# COMMUNITY'S RESPONSES TO FLOODS: CASE STUDY OF THORNWOOD TOWNSHIP IN MARIANNHILL, KWAZULU-NATAL, SOUTH AFRICA.

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**This thesis is submitted in fulfilment of the**

**Master of social sciences(MSS) in Sociology**

**In school of social sciences,**

**Collage of Humanities,**

**University of KwaZulu-Natal**

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**Date: November 2024**

## DECLARATION

I, Nteboheleng Annastarsia Taunyane, student number 218055520, hereby declare that this dissertation is my own work , except where states otherwise by reference or acknowledgement. Again, this work has not been submitted for any other degree or professional qualification.

It is hereof submitted to fulfil the requirements for the degree of Master of social science in sociology at the University of KwaZulu-Natal.

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## ACKNOWLEDGEMENTS

First and Foremost, I would like to praise and thank the Almight God, who has given me wisdom and strength to accomplish this dissertation.

I’m so grateful to my supervisor Prof Joseph Rudigi Rukema, for his guidance, support, advice, ecouragement and insighful feedback throught this dissertation.

I would like to express my gratitute to my family. Mom and Dad, thank you guys for everything, your love, care, support, and motivation.

Words cannot express my gratitude to my husband, for being there for me all the step of the way. I appreciate him so much.

I’m so grateful to my mother in-law, for her love and support.

I would like to acknowledge, Bishop P.L Hoffman, for his prayers and motivation.

A very big shout-out to all my siblings. I appreaciate you guys.

Lastly, I would like to thank all my research participants, for taking part in my study.

## ABSTRACT

The overall aim of this study is to explore and examine the community's response to floods in the Thornwood area. Particular focus was paid to the flood that occurred in 2022 in Thornwood township in the province of KwaZulu-Natal. This study adopted a qualitative method. In order to achieve its objectives, this study used both in-depth semi-structured interviews and focus group discussions. 13 participants were selected and interviewed for the in-depth semi-structured interviews, and 4 groups were interviewed, whereby each group comprised of 5 participants each. In total, there were 33 participants selected and interviewed for both the in-depth semi-structured interview and focus group discussions. The findings revealed that floods affected the community of Thornwood township severely. The findings also indicated that there were many serious challenges posed by floods in the study area. In addition, this study also found that the community in the study area used different coping strategies, whereby most participants indicated that those strategies were helpful. However, it was also discovered that the same coping strategies also had some limitations and disadvantages. This implies that even though these strategies were so helpful to a certain extent, but on the other side of the coin, this community was still vulnerable and unable to resist the flood effects. Furthermore, the findings again revealed that this community did not receive any external support, specifically, from the government.



**Keywords**: floods, Livelihood, coping strategies, effectiveness, Thornwood, MariannHill, KwaZulu-Natal, South Africa

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**LIST OF ACRONYMS**

| | |
|---|---|
| CARE | Cooperate for Assistance Relief Everywhere |
| COL | Cut-off Low |
| DFID | Department of International Development |
| FAO | Food and Agriculture Organization |
| IISD | International Institute for Sustainable Development |
| ITCZ | International Convergence Zone's |
| KZN | KwaZulu-Natal |
| SEI-B | Stockholm Environment Institute- Boston Centre |
| SLA | Sustainable Livelihoods Approach |
| SODC | Swiss Organization for Development and Cooperation |
| SWB | Subjective Well-being |
| UNDP | United Nation's Development program |
| WCU | World Conservation Union |
| WFP | Word Food Program |

# CHAPTER 1

## GENERAL INTRODUCTION

The issue of Flooding has been a world crisis and is still a public issue that continues to affect most people from all walks of life. Despite the suggestions and recommendations made by previous studies and even interventions made by governments, the issue of floods is still unresolved. According to Olanrewayu and Reddy (2022) globally, flood is regarded as one of the underlying causes of natural disasters causing disastrous and devastating damage. Braimah, Rahaman, Sekyere, Momori, Mohammed, and Dordah (2014) argue that over the last decades, African continent has increasingly witnessed more severe flooding, where more than one million people were affected in over 20 countries and approximately 500 lives were lost.

Furthermore, Thanyani and Mashupje (2022) questions the application of disaster management in most developing countries in Southern Africa, due to the continuous distraction, damage, displacement and loss of lives due to natural disasters, such as floods. Every year countries like Mozambique, Malawi and South Africa, continue to experience the severe floods, (Thanyani and Mashupje, 2022). In South Africa the climate change has increased the intensity of extreme precipitation events, such as those that resulted in the 2022 Durban floods (Ziervogel, Lennard, Midgly, New, Simpson, and Trisos ,2022). Ziervogel et al (2022) argue that this accelerated warming has caused water shortages and even worse reduced economic growth in South Africa. After the April 2022 deadly floods which severely affected the whole province of KwaZulu-Natal, led to people's death, displacement and infrastructure damage. Therefore, the researcher of this study saw the need to conduct this research.

This study also emerged out of understanding that the issue of natural disasters, such as flooding, has become a serious issue globally. This study seeks to explore and examine the community's response to floods that occurred in 2022. The researcher of this study has a strong believe that there is a need, and it is necessary to study and explore this research area of floods further, as it continues to be a crisis globally. Therefore, the researcher in this study saw the need to conduct the research on this issue of flooding.

## 1.1Background of the study

Floods have been identified as one of dangerous natural disasters, affecting the whole world. According to Angelakis, Antoniou, Voudouris, Kazakis, Dlezios, and Derca (2020), weather events such as floods and droughts have been regarded as the worst disasters in history of humankind. Braimah et al (2014), argues that the devastating effects of floods globally, has led to scholars, such as historians, hydrologists, and geologists to studying the role of floods on humanity and supporting ecosystems, they all agreed that the impacts of floods are devastating. Kundzewick, (2004) study, reveals that approximately more than 12,700 people globally had been killed by floods and 60 million others had been affected. In addition, 3,2 million people were left without homes. Bouchard, Pretorius, and Kramers-Olen (2022) add that in, 2021, due to floods, about 4,143 deaths had been reported, America stood at (43,2%), Europe(2,9%) , Asia (48,7%) Oceania(0,1%) and Africa (5,1%).

South Africa is not immune from devastating effects of climate change and flood in particular. Between 1980 and 2011, South Africa experienced about 77 flood disastrous events, which killed about 1068 people and caused damages estimated at approximately 1,1 billion American Dollar USD (Zuma, Luyt, Chirenda, and Tandlich 2012). According to Climate analysis Group (2018), South Africa is vulnerable to natural disasters, such as floods, storms and droughts. Mashao, Mothapo, Munyai, Letsoalo, Mbokodo, Muothe, Motsane, and Chikoore (2023) argue that in 2019, South Africa experienced severe floods in the east coastal area, which killed 85 people and led to loss of livelihoods. Recently South Africa has experienced extreme weather and climate events, including, heavy rainfall, droughts and extreme temperature, causing water restrictions, especially in urban agricultural sector.

Munyai, Chikoore, Musyoki, Chakwizira, Muofhe, Xulu, and Manyanya (2021) argue that the Eastern cape, KwaZulu-Natal, North-west and Limpopo provinces are the most vulnerable provinces to floods in South Africa because they are largely rural. The two South African provinces that witnessed these devastating floods which occurred in April 2022, were the province of Eastern cape and KwaZulu-Natal, (Ngcamu,2022). Madzivhadila (2022) argues that South Africa recently has witnessed one of the most serious flooding disasters, which resulted in death of more than 400 people.

In 2022, the extreme rainfall affected the entire east coast of South Africa, and led to destruction of more than 4000 households, electricity power lines , road infrastructure and killed about 448 people, (Mashao et al,2023) .Ngcamu (2022) adds that these extreme floods which affected the province of Kwazulu-Natal, left thousands of people homeless and having to live in shelters, damaged property estimated at R 17 billion and killed hundreds of people. The Mariannhill area is one of the KwaZulu-Natal areas that were severely affected by those floods of April 2022, and this area is also amongst the statistics of this province, as houses in this area were damaged by the heavy rains which led to flooding. Mariannhill is a cluster of suburbs and townships in eThekwini Municipality in Kwazulu-Natal, South Africa. Thornwood township, which is the study area of this study, falls under this cluster, and was mainly selected because it was one of Mariannhill townships severely affected during the floods that occurred in 2022.

Due to the severe impacts of these floods, prompted South African government responses and declared floods as a national disaster, (Mashao et al ,2023).Similarly, Aiseng and Gamede (2023) argue that KwaZulu-Natal flood disaster that occurred in 2022, destroyed and shattered many communities and left them without clean water, food , health care and psychological first aid, therefore this disaster was declared as a nation state of disaster by the South African president Cyril Ramaphosa. Government response is an indication that flood is a serious threat to South African society. In 2011, South African government crafted the national climate change response white paper as a way of acknowledging the threat of climate change (Ngcamu,2022).

In addition to the government guidelines to the flood many communities still use indigenous techniques to deal and recover from disasters such as floods, (Auliagisni, Wilkinson, and Elkharboutly,2022). According to Ziervogel et al (2022), Communities and smallholder farmers in South Africa still use indigenous and their local knowledge for predicting the short-term weather and climate forecasting and it has helped them in terms of implementing the anticipatory adaptation responses. In terms of effective interpretation of local based weather and climate forecasting, the use of African indigenous languages played a significant role, (Ziervogel et al,2022).

The study conducted by Ringo, Luvinga, Morsardi, Omary, Mayengo, and Kawonga (2016) reveals that the main indigenous techniques used by the local communities to cope and recover from floods, were steep slope controlling techniques (which includes, Contours and terraces),

planting of native vegetation( such as ,reeds and bamboos) and run, swim and climb on the tress and roofs of the house to escape from unsafe places .Against the backdrop of the above, this study explore and examines communities and government responses to floods in Thornwood township and how such combined efforts may have helped community recover from the effects of flood.

### 1.1.1 Background of Mariann-Hill

According to Cross (1992) the Mariannhill Monastery's founding in the preceding century is when the Mariannhill neighborhood got its start. The Mariannhill Fathers acquired two farms as part of their missionary work: Klaarwater, which contained the communities of St. Wendolins, Klaarwater, Link, and others, and Zeekoegat, which included what is now Thornwood, Mpola, and Tshelimnyama, (Cross,1992). Only those who were baptized into the Catholic religion were permitted to live on these properties. The same study argues that early in the 20th century, a town plan was made for St. Wendolins, which was established as a model Christian community. Plots of land were offered for sale, usually for £10 to £20, and title deeds to the land were given to about 80 families.

Furthermore, according to Indicator SA (1991) inadequate service delivery is present in the Mariann-hill area and other informal communities outside the DFR. Compared to Pinetown, even Klaarwater, a designated black township outside the municipal limits, is noticeably less developed. Essential services are still mostly absent from the unofficial zones, (Indicator SA,1991).

### 1.1.2 Climate in KwaZulu-Natal province

According to Dlamini, Nhleko, and Ubisi (2024) in South Africa's KwaZulu-Natal (KZN) province, the city of eThekwini is among the regions hardest hit by flooding, which has had disastrous effects on many of its enormous informal communities. Because of its high stream density and primarily undulating topography, KwaZulu-Natal (KZN) poses unique problems for the development of informal communities, (Dlamini et al, 2024). The Elands, Drakensberg, Umbilo, Umngeni, Amanzimtoti, Molteno, Elliot, Mzimkhulu, Mkhomazana, Umkomaas, Nhlathimbe, Nzinga, Mooi, Bushmans, Tugela, Klip, Beaufort, Busi, Blood, Mkuze, Pongola, Mfolozi and Mhlathuze rivers and Pholela are some of the province’s rivers.

Ndlovu, Clulow, Savage, Nhamo, Magidi, and Mabhaudhi (2021) argue that monthly, seasonal, and annual rainfall in the KwaZulu-Natal (KZN) province varies significantly across its several

climate zones. Rainfall patterns vary by location, with more inland areas receiving the least amount of mean annual rainfall and the Midlands and coastal regions receiving the highest. Because of the large variation in both intra-seasonal and inter-seasonal rainfall, particularly in regions, inland locations are more susceptible to dry spells during the autumn-winter months than coastal regions, particularly during the climatically drier times, (Ndlovu et al,2021).

However, the same study also add that inland locations are more susceptible to flash floods, heavy rainfall, and rainy spells in the spring and summer, while coastal regions see more consistent rainfall throughout the year. Because flood lines usually align with river and stream floodplains, it is prohibited and dangerous to live in regions that have been classified as flood lines. Informal communities have been formed in the eThekwini Municipality on low-lying slopes, including Prospecton, Isipingo, Sibongile, Ntuzuma, and uMlazi, among other places, (Dlamini et al 2024). Furthermore, the same study argues that some informal settlements are located near the coast, putting their occupants at risk from high tides and rising sea levels. In line with such concerns, Thornwood township, which is the study area, is also not immune to such climate conditions affecting the province of KwaZulu-Natal

### 1.1.3 Socio-economic and environmental conditions of townships in South Africa

Motloung (2024) argue that in South Africa, it is the duty of local governments to provide their communities with essential services and to make sure that living conditions are safe and healthy. However, the safety of these communities is at risk because many townships are situated in flood-prone locations, (Motloung,2024). Similarly, Nkonki-Mandleni, Omotayo, Ighodaro, and Agbola (2021) add that human rights are still being seriously and widely violated by the living circumstances in informal settlements all throughout the African continent. The same study argues that these towns are characterized by poor healthcare and environmental systems, insufficient government supervision and intervention, and subpar housing structures. They are also distinguished by high crime rates, high risk factors, inadequate security, and overpopulation.

In addition, Dlamini et al (2024) argue that the areas most impacted were townships and informal communities, which are usually found in areas left undeveloped by urban development, on steep slopes, beside rivers, or in other susceptible areas. Motloung (2024) argues that the township inhabitants are therefore extremely susceptible to flood hazards, which are impacted by elements including the settlements' geographic position and pre-existing

conditions prior to the calamities. These residents are vulnerable due to a variety of variables, including social networks, cultural traditions, political situations, and economic status, (Motloung, 2024).

Moghayedi, Mehmood, Michell, and Ekpo (2023) argues that the main housing issues in South African townships are violence, poor design, poor direction, and families' increased susceptibility to man-made and natural calamities. The absence of conventional home designs is largely to blame for these problems, which include inadequate natural ventilation, limited natural light, and the absence of open areas, (Moghayedi et al,2023). The same study argues that resilience and functionality of homes are compromised by this lack of consistency, which has serious detrimental effects on residents' general health and well-being.

In South Africa, townships are a glaring example of both economic and spatial inequality. Townships, which are located outside of well-established urban economies, are characterized by a large concentration of unofficial business activity and underdevelopment, (Rakabe,2016). The same study argues that despite offering economic prospects, these unofficial businesses can make underdevelopment worse because of their low productivity and lack of legal market integration. It's crucial to remember, meanwhile, that informal activity in townships vary widely. The study conducted by Motloung (2024) examined the methods used by local governments to control the risks of disasters while keeping in mind the geographical difficulties that South African townships face. In line with such concerns, this research has focused on Thornwood township, which is also one of townships in South Africa experiencing the same conditions.

**1.2Statement of problem**

Floods remain a global crisis, affecting both developing and developed countries. According to Angelakis et al (2020), the disastrous events caused by floods are affecting both developing and developed countries globally. According to the same study, the disastrous events of floods have been a serious threat globally, since prehistoric times (Angelakis et al ,2020). Moreover, Angelakis et al (2020), reveals that 80% of total outage events that took place in 2003 to 2012 were due to severe natural disastrous events. Recent study by Bouchard et al (2022), demonstrated that the Province of KwaZulu-Natal in South Africa had experienced severe and life-threatening floods in April 2022.

According to the same study, these extreme floods events caused chaos in the whole province and were regarded as one of the worst weather storms in history of South Africa. Several thousand homes, infrastructure, such as roads, bridges were severely damaged, approximately 435 people were killed, with several people still uncounted for (Bouchard et al ,2022). Angelakis et al (2020), argue that historically both urban and rural areas that were affected by extreme disastrous events of floods, experienced havoc and chaos. According to the same study, floods can cause chaos to the entire ecosystems by destroying economics and by changing the geography of the planet, in some instances even changing it completely (Angelakis et al ,2020).

Bubeck et al (2017), argue that floods have a long-term indirect effect on victims and communities. Victims are affected psychologically due to losing their loved ones, personal belongings and property, and some even lose everything they had, even their homes. Recent study by Bouchard et al (2022), points that the heavy rainfall that took place around April 2022 and early May, have caused floods globally in every continent, except for Antarctica.

For this study, particular focus is directed to the April 2022 floods in the province of KwaZulu-Natal, specifically in one of Mariannhill township/suburb (Thornwood). Flooding has wreaked havoc across many parts of KwaZulu-Natal province recently and Mariannhill townships. The April 2022 flooding has been a serious threat in the study area. This study seeks to explore the devastating effects of April 2022 floods on the socio-economic Livelihoods of people and strategies used by ordinary members of the community to cope and recover from the effects of flood. Government interventions and effectiveness is interrogated. Combined community's and government responses are interrogated and how such effort help or hinders community cope and recover from the effects of flood.

### 1.3 Research objectives and research questions

The overall aim of this study is to explore and examine the community's response to floods. Particular focus is paid to the flood that occurred in 2022 in the province of Kwazulu-Natal.

#### 1.3.1 Research objectives

- To explore the extent and the impacts of floods on the community of Thornwood in 2022.
- To explore community's responses to cope and recover from flood that occurred in 2022.

- To examine the effectiveness of strategies used by the community to flood.
- To explore government responses and how such response has assisted or hindered community cope and recover from floods of 2022.
- To suggest ways through which communities can be empowered to deal with floods when they occur.

### 1.3.2 Research questions

In line with the research objectives of this study, the following are the research questions that will guide this study:

-To what extent did floods affect the Thornwood community in 2022?
- How did the community cope and recover from the flood that occurred in 2022?
- How effective were the strategies used by the community during floods?
- How did the government respond to the flood and how these responses assisted or hindered community cope and recover from floods of 2022?
- How can communities be empowered to be able to deal with floods when they occur?

## 1.4 Thesis Structure

This thesis consists of seven chapters.

**The first chapter**

This chapter introduced the focus of current theses, by giving a brief background about the effects of floods, outlines the research problem, and outlines the overall aims of this study, research objectives and questions to be answered by this study.

**The second chapter**

This chapter reviews the relevant existing literature on the issue of floods in South African and globally. The literature that this current study reviewed shows that numerous scholars all point that the issue of flooding has become a global crisis affecting both the developing and developed countries. To present a brief understanding on this issue of flooding, several themes are discussed in this chapter, such as: nature of floods, its effects, types of floods, floods worldwide, floods in South Africa, Floods in both the developing and developed countries, urban flooding and flood management.

**Third Chapter**

This chapter provides the theoretical framework that was adopted in this current study, which is the Sustainable Livelihoods Approach. The chapter employed this framework because its perspectives best align with the aims, research objectives and questions of this study. This chapter establishes an overview of this framework by discussing its main aspects, such as its

nature and background, the vulnerability context in urban areas, livelihoods assets, structure/policies and livelihoods strategies.

**Fourth chapter**

This chapter outlines the research methods and methodology used in this current study, which is the qualitative research method. Firstly, the chapter started by giving a description of the study area which is Thornwood township. Secondly, it went on by unpacking methods and instruments used to collect data in this study, such as interpretive research paradigm, sampling (Purposive sampling method), data collection instruments (semi-structured interviews and FGD) and data analyses. Lastly the chapter also highlights the trustworthiness of the study and ethical considerations.

**Fifth chapter**

This chapter presents the empirical findings of the current study. This chapter unpacks these empirical findings in the form of themes and sub-themes. The main themes created in this study are divided into 3 sections. The first section is whereby the researcher is exploring and examining the effects and challenges posed by floods in Thornwood township. Under this theme, numerous sub-themes were created (such as, property loss, loss of infrastructure, loss of livestock, financial effects, health issues, psychological effects, hunger, water shortages and disruption of electricity). The second section is investigating the coping mechanisms/strategies used by the people of Thornwood community and assessing their effectiveness. Under this theme, several sub-themes were also created (such as, opening ditches, not sleeping, running away, using blankets to stop water and asking for help from the neighbors. In the last section, the researcher interrogates the government responses and effectiveness in helping Thornwood community.

**Chapter six**

This chapter provides brief and in-depth discussions and analysis of the empirical findings that were presented in previous chapter(chapter 5). In this chapter, the same key findings presented are unpacked and linked to the existing relevant literature.

**Chapter seven**

This chapter serves as the last chapter of this current thesis. This chapter began by providing a summary of the entire thesis. The chapter went on to highlight some of the limitations of this study and then went on to provide some of the recommendations based on the main findings and conclusions derived from this current study. These recommendations were also drawn from the interesting suggestions made by some of the study participants in the study area (Thornwood township).

# CHAPTER 2

# LITERATURE REVIEW

## 2.0 Introduction

The overall aim of this study is to explore and examine the community's response to floods. Particular focus is paid to the flood that occurred in 2022. In order to achieve its objectives, the study will begin by interrogating the extent to which flood affected community in Thornwood, strategies used by the community, effectiveness of such responses and how such responses might have supplemented by government intervention and how such collaboration may have affected the community responses. This chapter outlines, the nature of floods, the effects of floods, the causes of floods, types of flooding, overview of floods worldwide, overview of floods in South Africa, overview of floods in both developing and developed countries, Urban flooding, disaster management and prevention and gaps in literature.

