize the types of impacts as; physical (infrastructure), socio-economic (business and livelihood), environmental (waste/sanitation), and health.

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Physical, Socio-economic and Environmental Impacts of Floods

Table 2: Impact of flooding on infrastructure

Infrastructure	Frequency (N)	Percentage (%)
Bridges	4	6.56
Foot/Pathways	16	26.23
Road	41	67.21
Schools	7	11.48
Health facilities	7	11.48

Source: Field Survey Data, 2020.

The impact of flooding on infrastructure affected roads contributing to 67.21%. Foot /pathways were also destroyed by flooding. On health services, 11.48% of respondents confirmed that floods caused various levels of physical damage to health facilities as depicted in Table 2. whilst other respondents (67.21%) admitted that, the occurrence of floods obstructs access to roads. The finding agrees with Wang et al., (2019) that noted that road systems, as the backbone of human activity and social development, are naturally concentrated in major river basins. It is thus expected that more-populated areas will be more affected by floods than by other hazards, which calls for more attention to be paid to the reduction of the disaster risk posed by floods. This assertion on health services supports studies by Addei (2016) who emphasized that floods lead to the possible collapse of buildings and further make roads and streets inaccessible. The outbreak of diseases as reported by the UN-WDPAC (2010) was not substantially recorded in this study as only one respondent (1.64%) reported an extensive occurrence of malaria. The absence of water-borne diseases suggests that the majority of the inhabitants might be consistently taking serious preventive measures against water-borne and malarial diseases. This study is of the view that the absence of water-borne diseases reveals that, waste disposal and sanitary facilities are well managed in the *Haatso* community. Indeed, a great number of the residents (54.10%) utilize individual home toilets and only 3.28% of respondents admitted dumping waste into drains or streams. About 11.48% of respondents indicated that their family members sustained injuries ranging from knee injuries, sprains, and cuts, however, no death was reported. The absence of cases of death suggests that the community complies with some precautionary measures, hence the eradication of all the immediate causes of death such as fire outbreaks, drowning, and shocks as reported in flood studies by Jonkman and Kelman (2005).

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Post-Flood Adaptation Mechanisms

Table 3: Sources of post-flood support

Source of Relief	Frequency (N)	Percentage (%)
NADMO	0	0
Friends/Relatives	7	11.48
None	54	88.53
Total	61	100.00

Source: Field Survey Data, 2020.

Post-Flood Adaptation Mechanisms

This study further sought to evaluate the support, if any is even rendered to flood disaster victims in the *Haatso* community (table 3). As many as 54 respondents (88.52%) mentioned that they have never received any form of post-flood support, however, the few (11.48%) who responded in the affirmative, had their support from friends and families. Practically, no state agency such as the National Disaster Management Organization (NADMO) or the Municipal Assembly was pointed to have ever provided any direct post-flood support to the community. The absence of state post-flood support reveals that there is no institutional Flood Risk Management (FRM) system or perhaps no collaboration between the state agencies responsible for flood-related victims. Therefore this study is compatible with related studies by Challies, et. al. (2016), which proved that fragmental approaches to flood risk management are always never successful.

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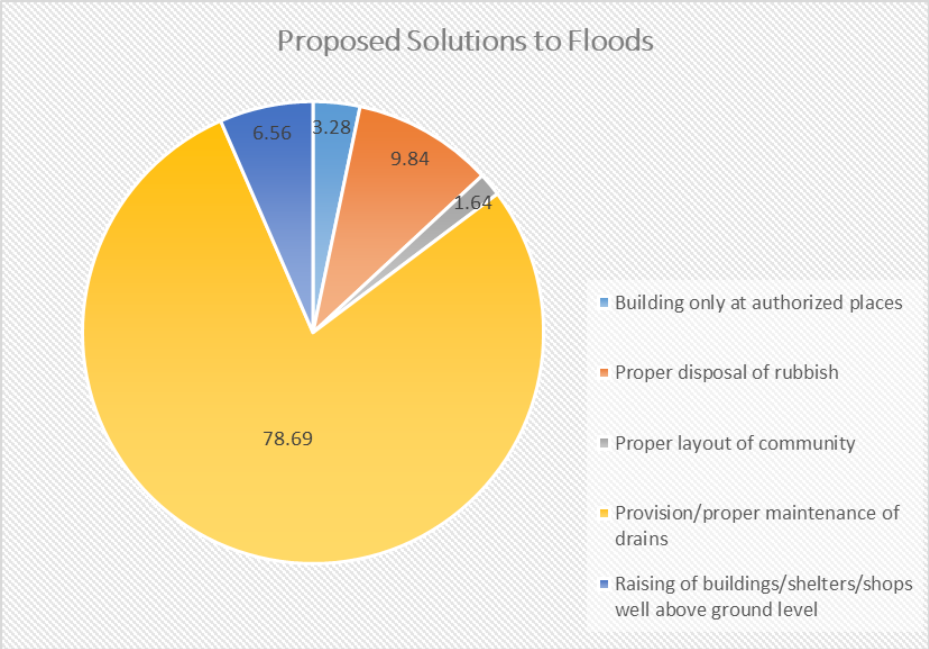

Figure 5: Proposed preventive strategies to mitigate flooding

In an attempt to reduce the risks that are susceptible to the community, all respondents were of a strong opinion that the floods in *Haatso* can be prevented by most importantly providing and maintaining drains among others (figure 5). This study realized that all the solutions proposed to the challenge of the *Haatso* annual floods have consistently been identified and further emphasized already in literature (see Addei, 2016). Certainly, the fact that the projected rainfall events classified as ‘‘heavy” between 2010 and 2050 will be on the increase, and already about 40% of Accra is classified as “highly prone” to flooding there is the need for the adoption of a more holistic and sustainable approach to the management of floods.

CONCLUSION

The basic intention for investigating the *Haatso* floods was performed using guidelines designed to identify the; causes, frequency, impacts, and post-flood adaptations of the annual floods in the area. Results of the research indicate that drainage related challenges are the main factors responsible for the annual floods in the study area. This accounted for over 80% of all responses even though other factors such as low elevation and unplanned settlement were reported. It also appeared that businesses are the most adversely affected by flood events as they tend to incur both direct and indirect losses whilst the adaptive strategies of flood victims still largely remain reactive.

Based on the research conducted, the following recommendations were made;

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i. The Municipal Assembly must strictly enforce local spatial plans or physical zoning to ensure that inhabitants do not encroach on wetlands and waterways to impede the drainage capabilities of natural channels.
ii. The Municipal Assembly ought to ensure the provision and adequate maintenance of flood control and sanitation infrastructure in the area.
iii. The Central Government through the Municipal Assembly needs to develop Sustainable Drainage Systems (SUDS) in the long term. SUDS mimic natural drainage facilities by employing a range of natural processes leading to increased recharging of groundwater, better drainage of flood waters, and further promoting urban wildlife and biodiversity.
iv. The National Disaster Management Organisation (NADMO) should intensify community education as well as hazard monitoring and forecasting activities.

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