



Causes, impacts and coping strategies of floods in Ghana: a systematic review



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Abstract

Urban flooding has become a major problem in many parts of the world due to its social, economic and environmental impact. In Ghana, flood occurs every year, which adversely affects livelihoods, property, infrastructure, lives and renders many people homeless. In this paper, we aim to understand the current state of flood research in Ghana, focusing on how the scholarly community has approached the causes, effects/impact, and the coping strategies adopted by people in the urban setting. Drawing on a comprehensive literature review, combined with individual co-author in-depth experience in research and practice in Ghana, we searched academic database such as SCOPUS, Web of Science, Springer, Taylor and Francis, Science Direct and Google scholar for recent studies. Our results, on the basis of 33 articles, indicate that poor urban planning and development (number of reported articles, $n = 18$), poor and inadequate drainage facilities ($n = 11$), poor environmental attitude ($n = 10$) and extreme rainfall ($n = 8$) are the top causes of urban flood in Ghana. The most commonly reported impacts/effects were physical cost ($n = 7$), destruction of economic infrastructure ($n = 5$) and health concerns ($n = 4$). The most reported coping strategies were relocation and protection of properties ($n = 9$) and construction of drains ($n = 8$). The review also pointed out critical research gaps in the context of Ghana and suggested a new area for future research direction and practice.

Keywords Climate change · Causes · Coping strategy · Effects/impacts · Floods · Ghana

Abbreviations

FGD	Focus Group Discussion
LID	Low Impact Development
MLGRD	Ministry of Local Government and Rural Development
MoH	Ministry of Health
MWH	Ministry of Works and Housing
NADMO	National Disaster Management Organisation
UNISDR	The United Nations Office for Disaster Risk Reduction

1 Introduction

One of the most threatening disasters confronting the world is flooding. Over the past decade, urban flooding has become a major problem in many parts of the world due to its social, economic and environmental impact. It has destroyed developmental infrastructure and increased human casualties around the globe [1]. For example, 5 million people were displaced during the period 1960–2000 globally due to temperature and heavy rainfall. The number is expected to increase by 11.8 million people by the end of the twenty first century [2]. In Pakistan, flood occurrence is pervasive and spreading uncontrollably. This led to a huge economic loss to the government in 2010 [3].

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Moreover, flooding has disproportionately destroyed building structures, and further worsened economic status, particularly people who live in lower areas and informal settlements [4]. In Europe, over the past 150 years, the total number of urban areas that are vulnerable to flooding has increased by 1000% whereas in Sub-Saharan Africa, losses due to flooding is over US\$300 billion [5].

In Africa, urban flooding has become one of the major threats to deal with given the poor and limited infrastructure, low capacity of local governments (e.g. human and financial resources) and limited coordination of relevant stakeholders in flood management [6]. The rapid urbanisation of the cities in Africa has also necessitated the demand for land. People with limited income who cannot afford housing in the flood-free areas tend to settle within the flood-prone areas, which are mostly cheap. Additionally, people in poverty are relatively overexposed to flooding. They usually accept and cope with flooding because of limited alternatives [7]. In Africa, management plans to deal with flood are being developed and implemented; however, it appears that effective implementation still remains a challenge. For example, despite the effort to address urban flooding in Ouagadougou, the problem continues to persist due to the high cost of mitigation measures and the inability of the people to effect change [8]. Related studies demonstrated that fragmental approaches to flood risk management are ineffective [9].

In the context of Ghana, apart from destruction of properties and economic losses due to flooding, people living in flood areas are at a high risk of contracting diseases such as cholera, malaria and hepatitis E [10, 11]. In an attempt to address the problem associated with urban flooding in Ghana, city authorities issue eviction notices to informal residents, particularly in settlements in floodplains and wetlands. However, it seems that the eviction order has not been effective and has increased flooding in the informal areas. There are an increased number of approaches available that could be tapped to address the socio-economic, environmental and institutional challenges in poor urban communities [12]. Local government and residents may play a role in dealing with urban flood; however, due to distrust and limited community engagement, policy implementation has become weak [13]. Numerous policy options and strategies have emerged to protect urban infrastructure against flooding and enhance urban flood resilience and sustainability. Moreover, there are efforts by the government to prevent development in the flood risk zones to enhance the growth of ecosystem [14]. There is also a growing effort to discourage people from building or farming in the flood plains and wetlands, however the effort is being resisted and politically contested [15]. To better adapt to urban flood, it is also suggested that climate change-related issues and strategies to encourage

local participation should be incorporated into the planning process [16].

The impact of climate change on rainfall intensity, duration and frequency has become relevant in recent research [17]. Intensification of rainfall has been associated with climate change [18]. Climate change increases the likelihood of extreme rainfall and its intensification creates a higher risk of damaging flood events that threaten both life and the built environment, particularly in urban regions where the existing infrastructure has not been designed to cope with these risks [19]. There is a growing concern over the causes and effects/impacts as well as coping strategies of people affected by urban floods; therefore, it is essential to comprehend the nature of flood and its associated risks in urban areas.