## 2.1 Nature of Floods

According to Doswell (2003) flooding can take place anywhere. Doswell (2003) asserted that "the origins of flooding, ultimately lie in atmospheric processes creating precipitation, no matter what specific event causes the flooding". Braimah et al (2014) defines flooding as a "natural hydrological cycle of the earth and main factor that led to floods". The overflow of water from a body of water that submerges the nearby land is referred to as flooding, (Week and Wizor,2020). The same study argues that water spills into the floodplain when the banks of a river or other body of water are breached, frequently posing serious hazards to civilization and causing substantial damage and fatalities.

It is a severe weather phenomenon that can happen in both rural and highly developed regions. Similarly, Randa (2022) also argues that both rural and urban areas experience flooding, but it manifests differently in urban settings due to the built environment and growing population, which also serves as the main driver of natural changes in rainfall duration and intensity. Unplanned communities that lack legal authority for settlement and housing plans and do not follow current housing laws and regulations are known as informal settlements, (Randa ,2022). The same study argues that inadequate physical infrastructure and restricted access to social services are common characteristics of these areas.

Billi, Alemu, and Ciampalini (2015) add that in the rocky highlands, heavy rainfall can quickly create water surges that can turn arid riverbeds or floodplains into strong torrents in a matter of minutes. As a result, when such floods pass through or close to infrastructure and populated areas, their effects are very severe and destructive, (Billi et al,2015). In addition, Yang and Liu (2020) categorize natural disasters into six groups as follows: Biological, geophysical, meteorological, hydrological climatological and extraterrestrial. The same study argues that floods fall under the category of hydrological group, and the same group is also divided into three disaster subtypes, such as (river) floods, flash floods and storm surges or coastal floods, (Yang and Liu, 2020).

Flooding has been regarded as one of the dangerous types of natural disasters that remains a serious threat to human society and the environment. Mensah (2020) argues that flooding has been regarded as one of the most serious natural hazards confronting the whole world. Due to its harsh effects, such as its social, economic and environmental impact, flooding has posed a threat in many parts of the world, (Mensah,2020). Paterson, Wright, and Harries (2018) also argue that floods are the type of natural hazard that occurs more often and have serious widespread health and social impacts. According to Stamos, Boufidis, Jose, and Andreadakis (2020), globally, flash floods are regarded as the most dangerous natural disaster that induce significant losses every year. Janizaden, Kim, Jun, Bateni, Pandey, and Mishra (2024) also refer to the floods as one of the serious and dangerous natural hazards that cause environmental and human fatalities.

Similarly, Paterson et al (2018) argue that the floodwaters pose a serious threat to human health, together with its long-term effects, because of human displacement and unfavorable living conditions. Burn and Whitfied (2016) argue that the flood regime may vary as a result of changes in land, use patterns and the intensifying effects of climate change. In addition, Bola, Gode, Tshimanga, Mark, Trigg, Hawker, Bates (2022) argue that climate or environmental changes can have an impact on catchment-scale hydrological processes, changing the dangers associated with water that could endanger infrastructure, agricultural systems, and human life. In this regard, knowing when floods occur is essential for a number of practical reasons., (Bola et al,2022). According to Burton, Rabito, Danielson, Tim, and Takaro (2016) the pace of water flow, the size of the impacted area, the depth of the flood, and the efficiency of early warning systems are some of the variables that affect how severe a flood is.

According to Markantonis, Farinosi, Dondeynaz, Ameztoy, Pastori, Marletta, Ali, and Moreno (2018) droughts and floods are examples of extreme weather disasters that significantly impede the development of the world's poorest nations. The same study argue that they cause fatalities, damage to homes and other vulnerable rural infrastructure, capital resource depletion, and declines in industrial and agricultural productivity. In addition, Anthonj, Nkongolo, Schmitz, Johannes, Hango, and Kistemann (2015) argue that floods are a crisis situation for all affected populations, but they are especially dangerous for communities' most vulnerable members, such as women, children, orphans, and those with long-term illnesses like HIV/AIDS. The livelihoods of impoverished rural populations are at risk due to the combined consequences on the economy, society, and physical infrastructure, (Parvin, Shimi, Shaw, and Biswas (2016). The same study argues that these groups constantly struggle to manage these effects while attempting to maintain their standard of living. Their vulnerability may worsen as a result of weak coping mechanisms in certain situations.

Furthermore, Nkwunonwo, Whitworth, and Bailyc (2020) argue that, when floods take place, the dry land areas get covered by water, which then cause a serious damage to critical infrastructure, farmland, lead to displacement of people. In addition, the same study, reveals that floods disrupt economic activities and even worse can lead to epidemic and death. According to Li, Chai1, Yang, and Li1 (2016) the regularity of flood events aligns with yearly changes in rainfall, suggesting a considerable influence on the timing of floods across different African areas. Typically, August experiences the greatest number of floods, with the rest of the year showing a more uniform distribution, (Li et al ,2016). The same study argues that Floods predominantly occur between August and October across northern and eastern Africa, primarily situated within the Nile basin. Williams, Costa, Celliers, and Sutherland (2018) also add that strengthening local governance in water management is critically needed, as evidenced by changes in the distribution of the human population and the effects of climate change, especially changes in precipitation patterns that cause more flooding in coastal areas.

Furthermore, Jonkman, Curran, and Bouwer (2024) argue that when compared to other natural hazards, floods occur more frequently with one or more fatalities than other disasters. Additionally, Nyarko (2024) argues that natural disasters, such as earthquakes and floods often affect international trade and economic activity seriously. Moreover, Kunze and Strobl (2024) argues that when the environment is friendly it can have positive impact such as prosperity and

growth. While on the other side of the coin, when the environment is hostile with natural catastrophes, then it can have negative impact such as stagnation, collapse and even worse can lead to death, (Kunze and Strobl,2024).

As demonstrated in Akademia and Slovakia (2015) study that because different countries often experience different types of floods, therefore they use different strategies of dealing with floods. For example, there are countries in flat flood-plain-like features, some are in temperate and moon-like climates, while some have mountainous, (Akademia and Slovakia,2015). According to the same study, countries like but not limited to Japan, China, United Kingdom, United States of America, and Vietnam, have mountainous areas, therefore they often experience the flash floods which occur after heavy rains (Akademia and Slovakia,2015). In particular, flash floods can happen in almost any place with steep topography, although they are most common in mountainous areas that frequently see strong thunderstorms, (Legese and Gumi,2020). According to Letsatsi and Kruger (2022) hilly places and landslides are more prone to flooding events, especially if soil is not stabilized.

Furthermore, Weldegebriel and Amphune (2017) argue that it is commonly known that environmental risks frequently affect people's quality of life everywhere. However, because people and nations differ in their degrees of development, which greatly affects their ability to respond to certain disasters, the effects of these dangers are not universal, (Weldegebriel and Amphune, 2017). According to Buttle, Allen, Caissie, Davison Hayashi, Peters, Pomeroy, Simonovic, St-Hilaire, and Whitfield (2016) seasonal snowfall covers a large percentage of Canada, and in certain regions, snowmelt-induced floods are common, often exacerbated by rain-on-snow conditions. Large drainage basins, where runoff from the entire basin may contribute to the water flow at the exit, are usually where these floods are most severe, (Buttle et al, 2016).

In addition, Ndlovu et al (2021) argue that KwaZulu-Natal rainfall in the coastal areas is different from the Inland areas. According to Ndlovu et al (2021) the areas that have the highest mean annual rainfall are the coastal areas, in the second place followed by the Midlands and then the Inland areas with the lowest mean annual rainfall. The same study adds that the Inland areas compared to coastal regions have more frequent torrential downpours, flash flooding and wet spells, specifically during the spring-summer months. Buttle et al (2016) also add that

during the summer, when air convection is more common, flash floods which are caused by intense rainfall occur most frequently. Additionally, Li et al (2016) also argue that the yearly cycles of flood catastrophes are closely linked to the patterns of rainfall, with the most frequent occurrences happening between December and March. In the western part of Africa, the southern area is characterized by a tropical rainforest climate, whereas the northern region is marked by a tropical steppe climate, (Li et al, 2016). The same study argues that, in both locales, the wet season coincides with the warmest month of the year. Furthermore, Billi et al (2015) add that about 80% of Ethiopia's yearly precipitation falls in the form of heavy downpours during the four-month rainy season, which runs from mid-June to mid-October. The same study argues that due to its topography and climate, the nation is especially vulnerable to extreme flooding, which can cause a great deal of damage, fatalities, and harm to livelihoods, infrastructure, services, healthcare systems, and economic assets.

According to Li et al (2016) there are no such occurrences of the usual two highest floods levels (in April and October) in August, thanks to the distinct rainy seasons in East Africa. These seasons span from March to May and September to November, respectively. However, the highest flood levels are seen in April in countries such as Burundi, Djibouti, and Rwanda, whereas in Kenya, the flood levels reach their zenith in both April and October, (Li et al 2016).

Njogu argues that there is estimation that if the larger parts of the area are more affected, then it means that even their critical infrastructure will be more affected, causing huge disruption of their infrastructure services, causing an increase in the costs of operational and maintenance. According to Njogu (2021) the transport sector is the most vulnerable sector to natural hazards, like floods, therefore, the type of the road serves as a determine on the quality of the road and its durability on the effects on these weather events. Furthermore, According to Brigadier, Ogwang, Ongoma, Ngonga, and Nyasa (2016) the Atlantic and Indian Oceans are the nation's main sources of moisture. The same study argues that Low-level convergence of moisture from both the Atlantic and Indian Oceans resulted from the conflict between the dominant westerly winds in the lower atmosphere during this time and the usual easterly flow.

### 2.2 Effects of Floods

According to Abuzoeme (2015), both developing and developed countries are experiencing the devastating effects of floods, which are characterized by losses of lives and properties, misery, hardships, diseases. Similarly, According to Legese and Gumi (2020) different flood kinds can have different effects, costs, and damages on the impacted areas as well as on the economy.

Hooli (2016) argues that although more people have been hurt in urban areas, rural communities have suffered more severely from the effects on livelihoods. For example, agricultural fields and livestock grazing grounds have been wiped away by flooding, (Hooli,2016). Additionally, Umar and Gray (2023) add that both individuals and society as a whole suffer from the effects of flooding, which can take many different forms. These include the loss of infrastructure and property, harm to agricultural land, the eviction of aquatic animals that could present new hazards, contaminated drinking water, and the spread of waterborne illnesses, (Umar and Gray,2023).

According to Burn and Whitfied (2016) Flooding damages can include fatalities, destruction of property, infrastructural damage, interruptions to the economy and society as a result of evacuations, and environmental degradation. In addition, Pierre (2015) also argues that the floods were claimed to have caused 56 deaths and more than 100 injuries. About 34,000 dwellings were completely destroyed, while another 200,000 were damaged. These floods had significant socioeconomic repercussions, especially in rural and disadvantaged areas in the country's northwest and central-northern regions, (Pierre,2015). The same study argues that these places' populations are especially vulnerable to crop losses and infrastructure destruction, which will probably take longer for them to recover.

In addition, Emem and Owojori (2023) argue that many factors that lead to crisis circumstances, especially in urban settings, interact to create the risk of flooding. Therefore, developing strategies to enhance the resilience of vulnerable groups in informal settlements requires teamwork, (Emem and Owojori,2023). The same study argue that many South Africans still live in unsatisfactory circumstances and in informal housing, which leaves them especially vulnerable to flooding and other extreme weather situations. Legese and Gumi (2020) add that one of the main natural calamities that annually affects many nations and areas around the world is flooding, which happens when water floods typically dry terrain.

Flooding has a significant effect on the overall economy in addition to upsetting the social cohesion of local communities. Crops, livestock, poultry, housing, transportation and communication networks, as well as institutional and educational infrastructure, are all severely damaged, (Parvin et al,2016). The same study also adds that floods also disrupt the regular operations of daily life, impacting households, farms, water supplies, sanitation, and entire economic systems. Although a lot of research has been done on the obvious economic effects

of flooding, like property damage, floods and other natural catastrophes have long-term effects that go beyond immediate repair expenses and lost output, (Hudson, Botzen, Poussin, and Jeroen, 2019). The same study argues that the Intangible consequences of these incidents include harm to a company's reputation and psychological suffering for individuals.

Kovacs, Doussin, and Gaussens (2017) argue that the livelihoods of people that are affected by the floods are impacted mostly by the material damage due to its capacity to destroy the buildings (such as housing and strategic infrastructure such as hospitals and schools), disrupt the networks (drinking water, sanitation, waste, energy and transport), disrupt economic activities and displace populations. Moreover, Umar and Gray (2023) add that flooding also causes deaths, a drop in general well-being, loss of livelihoods, economic downturns, and difficulties in achieving social development goals including reducing poverty and enhancing safety. In addition, Gqalindaba, Lukman, and Makiwane (2024) argues that floods are regarded as the main driving factor to the hazard-related losses, which affected approximately 34.2 million people in 2018 alone.

For many years, the weather-related hazards which impacted on the countries' economy have been recorded by many African countries, especially in rural areas and caused a damage to their infrastructure, (Sefolo, Daniyan, Ramdass, Akinbowale, Zerihun, and Mashigo (2024). In the impacted areas, the incident caused dozens of injuries and four fatalities, (Emem and Owojori,2023). Additionally, Paterson et al (2018) argues that these effects can be acute but again can be visible only for weeks to months after the disaster occurred.

Furthermore, Musah, Mumuni, Abayomi, and Jibrel (2013) argue that in most rural areas, such as rural communities in Northern Ghana, the agriculture is used as the main occupation and source of livelihoods. According to Weldegebriel and Aphume (2017) access to land is a critical factor in determining the quality of a living in rural communities, because it is a basic productive resource. Pierre (2015) argue that rice production was severely impacted by the floods, which severely damaged agricultural fields. Climate change as a current global issue often presents a serious threat to many sectors, such as agriculture sector, (Gunadal, Madhu, Harshitha, and Honyal (2024). Most people living in rural communities get about 40 percent of their exports from agriculture. Unfortunately, the agricultural sector remains the most vulnerable sector to climate change that has devastating effects on food security (Musah et al ,2013). The effects of climate change are particularly likely to affect agriculture, and African

nations are particularly at risk because of their reliance on rain-fed agriculture, (Week and Wizor,2020). The same study argues that inadequate food supplies are not the only factors contributing to food insecurity, households and the nation as a whole also face limited access to food and low purchasing power.

In addition, Hooli (2016) adds that weather event volatility has made it difficult to make decisions about agricultural activities, resulting in incorrect planting and non-planting calculations. The same study argues that in urban regions, where many people depend on agricultural products from their rural social networks, this uncertainty has also put food security at risk. In addition to this, Gunadal et al (2024) also add that the agriculture sector remains the most vulnerable sector to all climatic conditions which are different from season to season and place to place. Moreover, Zainudini (2024) categorizes the impact of flooding on the agriculture sector into six groups. The same study asserted that these categories include:

*"(1) livestock evacuation in urgent situation,(2) avoidance of spring field exposure, allowing livestock to be sheltered or moved to certain other flood-free places,(3) Harm to crop and grass productivity in worst affected areas with massive loss of pastures,(4) Driven production loss and affected performance of cultivation and agricultural land,(5)Destroyed irrigation structures and facilities at the farm, (6) loss of advantageous soil invertebrates, in particular earthworms, elevated risk of animal disease, including infection of liver fluke",* (Zainudini, 2024).

Many studies on the effect of floods on agriculture consistently argue that, in Africa, the poorest population depend largely on agricultural sector for food , jobs and income, yet this sector remains the most vulnerable sector to climate changes (Fredrick et al, 2010,Musah et al , 2013).

It is evident from other studies that floods can affect people psychologically. According to Foudi, Os~es-Eraso, and Galarraga (2017), floods as a natural disaster can have a long-term psycho-social effect on its victims, such as depression, social dysfunctions, distress and anxiety. Watts (2015) asserted that "severe distress in the worst cases may become mental disorders or so-called psychopathologies". Foudi et al (2017), argue that distress may take place during or after the event. Braimah et al (2014) also argue that flooding can traumatize individuals, more especially in case of death, property loss and serious injuries.

Floods affect people in many ways and can also affect their well-being and health. The impact of flood disasters on human subjective well-being (SWB) is substantial, (Hudson et al,2019). According to Abuzoeme (2015), flooding has a negative impact on people's health, it causes a serious health hazard, as a result of water borne disease as well as pollution, resulting from flood waters. In this instance, these illnesses are spread by mosquitoes (Abuzoeme, 2015). Many articles highlight the outbreaks of waterborne diseases and epidemics, which are exacerbated by contaminated water sources during flooding (Week and Wizor, 2020). Numerous human activities, including resource extraction, urbanization, industrialization, population growth, and infrastructure development, have contributed to the intensification of flood disasters (Week and Wizor, 2020).

In addition, According to Burton et al (2016) injuries are the main cause of health effects during floods, which are a leading cause of morbidity and mortality worldwide. Three major categories can be used to classify infectious diseases associated with floods: zoonotic, vector-borne, and fecal-oral transmission, (Burton et al,2016). According to Zainudini(2024) flood often results in health issues, which can cause both direct and indirect effects. In addition, Zainudini (2024) argue that the direct effects of floods include, deep water and flooding penetration, such as death, debris, pollution and hypothermia.

On the other side of the coin, the indirect effects of flood include, communicable diseases, obesity, famine-related diseases and other diseases caused by the displacement of the population due to floods, (Zainudini,2024).Similarly, According to Li et al (2016) the indirect harm caused by floods lies in alterations in the natural surroundings can lead to the forced relocation of communities and the increase in the distribution of disease-carrying natural habitats, which could lead to the emergence of widespread infectious diseases. On the other hand, floods directly affect human well-being by causing deaths, (Li et al ,2016).

Bouchard et al (2022), argue that people are affected based on their intensity, exposure and vulnerability to natural disasters, such as floods. The same study argues that the effects of floods can get even more serious over time, and they include illness and pollution. Moreover, Zainudini (2024) adds that there has been a warning issued by the public medical doctors and relief workers, that the corpse of the affected people after the natural hazards can lead to the outbreaks of diseases such as cholera. Furthermore, apart from the landslides the 2016 floods affected approximately 74 people worldwide, killed about 4720 people and also resulted into the loss of approximately $57 billion economic cost, (Paterson et al,2018). In contrast to the

negative effects of floods, Week and Wizor (2020) argue that floods have the potential to generate new sources of income in many developing nations, such as fish for fishermen and fertilized soil for farming. Therefore, the same study also adds that while reducing the negative effects of flooding is important, the positive features of floods have caused people in vulnerable locations to evolve tactics cantered upon "coping with floods" or "living with floods."

### 2.3 Causes of floods

Legese and Gumi (2020) argue that floods are commonly described as situations in which water pours into nearby areas in excess of the capacity of reservoirs, dams, lakes, ponds, river channels, and other bodies of water. Rentschler and Salhab (2020) argue that there are many different factors that cause floods. According to Akademia and Slovakia (2015), in most cases, flooding is often caused by heavy rains and melting of snow, where the area is no longer able to absorb rainwater. According to the same study, the local floods are also increased by factors such as urbanization, reduction of wetlands and deforestation. In addition, Legese and Gumi (2020) also argue that common causes of flooding include strong rains, snowmelt, groundwater rise, land subsidence, and dam collapses.

According to Qin (2020) flooding may result from heavy rains if the city's sewer system cannot handle the amount of runoff. Similarly, Kovacs et al (2017) argue that the risk of flooding results from multiple factors (such as land use, urbanization and meteorology) and is categorized by the exposure of vulnerable stakes to a disaster, in this case a temporary presence of water. Similarly, according to Liu et al (2016) flooding stands as one of the most devastating natural calamities, primarily caused by natural elements like weather patterns, water systems, and types of plants. In addition, Buttle et al (2016) argue that the human activities, such as urbanization and the collapse or malfunction of constructed flood control facilities like levees and dams, can also cause flooding. Activities such as cutting down forests, reclaiming land from water bodies, and establishing communities in areas prone to flooding or near rivers also contribute to this issue, (Liu ,2016). According to Islama (2018) continual danger of disaster is created by the combination of high population density, poor socioeconomic conditions, and recurrent natural hazards (such as cyclones, flash floods, and low-lying, flood-prone locations). Floods also have an impact on water quality factors like pH levels, metal concentrations, and sediment load, all of which have a big impact on river ecology, (Peters, 2016). Dube, Nhamo,

and Chikodzi (2022) adds that globally, most people reside on coastal areas, and this has a long history dating back to pre-civilization era.

Interestingly, Akademia and Slovakia also pointed that the poor drainage or congestion and saturated soil and embankment failure can also cause floods. Similarly, the risk of flooding is enhanced by the drainage system and clogging, (Dube et al,2022). In contrast, Thoithi et al (2022) argue that the Tropical temperate troughs or tropical extratropical cloud bands can also cause floods on occasion over South Africa and again result in 28% of the annual rainfall over the province of KwaZulu-Natal, with another 24% from westerly waves/COLs. For instance, Tropical storm Domoina in late/early February in 1984( infamous) and Tropical storm Irina in March 2012, which were regarded as amongst the top 20 extreme incidences over Northern region of KwaZulu-Natal, were other weather systems that were not linked to waves/COLs but still caused severe flooding in KwaZulu-Natal, (Thoithi, Blamey, and Reason, 2022). According to Letsatsi and Kruger (2022) the cut-off lows, tropical cyclones and tropical storms were the main driving factors behind the most devastating floods incidences witnessed in South Africa.