1.1 Gap analysis and goals of review

Ghana is not an exception when it comes to urban flooding. For example, Ghana recorded unprecedented flood event in November 2010, which affected 55 communities and displaced 700,000 people. Additionally, 3234 houses were destroyed while 23,588 acres of farmlands were submerged. The total cost of the flood was estimated to be US\$116,340.22 US according to the National Disaster Management Organisation (NADMO) report in 2010, Ghana. Moreover, on 3 June 2015, flood event led to over 150 deaths [20]. Research shows massive destruction of property and economic losses. The worse affected regions include Greater Accra, Volta, Central, Western and Eastern Regions. Table 1 shows some of the major floods in different cities from the reviewed papers and reports.

This phenomenon has become severe and widespread [26]. One of the important natural causes of flood is heavy rainfall, which is related to climate change. The rainfall patterns in Ghana have not been stable and this is known as the major cause of urban flood [20]. For example, Accra within the last few decades, has recorded average monthly precipitation from 160 mm (1991–2010) to 200 mm (2011–2020). Finding from Amoako and Inkoom [21] also revealed that rainfall intensity or storm surges trigger flash flood in urban areas. Research demonstrated that urban flood in Ghana occur due to poor drainage system [27], poor waste management [28], removal of urban vegetation [23] and poor urban and structural planning [23, 29]; however, the planning system in Ghana has failed to successfully control urban physical development [30] and this has exacerbated the effects of urban flooding.

The Government has relied on relevant agencies such as the Ministry of Works and Housing (MWH), Ministry of Health (MoF), Ministry of Local Government and Rural Development (MLGR), City Engineers and Lands Department and the public to deal with the socio-economic and

Table 1 A compilation of some major floods in different cities in Ghana Source: [21–25]

Year of reported major flooding	Region (city)
2000	Central (Cape Coast)
1968, 1997, 1986, 1995, 1999, 2001, 2002, 2003, 2004, 2005, 2007, 2008, 2009, 2010, 2011, 2013, 2014, 2015, 2016, 2017, 2018, 2019	Greater Accra (Accra)
2010	Volta (Keta)
2010	Eastern (Kwahu)
2002, 2010	Central (Kasoa, Swedru)
2018	Northern (Buipe)
1971, 2002	Western (Sekondi-Takoradi)
2004, 2018	Ashanti (Kumasi)
2005	Central (Saltpond)
2007	Upper East (Bolgatanga)

environmental impact of flood [31]; however, the methods have not been able to address flood event as new threat continues to resurface. For example, the recurring flood events in Accra, Kumasi, Tamale, Sekondi-Takoradi, Eastern and Volta regions claim hundreds of lives and destroys valuable resources and properties worth thousands of Ghana cedis yearly. This has led to an increase in relief expenditure and health control by government, and potentially increasing the overall national budget.

Previous research (see Table 1) has outlined different causes, effects/impacts and coping strategies; however, there has not been any methodological review on the causes, effects/impacts and coping strategies in the context of Ghana. According to the literature, two major shortcomings were identified. Firstly, in spite of a burgeoning threat of urban flood, limited studies so far have unearthed the current knowledge of causes, effects and coping strategies in Ghana and future research directions. Secondly, none of the existing reviews covered the three broad themes of flood research: causes, effects/impacts and coping strategies. While the works of Okyere et al. [32] and Gyekye [33] focus strongly on the nature and extent of floods in Accra, Asumadu-Sarkodie et al. [26] were mostly interested in causes of flood and mitigation measures. Additionally, Korah and Cobbinah [34] focused on institutional and social dimension, whereas Ahadzie and Proverbs [25] were interested in flood risk management strategies. From the foregoing, it is evident that none of the reviews did cover important themes of flood research in an integrated manner. The authors tend to fill the knowledge gap by exploring emerging (1) causes of flood in Ghana (2), effects/impacts of flood, (3) coping strategies used by residents living in flood-prone areas in urban areas and (4) discuss future implications for research and practice.

Building on the work of Ahadzie and Proverbs [25], this study explores the current state of flood research in Ghana, focusing on how the scholarly community has approached the causes, effects/impact, and coping strategies adopted

by people in urban setting. Based on the research issues identified, this research seeks to address the following questions:

- (1) What are main causes of flooding in Ghana?
- (2) What are the effects/impacts of flood in Ghana?
- (3) What are the coping strategies that are adopted by the community during flood events in Ghana?
- (4) What are the possible sustainable developmental and policy options for addressing flood problems in Ghana?

This study is organised into the following sections. Section 1 covers the introduction of the study. Section 2 outlines the methods used in the study. Section 3 outlines the results including sources of studies by regions, frequency of publication, research methods used in the studies, an overview of community flood responses along with the four themes. Section 4 discusses three themes: causes, effect and coping strategies. The last section presents the conclusion and directions for future research.

2 Method

2.1 Ghana: a brief introduction

Figure 1 shows the map¹ of Ghana. It is located in West Africa, bordered by Burkina Faso in the north, Cote d'Ivoire in the west, Togo in the east and the Gulf of Guinea in the south. Currently, there are sixteen regions, which are further divided into 260 local districts. The largest cities are

¹ All the 33 studies examined in this study referred to the former ten regional boundaries. On 27 December 2018, there was a new map of Ghana following a referendum on the creation of additional six new regions.

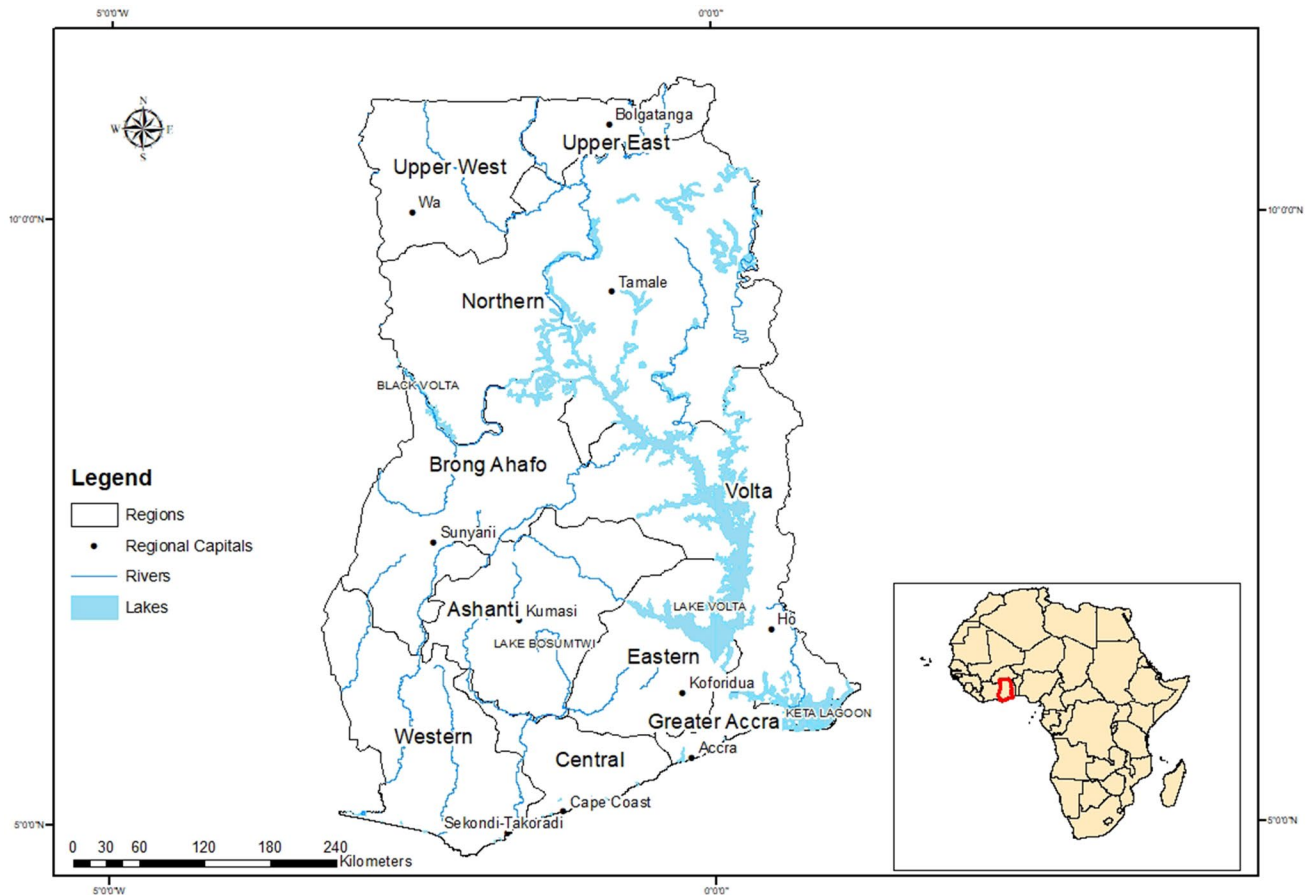


Fig. 1 Map of Ghana showing the ten regions

Accra of the Greater Accra Region (1,963,264), Kumasi of the Ashanti Region (1,468,609), Tamale of the Northern Region (360,579), Sekondi-Takoradi of the Western Region (232,919) [35]. Currently, Ghana has a population of about 29.6 million (2018) [36] with an area of 238,533 km². Ghana is endowed with a large number of streams and rivers with a catchment area of nearly 70% of the country's total land area. The Volta River is the most important river consisting of tributaries such as Oti and Afram Rivers. White and Black Volta form an important part of the Volta River in Ghana.