Dube et al (2022) argue that due to factors such as overpopulation, increase urbanization and non-adherence to environmental laws, some people end up setting on poor and vulnerable areas, such as coastal areas, estuaries, and waterways. On the other hand, the difference was found in Mahdi-Zadeh and Perez (2022) study, which suggested that the main cause of natural disasters like floods is climate change. The same study also pointed out that since the 1980's , the number of natural disasters has doubled. Additional findings by the same study also pointed out that climate change speeds the occurrence of natural disasters and that too with significant impact. According to Emem and Owojori (2023) it has been estimated that climate change will get worse during the 21st century and beyond, with potentially serious consequences.

The frequency of extreme weather events, like strong rainstorms that result in significant flooding, has already increased due to climate change (Emem and Owojori,2023). According to the same study, both climate change and human activities are predicted to make flooding one of the most frequent calamities in the years to come. Additionally, the issue of climate change, which causes extreme weather incidences, is worrying because it represents a serious threat to the socio-economic development of these coastal communities, (Dube et al,2022). In

addition, Janizaden et al, (2024) argue that as a result of global warming, climate change causes the spial and temporal rainfall patterns, which result in the increase frequency of floods. According to Sefolo et al (2024) climate change continues to pose dangerous and serious impacts which pose serious threats to human life, environment, biological habitat and general ecosystem, such as cyclone, changes in weather, temperature patterns and floods. According to Van der Berg (2018) human-induced climate change is likely to be the main driving factor behind the rapid growing trend in the occurrence of natural hazards.

In addition, Sefolo et al (2024) argue that if the impact of climate change on the infrastructure such as water-carrying structures, roads, bridges, telecommunications infrastructure and buildings, is ignored it can be costly and disrupt sustainable development. Dharmarathne, Waduge, Bogahawaththa, Rathnayake, and Meddage (2024) also refers to climate change as a global threat that often result in extreme weather patterns such as frequent and severe incidences, like urban flooding. According to Paterson et al (2018) floods are the most common natural hazards posing a serious threat globally, with their effects that are believed to increase in the future because of climate change and population shift. According to Sefolo et al (2024) climate change poses a serious danger to economy and sustainable livelihoods of population that are more vulnerable. It is commonly known that the global water cycle would be exacerbated by climate change, increasing the likelihood of flood dangers, (Parvin et al,2016).

In contrast, the Ngcam (2023) study rejects the fact that climate change is the main reason behind the occurrence of flood evets such as the April 2022 flood which occurred in selected provinces. Instead, this study argues that based on its findings the primary trigger for these particular flood disasters was the cut-off low, and as for the factors such as climate change, poverty, inequality, poor quality houses, poor policies on development and blocked drainage only contributed to worsening the impact of these flood events in both Eastern Cape and KwaZulu-Natal provinces. Similarly, Thoithi et al (2022) add that the April 2022 floods in KwaZulu-Natal were related to COLs moving over the region. In the past, this COLs have also resulted in devastating floods in some parts of coastal South Africa, such as in the Southern coast near East London (in August 2002), the South coast (in March 2003), and the Southern coast near Port Alfred (in October 2012), (Thoiti et al,2022). Similarly, According to Bopape et al (2021) the cut-off lows can cause a heavy rainfall flooding in some parts of South Africa, but it depends mostly on their location. In addition, an example of such incident took place in 2019 and as a result there was a heavy rainfall in most parts of the country, which resulted in

heavy rainfall and flooding over the KwaZulu-Natal province, (Bopape, Sebego, Ndarana, Netshilema, and Gijiben (2021).

In addition, Thoithi et al (2022) argue that the case of September 1987 floods in the province of KwaZulu-Natal was also a result of the COLs. In addition, Dube et al (2022) argue that human and natural factors ranging from extreme rainfall are the driving factors of the flooding in the Western cape urban areas, usually caused by persistent cut-off-lows, midlatitude cyclones, cold fronts and intense storms. Such flooding is worsened by poor drainage because of vegetative overgrowth on waterways and land pollution, which can be linked to poor drainage maintenance, (Dube et al,2022). In addition, Thoithi et al (2022) argue that during summer, the tropical low in the Northern KwaZulu-Natal is often the main driving factor to extreme floods, with cloud bands and COLs contributing, but more especially around October or November

### 2.4 Types of Flooding

Legese and Gumi (2020) argue that urban flooding, flash flooding, river flooding, coastal flooding, and snowmelt flooding are some of the several forms of flooding. Legese and Gumi (2020) add that usually, flash floods are brought on by heavy, brief rainfall. Homes, roads, and bridges over tiny streams are regularly destroyed by this kind of flooding, which seriously disrupts communities and transportation, especially in rural areas. In addition to this, Kovacs et al (2017) argue that there are 2 types of floods, such as runoff and rising river flooding. In addition, Kovacs et al (2017) define the runoff flooding as a runoff that often happens because of urbanization which then results in other developments (such as roads, buildings, parking lots) and decreases the infiltration of water. Moreover, Kovacs et al (2017) argue that it is often difficult to measure the impact of floods in the smaller catchment areas (of around 1 km2-beyond 100 km2), but rather it is reflected graphically on the rising river hydrography by the increase in peak flow. The same study argues that the rising river flooding is a type of flood that includes slow rise in water, and recession, and this usually happens when the river exits from its normal bed and reaches the major bed.

According to Rentschler and Salhab (2020) the Fluvial flooding takes place when intense or snow melts causing rivers to flood, while, Pluvial flooding, take place when rainwater builds up beyond the absorptive capacity of soil. On the other hand, Coastal flooding occurs due to storm surges and high tides in coastal areas, (Rentschler and Salhab,2020).

## 2.5 Overview of floods worldwide

As indicated earlier on, floods affect both developed and developing countries. According to Rentschler and Salhab (2020) flooding is one of the serious natural disasters affecting people around the world. Nwingwe and Emberga (2014) argue that sustainable development in human settlements is seriously threatened by the growing frequency of recent floods and their effects around the world. In terms of geographic distribution, Li et al (2016) argue that floods are common in Nigeria in Western Africa, Ethiopia, Kenya, Somalia, and Tanzania in East Africa, and Libya and Sudan in Northern Africa. Economic losses are greater in more developing nations like South Africa and Libya, whereas the majority of those impacted and the losses are concentrated in the eastern region, (Li et al,2016). According to Pierre (2015) Bangladesh is particularly vulnerable to a variety of natural disasters, such as earthquakes, cyclones, tornadoes, storm surges, droughts, floods, landslides, and erosion of riverbanks. With more than 230 rivers that carry water from the northern Himalayas to the southern Bay of Bengal, the country is mostly made up of low-lying floodplains, (Pierre,2015).

The findings by Rentschler and Salhab (2020) study reveal that during 1-in-100-year flood incidences about 1.47 billion people (or 19 percent of the world population), directly experience substantial risks. Globally, many countries are affected differently by the floods, some are often affected more than others, (Kovacs et al,2017). In addition, Kovacs et al (2017) argue that the most countries in Asia are often more affected by the floods (counties like China rank in the first place).

Similarly, Rentschler and Salhab (2020) argue that most people who are more vulnerable to flood, about (1.36 billion) of them are in South and East Asia, with China (329 million) and India (225 million) accounting for more that third of global exposure. Again, the findings by the same study pointed out that 1.47 billion of the people who are more vulnerable to flood, about 89 percent of them, reside in low- and middle-income countries. According to Svetlana (2015), the 21$^{st}$ century has already witnessed serious destruction caused by disastrous flood events across the globe.

According to Svetlana (2015), in the 1990s, Europe experienced flooding in the basins of the river Rhine and its tributaries from 1990 to 1995. In 1995, Germany, Northern France and Netherlands witnessed major floods (Svetlana et al, 2015). In the year 2000, UK, Italy, France and Switzerland also witnessed major flood (Svetlana, 2015). In the year 2013, many parts of

Europe, Asia, Canada and Australia also witnessed devastating effects of floods, which resulted in about 47% of total global losses and 45% of insured losses (Munich Re, 2013). In addition, Rentschler and Salhab (2020) argue that 132 million of the people who are estimated to reside both in flood-prone areas and in extreme poverty (under $1.9 per day), 55 percent of them are in Sub-Saharan Africa. Due to the continent's varied climate, Africa is home to a variety of natural hazards, such as landslides, erosion, droughts, and flooding, (Umar and Gray,2023). According to Kawasaki, Kawamura, and Zin (2020) the Future floods in Southeast Asia are predicted to occur more frequently, which might make life worse for underprivileged groups in flood-prone locations. Furthermore, Brigadier et al (2016) argue that an unusual easterly flow in the high atmosphere and unusual westerly winds at the surface defined Zambia throughout the rainy year.

According to Rentschler and Salhab (2020) it is not a deniable fact that each country often experiences its individual set of natural disasters, such as cyclones, earthquakes, or wildfires, but floods are amongst prevalent disasters that often present a serious threat to people's livelihoods globally. This often happens in low-income countries whereby their infrastructure systems are less developed, and due to this reason floods often impose a serious challenge by causing unmitigated damage and suffering, (Rentschler and Salhab,2020). According to McDermott (2022), more than one in five people worldwide live in locations that are immediately at danger of a flood event that occurs once every 100 years, making flooding a common natural hazard. The world's lower-income households are particularly vulnerable to flooding, (McDermott, 2022).

According to Rentschler, Salhab, and Jafino (2022) One of the most frequent natural disasters is flooding which may be particularly destructive in low-income nations. The same study concluded that a 1-in-100-year flood catastrophe directly threatens 1.81 billion people, or 23% of the world's population. In addition, Rentschler et al (2022) argue that approximately, 1.24 billion of world' population reside in South and East Asia, with China and India accounting for almost a third of the global population (395 million and 390 million, respectively). The same study argues that 89% of the world's population lives in low- and middle-income nations, which are particularly vulnerable to flooding.

Islama (2018) argue that having experienced flooding, droughts, and cyclones for a long time, the people of Bangladesh are no strangers to the effects of the environment. Nonetheless,

flooding is becoming more frequent and severe, (Islama, 2018). Flooding is the most common and frequent risk among the many natural hazards that Bangladesh faces, and the country is seeing an increase in the frequency of flood disasters, (Parvin et al,2016). The recent events in Bangladesh and Nigeria, United States and Vietnam, clearly shows that the threat caused by floods is a serious global reality, (Rentschler and Salhab,2020). During the summer of 2021, comparable rainfall and flooding damage occurred in other parts of Europe and the world, such as Afghanistan, Austria, China, Croatia, the Czech Republic, India, Italy, New Zealand, Pakistan, Romania, Switzerland, Turkey, the United Kingdom, and the United States, (Fekete and Sandholz,2021). Munyai et al (2021) argue that African rural communities are extremely vulnerable to floods, especially those that live close to rivers, in low-lying areas, or in tropical storm-prone locations. Seven million people were impacted by floods in Africa in 2020, the most since 2006, (Balgah, Ngwa, Buchenrieder, and Kimengsi, 2023).

Furthermore, Svetlana et al (2015), argue that in 2013, the most deadly and disastrous flood events globally were from flash floods which hit most countries, such as Nepal and Northern India and approximately more than 1000 people were killed. According to Wink et al (2024) the southern Brazilian state of Santa Catarina had an exceptional flash flood in 2008. Over 600,000 people were impacted by the incident, and 97 fatalities were reported in the most severely affected area, (Wink, Santos, Ribeiro, and Trindade, 2017). According to Rentschler and Salhab (2020) since the year 2010, urbanization and development in flood-prone areas of coastal zones has been repeatedly occurring in many parts of the world.

In addition, Paterson et al (2018) revealed that floods that occurred in Taxas, together with other floods that occurred in other parts of Southern United States after Hurricane Harvey have received an international recognition. Furthermore, due to the floods that occurred in India, Nepal and Bangladesh approximately 1000 people lost their lives and severely affected tens of millions of people, (Peterson et al,2018). Notably, Canada's first natural disaster to cause economic damages over CAD $1 billion was the Saguenay flood in Québec in 1996, (Burn and Whitfied,2016). Furthermore, the same study argues that the Red River flood of 1997—often dubbed the "flood of the century"—was Manitoba's worst flooding incident since 1852.

Furthermore, Rentschler and Salhab (2020) argue that human activities, like ground water extraction, are increasing the risks because when land subsidence increases the extent then flooding intensity increases as well. Similarly, Han, Kim, Wang, and Jung (2022) argue that in

2011, the United States of America witnessed torrential rains, which resulted in approximately 20 human causalities and over 16,000 evacuees. In 2012 South Korea also witnessed 3 typhoons, which killed about 7 people, and about 520, 000 homes experienced power outages (Han et al ,2022).

The same study argues that since the year 1989, the UK has witnessed most destructive flood events over 50 years, (Han et al, 2022). In addition, Mudefi (2024) argued that the poor and vulnerable groups often experience the serious consequences of flood disasters, with Asia (41%) at the forefront, followed by Africa (21%). The same study argues that between 1959 and 2021, South Africa has experienced over 40 devastating floods. According to Van der Berg (2018) the losses caused by natural hazards and human exposure to natural disasters are increasing globally. In addition, Tramblay, Villarini, Khalki, Grundemann, and Hughes (2021) add that the most recent decades, have proved that the continent of Africa is indeed vulnerable to flooding events. The North and South Africa experience more floods during late fall and winter, whereas the Western and Central Africa experience more floods in summer, (Tramblay et al,2021). According to Nka, Oudin, Karambiri, Paturel, and Ribstein (2015) River flow has mostly been impacted by changes in land use and rainfall variations since the West African drought of the 1970s. Flooding has increased in frequency throughout the region in recent years, (Nka et al ,2015). The same study argues that the Concerns over how flood patterns in West African nations may be impacted by climate change have been raised by these developments.

Sub-Saharan Africa is home to 44% of the 170 million people who live in severe poverty (making less than $1.90 a day) and are at high risk of flooding, (Rentschler et al,2022). Furthermore, more than 780 million people who make less than $5.50 a day are at serious risk of flooding, (Rentschler et al,2022). Research on the epidemiology, management, and effects of extreme events—especially floods—on livelihoods in Sub-Saharan Africa (SSA), especially for households that rely on agriculture, has increased as a result of the events' growing frequency, (Balgah et al,2023). In addition, according to Bangalore, Smith, and Veldkamp (2019) Vietnam is a rapidly expanding nation that is especially prone to natural disasters. Although floods are a known natural hazard in Germany, the amount of precipitation that followed the events of July 14–15, 2021, and the ensuing high death toll and extensive destruction were unexpected, (Fekete and Sandholz ,2021). In addition, Fekete and Sandholz

(2021) argue that this led to immediate worries about the effectiveness of Germany's response overall and about early warning system failures, which were also brought up globally. According to the same study the impacted communities, government representatives, the commercial sector, the media, and the general public who depended on media reports for information were all caught off guard by the July 2021 floods in Germany.

### 2.6 Overview of floods in South Africa

According to Busayo, Kalumba, Afuy, Olusola, Ololade, and Orimoloye (2022) South Africa is one of the African nations that have been affected by natural hazards, such as floods. In addition, Busayo et al (2022) argue that South Africa has been witnessing the flood hazards since 1959. In the past decade (2010-2020) extreme weather events caused by climate change have increased rapidly across the continent of Africa and globally, (Dube et al ,2022). The same study argues that many cities and communities in Southern and Eastern Africa still battle with the issue of floods. As indicated earlier on, that South Africa have not been spared from climate change related hazards, such as floods. Ziervogel et al (2022) argue that South Africa is still battling with the issue of climate change, which increased the drought events, (such as the drought of 2016-2018 in Cape Town) and increased floods events, (such as, Durban floods in 2022). According to Busayo et al (2022) the 1996 and 2014 floods were the serious floods events in South Africa that occurred between 1959 and 2019. 1996 (Mpumalanga, Gauteng, Free State, North-west, Eastern Cape, and KwaZulu-Natal provinces) whereby approximately 7000 people were left homeless and seventeen people lost their lives. 2014 (Gauteng, KZN, Limpopo, Mpumalanga, North-west provinces) whereby approximately 7,185 people were displaced and 32 lost their lives, (Busayo et al, 2022). In addition, according to Mbatha, Bopape, Mbokodo, Kruger, and Chikoore (2023) an examination for provincial extreme rainfall events indicates that the province of Gauteng tends to be one of the most affected provinces by flood events. The study conducted by Mbatha et al (2023), shows that the province of Gauteng is more affected by such events (25.8%) followed by the province of KwaZulu-Natal at (21.8%) whilst the province of Northen Cape (3.5%) is less vulnerable to such incidences. The same study argues that the floods incidences which occurred in 2015 and 2018 appeared to be the worst events with severe effects over the province of Gauteng, causing damage to 5000 homes, and many people lost their lives in the process. Additionally, South African Weather Service (2022) reported that the floods which occurred in December 2022 negatively affected parts of Gauteng province and Northwest province by hitting hardest places like Brakpan, Vereeninging, Johannesburg, Erkhuleni and Soweto (Gauteng province) and

Bojanala, Rustenburg (North-West province). The same study shows that these events affected over 40 000 people. According to Mawasha and Britz (2021) historically, the Jukskei river in township of Alexandra situated Northwest of Johannesburg in South Africa, has experienced multiple floods events which caused widespread destruction. The same study argues that the township of Alexandra is one of the overcrowded townships in Johannesburg and vulnerable to floods events during the rainfall season.

Again, the worst floods events that South Africa has ever experienced in history were the floods of 1981, 1984, 1988 and the recent one in 2000, (Spuy and Plessis, 2024). According to Mothapo, Tawodzera, and Sibanda (2022) in South Africa the occurrence of floods varies considerably, with some places being more vulnerable to natural disaster like floods than others, and with places such as Limpopo experiencing floods even more often. As compared to other provinces, the province of Limpopo is more prone to flood disasters, (Mothapo et al,2022). The same study argues that Lephalale municipality is one of the municipalities in Limpopo province that was severely affected by the flooding, reason being that the Mokolo, Phalala and Limpopo rivers and streams adjacent areas that are low-lying. In addition, the study conducted by Muyambo, Belle, Nyam, and Orimoloye (2022), shows that similar to other parts of Southern Africa, Qwaqwa in the province of Free State also experience multiple effects of climate change, through severe winds that are destructive, rising summer temperatures, increasing variability in pattern of rainfall, droughts and flooding

Moreover, Mudefi (2024) argues that in KwaZulu-Natal, prior to the April 2022 flood incident, there was a recent flood event that took place in 2019, which resulted in over 80 fatalities, displaced over 1400 people and caused damage estimated at USD71 Million. Additionally, Thoithi et al (2022) argue that in April 2019, the province of KwaZulu-Natal witnessed another heavy rainfall event which resulted to 80 deaths and left up to 100 people homeless. In addition, according to Kruger (2022) the recent flood incidences in the province of KwaZulu-Natal resulted in serious negative impacts, such as human casualties and severely damaged the critical infrastructure.

According to the study conducted by Munyai et al (2021), flooding significantly damaged the three study locations in Mopani District (Limpopo province) Ga-Kgapane, Nkowankowa, and Lenyenye, where families were severely affected; many homes were flooded, several people drowned, rivers overflowed, and some highways were rendered unusable or shut off entirely.

According to Munyai et al (2021) the climate of the province of Limpopo is affected seasonally by far-off climatic phenomena that originate from important areas of the Pacific and Indian oceans.

In addition, Thoithi et al (2022) argue that in September of 1987, the province of KwaZulu-Natal experiences up to 800 mm of rain which lasted about 5 days but resulted in more than 500 deaths and displaced about tens of thousands of people. According to Ndlovu et al (2021) the province of KwaZulu-Natal has a high annual, seasonal, and monthly rainfall variability across and within its different climatic regions. In addition, Letsatsi and Kruger (2022) argue that the coastal region of KwaZulu-Natal, such as Durban are vulnerable to flooding because of its hilly region location, with many gorges, therefore it experiences relatively high rainfall. Areas along the coast are especially susceptible to the consequences of climate change, (Nath, Laerhoven, Driessen, and Nadiruzzaman (2020). The same study argues that governments have made significant expenditures in coastal infrastructure, including the construction of polders, in order to improve the resilience of the infrastructure in these areas, lessen the vulnerability of local livelihoods, and offer sustainable livelihood strategies. Areas along the coast are particularly susceptible to the effects of climate change. These places are vital to the local inhabitants' means of subsistence, but they are also heavily populated, (Nath et al,2020).

In 2022, South Africa experienced severe floods in the south-eastern part, where over 400 people lost their lives, 16 000 houses were damaged and resulted in disruption of water supplies, (Naidoo, Manyangadze, and Lokotola, 2022). The most provinces that were affected by these floods of 2022 were the KwaZulu-Natal and Eastern cape provinces. Ngcamu (2022) argues that the year 2022, is regarded as year which brought tragedy, in the two coastal provinces in South Africa, which is KwaZulu-Natal Province and the Eastern cape province. According to Emem and Owojori (2023) significant flooding took place in these areas, with the most serious floods occurring in April 2022 in the KwaZulu-Natal and Eastern Cape regions. The same study argues that there is a greater level of societal vulnerability because millions of people live in flood-prone locations worldwide, and this number is predicted to rise drastically in the years to come.

In addition, Zhou, Kori, Sibanda, and Nhundu (2022) argue that in South Africa, severe weather occurrences, including droughts, floods, heatwaves, cold snaps, and hailstorms, impact both city and countryside regions. Severe flooding and droughts were identified as the primary climate change-related challenges that increased vulnerability in both city and rural environments, as reported by a considerable portion of the studied studies, (Zhou et al,2022). However, notable differences that Zhou et al (2022) observed, indicating that cities faced a higher risk of flooding, while rural areas were at a greater risk of experiencing droughts.