2.2 Data sources and collection methods

This paper tends to understand the current state of flood research, focusing on causes, effects/impacts, coping strategies and identify gaps in the conventional literature in order to inform future research and practice. We reviewed 33 peer-reviewed articles from 2009 to 2019. Table 2 shows the selected list of publications and their corresponding journals and conferences. As part of the review, co-authors with longstanding experience in urban flood,

both in research and practice in Ghana, critically examined and refined selected articles to improve the validity of the findings. This study uses the term secondary data to mean existing research data that are examined to find the answer(s) to research questions that are different from the original research goal [37].

The author followed the guidelines from Cronin et al. [38] for the traditional literature review, namely: literature search; gathering, reading and analysing the literature. Considering electronic search, the author used the phrases and keywords that were relevant to the study. Each of the respective search engines covered articles within the last 10 years (from 2009 to 2019). The selection of the year was important to ensure that recent literature and discussion of the subject area are included in the study.

The author searched through academic databases such as Google Scholar, SCOPUS, Web of Science, Springer, Taylor and Francis. For example, Scopus used the following search rule to collect relevant literature: "coping strategies" AND "Ghana" AND "flood" AND "adaptation" AND "causes" AND "mitigation" AND "impacts" OR "effects". These search words and phrases were entered in different combinations

Table 2 A selected list of publications and their corresponding journals and conferences

Journal title	Number of publications	Sources
1. GeoJournal	3	[23, 39, 40]
2. Jàmbá Journal of Disaster Risk Studies	2	[7, 29]
3. 6th International Conference on Infrastructure Development in Africa	1	[41]
4. 35th AFSAAP Annual Conference Proceedings	1	[42]
5. International Conference on Infrastructure Development in Africa	1	[43]
6. International Journal of Safety and Security Engineering	1	[44]
7. Natural Hazards	1	[45]
8. International Journal of Disaster Risk Reduction	1	[46]
9. Sacha Journal of Environmental Studies	1	[47]
10. International Journal of Humanities and Social Science	1	[48]
11. The geography of climate change adaptation in urban Africa	1	[34]
12. Policy Research Working Paper Series	1	[49]
13. Ghana Journal of Geography	1	[50]
14. Ghana Journal of Science	1	[27]
15. Urban Studies	1	[21]
16. Environment, Development and Sustainability	1	[51]
17. Geoenvironmental Disasters	1	[52]
18. Urban Water Journal	1	[53]
19. Journal of Disaster Research	1	[54]
20. Advances in Applied Science Research	1	[20]
21. International Journal of Agricultural Policy and Research	1	[55]
22. Journal of Sustainable Development	1	[56]
23. International Journal of Urban Sustainable Development	1	[22]
24. International Journal of Environment and Bioenergy	1	[57]
25. Theoretical and Empirical Researches in Urban Management	1	[32]
26. International Journal of Agricultural Policy and Research	1	[55]
27. International Journal of Development and Sustainability	1	[58]
28. International Journal of Applied Science and Technology	1	[59]
29. International Journal of Disaster Risk Reduction	1	[60]
30. Journal of Environmental Policy and Planning	1	[31]
Total	33	

and were searched for in the search engines. In order to include articles that were not found in the search engine, the authors applied the snowball approach technique to identify hidden publications or articles relevant to the study.

2.3 Data analysis

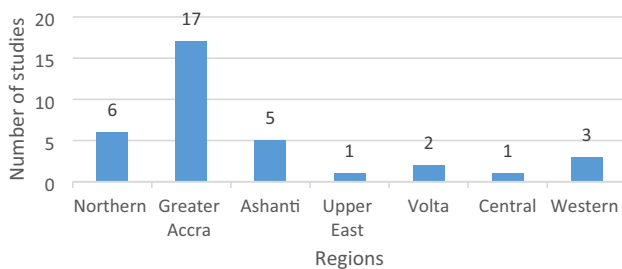
In the content analyses of the selected articles, a qualitative data analysis tool (NVivo 10) was used to store textual information. The short-listed studies were analysed to identify themes, and topics emerging from the selected articles. Articles were further analysed in terms of frequency of publication in journal outlets, year of publication, research methods and region where the study was conducted. These were imported into an excel spreadsheet for easy descriptive analyses to be done.

Finally, the frequency of themes across the 33 studies was also examined. The search excluded studies that include reports, dissertations, tutorials, workshops, panels and poster sessions. We selected articles based on author's generated codes; therefore, articles that could not meet at least one or more codes were excluded from the study. The following codes were used for the content analysis.