Furthermore, Ngcamu (2023) argues that the local government sector in 2014 reported that both the KwaZulu-Natal and Eastern Cape provinces are vulnerable to natural disasters such as droughts, strong winds, tornadoes, fire, thunderstorms, excessive rainfall, floods, sea level and storm surges. In addition, Mudefi (2023) argues that in the past 3 decades South Africa's east coast, which include, both the (Eastern Cape and KwaZulu-Natal provinces) has repeatedly experienced the devastating effects of floods.

The same study argues that for some scholars the KwaZulu-Natal floods that occurred in April 2022 were not unexpected because of the recurring nature of flood incidents in the province. In 2022, the South African president claimed that across the provinces of KwaZulu-Natal and Eastern Cape, in many districts the La Nina weather patterns were behind the above-average rainfall, which destroyed houses, bridges and roads, (Ngcamu, 2023). In addition to this, Thoithi et al (2022) study, adds that in the Subtropical Southern Africa the COLs, usually takes place in austral autumn, but this time around there has been a slight change, because it has produced heavy rains over the province of KwaZulu-Natal mostly during summer. According to Thoithi et al (2022) this means that the KZN 2022 April floods were slightly unusual. Another unique point about this event is that it took place during La Nina episode (2020-to date) at a same time with East coast of Australia's COL-related flood incidences, (Thoithi et al,2022).

Mudefi (2023) adds that this recurrence of flood disasters in the province of KwaZulu-Natal questions the effectiveness of South Africa's disaster management framework. The same study points that the main reason why the disaster management remains challenging everywhere, is because it is inherently complex, making so challenging to transform theoretical concept into reality, just like during the covid-19 pandemic and February 2023 Turkey-Syria earthquake, where the actual results turned out to be completely opposite of the disaster management plans. Similarly, CIWEM (2024) adds that the repeatedly occurring of recent flood incidents globally,

shows the critical issues in disaster management. For instance, in many cases, when the weather warnings are issued is either the decision-makers or the public do not receive it, or misunderstood it, (CIWEM,2024). In addition, Concerns over flood preparedness and vulnerability have increased in the northeastern interior of South Africa as a result of flooding occurrences brought on by continental tropical lows in 2011, 2013, and 2014, as well as by the ex-tropical storm Eline in 2000, (Munyai et al ,2021).

However, Mahdi-Zadeh and Perez (2022) suggested that, if countries can put the accurate flood forecasting as the first priority, it might help in future damage reduction, (Mahdi-Zadeh and Perez,2022).

According to Paden, Mayhew, Baker, Mayedwa, and Saunders (2023) there are many reasons why the flood mitigation and response in South Africa continues to be a serious challenge. From an environmental point of view, the issue of blocked drainage channels in urban areas, development of poor-quality housing in areas that are more vulnerable to flooding, stormwater infrastructure, inadequate sewage and poor access to services all increase flood risk, (Paden eta al,2023). Unlike in an environmental point of view, in a policy point of view, the problem now lies in the district level where there is often a lack of resources and limited disaster management structures, which then leads to civil defense authorities being unable to effectively deal with flood response due to the overburden, (Paden et al,2023).

Moreover, the findings by the Mudefi (2023) study, revealed that the disaster response in KwaZulu-Natal province failed during the April 2022 floods because of the inadequate disaster preparedness. The same study argued that the ineffective and inefficient response of this disaster in the province is further justified by the loss of many lives and damage of infrastructure and property. Similarly, According to Zakwe (2023) mitigation after the floods that affected the province of KwaZulu-Natal in April 2022 shows that the approach was ineffective and inadequate, as the disaster killed approximately 435 people in the province including the unknown number of missing people.

Despite all the efforts made by both the South African president and some organizations such as South African red cross society and democracy development program on the emergency relief, which included more than R1 billion and other contributions such as (food meals, shelter, blankets, clothes, mattresses, and many more) many businesses and residents in

KwaZulu-Natal still battle with issues of water, power and other needs after the April 2022 floods,(Mudefi,2023).

According to Thoithi et al (2022) the historical records show that in the last 2 centuries there are several occasions of extreme rainfall that occurred on the coastal of KwaZulu-Natal province, (1848,1856,1868,1893,1905,1917 and 1959. In addition, Thoithi et al (2022) argue that in September of 1987, the province of KwaZulu-Natal experienced up to 800 mm of rain which lasted about 5 days but resulted in more than 500 deaths and displaced about tens of thousands of people. Additionally, Thoithi et al (2022) argue that in April 2019, the province of KwaZulu-Natal witnessed another heavy rainfall event which resulted to 80 deaths and left up to 100 people homeless. The extent of these 2019 floods events were more devastating to the point where they were declared as a provincial disaster by the president of South Africa, Mr. Cyril Ramaphosa after his visit to the affected areas, (Bopape et al,2021). All these flood incidents, justifies the argument made earlier in this study that South Africa is indeed not immune to floods.

### 2.7 Overview of Floods in both developing and developed countries

It is evident that both developing and developed countries are all facing the crisis caused by natural disasters, such as floods. According to Twum and Abubakari (2019), in the developing world, flooding is a common problem for many cities. Khan, Zam, Shoukry, Sharkawy, Sasmoko., Ahmad, Sanil, and Hishan 2019) argues that natural disasters pose a major threat to economies worldwide, particularly in developing countries, because to the massive financial losses and physical damage they inflict. Floods are a big problem in Ghana, a developing country, especially in its major cities. Njogu (2021) argues that developing countries are not proactive when it comes to mitigating the floods effects on the critical infrastructure, and this is evident by lack of preparedness before, during and after the devastating incidences of floods.

According to Tucci (2005) floods in developing countries are usually connected to urban development, which is often characterized by poor public transportation, lack of water facilities and overcrowding. In addition, Zainudini (2024) argues that the dangerous flood causalities are often experienced by the low-income countries, such as South Asia and Africa. In addition, Nyarko (2024) adds that the developing countries often struggle to build resilience against external shocks because of vulnerability to global market fluctuations, economic disparities and limited institutional capacity. Although the temporal and spatial aspects of informal

settlements, as well as the use of local knowledge systems to comprehend their creation, are still fragmented, they constitute a large part of urbanization and urban sprawl in developing nations, (Dlamini et al,2024).

For instance, in 2010, Ghana experienced the most serious and life-threatening flood incidence, which resulted into 700,000 human displacements, destroyed 3234 houses, 23 585 acres of farmlands were damaged, and 55 communities were affected,(Mensah,2020). Nkwunonwoa et al (2020) argue that even though it is especially crucial for developing countries (DCs) like Nigeria, where the hazard is frequently poorly understood and insufficiently studied, the frequency of flooding occurrences and the risks connected with them in urban areas are becoming a more significant global issue. According to Beshir and Song (2021) rapid urbanization has emerged as an unavoidable and enduring trend in the developing countries. The same study argues that unplanned urban growth and the effects of climate change provide significant challenges to sustainable development and increase risks.

Additionally, the increased risk of flood events has been reported in historical tropical countries, such as Asia, Africa and Middle East, (Zainudini,2024). a standard set of responses for all communities during disaster. Montanaa and Dasb (2017) argue that after using data from a field survey and the Vulnerability as Expected Poverty (VEP) approach, they discovered that about 83% of the families are at risk of poverty due to flooding. Furthermore, the main roots of problems facing developing countries today are deeply embedded in the poor management of water supply, sewage urban drainage and flood plain (Tucci, 2005). Auzzir, Haigh, and Amaratuns (2014), argue that the governments of developing countries have been facing the devastating effects of floods, especially on economic development.

Auzzir et al (2014), contends that the developing countries and the countries that are less developed are usually the most vulnerable countries to natural disasters, such as floods. According to Randa (2022) the goal of resilient and sustainable urban ecosystems, especially in developing countries, requires a great deal more effort than the current efforts to make cities more resilient. Linneerooth-Bager and Mechler (2007) also argue that developing countries have underdeveloped financial markets. According to Auzzir et al (2014), in developing countries, the private insurance only covers about 9% of losses of property from natural disasters. However, this is different from most developed countries, where about 75% to 100% of losses due to disasters are respectively covered by private insurance (Sawaba and Zen,2014).

The cooperation between public and private actors in countries that are developed has played a crucial role in creating new programs for loss prevention and disaster resilience (Auzzir et al, 2014). According to Kovacs et al (2017) flood risk management in developing countries that hold a position on other natural and social elements regarded as a risk to the population. Kovacs et al (2017) argue that the flood risk level that is socially acceptable in the developing countries is often higher than that of developed countries. Few developed and developing countries will be discussed below:

***Developed countries***

***Canada***

Legese and Gumi (2020) argue that more people are impacted by flooding each year than by all other natural and man-made disasters put together. Communities are increasingly affected by this natural calamity, which is frequently connected to weather unpredictability, global climate change, and environmental degradation. The same study argues that the effects seem to have gotten worse in recent decades. According to Burton et al (2016) It is difficult to precisely estimate the entire range of flooding-related health effects in Canada. In addition to hypothermia, mental health problems, the decline of health in the elderly or patients requiring emergency treatment, homelessness, and the spread of infectious diseases, these effects may include death, drowning, and other bodily harm, (Burton et al ,2016).

The same study argues that the, with a wide range of socioeconomic backgrounds, demographic traits, and underlying medical issues, the Canadian populace is diverse. In addition, Buttle et al (2016) argue that although flooding can happen at any time of year in Canada, the main causes of flooding change with the seasons. For instance, ice jams usually happen during the spring thaw when river ice breaks up, whereas floods caused by snowmelt are more frequent in the spring and early summer (Buttle et al ,2016). Burn and Whitfied (2016) argue that in Canada, floods are a common natural disaster that can have serious negative effects on the environment, society, and economy. In addition, According to Burn and Whitfied (2016) More money is spent on property damage from floods than from any other natural disaster in Canada.

***Germany***

According to Fekete and Sandholz (2021) the storm system in Germany also caused torrential rains in neighbouring countries, including as France, Luxembourg, and Belgium (where more than 30 people were killed).

***New Zealand***

According to Auliagisni et al (2022) one of the most common and destructive natural catastrophes in New Zealand is flooding, which is predicted to become more frequent and intense as a result of climate change.

***Developing countries***

***Lesotho***

Because of its landlocked, mountainous topography, which is marked by a thin regolith layer and a difficult economic climate, Lesotho is especially vulnerable to climate-related hazards such severe frost, droughts, floods, strong winds, and heavy snowfall, (Letsie and Grab,2015). The same study argues that since more than 70% of the population lives in isolated and environmentally vulnerable places, the effects of these natural hazards are more severe in many mountainous regions.

***Ethiopia***

Weldegebriel and Amphune (2017) argue that even while flooding has gotten less attention in Ethiopia than drought, it has long been recognized as a serious environmental risk that often turns into a disaster, negatively affecting the lives and means of subsistence of impacted populations for lengthy periods of time. In addition, Beshir and Song (2021) argue that flooding has recently become one of the most prevalent, frequent, and devastating natural disasters in countries such as Ethiopia. Billi et al (2015) add that early in the twenty-first century, flash floods became much more frequent in Ethiopia, particularly in the town of Dire Dawa.

These flash floods seriously hinder the economic growth and development of a low-income nation like Ethiopia, (Billi et al,2015). According to the same study, to reduce this risk, it is essential to comprehend the roles that two significant factors the amount of rainfall and changes in land use play. In addition, among the different forms of flooding, river floods and flash floods are common and negatively affect Ethiopia's economic resources and human lives, (Legese and Gumi,2020). The same study argue that the nation is known for its extremely erratic climate, which includes both floods and droughts.

***Zambia***

According to Brigadier et al (2016) between December and February, Zambia has unimodal rainfall, with notable regional variance. Because of the Intertropical Convergence Zone's (ITCZ) fluctuating position and dynamics, the northern region usually receives more rainfall than the southern region. As a result, compared to the southern region, the northern region is more likely to have above-average rainfall, which raises the risk of floods, (Brigadier et al,2016). The same study argue that the nation experienced an increase in enhanced low-level

convergence and corresponding upper-level divergence in 2010, which aided in the formation of clouds and produced the heavy rainfall that caused the floods that year.

***Congo***

Karam, Seidou, Nagabhatla, Perera, and Tshimanga (2022) argue that rainfall variability is linked to these extreme occurrences in the Congo basin, and climate change may make them worse to the point that it could threaten the livelihood of those who live there. Bachinyaga et al (2022) add that with a population of about 600,000, Uvira is a fast-expanding city in the Democratic Republic of Congo. It is located between the coasts of Lake Tanganyika and rugged rocky terrain, and its tropical environment makes it vulnerable to flash floods, (Bachinyaga et al,2022). But in contrast to earlier decades, the April 2020 flash flood catastrophe had a profound effect. The same study argues that at least 43 people lost their lives, another 200 were injured, over 5,500 homes were destroyed, and at least 70,000 people were displaced as a result of the debris-filled floodwaters. Numerous socio-economic facilities were also devastated, and the city's water and electrical distribution networks were destroyed, depriving roughly 280,000 citizens of hydroelectric power, (Bachinyaga et al,2022).

***Namibia***

Hooli (2016) argue that North-Central Namibia has a semi-arid climate with seasonal changes that include severe drought and flood episodes. The same study argues that, although there are notable annual variations in rainfall patterns, precipitation is often concentrated between January and March. Anthoj, Carmen, Odon, Nkongolo, Schmitz, Hango, and Kistemann (2015) argue that about 138,300 people were affected by the 2011 floods in northern Namibia, with about 60,000 of them losing their houses and 18,000 taking up residence in relocation camps. Hooli (2016) also adds that the indigenous population in northern Namibia has long adapted to the unpredictable weather patterns, which are typified by a stark contrast between the dry and wet seasons. However, the region's river system has been disrupted by recent changes in socio-environmental dynamics brought on by urbanization, poor spatial planning, and population increase, (Hooli,2016). The same study argues that apart from notable seasonal precipitation, these modifications have intensified the socioeconomic consequences of floods.

Long, Fatoyinbo, and Policelli (2014) add that the Caprivi region of Namibia experiences annual seasonal flooding and has seen significant floods again following a long period of drought in the 1990s. The same study argues that since these floods have resulted in a significant loss of life and livelihood for the local community, disaster aid organizations have

taken notice. Tuwilika (2016) add that since 2008, Namibia has seen frequent [documented] seasonal floods that have destroyed rural livelihoods for several subsistence-agricultural populations.

The same study argues that existence of populations and cultures that depend on livestock production, such as the rural Cuvelai, depends heavily on cattle for their status, income, and means of subsistence. Again Hooli (2016) argue that Seasonal floods, or *efundja*, have historically been crucial for Namibia's rural population, whose livelihoods are mostly dependent on agriculture. Fishing opportunities, meadows, and groundwater resources have all been restored as a result of these floods, (Hooli,2016).

But over the last ten years, the same study argue that this delicate river system has been upended by swift shifts in socio-ecological dynamics, turning floods from a natural resource into serious social catastrophes. The biggest enduring environmental problem in Nigeria is flooding, which usually happens when rushing water floods previously unaffected land areas, (Week and Wizor,2020). In particular, the same study argues that flooding occurs when water submerges land, frequently as a result of rising water levels or an aquatic ecosystem's incapacity to absorb surplus water.

***Nigeria***

According to Nkwunonwo (2016) Nigeria's frequent flooding, which is frequently caused by climate change and poor urban design, is a serious problem for the country's progress. The same study argues that Over 11 million people were impacted by flooding in the nation between 1985 and 2014, which also caused over US$17 billion in property damage and about 1,100 fatalities. Mar and Gray (2023) claim that extended, intense rains throughout the nation and the discharge of surplus water from the Lagdo Dam in northern Cameroon—which is utilized for agriculture and the generation of electricity—caused Nigeria to experience its worst floods in nearly 40 years in 2012.

The same study argues that of the 32 states affected by this catastrophe, 24 experienced significant damage. Over 7 million people were displaced by the July–October flooding, with over 2 million of those affected being considered internally displaced persons (IDPs). According to Ngwingwe and Emberga (2014) almost everyone in Nigeria is susceptible to both man-made and natural calamities. Every rainy season, tropical storm wind gusts cause millions

of naira's worth of property damage and fatalities nationwide, (Ngwingwe and Emberga,2014). The same study adds that flash floods brought on by torrential rainfall frequently wash away thousands of hectares of cropland, and these floods frequently cause dams to fail, for instance, 142 people lost their lives, 18,000 homes were destroyed, and 14,000 farms were lost when the Baguada Dam collapsed during a significant flood in August 1988. According to Komolafe, Adegboyega, and Akinluyi (2015) Nigeria has seen numerous floods in recent years, and because of its population's high susceptibility and low ability to adapt, the frequency of extreme events associated with climate change poses a serious risk to human life and property. Nigeria experiences flooding due to both natural and man-made causes, (Komulafe et al,2015). The same study argue that Heavy rains and coastal storms are the main natural causes, although human problems like ruptured water pipelines, poor drainage systems, and dam failures or spills also play a role.

**2.8 Urban Flooding**

Urban flooding is still a major and unsolved problem, despite efforts like low-impact construction and water-sensitive urban design that have been put forth to manage rainwater on-site through retention, detention, infiltration, harvesting, evaporation, transpiration, or reuse, (Qin, 2020). Devastating catastrophes have occurred frequently throughout history, but since the 1970s, they have been much worse, (Khan et al,2019). The same study argues that the natural disasters continue to be a significant global issue that impact many different aspects of the economy. The economy must withstand large losses, including both physical injury and the destruction of infrastructure. According to Pregnolato, Ford, Sean, and Dawson (2017) the built environment, assets, and communities are under increasing strain due to factors including climate change, fast urbanization, and the rising interconnection of infrastructure. The same study argues that this is particularly noticeable in cities, where weather-related dangers have the potential to impair transportation infrastructure.

Liu, Duan, and Feldman (2024) also agree that climate change and growing urbanization are contributing to an increase in the frequency and severity of flooding-related transportation disruptions. The same study adds that to help municipal authorities lessen the negative consequences of floods, it is crucial to analyse how surface water flooding affects road infrastructure and transportation systems**.**

Katherine, Yankson, Wilby, Amankwaa, Abarike, Codjoe, Griffiths, Kasei, Kayaga, and Nabilse (2019) argue that as extreme weather events become more frequent and disproportionately affect low-income urban populations, many cities in the Global South are facing serious problems. In addition, Katherine et al (2019) also adds that many cities in the Global South are struggling with the growing frequency of extreme weather events, which disproportionately impact low-income urban populations. When fragile infrastructure systems are exposed to excessive heat or flooding, the interconnectedness of services, especially in sectors like water, power, and healthcare, has a cascading effect. The urban poor, who primarily reside in informal settlements in developing cities, are particularly impacted by urban flooding, claim Randa, (2022).

These cities' fast population growth and urbanization may be signs of economic expansion and urban advancement, but they also draw attention to the greater danger of hazards and susceptibility to natural disasters, (Randa ,2022). The same study argues that this is mostly because of these cities' poor adaptability, which is shown by the growth and spread of informal settlements.

Peri-urban zones, which are found outside of cities and towns, are also considered urban informal areas, (Zhou et al, 2022). On the other hand, smaller population densities, few or no governmental institutions, and mostly agricultural means of subsistence characterize rural areas, (Zhou et al ,2022). The same study argue that aforementioned differences point to a number of characteristics that set rural and urban regions apart and could be responsible for differing susceptibilities to climate change. According to Emem and Owojori (2023) by working with local governments to implement "upgrading" projects, informal settlements can greatly increase their resilience to the effects of climate change.

The study by Randa (2022) argues that because of the ongoing consequences of climate change and the rapid expansion of informal settlements, it is anticipated that these instances would rise. But little attention has been paid to understanding the relationship between urbanization and climate change, especially in large African cities (Beshir and Song, 2021). According to Bernhofen et al. (2018), the intensity of flood impacts is anticipated to intensify over the next three decades due to a projected 31% increase in the population at risk of river floods.

According to Bernhofen et al (2018) with a projected 31% rise in the population at danger of river flooding over the next three decades, the severity of flood impacts is expected to worsen. Incidents of urban flooding, like the Ogunpa catastrophe in Ibadan, which killed more than 200 people and severely damaged a lot of property, also happen often, (Nwingwe and Emberga,2014). Randa (2022) argue that Urban flooding has increasingly affected cities, particularly in the informal populations that are growing in urban areas, with disastrous repercussions. The same study argues that because of the ongoing consequences of climate change and the rapid expansion of informal settlements, it is anticipated that these instances would rise.

Informal settlements, according to Dlamini et al. (2024), are residential places that don't adhere to the rules established by the local government for official townships. Informal settlements typically lack basic infrastructure, such as adequate roadways, sanitary facilities, and stormwater drainage systems, according to Dlamini et al. (2024). Some informal communities are located on marshes, floodplains, or in environmentally fragile locations that are prone to landslides, according to Dlamini et al. (2024). Basic services are either non-existent or very basic in these places.

### 2.9 Disaster Management

The primary responsibility of disaster mitigation organizations is to manage and reduce the devastating impacts of severe disasters on a global scale, (Khan et al,2019). The severity and duration of a flooding event, together with the availability and efficacy of flood management measures put in place by the government or local communities, all have a significant impact on the amount of damage that is produced, (Week and Wizor,2020). According to Paterson et al (2018) every hazard represents an opportunity to prepare and improve preventive measures. According to the Williams et al (2018) study, policy planners and decision-makers continue to face a major obstacle in adapting to climate change. More efficient incorporation of Quarry Road West informal settlement people into local governance mechanisms for water management is desperately needed, (Williams et al,2018). The same study argues that in the context of marginalized informal settlements, which frequently lack the governing tools required to bring about significant change, this is especially important.