- *Year* Year of publication
- *Article* Title of the article
- *Journal* Publication in which the article was published
- *Geographical jurisdiction* Region from which the data was collected
- *Study focus* Causes, consequence, coping strategies, adaptation, mitigation
- *Research type* Survey, interview, secondary data, others

Table 3 The selection process of required studies

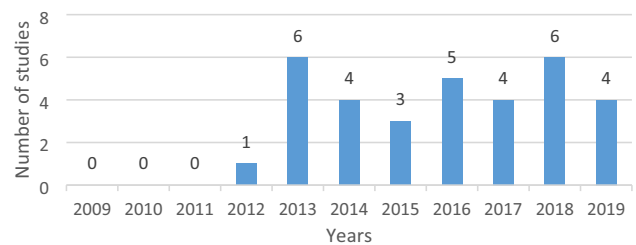
The selection process	Number of studies
Stage 1: identification Search electronic databases (SCOPUS, Web of Science, Science Direct, Springer, Taylor and Francis, Google scholar) for relevant papers	350
Stage 2: screening Exclude publications on the basis of titles, abstract and keywords	114
Stage 3: eligibility Obtain papers by reviewing paper content for causes and effects/impacts, adaption/coping and mitigation	43
Stage 4 included Primary papers included in the synthesis	33

**Fig. 2** Study regions

- *Major findings* Significant findings explicitly stated in the article

2.4 Delimitation and limitations

The reviews focus on the causes and effects/impacts of flooding, coping strategies and identify gaps in the conventional literature in order to inform future research and practice. The present study focuses on Ghana. The selection process of primary articles was carried out based on Meta-Analysis (PRISMA) guideline [61]. The study selection process is described in Table 3. Mendeley was used to store citations of relevant articles from steps 1 to 4. The electronic searches generated 350 papers after searching academic databases: SCOPUS, Web of Science, and Google scholar search. In the second step, 114 papers were obtained after examining titles and keywords. After the abstract review, 43 papers were identified through an in-depth screening process. This is because the articles' title and keywords could not represent the content of the paper. Thirty-three (33) out of the 43 papers were found to be adequate for the study in step 4.

**Fig. 3** Frequency of research publications

3 Results

3.1 Overview of studies

Figure 2 shows Accra with 17 articles as the most active region. The second most active regions are Northern and Ashanti, with six and five articles, respectively. The analysis shows that there is an increased number of flood researches in Ghana, with the majority focusing on Greater Accra [20, 22, 31, 39, 62, 63]. This could be as a result of higher frequency of flooding in recent years. Another reason could be increased exposure, the susceptibility of Accra to flood hazards, leading to more flood events [64], and thus increasing research engagement. Results indicate that flood research has only recently been conducted in these themes: causes, effects/impacts and coping strategies, however, we expect more relevant research to exist, published outside of the academic databases.

Figure 3 presents the frequency of publications between 2009 and 2019 with a focus on causes, effects/impacts, and coping strategies. It shows increasing research in 2013 with 6 publications, respectively, followed by 2014, 2016 and 2019 with 4 publications each. Flood research has been around for some time; however, incorporating "causes, effects/impacts and coping strategies" into research gained momentum in 2013 and, since

Table 4 Frequency of research methods

Research methods	Number of publications
Field survey/interview	7
Review	5
Interview	5
Interview/FGD	4
Field survey/interview/observation	2
Field survey/interview/FGD	2
Field survey	2
Interview/mapping	2
Field survey/FGD	1
Household survey	1
Field survey/Interview/mapping	1
Review/interviews/observations	1
Field survey/mapping	1

then, a good number of research papers have constantly been published yearly. Table 4 shows the frequency and various research methods used in studies (Table 2). Field survey and interview ($n=6$) were the most popular forms of collecting data, followed by review ($n=5$), interviews ($n=4$) and interview/FGD ($n=3$).

Table 5 shows the content analysis of flood research for three main themes. The theme “causes” comprises of papers that discuss the underlying causes of urban flood. A total of 18 articles were identified and coded for patterns in data [65]. Eighteen studies reported poor urban planning and development as the causes of flood, for instance, [23, 29, 57, 66]. Next, 11 studies reported on poor drainage network, for instance, [27, 67, 68]. Similarly, ten studies attributed the cause of flood to indiscriminate disposal of waste materials, for instance, [23, 28, 68].

The theme “effects/impacts” includes those papers that discuss the underlying effects/impacts of urban flood. About seven studies mentioned that flood can cause damage to homes, destruction of livelihoods, collapse of houses, etc. [52, 69]. Five studies mentioned that floods have led to the destruction of economic infrastructure, property, public areas and the environment, thus putting enormous costs to the national government and individuals [66, 70]. For instance, it was revealed by [66] that residents spent GH¢ 100.00 and GH¢500 (\$45 and \$220) to repair and renovate their homes in the aftermath of the flood. Moreover, four studies indicated that flood can potentially increase the transmission of communicable diseases and mental health condition [46, 71, 72].

The results show three coping strategies used by residents, namely reactive, preventive and recovery, for instance, [53]. In terms of reactive, nine studies demonstrated that flood victims relocate to a safe place and

protect their valuables and collectables, for instance [7, 40]. Regarding the preventive measures, majority of the studies (8) mentioned that people construct drainage to make easy flow of stock water, for instance, [72, 73] and six mentioned that people repair, rebuild their house and protect from further damage, for instance, [73]. Finally, three studies mentioned flood victims seek Government, friends and family support for relief items and cash, for instance, [53] and five studies reported community clean-up such as disposal of wastes and clearing of gutters, for instance [53].

4 Discussion

4.1 Overview of causes of urban flood

Human activities increase the risks of flood due to human and ecological interaction. In Africa, urban flood has become one of the major threats to be dealt with in the face of poor socio-economic conditions [6]. For example, poor people tend to build houses and live in flood-prone areas as those areas are considered affordable. Moreover, the majority of them rely on government and other stakeholders for support when flood events strike [74]. In a similar study, 18.5% of inhabitants lived in flood-prone areas in the megacity of Dhaka [75]. Generally, in Ghana, flood occurs as a result of natural and anthropogenic factors. However, the most recurring causes are anthropogenic activities such as poor urban planning and development and inadequate drainage facility [22, 62, 66].

In urban areas, roads, pavements, and compacted soil areas have increased impermeable surfaces, thereby increasing surface water runoff. This has also led to the increase in discharge that overloads drainage channels [66]. Research demonstrated that poor planning is a major cause of the increasing urban flooding in Africa [76]. This has implication for real estate developers and homeowners to understand community and individual impact of flood and re-thinking of sustainable urban land use policy and development. Human activities such as throwing rubbish into river bodies can cause flood during the raining season [28, 46, 53]. Similarly, half of the residents dispose of waste into gutters, streets and bushes causing health problem [77]. This suggests that flood event may be more rampant due to improper waste disposal in urban areas. This has implications for the promotion of flood resilience through improved drainage and green infrastructural systems.

In other related studies, land use control is established as a contributor to flooding. For example, it was found that delays in permit approvals, lack of monitoring and inspections of physical developments, non-conformance with permit laws and regulations, and poor enforcement

Table 5 Content analysis in flood research for three main themes

Themes	Number of reported articles	Commonly used phrases
Causes		
Anthropogenic		
	18	<i>Poor urban planning and development:</i> haphazard housing development; delay in permit approval; poor urban planning; poor planning of the city; non-compliance with permit regulations; no planning guidance for informal settlement; uncontrolled conversion of vegetated land, poor coordination among state agencies in flood management; neglect of city authorities and official insensitivity to communities' problems; unregulated physical expansion; uncontrolled urbanisation and slum development; building on waterways; improper waste management, improper structural planning; poor waste management; destruction of the natural defence; sand mining for construction; land-use intensification and urban expansion; urban expansion; indiscriminate disposal of waste material; houses built in wetlands; loss of surrounding vegetation the proximity of buildings to floodplain and river
	11	<i>Poor and inadequate drainage facility:</i> poor drainage; poor or lack of storm drainage system; dam and diversion drains; lack of drain covers; spillage of dam; poor drainage system; poor drainage; drainage conditions; lack of drainage system
	10	<i>Poor environmental attitude:</i> dumping of refuse in gutters; improper refuse disposal; domestic waste in streams and drains; waste into the drainage system; indiscriminate disposal of waste materials; poor waste disposal; improper waste and refuse disposal
Natural		
	8	<i>Extreme rainfall:</i> heavy rainfall; heavy and unpredictable rainfall; overflow of river and lagoon; heavy rainfall; high rainfall events; unusual heavy rainfall events; prolonged and intense nature of rainfall; excess rainfall; intense rain; torrential rains; heavy rain; intense rainfall; landslides
Effects/impact/consequences		
	7	<i>Physical cost:</i> loss of household items; collapse of building; disruption and loss of services and businesses; loss of human and animal lives; destruction of livelihoods; collapse houses; loss of livestock; destroyed sources of livelihood, injuries; destruction of household properties; house developed cracks; damage and destruction of crops and farmlands; ripping of roof on mud houses
	5	<i>Economic cost:</i> asset losses; missed days of work and medical costs; housing repairs; labour income losses, inability to go to work; high cost of renovating homes; out migrate; loss of business; destruction of storm drains and community roads, bridges, schools and health facilities
	4	<i>Health implication:</i> cholera pandemic; outbreak of disease; drowning; personal injuries; outbreak of waterborne diseases; filthy and smelly environment; outbreak of cholera or dysentery; filth; bad stench, injured people; malaria outbreak; flood debris
	3	<i>Psychological effects:</i> psychological distress; social stigmatisation of resident; anxiety
	2	<i>Human cost:</i> deaths; loss of lives
	2	<i>Displacement of victims:</i> displaced residents; increased migration
	1	<i>Decrease economic activities:</i> close down of community health and educational facilities; community cut-off; inability of children to go to school
	1	<i>Ecological cost:</i> destruction of fertile top soil
Coping strategies		
Reactive strategies		
	9	<i>Relocation and protecting properties:</i> relocating to stay with friends; evacuation of victims and properties; early transfer of items to safe places; temporarily seeking refuge; transfer valuables to neighbours; relocating during floods; packing items on shelves and high levels; placing valuables on shelves; packing of assets to safe place; constructing platforms in the rooms to keep valuable properties; raising foundations; sandbags to block water flows; mounting beds on concrete blocks; elevate land before building, walls and entry points of the house; rebuild destroyed houses with cement; build flood steps; put stones at the edge of the river; filling their compounds with gravel; construction of barriers; re-roofing housing before the rains set in
Preventive strategies		