In addition, Janizaden et al (2024) argue that in order to reduce the impact of floods, it is crucial to predict flood susceptibility across the vulnerable areas accurately. Planning and implementing successful flood risk reduction programs requires an understanding of the unique effects of floods on the livelihoods of rural impoverished people and their coping mechanisms, especially in light of projected climate change, (Parvin et al,2016). The same study argues that this information can also assist vulnerable groups develop better coping strategies, which will lessen their exposure to additional risks and vulnerabilities related to flooding. Creating a thorough policy framework for flood management is one way to lessen the effects of floods in Sub-Saharan Africa, (Balgah et al,2023).

In addition, Emem and Owojori (2023) argue that Opportunities for local viewpoints to be heard and successfully incorporated into project, policy, and process planning must be established. For instance, local communities' traditional flood management techniques must be acknowledged by the government. In a similar vein, the government ought to recognize and encourage the locally created early warning systems as the populace is accustomed to them, (Emem and Owojori,2023). Furthermore, Hooli (2016) adds that rapid socio-ecological changes have made inhabitants more susceptible to flooding occurrences, while also eroding their traditional Indigenous Knowledge (IK)-based coping mechanisms. These changes are exacerbated by a number of stresses associated with poverty, (Hooli,2016). The same study suggests that efforts to increase resilience should move from concentrating only on the communities' capacity for self-organization to tackling the larger socio-political dynamics that underlie their susceptibility.

In addition, according to Zhou et al (2022) the vulnerability of South Africa's rural and urban areas to the consequences of climate change is well established, but the distribution of these effects is uneven. The inability to precisely define the susceptibility difference between rural and urban areas hinders the development of context-specific climate policies and frameworks to aid adaption efforts, (Zhou et al, 2022). The same study argue that effective climate adaptation planning necessitates a thorough understanding of these vulnerability variations. Furthermore, Risi et al (2013) argue that Urban informal settlements are especially vulnerable to floods because of their high population density and generally poor construction quality. The several sources of ambiguity surrounding the problem should be taken into consideration and addressed in a thorough analysis of flood risk in these communities, (Risi et al,2013). The same study argue that this covers elements like how rainfall patterns are described, the risk of floods,

and how vulnerable the buildings are in certain locations. Thus, it is imperative to enhance and fortify adaptability to these shocks, first by guaranteeing access to information about their effects and vulnerabilities, and subsequently by putting policies in place targeted at lowering vulnerability, (Motsholapheko, Kgathi, and Vanderpost, 2015). The same study argue that incompatibility of the ideas of disaster risk reduction and adaptation is a major issue for developing nations.

Baan and Klijn (2004) argues that a society that is aware of flood risks does not only focus on prevention of flood risks but also prioritize crucial measures such as reducing causalities, flood damages and improving recovery, also known as disaster management. In addition, flood risk management in developing countries also includes and covers other risks considered harmful to humans (Baan and Klijn, 2004). According to Zainudini (2024) the flood measures can be divided into two categories, such as structural measures and non-structural measures. Similarly, Yang and Liu (2020) argue that there are nonstructural and structural measures often used to prevent or reduce the effects of floods. In terms of nonstructural measures include early flood warning, flood emergency planning, hydrological taxes as well as environmental education, (Yang and Liu,2020). In addition, the non-structural measures include flood forecasting, flood warning, flood mapping, emergency evacuation plans and land use zoning, (Zainudini,2024).

On the other hand, structural measures include, retention ponds, dams, river improvement, urban drainage systems and retain flood water to reduce the effects of floods (Yang and Liu ,2020). Similarly, Zainudini, (2024) also adds that the structural measures include the physical ways of reducing the risk of flooding, such as dams, dikes, storm surge barriers. Moreover, Yang and Liu (2020) pointed that warning, emergency response strategy and prediction plays a significant role to disaster management because they are proactive approaches. Due to such precautionary measures, the impact of disasters can be reduced.

On the other side of coin, Kovacs et al (2017) consider the sustainable development as the best way that can help in the reduction of natural disaster and to increase the urban resilience (such as, rebuild after crisis). In a territory, when risk prevention and sustainable development are used together, they enable various stakeholders to take part in an approach, at a level that is acceptable based on the areas of the territory and to adapt the land use, (Kovacs et al, 2017). In addition, Danso and Addo (2017) argue that flooding has devastating effects on its victims. In addition, according to Ndlovu et al (2021) it is crucial to assess the extreme rainfall days, as

these rainfall events can severely affect human activities and many sectors, which include agriculture and infrastructure.

Danso and Addo (2017), therefore, suggest that the current regulations and policies should be implemented in a way that will be able to save lives and properties, specifically in the wake of any natural hazard, rather being 'politicized'. According to Bopape et al (2021) the impact of floods events can also be reduced if the detailed and accurate weather forecasts are given on time so that the action can be taken on time prior to occurrence of the disaster. In addition, Bopape et al (2021) add that in South Africa it is the government departments and state-owned entities (the South African weather services) that are responsible for providing such forecasts.

According to Montanaa and Dasb (2017) the United Nations considers catastrophe risk reduction to be a crucial development approach for ending poverty at the family and community levels. In addition, according to Liu et al (2024) a successful approach for lowering poverty and lessening the effects of natural disasters is disaster resettlement. Long et al (2014) suggest that a comprehensive understanding of the spatial scope of catastrophic floods can enable disaster relief groups and decision-makers assist communities affected by flood catastrophes quickly and effectively.

**2.10 Gaps in literature**

While this topic of floods has been widely studied, unfortunately, there is a lack of research on the effects of April 2022 floods on socio-economic livelihoods of people in the province of KwaZulu-Natal, specifically in Mariannhill townships. In fact, there is lack of information on the effects of floods in South Africa. At this point, further research on the April 2022 KZN floods, specifically in Mariannhill townships, is needed. To close that gap, this paper explores the effect of April 2022 floods on socio-economic livelihoods of the people in one of Mariannhill townships, which is Thornwood. Therefore, this study is crucial and necessary because it has added important information to the body of knowledge, possibly suggesting solution through which flood and its effects on marginalized and poor communities can be resolved. Again, it has opened new avenues for further research.

**2.11 Conclusion**

This chapter discussed numerous existing relevant literatures on the issue floods. This was done by laying down the detailed literature review on the following aspects: nature of floods, effects, causes, types of floods, also provided a detailed overview of floods globally, in South

Africa and in both developing and developed countries, urban flooding. Lastly have also discussed flood prevention and management.

# CHAPTER 3
# THEORETICAL FRAMEWORK

## 3.0 Introduction

The previous chapter discussed in detail the numerous aspects of the issue of floods by consulting relevant literature. Then this chapter takes over by presenting the theoretical framework that informs this study. This chapter provides detailed nature and background of Sustainable livelihoods Approach. Then outlines some of the main aspects of this framework, such as vulnerability context in urban areas, livelihoods assets(capitals), transforming structures and processes, and livelihoods strategies.

## 3.1 Background and nature of SLA

According to Natarajan, Newsham, Rigg, and Suhardiman (2022) In both academic and applied fieldwork, more especially in the rural areas of the global South, the Sustainable livelihood approach has become a mainstay since it was introduced in the early 1990s. Sarker, Wu, Hossin, Alam, and Shouse (2019) argued that before 1990s, it was impossible to measure the vulnerability of humans to possible natural disasters because there was a lack of data availability, no appropriate measurement approaches, and no appropriate scales. In 1987, the SL was introduced based on resource ownership and access to basic needs and livelihood security, especially in rural areas, (Sudan ,2005). The sustainable livelihood approach has emerged out of operationalization of sustainable livelihoods concept, created by UK's Department for International Development (DFID), as well as other key agencies and organizations, like Food and Agriculture Organization (FAO), of the United Nations, the UN World Food Programme (WFP), CARE International, Oxford and UN Development Programme (UNDP), (Hammill, Leclere, Myatt-Hirvonen, and Salinas, 2005).

In addition, Knutsson (2006) argues that Sustainable livelihood Approach was only adopted by many key important donor institutions like, Oxford, United nation's development (UNDP), the UK department of international development (DFID) and Care, after five years of its formal introduction by Robert Chambers and Gordon Conway in 1991. In addition, the principles of sustainable livelihood framework have influenced some key major organizations, such as Cooperative for Assistance for Relief Everywhere (CARE), Department for International development (DFID), Oxfam and the United Nations Development Program, to develop their operational livelihood analysis framework in the light of SLF, (Sarker et al,2019). According

to Sarker et al (2019) the sustainable livelihood framework is well-accepted all over the world due to its strength of providing a strong assessment of livelihood.

The Sustainable livelihood approach has successfully managed to grab the attention of many key important donor institutions because it has presented a fresh and new vision of an integrative approach that can analyses and understand the complexity of rural development, (Chambers and Conway 1991, UNDP 1999, Solesbury 2003, and Knutsson 2006). Since its emergence in the 1990s, the sustainable livelihood approach has been a well-accepted approach that assesses the livelihood system and strategies in the face of natural hazards and vulnerability of people, especially in rural areas, (Sarker et al.2019). As a result, this framework helps agencies to develop the risk responses that are flexible and logically appropriate. According to Natarajan et al (2022), the Sustainable livelihood approach is more than just a method, but it is an approach, and it is more than just a theory, but it is a framework. The same study argues that Sustainable livelihood approach present a fresh viewpoint that values the local knowledge and also engages with the local people by putting the last first ).In addition, Hammill et al (2005) pointed out that that Sustainable livelihood approach is more than just a single approach but rather, many different organizations and agencies are applying its key concepts in many ways, some focusing more on certain aspects than on others.

Knutsson (2006) stated that "a number of recent approaches to sustainable development, such as the Sustainable livelihood approach are genuinely transdisciplinary as they are produced, disseminated and applied in the borderland between research, policy, and practice".

This paper is informed by a sustainable livelihoods Approach (SLA). This framework best aligns with the research questions, aims, and objectives of this study. The overall aim of this study is to explore and examine community's response to floods that occurred in 2022. Through the perspective of Sustainable livelihoods approach, this study seeks to answer the question of 'to what extent did the flood affect the community's livelihoods in Thornwood township'. For Elasha, Elhassan, Ahmed, and Zakieldin (2005) the livelihoods mean the entitlements, activities, and assets by which people make a living. Elasha et al (2005) also argues that assets include more than just natural/biological (such as land, water, common-property resources) but also includes social (such as community, family, social networks) as well.

This theory centers around the notion of sustainable livelihoods for the poor. According to DFID (1999) study, the livelihoods are sustainable when they can survive the external shocks,

stresses, and trends. The following are the Sustainable livelihoods Approach tools and principals that will help the researcher to analyze and perfectly align this theory with the aims of this study, this includes vulnerability context, capital assets, policies and institutions and livelihoods strategies and outcomes.

This approach presents an interesting point of view, which explains why people, especially people who live in poverty, are more vulnerable to external shocks, such as disasters and how these issues can be resolved. Guided by perspective of Sustainable livelihoods framework, this study has successfully met research objectives and answered research questions, like how and why the socio-economic livelihoods of the people in Thornwood community were severely affected by the April 2022 floods. This approach gives a better understanding of the livelihoods of the poor. According to Sudan et al (2005) the main aim of Sustainable livelihood assessment is to provide an understanding of the role and impact of a project in improving and securing the livelihoods of the local people. Additional findings by other studies also point that sustainable livelihood theory is centered around the principles of putting people at the center of development, (Ashely, 1999, DFID,1999).

### 3.2 Vulnerability Context in urban areas (Townships)

This study decided to focus on vulnerability context in urban areas, because the study area (Thornwood) is in the urban setting outside the major city of Pine Town. According to cross (1992) Mariannhill area is balancing on the edge of the urban zone and has transformed from rural to urban. According to Williams et al (2018) Cities are particularly vulnerable to climate change's effects, which include longer stretches of drought and less precipitation, longer heatwaves and cold spells, increasing sea levels, and an increase in rainfall, storms, and flooding. In urban contexts, social vulnerability is often concentrated in regions that are prone to hazards, and urban infrastructure is becoming less and less capable of managing the effects of climate change and protecting the populace, (Williams et al,2018).

The general well-being of communities in South African townships is similarly poor as housing and neighbourhood circumstances, with a reported 49%, (Moghayedi, Mehmood, Michell, and Ekpo,2024). The same study argues that financial instability and dangerous living circumstances are the main obstacles to well-being in these townships, and they are made worse by high unemployment and low-income levels. Psychosocial problems, such as substance misuse, criminality, and violence, are also pervasive contextual elements that have an

additional impact on township residents' well-being. As stated earlier that Thornwood township is also not immune to the challenges facing South African townships today. Again, as stated, that Sustainable livelihoods approach gives a clear explanation of why people, especially poor people are more vulnerable to external shocks, like floods. Looking at the living conditions in most of South African townships, specifically Thornwood Township with limited access to infrastructure (physical capital), lack of quality education/skills and high unemployment rate (human capital), low-income levels (Financial capital), lack of clean water (Natural capital), poor relationship between residents and government (social capital).This shows that when people have no or limited access to these capital assets, their livelihoods can be easily affected by these external shocks, which in case of Thornwood township was floods. Under the SLA's perspective of vulnerability, Thornwood township would be identified as one of vulnerable townships to external shocks, like floods because people in this community have limited capital assets to face these external shocks. This tend to explain why this community was severely affected by the devastating effects of 2022 floods.

The DFID (1999) research pointed out that there are critical trends, shocks and seasonality that often affect people's livelihoods, which are external to them and have no control over. According to Hammill et al (2005) there is a vulnerability context which is the external environment in which individuals exist. People have no or limited control over these external factors which often negatively affect their livelihoods, (Hammill et al,2005).

In addition, Hammill et al (2005) points out that shocks are one of these external factors which present the change that is most extreme, sudden, and unexpected in people's livelihoods, such as disasters, civil conflicts, economic shocks or outbreaks of disease or pests. Unlike the shocks, trends are more predictable and long-term, such as economic and population trends, (Hammil et al,2005). There is another external factor called seasonality, which is the seasonal fluctuations in prices and employment and food and resources availability because of seasonal weather and other factors, (Hammill et al,2005).

According to the DFID (1999) study, people operate in the context of vulnerability. According to Sarker et al (2019) Livelihood vulnerability means exposure, sensitivity, and adaptive capacity of people's livelihood in the face of natural hazards. There are 3 main components of vulnerability, such as exposure, sensitivity, and adaptive capacity, (Sarker, et al. 2019).

In addition, often the most affected people by these external environments are the world's poorest people, (DFID,1999) Additionally, Douglas (2008) also pointed that most people that are poor live in the most hazardous and on environment, which is not healthy, in urban areas. According to WCU (2004) the poor people are more likely to be affected by climate risks. Settling on marginal or on lands that are unstable, such as floodplains, steep slopes, often increase their vulnerability to climate hazards, (WCU ,2004).

Mike (2002) argues that most poor people around the world live in urban areas, (90% in Latin America, 45 % in Asia and 40% in Africa). Sarker et al (2019) argued that the livelihood of the people from the developing countries with lack of resources, is most affected by the natural disasters. Williams et al (2018) add that more than 1 billion people, mostly in the Global South, live in informal settlements as a result of urban poverty, fast urbanization, the growth of already congested urban centres, and the inability of the market and the government to provide cheap housing for the urban poor.

In addition, UNDP (2008) adds that people in developing countries are more vulnerable to natural disasters due to the low income and because they depend more on agriculture. More depending on the ecosystem services (natural resources), they often put their welfare and survival at risk to environmental conditions, (WCU,2004). As a result, the decline of such available natural resources due to climate risks will heavily affect their livelihoods. As a result, they become unable to respond to stress such as droughts and floods and unable to meet basic needs or move out of poverty, (WCU,2004).

Sarker et al (2019) argues that the citizens of the developing countries often share the same vulnerability all over the world, such as flooding, storm, droughts, riverbank erosion, crop, and livestock diseases infestation. Climate change serves as a main threat that increases the existing vulnerabilities and on the other hand, also creating new ones for the poor, (WCU, 2004). Just to mention few of these new vulnerabilities, they may include loss of livelihoods because of increased extreme events, displacement by sea-level and coastal inundation, food insecurity, increasing morbidity and mortality associated with a rise in water and vector-borne diseases, and a deepening poverty cycle, (WCU,2004).

What shapes urban poverty is nothing other than what city municipalities do or do not do, (Mike,2002). In terms of several trends, shocks and seasonality that are external to people's

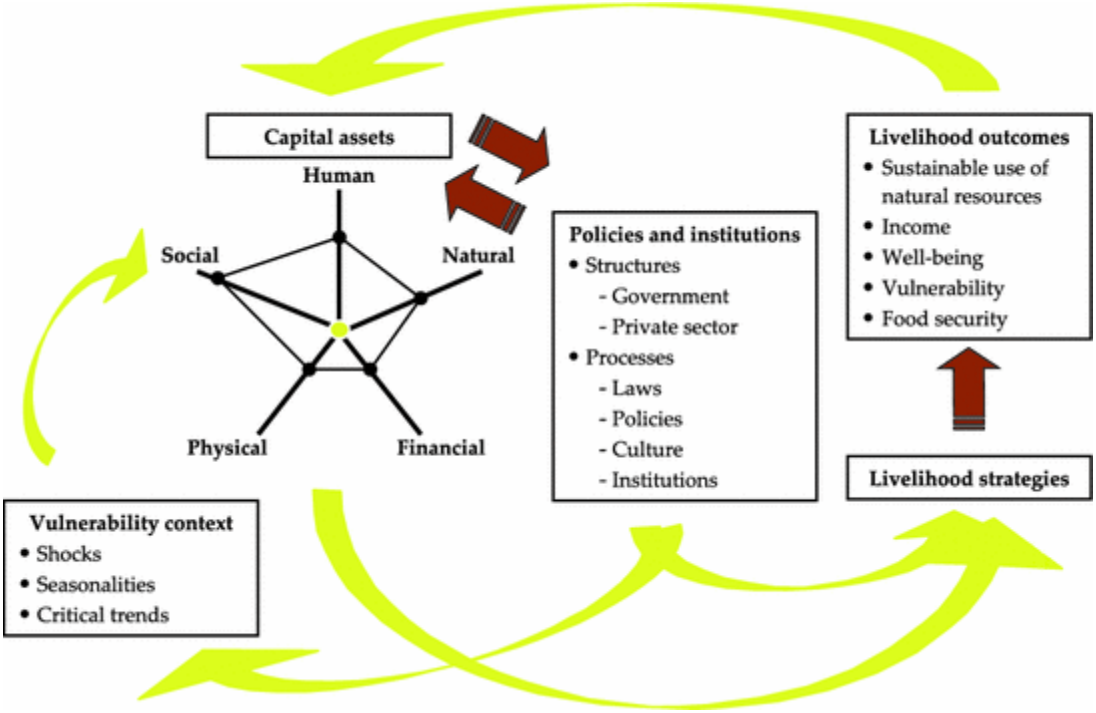
livelihoods, in this study the focus will specifically be paid to floods as an external shock, as a way of explaining how the April 2022 floods have severely affected the socio-economic livelihoods of people in one of Mariann-hill suburbs (Thornwood).

### 3.3 Livelihood assets (Capitals)

According to Hammill et al (2005) there are five livelihood assets(capitals) portrayed by the sustainable livelihood approach, such as human capital, natural, financial, social, and physical capitals. Human capital determines the quantity and quality of available labor, such as skills and knowledge, education, and health levels of people, and can even make use of other capitals. Natural capital includes assets that can be used for production, such as land and trees, and water, and intangible assets such as quality of the environment, (Hammill et al,2005). Financial capital refers to the income and savings, both cash and credit. Social capital refers to membership in groups and networks, relations of trust, common rules, and norm, and social resources enabling people's access to other resources, (Hammill et al,2005). Physical capital includes both infrastructure such as houses and buildings, means of transportation and means of production, (Hammill et al,2005). Ludi and Slater (2008) argue that financial and physical assets are not the only assets highlighted by the SL Framework, but also include social, human, and natural (to form the 'asset pentagon') with political asset which has been recently added to the framework (to form the 'asset hexagon').

### 3.4 Transforming structures and processes

Most interestingly, Sustainable Livelihoods Approach (SLA) brings together the practice of poverty reduction, sustainable development, and empowerment processes in one place (Ashely,1999). Although the SL Framework strongly focuses on the micro-level which is individuals and households and their assets, it also highlights the specific contextual settings which includes the examination of risks and vulnerability, and how policy, institutional structures and processes might affect different groups of poor people,(Ludi and Slater,2008).




**3.4.1 Source:** Serrat (2017).

Mike (2002) also argues that the options available for livelihood strategies and the access people have on the types of capital assets (human capital, social capital, natural capital, financial capital, and physical capital) are shaped by the same structures and processes (Mike ,2002). This approach aims to transform the very same structures.

According to Mike (2002), it is crucial to consider the fact that the reason behind most problems facing poor people, especially those who resides in informal settlements is because of failed policies, inappropriate regulatory frameworks, bad governance, and corruption, so as a result people are unable to achieve sustainable livelihoods. In situations like this, Sustainable livelihoods framework seeks to intervene to address issues related to policies and this affects the living conditions of ordinary people. Sarker et al (2019) argues that sustainable livelihood framework considers assets to be the main concern which is mainly affected by environmental stressors. The main ways to transform the vulnerable context to sustainable livelihood are the livelihood strategies and institutional process, (Sarker et al,2019).

Mike (2002) argues that this approach seeks to unite different actors, such as local government, municipal authorities and local communities in decision making, policy formulation and

implementation. In addition, Williams et al (2018) suggest that in order to develop knowledge jointly, a wide range of stakeholders must be included in participatory governance procedures for effective local government for water management. Thus, local government, the commercial sector, scientists, the larger research community, and local communities must all be involved in a thorough examination of governance. In other words, it seeks to act as a bridge to close the gap between policies at a macro level and at micro level.

### 3.5 Livelihood strategies and Using Sustainable livelihood Approach to reduce vulnerability.

Livelihood strategies are regarded as strategies taken by individuals to maintain their livelihood, and institutional process translate the assets and strategies into action for making important changes in people's livelihood, (Sarker et al, 2019). Sudan (2005) views the livelihood assessment as a way of accessing how individuals and communities behave under given frame conditions. Elasha et al (2005) argue that the livelihood systems can be understood by analyzing the coping and adaptive strategies used by individuals and communities to respond to external shocks and stresses such as drought, civil strife, or policy failures. According to Ludi and Slater (2008) the main argument of Sustainable livelihood framework is that people can use their assets in responding to opportunities and risks, to minimize vulnerability and to maintain and improve their well-being, by using livelihood and coping strategies.

It is essential to have a thorough understanding of the livelihood -climate change interactions before attempting to try and reduce people's vulnerability to shocks such as climate-related disasters, (Hammill et al,2005). Understanding the reason behind people's vulnerability and how they cope, if the first important step that can help in identifying entry points for adaptation strategies, (Hammill et al,2005). In addition, Hammill et al (2005) suggested that the following four steps can be used in the participatory process:

. Identify how livelihoods are conducted.

. Identify the main climate-induced vulnerabilities that affect livelihoods.

. Identify existing coping strategies.

. And identify the needs and priorities of stakeholders in the face of climate-induced vulnerabilities.

Ludi and Slater (2008) argue that individuals and households are not only embedded in context of exposure to risks and opportunities but also to services and policies, institutions, processes, and structures (PIOPS) as well. These often influence and shape how individuals and households use a combination asset in developing a particular livelihood activity or coping strategy, (Ludi and Slater,2008).

Bebbington, (1999) argues that sustainable livelihoods approach seeks to help people to convert their strength, which is their assets into positive livelihood outcomes. UNDP (1999) also pointed out that this framework seeks to improve the livelihood of poor people, by helping them to build on what they have, by focusing on their own assets. Furthermore, Ludi and Slater (2008) argue that the Sustainable livelihood Framework focuses on people's strength rather than their needs. This framework views individuals as actors with assets, capabilities who use livelihood goals, rather than being victims or simply beneficiaries, (Ludi and Slater,2008).

According to Hammill et al (2005) to build resilience for the poor who turn to be the most vulnerable group to disruptive shocks and trends, like climate-related hazards and climate change, the first step is to clearly understand how their livelihoods are comprised and conducted. Such understanding of people's livelihoods, especially the poor, can help to create the overall understanding of how they will be affected by climate change impacts, how they might respond with the resources they have and how these conditions can be reflected and used upon building successful adaptation strategies, (Hammill et al,2005).Therefore, the Sustainable livelihood approach is a suitable and appropriate framework for this study.

### 3.6 Limitations of SLA

Serrat (2017) stated that the limitations of Sustainable livelihoods approach are as follows:

. *"Underplays elements of the vulnerability context, such as macroeconomic trends and conflict*

. *Assumes that capital assets can be expanded in generalized and incremental fashion.*

. *Does not pay enough attention to inequalities of power.*

. *Underplays the fact that enhancing the livelihoods of one group can undermine those of another".*

According to Kranz (2001) the Sustainable livelihood approach does not address the issue of

how to identify the poor that it is claiming to help. The same study argues that the main idea around the SL approach is to begin with an analysis that is broad and open-ended, but this needs a highly flexible planning situation which rarely exists. In addition, Tambe (2022) also adds that over time, the SL approach was criticized for putting lot of focus on household and for being too abstract in terms of providing insights on general patterns and policy analysis.

### 3.7 Potential lessons SLA that offer

Norton and Foster (2001) asserted the following about the SL approach:

*"It aims to reflect the complex range of assets and activities on which people depend for their livelihoods and recognises the importance to poor people of assets which they do not own. It provides a framework for addressing the whole range of policy issues relevant to the poor, not just access to health and education, but issues of access to finance, markets, and personal security. It emphasises sustainability, and the need for a people centred and participatory approach, responsive to changing circumstances, and capable of working at multiple levels from national to local, in partnership with public and private sector".*

### 3.8 Conclusion

This chapter presented in detail the theoretical framework adopted by this study which is Sustainable livelihoods approach. This chapter argued that this framework was suitable and appropriate for this study.

# CHAPTER 4
# METHODOLOGY AND METHODS

## 4.0 Introduction

This section outlines the research methods and methodology employed for the execution of this study. It represents the study design and sample selection and size. This section begins with the description of the study area, which is Thornwood township. Then this chapter presented the study's research design (qualitative research method). Then it goes on to discuss the sample selection and size, participant criteria/sample size, data collection instruments and data analysis used in the study. Lastly, the chapter presents the trustworthiness and ethical considerations of the study.

## 4.1 Description of study Area

The study was carried out in Thornwood township, which is one of the Mariann-Hill townships in the province of KwaZulu-Natal in South Africa. This township was selected because it was one of Mariann-Hill townships severely affected by floods which occurred in April 2022 in KZN. Thornwood is a suburb in eThekwini, KwaZulu-Natal, situated nearby to the suburbs of Mariann-hill and Dassenhoek. This how Cross(1992) describes the location of Mariann-Hill townships:

The area of the Mariannhill Region is roughly 176 square kilometers. The N3 highway forms its northern boundary, Shallcross, Chatsworth, and Queensburgh form its eastern boundary, the Mlazi River and the KwaZulu border form its southern boundary, and the Mgoshongweni Rivers form its western boundary. The following settlement regions are being examined: Emmaus region (1 km²): This region has somewhat hilly, livable topography and is situated west of the Westmeade Industrial Township and north of the N3 freeway. The settlement is the source of a perennial stream.

Tshelimnyama Area (5 km2): Located on the Situndu Hills' northeastern slopes, this area is appropriate for development because it is not extremely steep. The Mhlatuzana River receives water from non-perennial streams.

The five-kilometer-square Mpola Area is situated on the northeastern slopes of the Situndu Hills and is likewise distinguished by non-perennial streams that feed the Mhlatuzana River.

Thornwood Area (around 2.5 km2): This area is situated on the Situndu Hills' eastern slopes and has a topography that encourages the growth of settlements.

### 4.2 Qualitative research

This study employed qualitative research technique. According to Mariaety (2011) a qualitative research method provides in-depth understanding and interpretation of the social world. According to Hennink (2020) it is not easy to define the qualitative research method because it is a broad umbrella term that covers many techniques and philosophies. Broadly, qualitative research can be defined as a method that helps researchers to examine people's experiences in detail by allowing them to use specific set of research methods including in-depth interviews, focus group discussions, observations, content analysis, visual methods and life histories/biographies, (Hennink, 2020). Participants being at the Centre, their subjective understanding, their social, material circumstance, their experiences, perspectives and histories form part of a qualitative approach. As this study wanted to explore the extent of floods on the community of Thornwood in 2022 and to explore both the community and government responses and the effectiveness of such strategies, the qualitative research method became the most suitable and appropriate method to fulfill that aim, as it allowed for in-depth understanding of a targeted phenomenon.

Hammarberg, Kirkman, and de Lacey (2016) adds that qualitative research methods allow the researchers to answer questions about experience, meaning and perspective, usually from the participant standpoint. The same study asserted that qualitative research techniques include:

*" 'small-group discussions' for investigating beliefs, attitudes and concepts of normative behavior, 'semi-structured interviews', to seek views on the focused topic or, with key informants , for background information or an institution perspective, 'in-depth interviews', to understand a condition, experience or even event from a personal perspective and 'analysis of texts and documents, such as government reports, media articles, websites/diaries to learn distributed/private knowledge",* (Hammarberg et al, 2016).

Similarly,Woodsong, Macqueen, Guest, and Namey (2005) argued that qualitative research method effectively identifies intangible factors, such as, ethnicity, religion, socioeconomic status and social norms. It does not take only just applying the methods to become a qualitative researcher, but rather, it requires one to be able to identify issues from the perspective of their

study participants and understand the meanings and interpretations that they give to behavior, events and objects, (Hennink,2020). Therefore, the qualitative researcher needs to be flexible, curious, open-minded and must have ability to listen to people when sharing their own stories and experiences, (Hennink,2020).

This method aligned very well with the objectives of this study and have helped the researcher to successfully answer the research questions of the study. Using a qualitative research technique this study has been conducted in one of Mariannhill townships, known as Thornwood ,in the province of KwaZulu-Natal. This community was mainly selected because it has witnessed and experienced the devastating effects of the severe floods that occurred in 2022. This study had a discussion with community members through in-depths key informants' interviews and focus group discussions. The data have been collected from community members above the age of 18 years, in the settlement through in depths semi-structured interviews and the focus group discussions.

This study has also included the secondary sources , such as government publications websites, books and journal articles. In terms of location for the interview's, semi-structured interviews were done on the participants' households. For the focus group discussions, the researcher has secured a safe place with enough space which accommodated the group members.

**4.3 Sample Selection and Size**

According to Obilor (2023) a sample refers to a targeted group that a researcher collects data from. Similarly, Sulaiman (2016) defines a sample as a portion of a population or universe. Moreover, Obilor (2023) defines a sampling as a process, technique and act whereby the researchers select a suitable sample to determine the characteristics or parameters of the whole population. The same study argue that the sampling process consists of many stages such as defining a targeted population, choosing the unit of analysis (person , group, country or objects) and a researchers must be able to choose a sampling frame using a suitable sampling technique, (Obilor ,2023).

The target population, for this study was the community members in Thornwood township above the age of 18 years. In terms of selecting a population sample, this study has employed a purposive sampling method. According to Cresswell and Plano (2011) a purposive sampling technique allows the researcher to identify and select individuals or group of individuals that

are especially knowledgeable about or experienced the phenomenon of the interest. Similarly, Mack et al (2005) adds that a purposive sampling is a very common sampling strategy which is used by the researchers to group their research participants based on preselected criteria relevant to a specific research question. In addition, Obilor (2023) argue that purposive sampling is a non-probability sampling technique used by the researchers to select specific subjects suitable for the objectives of the study based on the conviction of the researcher. This simply means that the entire sampling process rely on the judgment of the researcher and their knowledge of the context, (Obilor, 2023).

In this case, this study targeted the community residents in Thornwood above the age of 18 years, as they now can make their own decisions whether to participate in the study. This study has used the in-depth semi-structured interviews and focus group discussions to collect the data from the research participants in the study area. For the semi-structed interviews, about 13 participants were selected and interviewed. For the focus group discussions, 20 respondents were selected and interviewed, and were divided into 4 groups, whereby each group was comprised of 5 participants. Altogether, about 33 participants were selected and interviewed for this study, in this community.

### 4.4 Participant Criteria/sample size

The study was aiming to select and interview 35 participants. This study was aiming to conduct the in-depth semi-structured interviews with 13 community members and with 2 community leaders. Unfortunately, the researcher was not granted a permission to interview the 2 leaders. Therefore, the study ended up interviewing 13 community members and 20 participants for the focus group discussions, which consisted of 4 groups with 5 members each. In total, the study consisted of 33 participants.

### 4.5 Data collection instruments

According to Monday (2019) the data collection is the essential component in conducting research. In addition, Umen-Akyildiz and Ahmed (2021) argue that a crucial step to keep in mind as a researcher who wants to conduct the qualitative study is thinking about what tool to use to collect data and which techniques to use to analyse collected data. The same study, adds that there are several methods one can choose from when collecting data using a qualitative research method, however, choosing which type of method will depend on the aims/objectives

of the researcher, (Umen-Akyildiz and Ahmed,2021). To collect the data, the researcher of this current study used two data collection instruments, which are the in-depth semi-structured interviews and the focus group discussions, which has been discussed in detail below:

### 4.5.1 In-depth semi-structured interviews

According to Naz, Gulab, and Aslam (2022) the semi-structured interviews enable the researchers to explore the opinions and ideas, views and experiences of the participants, as well as allowing for the in-depth understanding and clarification of complex/sensitive subject matter. In addition, Omolala and Nicole (2021) add that, generally the semi-structured interviews are the suitable type of data collection in qualitative research, especially in addressing more complex social behavioural research questions. The in-depth semi-structured interviews were conducted in participants' households in the study area, whereby the about 13 participants were selected and interviewed. The in-depth semi-structured interviews took between 3-10 minutes. The interviews were conducted from 11$^{th}$ of May to the 19$^{th}$ of the same month in 2024.

**Table 1: Participant details**

| Participant number | Date | Area |
|---|---|---|
| Participant 1 | 11 May 2024 | Thornwood |
| Participant 2 | 11 May 2024 | Thornwood |
| Participant 3 | 11 May 2024 | Thornwood |
| Participant 4 | 11 May 2024 | Thornwood |
| Participant 5 | 11 May 2024 | Thornwood |
| Participant 6 | 11 May 2024 | Thornwood |
| Participant 7 | 11 May 2024 | Thornwood |
| Participant 8 | 11 May 2024 | Thornwood |
| Participant 9 | 11 May 2024 | Thornwood |
| Participant 10 | 11 May 2024 | Thornwood |
| Participant 11 | 18 May 2024 | Thornwood |
| Participant 12 | 18 May 2024 | Thornwood |
| Participant 13 | 19 May 2024 | Thornwood |
| | | |

**Source: The researcher**

### 4.5.2 Focus group discussions

To collect more rich information and understanding of respondents' experiences, views and beliefs, this study has employed the focus group discussions. Mishra (2014) asserted that the focus group "is a type of in-depth interview accomplished in a group, whose meetings present characteristics defined with respect to the proposal, size, composition and interview procedures". The focus group discussions were also conducted in the study area, whereby 20 participants were selected and interviewed. There 4 groups and each group consisted of 5 members each, so in total 20 participants were interviewed for the focus group discussions. The FGD took about 5-20 minutes in length. The 4 focus group discussions were conducted on the 19th of May 2024.

**Table 2: Focus group discussion Participants details**

| Group number | Number of participants | Date | Area |
|---|---|---|---|
| Group 1 | 5 members | 19 May 2024 | Thornwood |
| Group 2 | 5 members | 19 May 2024 | Thornwood |
| Group 3 | 5 members | 19 May 2024 | Thornwood |
| Group 4 | 5 members | 19 May 2024 | Thornwood |

**Source: The Researcher**

### 4.6. Recording and Transcription

According to Omolala and Nicole (2021) it is crucial for the researchers to decide if they want to record the interview. However, the same study, recommends that researchers should record the interviews, so that the data being collected can be recorded and captured effectively and accurately for analysis, and that can help the researcher to be more present during the interview process to allow the conversation to flow naturally. Both the in-depth interviews and focus group discussions on this current study, were recorded to capture accurately the insights of the key informants/research respondents. Because most people living in Thornwood area are Zulu-speaking people, informed consent was translated into a language that the respondents best understand. Interviews were also conducted in the same language which the respondents have understood, and then later were transcribed into English.

## 4.7 Data analysis

The first step towards data analysis was transcription. The researcher started with by firstly transcribing the audio into a word format. Both the interviews from semi-structured interviews and focus group discussions were recorded in Isizulu language. After transcribing the audio (recorded in Isizulu) then the researcher transcribed it again into English.

Study have used a narrative analysis. This study is a type of qualitative research approach known as a case study, because it particularly focused on the case of Thornwood township. For that reason, the narrative data analysis was more appropriate for this study, as it has allowed the researcher to interpret the personal experiences, realities and to understand how each resident in the study area experienced the effects of floods that occurred in 2022, and how they responded to it. The data was coded using the NVivo software. The key findings were categorized into common themes and sub-themes. This data obtained from the semi-structured interviews and from the focus group discussions, was analyzed by using an inductive coding system\approach, to interpret participants' stories by identifying the patterns and themes in this data and align them with the aims of this study.

## 4.8 Trustworthiness

Noble and Smith (2015) argue that in contrast to the quantitative research that applies methods that are statistically to establish validity and reliability of research findings, the qualitative research, on the other hand, use methodological strategies that allow the researcher to ensure the "trustworthiness" of the findings. In addition, Gunawan (2015) adds that the study is only be regarded to be trustworthy only if the audience (reader) claim it to be so. Similarly, Rachel (2022) also argues that for the research to be relevant, it must be trustworthy. The researcher of this current study was more committed to enhancing the trustworthiness in every aspect when conducting this research.

Furthermore, Elo, Kääriäinen, Kanste, Pölkki, ,Utriainen, and Kyngäs (2014) argued that the terms like credibility, dependability , confirmability, transferability are often used to present the trustworthiness in the qualitative content analysis.

*Credibility*

Lincoln and Guba (1985) argue that credibility can be established when the researcher is able to present plausible information of the original responses of the participants and when the

original views of the participants are interpreted correctly. In the current study, the researcher was more committed to enhancing credibility.

*Dependability*

Elo et al (2014) refers to dependability as a stability of data over time under various conditions that are different. Again, the researcher of this current study was determined to enhance dependability.

*Confirmability*

According to Diana (2014) the researcher can establish confirmability by being able to describe how conclusions and interpretations were reached, and the findings should derive directly from the data. In this current study, the researcher ensured that all the empirical findings and conclusions of this study were taken directly from the actual responses of the study participants.

*Transferability*

According to Diana (2014) the researcher can establish transferability by providing sufficient information on the participants and that enable the reader to see the findings' capability of being fit/transferable. Again, in this current research, the researcher was more committed to enhancing transferability.

### 4.9 Ethical consideration

According to Moriarty (2011) all research raises ethical issues, therefore its crucial for researchers to firstly seek ethical approval .Mack et al (2005) adds that whenever, the research is conducted using people their well-being must always be a top priority, and the research question must always be of secondary importance. This simply means that if a researcher is to choose between doing harm to participants or to research, they must sacrifice the research instead, (Mack et al,2005). Therefore, the researcher of this study also fully understands that when conducting research using human beings, there are some important research ethical policies that must be adhered to, and research may not be conducted if any of these ethical /policies are violated. This study has been abided by UKZN research ethics policy and have avoided any activity, which might be in violation of this research policy.

The researcher of this study also understands that sharing the experiences of something painful experience, such as the effects of April 2022 floods on residents, can be a very sensitive topic in nature and social stigmatization and secondary victimization can happen, therefore , to avoid that, the researcher was guided and complied with research ethic policy. The in-depth interviews were conducted in ethical manner and respected all the respondent's confidentiality

and privacy. To respect the participants autonomy, their names were not recorded and their identifying information as well. In other words, all their information and interview responses were kept confidential.

The informed consent was used, by fully informing all the respondents of this study about aims of this study, their consent to participate and that they have a right to withdraw anytime if they feel uncomfortable to continue participating. Both the informed consent and interviews were written in Isizulu, to make sure that all the participants understood everything clearly.

### 4.10 Conclusion

This chapter presented the methodology of this study. It has discussed and outlined all the aspects used in this study to collect data from the participants.

# CHAPTER 5

## PRESENTATION OF THE FINDINDS

### 5.0 Introduction

The previous chapter have discussed the main methods and tools used by this study to collect data from the participants. Now this This chapter expands on that by providing the presentation of the findings obtained from the previous chapter. This chapter presents the findings by outlining the main themes. The first key theme that this study presents is the challenges/effects of floods on the community in the study area and recovery process. Second theme include the coping strategies and their effectiveness. Lastly, the chapter interrogates the government interventions.

### 5.1 Challenges /effects of the April 2022 floods on the community of Thornwood Township

Thornwood township is one of Mariann-Hill townships that have experienced and witnessed the devastating effects of the flood that occurred in April 2022. Many residents in this community were severely affected in many ways by the challenges imposed by the flood. To adequately explain this further, this study will discuss the following effects/challenges that has severely affected the community members in this area, such as, loss of property, loss of infrastructure, loss of livestock, financial effects, health issues, psychological effects, water shortages and electricity outages.

Montanaa and Dasb (2017) argues that floods have a detrimental effect on income, spending, employment, and mental health in addition to causing substantial damage to property and life and displacing people. According to Ainehvand, Raeissi, Ravaghi, and Maleki (2019) in human communities, natural calamities such as floods, earthquakes, and extreme weather events are unavoidable and usually affect different food systems in comparable ways. Following such incidents, emergency conditions arise, which are marked by damage to food preparation equipment, road closures, and interruptions to basic utilities like electricity and water, (Ainehvand et al,2019). The study argues that emergency food, such as ready-to-eat meals, is crucial under these circumstances for the survival of the injured as well as aid workers. This aid, which is usually organized by governments and aid organizations, is crucial for those

who have been left stranded for hours on closed highways, in isolated areas, or for prolonged periods of time in inclement weather after earthquakes and floods.