Table 5 (continued)

Themes	Number of reported articles	Commonly used phrases
Recovery strategies	8	<i>Construction of drains:</i> construction of temporal drains; construction of temporary drains; construction of storm drains; removal of constructions in waterways; redirecting flood water out of community; creating temporary channels; self-constructed channels: construction of new channels around the house; creating channels for storm water; removing blockade
	5	<i>Community clean-up:</i> proper disposal of wastes; clearing of gutters; community clean-up exercises; cleaning of choked local drains; organising spraying exercises; waste management; desilting of choked drains
	3	<i>Government, friends and family support:</i> relying on city authorities and other stakeholders for relief items; relying on media; friends, relatives, governmental and non-governmental organisation; extension information; personal savings to repair damages

were responsible for urban flood [29]. Tasantab [29] suggested early approval of permit as well as inspecting and monitoring of physical development to ensure compliance with planning requirements could be an important strategy to mitigating flooding events. Similarly, the land ownership system is an impediment to the successful management of wetlands by city authorities [57]. Owusu-Ansah et al. [73] mentioned that local chiefs take advantage of government administrative inefficiencies to sell out land designated for urban green, wetlands, riparian lands, and open space. It was observed that wetlands, riparian lands and urban vegetation are being cleared for built-up purposes [23]. The rate at which water flows into river channels depends particularly on the available vegetation cover. It is important to protect wetlands to hold some of the volume of water during heavy downpour. Flash flooding has increased in urban areas, particularly in Accra due to the increases in deforested land and urban sprawl. The government needs to enforce urban planning policy and make sure new homes are not be built within flood plains. Moreover, educational policy should target potential victims and community because a lot of people do not understand the value of wetlands [78]. Previous research indicated the value of an integrated approach comprising of active participation of all the relevant stakeholders, including, governments authorities, international and local and private sectors in resolving and addressing flooding problems [3]. It was revealed that torrential rainfall is not just the main cause of recent flood, but poor drainage system was actually the main cause of flood in the urban areas [23, 27]. It is important to strengthen the drainage system design at where wetlands are reclaimed for developmental purposes to help control flood.

4.2 Overview of effects/impacts of urban flood

In June 2015, Accra, the capital of Ghana, experienced an unprecedented flash flood event claiming at least 152 lives and caused around US\$100 million in asset losses [49]. As economic infrastructure such as electricity, bridges and roads are damaged, communities are cut-off and some economic activities become disrupted. This can increase community vulnerability economically and normal life comes to a standstill. Similarly, the impact of flood has led to the deterioration of people's health, including waterborne diseases, injuries and animal bites, especially among the poor people. This is due to the absence of infrastructure and effective polices to mitigate the effects [46]. In the aftermath of the flood in 2013, about 36% of the residents were very injured or lost their lives [66]. Dziwornu and Kugbey [71] discovered mental health problems among flood victims and therefore suggested that care must be taken to address the psychological needs of victims in the aftermath of flood disaster. For example, the loss of loved ones and properties can cause depression and stress among adults and children. The psychological impact can last for a long period of time when their psychological needs are not met quickly. People leaving in low lying areas are more likely to be affected by the flooding [47]. Due to rapid urbanisation, appropriate policy guidelines and intervention, supported by effective enforcement mechanism should be developed and implemented to abate flooding in the cities [79]. The impact of floods can be experienced by individuals and society, and have social, economic, and environmental consequences. Research demonstrated that floods damage properties, disrupt economic activities, lead to loss of income, emergency cost and changes in morphological process [80]. In the face of growing private interest of political parties and public service in Ghana,

flood issue should not be “politicised” but must be considered as an important national issue. Consequently, flood mitigation plans should be fully implemented and continually revised with broad consultation of relevant stakeholders.

4.3 Overview of coping strategies of flood disaster

Coping strategy is an important measure to assess a community ability to respond to a flood event. Residents or communities commonly adopt strategies to sustain their lives and restore their losses (Table 5). Whereas most of the studies mentioned preventive strategies as the common coping strategy, other studies identify some relevant reactive coping strategies. In previous research, local communities provide measures to deal with flood events [81]. For example, improving Green Infrastructure (GI) has the tendency to mitigate the adverse effects of climate change and urban flood as it increases the vegetation cover and protects urban drainage systems [82]. To better adapt to urban flooding and build resilience, it is important to allow local actions to prevail as local people are able to address a problem in their own community. Additionally, research has demonstrated myriad options in managing urban flood risk, essential for effective urban flood management. For example the development of low impact development (LID) techniques [83, 84], resilient housing [85] and the use of floodplain and wetland green infrastructure [15] for flood risk reduction. It is worth mentioning that some of the coping strategies are costly and sometimes ineffective [53]. There is the need to integrate and engage indigenous coping strategies into flood planning process and recovery as well as socially vulnerable populations in addressing flood issues in the country.

5 Conclusion and future research directions

The overarching objective was to explore the current state of flood research, focusing on the causes, effects/impacts, coping strategies of urban flooding and identify literature gaps to inform future research and practice. The analysis showed an increased attention on the subject among scholars over the last decade, with the majority focusing on the Greater Accra Region in Ghana. Despite the increasing number of flood research in Ghana, “causes, effects/impacts and coping strategies” started gaining momentum in 2013 and, since then, a good number of peer-reviewed articles have been published yearly. Generally, the majority of the studies attribute the causes of flood to poor urban planning and development and this has resulted in the destruction of homes, properties, livelihoods, and left many people homeless. Residents or

communities commonly adopt strategies to sustain themselves and restore their losses.

Based on the findings of the review, it is important to continuously create awareness of the consequences of flooding, promote education on better house building techniques, proper waste management, provide affordable houses which will move people out from high risk zones, stricter enforcement against building in flood-prone areas, communicate risks, construct drainage and green infrastructural systems in all risk areas. Further, provide up to date weather forecast and early warning system during peak rain season because floods are more devastating when they occur without warning. Although the results of the present study make profound contribution to flood scholarship and the planning process in Ghana, a number of gaps remain in the conventional flood literature. The ensuing section identifies the gaps and suggest the possible ways forward.

- Although some studies demonstrated that hydrological factors, particularly torrential rainfall as the major cause of flood in Ghana, limited studies have been conducted on designing flood estimation, flood frequency, flow direction and accumulation that are essential for flood risk management. Thus, there is the need to conduct hydrological modelling research to help control flood.
- Most studies relied on field survey and interview to explore the causes and effects/impacts and coping strategies [29, 39]. Although these designs have significantly contributed to our understanding of the subject matter, they are limited in terms of providing the data that are required to develop models to predict flood risk in the community. For example, due to changing flood event patterns, future studies should explore changes in flood risk to adjust flood risk maps for a better picture of flood hazards [86, 87].
- There is a need for more research that establishes the role of stakeholders before, during and after a flood event. The factors that promote and inhibit the effective participation of stakeholders in flood reduction and mitigation should also be examined [88]. There is also a need for more research that examines how and what flood information get to people leaving in flood-prone areas [63]. Such knowledge would improve our understanding of what communication and information modes are most effective.
- There is the need to conduct research on evacuation strategies during flood events as well as assessing the capacity for flood monitoring and early warning in Ghana.
- There is a need to further examine the factors that influence local communities in coping with flood events [39, 46].

- Research indicated that new flood risks are emerging [47]; nevertheless, additional research needs to focus on flood vulnerability and interventions that are adaptable to the communities [21].
- Few comprehensive epidemiologic studies have been conducted to assess the health implication of flood [46, 72]. It is also important to conduct research on environmental impact of flooding [71].
- Lastly, there is limited focus on gender-based adaptation and vulnerability to flooding. This knowledge will increase our understanding of how men and women cope and adapt to urban flood as well as the possible intervention that are likely to benefit them.

This study has a few limitations that are worth mentioning. First, despite the search procedure employed for the study, it is possible that some relevant studies on “causes, effects/impacts and coping strategies” were omitted. However, the study contributes to scholarship and practice by providing a current state of flood research in Ghana, with a focus on the causes, effects/impacts and coping strategies of urban flooding and identifies gaps in the conventional literature. The findings of the study will inform future research and practice and enhance communities’ resilience in future flood event in Ghana.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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