### *5.1.1 Loss of property*

Loss of property due to floods has been considered to be one of the serious effects/challenges by many participants. The indications of participants reveal that the issue of flooding in Thornwood township has imposed severe damage on their personal belongings and properties, such as damaging and destroying their homes, furniture (cupboards).To comprehend these findings, one of the participants had this to say:

*"I was affected because my property was damaged",*
*(Participant 10, 11 May 2024)*

*"A lot happened, we lost a lot of things, including furniture and groceries".*

*(Participant 1, 11 May 2024)*

To elaborate further on this issue of property loss, one of the participants also pointed out that her house was damaged inside due to the force of floodwater causing everything to be damaged and wet. This participant had this to say:

*"I was affected because there was water inside my house and my property was flooding in the water".*
*(Participant 7, 11May 2024)*

In support of participant 7, participant 6 had this to say:

*"My clothes were very wet, even my cupboards were damaged".*
*(participant 6, 11 May 2024).*

Again, some participants, such as participant 5, participant7, participant 8 and participant 9 also pointed out the same issue of floodwater inside their homes, which resulted in in their

property being severely damaged. To elaborate on these findings, these participants had this to say:

*"I was affected a lot by the floods because my house was liking and everything inside the house was so wet".*
*Participant 5, 11 May 2024).*

*"I was affected because there was water inside my house and my property was flooding in the water".*
*(Participant 7, 11 May 2024)*

*"The house was full of water and most of my things were damaged a lot".*
*(Participant 8, 11 May 2024)*

*"The was water inside my house everything was damaged".*
*(Participant 9, 11 May 2024)*

*"Floods affected us because it damaged our house, the water inside the house, food and everything was ruined".*
*(Group 3, 19 May 2024)*

The participants' views reflect the impact that floods had on their personal belongings and properties. The participants indications show that floodwater had caused severe and serious damage to their properties and belongings, ranging from the damage caused inside their homes and damage caused to their property such as furniture (cupboards) and groceries. This finding is in line with Badamosi, Obafemi, Olukoy, Adegoroye, and Aturamu (2024) study, which investigated the Socioeconomic impacts of flooding and its coping strategies in Nigeria. The findings from this study reveal that roughly 48% of their respondents said that their homes or structures had been damaged or lost, and 35% said that their personal items had suffered comparable losses. Similarly, Hooli (2016) argues that the significant damage has been done to individual homes and personal property by water.

The same study adds that in rural places, it has caused mud houses to collapse, which are frequently the only possessions of many households, while in urban areas, it has twisted and rusted the corrugated iron sheets used in settlements. In addition, Davis and Black (2020) argue that the main economic consequence of flooding is typically property damage, which affects homes, businesses, and public infrastructure. According to Davis and Black (2020) the damage to physical assets is just one of the consequences that might result in inequality. Temporary or permanent unemployment, decreased business revenue or rental income, health problems, increased costs for goods and services, and evacuation-related travel and accommodation expenses are a few examples, (Davis and Black,2020). With more fatalities and property damage than any other natural or man-made danger, flood hazards are now regarded as one of the most damaging natural disasters in the world, (Week and Wizor). As a result, climate experts consider floods to be one of the biggest obstacles to weather forecasting. To sum up, the current findings on the property loss emphasize that losing one's property and personal belongings which the person worked for, for many years and almost their entire life, can be heartbreaking. Therefore, this shows that this spelled a serious trouble for the people in the study area.

Cannon, Twigg J, and Rowell (2003) argued that the vulnerability of an individual is shaped by how weak or strong livelihoods are, if they have good access to the capital assets which enhance their livelihood strategy, and how helpful are the different institutions in maintaining social protection. According to Sarker et al (2019) the livelihood capitals (e.g. social, natural, human, physical and financial capital) assist in enhancing people's capacity in order to be able to face the vulnerability of climate change. This simply means that if these livelihood assets are limited or damaged then individuals will suffer from external shocks. This has been the case in Thornwood township, whereby due to floods people lost their property and personal belongings which can be categorized as (form of physical capital) based on the SL approach. Based on the SL perspective, losing one's property (physical capital) can be explained in terms of vulnerability context.

### *5.1.2 Loss of infrastructure*

Numerous participants indicated that the loss of infrastructure was one of the serious challenges imposed by the flood. Most participants pointed that the critical infrastructure, such as roads,

bridges and train railways were severely damaged and destroyed by the floods. From the narrative of participants, it is clear that this damage severely affected most people in this community as this limited their access to certain resources and services. They were unable to go to work and children could not go to school because roads were damaged. To elaborate these findings, one of the participants in the focus group discussions had this to say:

*"We were affected very badly, to an extent that bridges and roads were damaged. We ask government to intervene. The floods caused lot of damage".*

*(Group 4, 19 May 2024)*

Furthermore, one of the participants also reported that due to the massive disruption to the infrastructure (roads and bridges) municipality was unable to deliver essential services, such as water. To adequately explain this, this participant had this to say:

*"Municipality could not bring water because the roads were damaged".*
*(Participant 13, 19 May 2024)*

The responses from the Focus group discussions with some participants in group 1, 2, and 3. revealed that the important infrastructure like roads, bridges and railways were destroyed and damaged by the flood in this township. To explain this adequately, these participants had this to say:

*"Roads were damaged, even the railways were damaged"*
*(Group 1, 19 May 2024).*

*"Bridges were damaged".*
*(Group 2, 19 May 2024).*

*"We could not go to work because roads were damaged, at work there was no water nothing".*
*(Group 3, 19 May 2024)*

The above-cited narratives of the participants provide an insight into several challenges and barriers that were presented by the loss of infrastructure as a result of floods. According to the

indications of the participants, these challenges and barriers caused by the loss of infrastructure in this community ranged from, limited access to essential resources and services, people not being able to go to work, with children also unable to go to school. These findings conform with earlier findings by Badamosi et al (2024) study, who stated that flooding has a major socioeconomic impact on education. This study by Badamosi et al (2024) also reveals that thirty percent of respondents reported disruptions in the education system, mostly as a result of damaged school buildings and inaccessible roads.

This clearly shows that the critical infrastructure in the study area was in a dire situation, with roads, bridges and railways severely destroyed and damaged. According to Pant, Hacker, Hall, Alderson, and Barr (2018) the national critical infrastructure such as water, digital communications, energy and transport are vulnerable to natural disasters, like floods. Their geographical location becomes the main determining factor, more especially in the case of the floodplains, (Pant et al,2018). Similarly, the findings from a study conducted by Stamos et al (2020) reveals that the roads were flooded away during the 2017 Mandra flood, and as a result these roads were closed, and there was a serious damage on the foundation of the roads.

Due to loss of infrastructure the normal daily movement of transport in the study area experienced a huge disruption, whereby even the local municipality was unable to deliver essential services like water to the people. This finding aligns with the study by Stamos et al (2020), which found that the floods events often put the transportation and its infrastructure into a great risk, disturbing their crucial role in numerous socioeconomic activities and safety of the commuter. These findings also align with the study by Pregnolato et al (2017), which found that transportation networks are vital to economic activity because they facilitate the movement of people and goods. The transportation infrastructure may be directly or indirectly damaged by extreme weather events, putting public safety at risk and producing significant disruptions with far-reaching social and economic effects, (Pregnolato et al,2017). Flooding is the primary cause of weather-related interruptions in the transportation sector, particularly when it follows heavy rainfall.

The sentiments expressed by the participants reflects how serious this issue of damaged infrastructure was in this township. This finding is in line with Stamos et al (2020) research findings, which reveals that reveals that during the extreme flood events, the river crossing infrastructure( such as bridges, ford crossing, culverts) and crucial part of the road network

often experience serious damages .Again, To sum up, the current findings on the loss of infrastructure in the study area emphasize that this effect caused by floods, had dire consequences and exposed people to more risks, such as having to live without clean water, and also losing their jobs and caused disruption in education.

According to Fauziyanti and Hizbaron (2020) the livelihood can be entitled as sustainable only if it can face shocks, stress, seasonality and trends, with enough assets that lead to stable social political structure and processes, enabling people to get more income, improve security and sustainability. In other words, losing livelihood assets, which in the case of Thornwood township people lost their infrastructure (physical capital) they become more vulnerable to external shocks . This was reality in the study people, whereby people experienced serious problems such as losing their jobs and income, a s a result of loss of infrastructure.

According to Sarker et al (2019) there is an increase in susceptibility of people experiencing vulnerability posed by natural disasters, from all walks of life, such as social, physical, human, financial and natural dimensions. This has also been the case in Thornwood township where this community lost their infrastructure, such as roads, bridges, railways (physical capital). Based on the SL approach, losing livelihood capital can hinder individuals from coping with external shocks.

### *5.1.3 Loss of livestock*

As indicated by some of the participants, loss of livestock was also another challenge posed by the floods in this community. Through their narratives, it is crystal clear that the livestock like chickens and their eggs played a huge role in the livelihoods of some of these participants. Therefore, this indicates that losing their livestock presented s huge challenge. To elaborate on this issue, one of the participants in the focus group discussions, had this to say:

*"Lot of things we had, our livestock, like chickens and more. We lost everything during the floods".*
*(Group 1, 19 May 2024)*

*"Floods affected us very much because our livestock, such as our chickens, eggs were affected. I was really affected because my livestock was very helpful to me".*

*(Group 4, 19 May 2024)*

The participants' views reflect the impact of floods on their livestock, specifically on their chickens. As it can be concluded from the above narratives that chickens served as helpful livestock because it provided the participants with eggs, which helped them a lot. This indicated that it was easy for the participants to get eggs without having to go to the store to buy, because they had chickens. The loss of these chickens spelled a serious trouble for these participants, as they now had to go and spend money to buy if need eggs or chicken to make some curry. To sum up, the current finding, shows that the loss of livestock had dire consequences on those participants in the study area, who were heavily depending on their livestock (chicken and eggs).

Sarker et al (2019) argue that the livelihood system of a community is the main aspect of social system that often experiences frequent disruption of ecological, financial and human-made vulnerability. Due to floods some people in the study area lost their livestock (natural capital). This explains why these people were affected because they depended to their livestock (natural capital).

### *5.1.4 Financial effects*

Financial effects have been considered to be another serious effect of flood by numerous participants in the study area. The indications of these participants reveal that financial effects have presents a huge challenge posed by floods. As highlighted by dome of the participants, that due to these floods they lost their jobs, and some could not go to work. Firstly, because the transport networks facilitating their movement to work was interrupted due to the massive disruption to the infrastructure such as roads, train railways and bridges caused by floods. To comprehend these findings, one of the participants had this to say:

*"We were really affected, even at work because there was lot of water at work. There was no food, we had to stop going at work because they had to fix everything that was damaged. We were really affected".*

*(Group 4, 19 May 2024)*

Secondly, because of the floodwater that also affected the buildings where they work. These indications, clearly shows that, this issue presented a huge challenge to these participants, as

they were no longer receiving any income, and other side also having to deal with the damage caused by the floods. To explain this adequately, one of the participants had this to say:

*"Financially, I do not have money".*
*(Participant 10, 11 May 2024)*

*"Financially, I don't have money, there is no father nor grandfather here as you can see".*
*(Participant 8, 11 May 2024)*

Furthermore, other participants indicated that food prices went high, and everything became expensive. According to this participant this presented a huge challenge because they could not afford to buy anymore as they lost their jobs and there was no income at all. As a result, they became even more vulnerable to that situation and to poverty as well. To comprehend these findings, these participants had this to say:

*"In terms of financial effects, we were also affected because as we speak, the food is very expensive, and we even lost our jobs in the process".*
*(Participant 2, 11 May 2024)*

*"We could not go to store to buy even airtime. I remember that at that time bread used to cost us R30, so it was very hard."*
*(Group 1, 19 May 2024)*

*"Everything was tough, we became poor and prices went"*
*(Group 3, 19 May 2024)*

In addition, Participant 8 and participant 10 both reported the same issue that due to floods they could not go to work. To comprehend this finding, these participants had this to say:

*"We suffered a lot especially, financially because we couldn't go to work"*
*(Participant 12, 18 May 2024)*

*"We also couldn't go to work".*
*(Participant 4, 11 May 2024).*

The above-cited narratives provide an insight into the many challenges and barriers of the financial effects experienced by the participants in the study area, which ranged from loss of income (because they lost their jobs), could not afford to buy food because prices went high (and everything became more expensive). This finding is in line with Badamosi et al (2024) study, which argue that since households with lower incomes are typically less resilient and have few or no financial resources to rely on during a flood event, income plays a crucial role in vulnerability. In addition, according to Davis and Black (2020) the effects on underprivileged neighbourhoods and low-income individuals are typically given more attention after a major storm. According to Roy (2023) the Significant property damage and financial losses have resulted from flooding occurrences in New Zealand in recent years. Nationwide, household income, spending, consumption, and employment have all suffered significantly as a result of floods, (Roy,2023)

From the above narratives, one can conclude that there is a strong link between the challenges and barriers presented by both the loss of infrastructure and financial effects. Because people in this community lost their jobs as they could not go to work because their critical infrastructure, such as roads, bridges and railways were severely damaged. The finding is in line with Stamos et al (2020)study, which argue that the extreme flood events often limit access to extensive areas, and the vehicle occupants is compromised without a doubt. In addition, Pant et al (2018) argues that the critical infrastructure (water airports, ports, railways, roads, electricity grids) serve as the main backbone of the modern societies in the modern era, because they maintain economic and social well-being, by allowing a smooth delivery of goods and services.

During the 2017 floods in Mandra, the safety of the pedestrian was affected because their foot bridges were collapsed and there was erosion on sidewalk and subsidence (Stamos et al,2020). Therefore, this clearly shows that loss of infrastructure in the study area became the driving factor behind the financial effects experienced by the participants in the study area and a determining factor on the quality of the road and its durability on the effects on these weather events. Njogu (2021) argues that climate change causes weather events, such as floods, which compromises the reliability and smooth operation of infrastructure services, disturbing the main socio-economic activities. In developing countries, many people using infrastructure often witness the cost, distance and time to have access to the infrastructure services due to

outages caused by flooding, (Njogu, 2021). In addition, the impact on low-income and vulnerable groups is often severe, according to evidence from nations like Canada and others, (Davis and Black, 2020). In addition, Owusu and Wright (2015) on a smaller scale, major direct financial losses can also result from flooding in residential properties. To sum up, the current findings on the financial effects, it can be argued that financial effects presented huge and serious challenges that made people in this community to become even more vulnerable to the situation.

People that are poor are often the ones that suffer the most from disasters more than the richer people, because they have a lack of savings, income, production options and resources, therefore, they are more likely to experience vulnerability and often takes a long time for them to recover, (Cannon et al,2003). Clearly this has been the case in Thornwood, where people lost their jobs and income (financial capital). This clearly explains why they were more vulnerable to floods.

### *5.1.5 Psychological effects*

Psychological effects were also pointed out as one of the flood effects that presented a challenge for some of the participants. The indications of the participants reveal that one of the psychological effects they experienced during floods was trauma and shock. To comprehend these findings, one of the participants had this to say:

*"Even now we still have a trauma of seeing people being flooded away with their furniture. I was more affected psychologically".*
*(Participant 2, 11 May 2024)*

*"I was shocked"*
*(Participant 8, 11 May 2024)*

In addition, both participant 2 and one of the participants in Group 1, reported that they experienced trauma of seeing people getting flooded away and of seeing the dead bodies of unknown people. To elaborate further on this finding, these participants had this to say:

*"Even now we still have a trauma of seeing people being flooded away with their furniture. I was more affected psychologically".*
*(Participant 2, 11 May 2024).*

*"Another challenge was of dead bodies, we saw the dead body that we did not know whose family it belonged to, so it was very traumatizing".*
*(Group 1, 19 May 2024).*

The above-cited narratives show that floods have exposed some people in the study area to more psychological effects, such as trauma and shock. The sentiments expressed by some of the participants reflect that trauma and shock were the main two dominating psychological effects experienced in the study area. Whereby, in terms of trauma, people reported that they were traumatised because of witnessing dire situations of some people being flooded away. In terms of shock, the participants' sentiments show that the whole situation was shocking. Similarly, these Findings agree with Hooli (2016) study, which argue that households already dealing with a number of poverty-related issues have experienced increased stress and trauma as a result of the floods. In addition, they may also cause harm, including psychological issues, and even death, (Davis and Black,2020) To sum up, the current findings on the psychological effects revealed that floods had dire consequences on those participants.

Cannon et al (2003) argue that in most cases, there is often a problem when it comes to considering the need to reduce vulnerability, support livelihoods and future resistance of people to disasters by disaster relief and recovery assistance. The same study adds that vulnerability to hazards is also part of a wider environment, just like how the livelihoods opportunities of people, assets and income are shaped by wider political and economic processes. This has been the case in the study area whereby some people experienced some psychological issues but did not receive government assistance such as taking them to official psychological assistance (Social capital).

### *5.1.6 Health issues*

The health issues are one of the effects of flood that was pointed out by the participants in this community. Some of the participants indicated that they have experienced the devastating health issues posed by the floods. As highlighted by the participants that floods have presented

illnesses such as colds, which were more experienced by the children. To explain this adequately, one of the participants had this to say.

*"In terms of health, lot of illness emerged because of the rain which entered inside the house. Children also had colds(flu)".*
*(Participant 1, 11 May 2024).*

To elaborate further on the health effects, another participant pointed out that due to the damage caused by these floods, hospitals were also closed. To comprehend with these findings, this participant had this to say:

*"It was very hard and another thing we could not even go to the hospitals because hospitals were closed".*
*(Participant 4, 11 May 2024)*

The participants' views reflected the impact that floods had on their health. The indications of the participants revealed that floods have exposed people in the study area to more health risks, such as colds and flu. This finding agrees with Burton et al (2016) study, which argue that the most common natural disaster in the world, floods have a variety of negative health effects. In addition, according to Davis and Black (2020) Floods disrupt revenue, public services, healthcare, and consumer product availability in addition to damaging properties. From the narrative of one of the participants pointed that children were more vulnerable to that situation, as they ended up catching colds. Another participant also reported that during that period even the hospitals were also struggling to provide adequate healthcare services to the people in the study area. This spelled serious trouble for the people in the study area, especially those whose children had colds. This means that they could not get treatment/medicine as services in hospitals were disrupted, and also, they could not reach hospitals because their infrastructure was severely damaged. The findings by Stamos et al (2020) also reveal that as the result of closures/inundation about 42.5% of road network was not accessible and above 80% of river crossing infrastructure ( bridges, culverts, ford crossing) were seriously damaged. Therefore, the infrastructure was found to be more vulnerable to extreme flood events and more likely to experience many structural damages, (Stamos et al,2020).

This also, shows a link between loss of the infrastructure and health risks. This means that, the loss of infrastructure acted as a barrier that limited people from the study area into receiving health care services. This finding agrees with Hooli (2016) study, which investigated the Resilience of the poorest: coping strategies and indigenous knowledge of living with the floods in Northern Namibia. The findings of this study pointed that for several months, it has been challenging to reach healthcare, work, and education due to road degradation. According to Anthoj et al (2015) the delivery of food and medical care is seriously hampered after a flood, particularly in rural and underdeveloped areas. Karagiannis, Turksezer, Alfieri, Feyen, and Krausmann (2019) argue that the community resilience also depends on the security and safety of critical infrastructure. Therefore, when there is loss of critical infrastructure, that can affect or disrupt the economy, health and security of that society, (Karagiannis et al, 2019 ).To sum up, the current findings on the health issues, pointed out that health risks presented by floods in the study area had dire effects on the participants.

According to Sarker et al (2019) the livelihood of people in the developing nations with lack of resources is more vulnerable to natural hazards. This explains why people in the study area were vulnerable to floods as they lack resources such as infrastructure and health facilities. Because of the conditions of infrastructure due to floods people in this area ended up with limited access to healthcare facilities, transport and their daily movement was destructed.

### *5.1.7 Hunger*

Hunger has been widely considered to another effect of flood experienced by numerous participants in the study area. A plethora of participants indicated that they had no food. From the narratives of the participants the driving factor behind this hunger, was due to the severe damage caused by floods to critical infrastructure, as roads were closed, and bridges were damaged. Therefore, there was no movement to go to buy any groceries. To elaborate on this issue of hunger, one of the participants in the focus group discussions (in Group 1 and Group 4) had this to say:

*"It was difficult, I would first say hunger. Because roads were closed due to bridges that were damaged, so we could not make any movement".*
*(Group 1, 19 May 2024).*

*"There was no food, no water, no electricity, no place to stay, it was a struggle".*
*(Group 4, 19 May 2024)*

Furthermore, to elaborate further on the reasons behind this hunger, another participant reported that they could not cook because there was no electricity for months. To explain this adequately, this participant had this to say:

*"Another thing is that we only ate bread and water with sugar because we did not have electricity, so we could not cook to make porridge".*
*(Participant 4, 11 May 2024).*

The sentiments expressed by the participants reflect that hunger caused by floods, presented huge challenge in the study area, as it can be argued that food is a basic need for human survival. When there is lack of this basic need, it becomes difficult for people and their survival can be threatened. With the other flood effects that were discussed above, such as loss of property, loss of livestock, health issues, financial and psychological issues, it becomes so challenging to face such challenges on an empty stomach, without physical strength that food as a basic need provide. Therefore, the above narratives posit that hunger had dire consequences on the community in the study area. These findings conform with earlier findings by Ainehvand et al (2019), who stated that after a natural disaster, providing emergency food aid to the afflicted is one of the main duties of governments and relief organizations. The same study argues that given the scarcity and unpredictability of domestic and local food sources in the wake of such incidents, this strategy is essential for saving the lives of the injured and those who have been rescued. But in the study area, this was not the case, instead it was a different story. People in this community had to stand on their own and put effort so that they do not sleep on the empty stomach, as they all reported that there was no intervention from the government's side.

Again, the above -cited narratives provide insights into the main driving factors behind the issue of hunger, such as loss of infrastructure and power outage that resulted from floods. The sentiments expressed by the participants reflect the reason behind this hunger was due to the loss of critical infrastructure, whereby roads were closed, and bridges were damaged. This indicate that they could not make any movement and could not go to the stores to buy food. These findings align with the study by Badamosi et al (2024), which argue that while 38% of their respondents cultivate their staple foods through subsistence farming, over 62% of

respondents get their food from the market. According to Badamosi et al (2024) study, this emphasizes that since trading is many people's main source of income, frequent flooding exposure will increase their vulnerabilities by upsetting their revenue streams and lowering their purchasing power. Katherine et al (2019) argue that Severe flooding severely disrupts the daily lives of urban dwellers. Respondents of this study stated that during floods, it was difficult to perform necessities like getting food. The same study adds that due to waterlogged areas, flooding makes it difficult for low-income urban people who depend on regular food purchases to access markets and prepare meals.

This has been the case in the study area (Thornwood) where people were unable to buy food because of the damage caused by the floods. It is also evident that many townships located in urban areas get their food from the market. Another argument made by the participants, was that, living without electricity for months became another reason for their hunger, as they could not cook because they had no electricity. It can be argued that this was so challenging, as they had to cook outside. This shows that it is essential to consider that Thornwood is township is not located on the rural areas where some people do not mind cooking outside, but it is in urban area outside major cities, where people depend largely on electricity for their daily activities. According to Gunduz, Küfeo ˘glu, and Lehtonen (2017) energy is essential to the continuation of life. Since its first use, electricity has grown in significance due in part to how easily it can be produced and transformed into different types of energy, (Gunduz et al,2017). The same study also adds that electrical power has become more and more integrated into almost every aspect of daily life over time, increasing both the economic and cultural reliance on it. To sum up, the current findings on the issue of hunger, it can be concluded that there is a link between loss of infrastructure and hunger, whereby the loss of infrastructure due to floods is regarded as the main cause of hunger in the study area. Again, it can also be concluded that there is another link between the disruption of electricity and hunger, whereby the power outage caused by floods also served as the main factor behind this hunger in the study area.

Sarker et al (2019) argue that the SL approach focuses on the socio-economic, demographic, political and ecological context of life of the individuals and their access to different capitals, such as (social, economic, physical, natural and human capitals) and also considers the institutional aspects that ensure that people have access and control over these assets. This shows that in the study area, these different capitals were connected, meaning that if one capital is damaged then it also affects other capitals. In other words, as the infrastructure (physical

capital) was damaged, people in this community lost their jobs as they were unbale to go to work and then lost their income (financial capital). As a result, they ended up without food (natural capital). This community did not even receive food parcels from the government, which explains why they were more vulnerable as they did not receive any external assistance.

### *5.1.8 Water shortages*

The indications of the participants reveal that the water shortages, is one of the serious effects of floods, that presented a huge challenge in this community. As it can be argued that water is a basic human need, so living without water, is indeed a huge challenge. From the narratives of the participants, it is crystal clear that flood was the main driving factor behind this issue of water shortages in the study area, as water supply was heavily disrupted during the floods. As highlighted by one of the participants in one of focus group discussions that during the floods, water pipes busted due to waterflood, and they ended up having no water for months. To comprehend these findings, this participant had this to say:

*"After the floods, pipes busted, we could not get any water, there was no electricity for months".*
*(Group 4, 19 May 2024)*

To elaborate on this issue of water shortages, due to floods, numerous participants indicated that they had to fetch water very far away in the rivers. This clearly demonstrates that they had to adapt to their new normal routines, by travelling long hours in search of water. To adequately explain this, one of the participants had this say:
*"We fetched water very far".*
*(Group 3, 19 May)*

*"Fetch water from the river".*
*(Participant 11, 18 May 2024)*

Furthermore, to elaborate further on this issue of water shortages in this community, numerous participants reported that they had to drink unhealthy water. To elaborate on these finds, one of the participants in focus group discussions had this to say:

*"It was bad since the was no water and electricity. To survive we had to drink the very same unhealthy water, because this water was running, where there were dead bodies and even the used pampers. So, we had to drink even though we knew that it was unhealthy for us".*
*(Group 1, 19 May 2024).*

To support this argument, Participant 13 also pointed out the same issue that was reported by one of the participants in group 1. This participant had this to say:

*"We struggled with water and electricity, so ended up going to fetch water in the river, which is not even clean".*
*(Participant 13, 19 May 2024).*

From the narratives of participants, it can be argued that this issue of water shortages due to the floods posed a serious challenge in the study area. Again, the above-cited narratives provide insights into numerous challenges and barriers that were presented by water shortages in the study area, ranging from serious disruption in the water supply due to the pipes that were busted during floods, people had to now travel long hours, fetch water in the rivers and even consume unhealthy water. From the above narratives it is evident that water shortages spelled serious trouble for the people in the study area, since they were left without clean water, and no one came into their rescue, even the local municipality could not deliver water because of the damaged roads and bridges. These findings confirm with a recent study conducted by Badamosi et al (2024), which reveals that based on a senior council administrator interviewed, the flood-damaged pipes kept the government-provided water tap out of commission for months.

Furthermore, this shows a link between loss of infrastructure and water shortages, whereby these damaged roads and bridges served as barriers and restricted the local municipality from fixing the busted pipes and to deliver water to the study area. This finding agrees with Karagiannis et al (2019) study, which found that natural disasters often affect the critical infrastructure, in the way that the response and recovery process becomes too slow, and on the other site of the coin, cost of reconstruction increases. Floods make poverty worse by increasing the risk of disease transmission, causing food shortages, and restricting access to clean water, (Anthonj et al, 2015). To sum up, the current findings clearly show how desperate people in this community were, because of floods.

According to Gyawali, Tiwari, Bajracharya, and Skotte (2019) livelihood can be regarded as sustainable when it has an ability to boost its assets and capabilities to cope with and recover from external shocks. Because people in the study area ended up having water shortages (natural capital) due to floods and experienced serious issues because of that, it can simply mean that their livelihoods were not sustainable.

The fact that the livelihood system of a community consists of natural, social, physical and financial capitals, it means that is relying on the socio-ecological system, (Sarker et al,2019).

### *5.1.9 Interruptions in electricity supply (power outage)*

Numerous participants also pointed out the issue of electricity as one of the serious effects of flood that affected this community. The narratives of the participants demonstrates that the interruption in the electricity supply was a direct result of floods in the study area. As argued, this issue of power outage presented many challenges in this area, as there was no electricity for months. Due to this the network connection was heavily disrupted. This presented a huge challenge as many people in this community were unable to get in touch with their loved ones (family and friends) due to poor network. To comprehend these findings, one of the participants had this to say:

*"We were very affected, to an extent that, after floods there was no water, electricity".*
*(Participant 13, 19 May 2024).*

*"It was hard the was cut of electricity, the was no network, we could not contact our other families to ask for help or even check how they are doing if they are fine or not since they are far".*
*(Group 1, 19 May 2024)*

Another participant revealed that they had to cook outside, since there was no electricity. The indications of the participants show that living without electricity affected them severely because people in this community depend more on electricity. Due to flood, they found themselves having to cook outside, which again presented a challenge. To elaborate on these findings, one of the participants had this to say:

*"We lost electricity for a whole month, so we had to cook outside".*

*(Group 3, 19 May 2024).*

The participants' views reflect the impact that floods had on the electricity in the study area. Due to flood people in the study area had to live without electricity for months. This finding is in line with Karagiannis et al (2019) study ,which argues that flood can have a negative effect on the power grid assets and can result to power outages. The same study argues that in many cases 100% disruption of electricity due to heavy rainfall or hurricanes, have resulted to the blackout. In addition, according to Gunduz et al (2017) since climate change and sustainable energy are inextricably linked, it is difficult to talk about one without taking the other into account. Global electrical supply security is seriously threatened by the increasing frequency of natural disasters. The same study argues that long-lasting power outages that are deemed inappropriate have occurred in Sweden in particular.

Again, the above-cited narratives provide an insight into the several challenges that were presented by the issue of power outage in the study area, ranging from having to live without electricity for months, experienced poor network connection and being unable to get in touch with the loved ones due to network issues and having to cook outside. From the above narratives one can conclude thar the interruptions of electricity supply had dire consequences on the participants in the study area. To sum up, the current findings on the issue of power outage, it can be argued that there is a link between the loss of infrastructure and power outage. It is important to consider that loss of infrastructure is not the main factor behind the disruption of electricity in the study area, but rather it can be considered to have had some influence. The reason being, the fact that people dealing with electricity (Eskom) could not go to fix the damages caused by floods to electricity, simply because the infrastructure was severely damaged with roads being closed.

Stralen (2021) refers to the transportation infrastructure as relation's topology that gives people an access into different places and also gives travelers safety and support. In addition, Stralen (2020) argues that transportation infrastructure serves as a backbone that supports the movement of materials and people around the country,( such as roads, highways, and railways). Similarly, According to Karagiannis et al ( 2019 ), in the modern society, the critical infrastructure plays a crucial role as a backbone that allows essential services which play crucial role in country's economy. Furthermore, regardless of who owns the infrastructure, everyone is impacted when vital services like energy, water, and transportation are

compromised, (Davis and Black, 2020). Damage can have a variety of effects, particularly on critical public facilities like hospitals and schools, which can disrupt crucial services (Davis and Blak,2020).

According to Sarker et al (2019) in SL approach the livelihood vulnerability looks at the exposure, sensitivity and adaptive capacity of the livelihoods of individual or community in the face of natural hazards. Exposure indicates the frequency and extent of loss regarding people's livelihood capitals. In the study area the extent of exposure to floods has been severe because people lost their livelihood assets such as infrastructure (physical capital), and people experienced outages and as a result they experienced many challenges.

The sensitivity shows people's reaction towards climatic situations. The adaptive capacity shows the people's ability to face and control effects of natural disasters (Sarker et al,2019). Even though people in the study area were unable to resist the devastating effects of floods, fortunately, no life was lost due to the incidence.

### ***5.1.10 The recovery process***

After the in-depth discussion made above, the researcher finds it necessary to also discuss the recovery process in this community as this has given an indication on how severely this community was affected by the floods and for how long. The indications of the participants show that it took them a long time to recover from the damage caused by floods. To comprehend the findings one of the participants had this to say:

*"It took a very long time because even after going back to work we had to cover every damage caused by the floods".*

*(Participant 12, 18 May 2024)*

*"It took very long time because no one helped me, my children we trying to help until it got better".*

*(Participant 10, 11 May 2024).*

Furthermore, some participants also reported that even today they have not fully recovered from the devasting effects of that flood. To explain these findings adequately, one of the participants had this to say:

*"We still not recovered fully even today, we still struggling a lot .and we still hustling just for a living. What we have is just for buying food so that we can survive, even people here in this community are still struggling a lot because of that destruction".*

*(Participant 1, 11 May 2024).*

*"It took a long time because even now we still struggling somehow, and I can't say that we have recovered fully because most of the things we lost, we have not regained them back yet".*

*(Participant 2, 11 May 2024).*

The participants' views reflect how long it took them to recover and get back into their own feet after the disaster. Judging from the indications of the participants, it can be argued that the recovery process in this community was not easy and took a long time to happen for some participants. The sentiments expressed by the participants reflected that their journey into recovery process was a long one filled with many challenges, obstacles and barriers, ranging from having to fix all the damages caused by the disaster, for example, on their personal belongings and property. Having to embark on that journey without any help from the government, all the sentiments expressed by the participants reveal that it was a challenging one, and for some participants it is still a challenging one. In addition, some of the participants demonstrated that even today they are still not yet fully recovered from the damage caused by the floods. To sum up the current findings on the recovery process, it can therefore, be argued that this community in the study area was severely affected by the floods and unable to resist the flood effects.

According to Cannon et al (2003) there is a strong link between all the variable vulnerability and people's livelihoods (whereby lower vulnerability happens mostly when people's livelihoods are sustainable and adequate), and in terms of poverty (in most cases poor people become more vulnerable than other groups because they have less capacity to recover from external shocks). This explains the vulnerability of Thornwood community to the floods, as most people in the study area had less capacity to deal with and recover from the effects of

flood, as their livelihoods were not sustainable, more specially after losing their livelihood assets.

## 5.2. Community responses to floods and coping strategies used by people in the study area (Thornwood) and their effectiveness

The backbone of this research revolved around the issue of the coping strategies used by the people in Thornwood Township to cope and recover from the devastating flood effects of April 2022 and their effectiveness in the recovery process. The main aim of this study was to combine both the community and the government responses and access their effectiveness in helping this community to cope and recover from the flood. According to Twum and Abubakari (2019) Low-income people still stay in informal settlements like Accra despite the devastating effects of floods and the dangers they pose. Based on their prior experiences, these urban poor have so created their own coping mechanisms, encompassing both proactive and reactive actions, to control and adjust to flood risks, (Twum and Abubakari,2019).

Because of the infrastructure issues they encounter, people living in informal settlements have come up with their own ways to deal with flooding, (Emem and Owojori,2023). According to Parvin et al (2016) floods make people more vulnerable because they ruin livelihoods and leave them with little money to recuperate. Floods cause employment losses and a large income reduction, often by up to two-thirds, in rural communities, especially among the poor, (Parvin et al,2016). The same study also argues that this makes it more difficult for them to plan for, respond to, and recover from future flooding disasters. Affected people frequently accrue significant debt and lose valuable possessions as a result of coping with these effects.

### *5.2.1 Opening ditches*

Opening ditches is one of the coping mechanisms used by most people in this community. The indications of the participants show that this strategy of opening ditches was a good way of controlling the floodwater so that it does not cause any harm to their houses. To explain these findings adequately, one of the participants had this to say:

*"We were able to be safe by opening the ditch"*
*(Group 4, 19 May 2024).*

*"What helped us is that we opened the ditch so that the water does not come inside the house".*
*(Group 1, 19 May 2024).*

In addition, some of the participants in Group 2 and Group 3 also indicated that they opened ditches as a coping strategy to control floodwater and for their safety. To comprehend with these findings, these participants had this to say:

*"We opened the ditch".*
*(Group 2, 19 May 2024)*

*"We opened ditch so that we can be safe".*
*(Group 3, 19 May 2024).*

***5.2.1 (a) Its effectiveness***

From the above narratives of the participants, it can be argued that opening ditches as the coping mechanism helped most people in this community. To comprehend these findings, one of the participants had this to say:

*"Opening the drain helped a lot. Because as I was opening the ditch, my other neighbours did the same, so we managed to control water and made it flow along the drain up until it reached the main river".*
*(Participant 2, 11 May 2024).*

*"It worked perfectly because my house was not affected by flood water, it was just flowing along the drain that I opened".*
*(Participant 3, 11 May 2024).*

However, some participants did report that opening ditches did help somehow but was not good enough. To elaborate further on these findings, one the participants had this to say:

*"It helped even though it did not really help much but it did".*
*(Participant 10, 11 May 2024)*

Therefore, it cannot be concluded that this strategy was effective enough. Judging from the above narratives of the participants, there is a strong reason to believe that opening ditches as a coping mechanism did help many participants in the study area, but on the other side of the coin also presented some weaknesses and limitations. This clearly shows that people in this community were, therefore, vulnerable and unable to resist the flood effects.

### *5.2.2 Not sleeping*

As highlighted by the participants, that they managed to survive because they did not sleep until morning trying to control water all the night. Some participants also indicated that they did not sleep inside their homes. To elaborate on these findings, one of the participants had this to say:

*"What really helped us was the matter of not sleeping inside our houses. After we saw that the was lot of water we decided to go outside of our homes and not sleep, until morning. It was very hard, but we did it with some of my neighbours, we also opened the ditch, that is how we were survived".*

*(Group 4, 19 May 2024)*

*"We woke up at night so that we can try and control the water, we worked all night, without sleeping".*

*(Group 3, 19 May 2024)*

*"The only idea it was not to sleep, because even my children slept at 3".*

*(Participant 8, 11 May 2024).*

To elaborate further on this coping strategy of (not sleeping), another participant indicated that they did not sleep after receiving alert from the news. To comprehend with the findings, this participant had this to say:

*"Since it was at night, Luckly we watched the news and heard that heavy rain is coming so we did not sleep. So, it was how we managed to escape".*

*(Group 1, 19 May 2024)*

### *5.2.2 Its effectiveness*

Judging from the indications of the participants in the study area, not sleeping as a coping strategy did help somehow but it was not effective enough. To explain this finding, one of the participants had this to say:

*"It did not help that much".*
*(Participant 8, 11 May 2024)*

### *5.2.3 Running away*

Running away is one of the coping strategies used by some of the participants in the study area. These participants demonstrated that they ran away for their safety. Some of them also reported that they went to their neighbour's house where it was safe. To elaborated on these findings, one of the participants had this to say:

*"For me running away was the solution. I went to my neighbour's house because there was lot of water and because of the rock that had hit my house there was a big hole, so I did not have another option but to run away".*
*(Group 1, 19 May 2024)*

*"I took my children, IDs and other things and ran away".*
*(Participant 1, 11 May 2024)*
*"At night we ran away from our houses, we slept outside in the trees and there was water everywhere".*
*(Group 3, 19 May 2024).*

### *5.2.3 Its effectiveness*

The indications of the participants reveal that running away as a coping strategy was somehow helpful, but it was a matter of few days, and it was a temporal solution as they needed to come back in their homes. To explain this adequately, one of the participants had this to say:
*"We ran away from our houses to stay in other people's houses where we felt it was safe enough for 3 days".*
*(Group 3, 19 May 2024)*

### *5.2.4 Used blankets to stop water*

Some participants in the study area indicated that it the matter of using whatever you have try blocking floodwater from entering their homes. Using blankets to stop waster is one the coping strategies used in this community by some of the participants. To comprehend with these findings, one of the participants had this to say:

*"It was that I didn't sleep, took out blankets, and put them on the floor to block water from entering".*
*(Participant 7, 11 May 2024)*

*"We closed with clothes".*
*(Participant 11, 18 May 2024).*

*"What I did was that I took blankets, the old ones which we do not use anymore, we would lay them down so that we do not get sick because it was very cold and at night when try to sleep".*
*(Participant 4, 11 May 2024).*

### *5.2.4 Its effectiveness*

Looking at the narratives of the participants, it can be argued that this strategy was not effective enough to control floodwater. To comprehend these findings, one of the participants had this to say:

*"I would say that it didn't work till the end of floods because I used to change blankets every time, until the floods were over, it was the only time, when I was able to take out somethings outside".*
*(Participant 7, 11 May 2024)*

### *5.2.5 Seeking help from neighbours*

Seeking help from neighbours was also another strategy used by some of the participants in the study area. To explain this strategy adequately, one of the participants had this to say:

*"What I did was that I became very close with my neighbours, and they really helped me a lot until I was able to go back to my place after my things were dry".*
*(Participant 5, 11 May 2024)*

*"By the help of community members. When one has a problem, we all contributed to helping that person, that is how we managed to escape".*
*(Group 4, 19 May 2024).*

### *5.2.5 Its effectiveness*

The narratives of the participants demonstrate that seeking help from the neighbours as a coping strategy did help a lot somehow. To elaborate on the finding, one of the participants had this to say:

*"Seeking help from my neighbours did help a lot, because they helped a lot and gave me money to buy food for my children".*
*(Participant 5, 11 May 2024).*

According to Islama (2018) The temporary steps used to deal with a tragedy are necessary, but they don't provide long-term answers. The same study argue that people know that after the emergency passes, the trauma they have endured will probably come back, leaving them to fend for themselves once more. This has been the case in the study area, whereby all the coping strategies that were in this community were only temporary and not for a long term.

According to Fauziyanti and Hizbaron (2020) the unsustainable livelihoods are often the products of factors, such as limited access people have on politics, lack of economic opportunities, as well marginalized social groups. Fauziyanti and Hizbaron (2019) also argue that according to the SL approach, although the livelihood strategies have potential to minimize poverty, a long process is required with community involvement and assistance from the government. This tends to explain why the coping strategies used by this community had some limitations as they were only served as a temporary solution. This means that government assistance was needed for this community to be able to resist the devastating effects posed by floods.

## 5.3 Government Responses in Thornwood Township

Almost all the participants demonstrated that there was no support on the government's side in the study area. The indications of the participants show that the government did not intervene in the flood situation in this community. This mean that people were on their own and had to find their own means of survival. The narratives of the participants demonstrates that they were able to stand as a community and helped each other. To comprehend these findings, some of the participants had this to say:

*"No, we did not get any help but the only help that we got was from our neighbours but no help from the government".*
*(Group 1, 19 May 2024)*

*"It was just about helping yourself and helping each other as neighbours. We were just helping each other as community. As from the government's side we received no help at all".*
*(Participant 2, 11 May 2024)*

*"The only help I got was from my neighbours, it was only from my neighbour".*
*(Participant 5, 11 May 2024).*
*"No, but as a community we were able to help each other there and there".*
*(Group 4, 19 May 2024).*

Furthermore, some participants also reported that government only made empty promises that even today remained unfulfilled. In addition, the participants also pointed out that that there was no follow done by the government till this day. To comprehend with these findings, some participants had this to say:
*"Even today after registering for losing our home, nothing has been done about it, nothing at all".*
*(Group3, 19 May 2024)*

*"After floods, we were expecting the government to help us immediately as promised but we waited till we were tired. On top of it all we are waiting while struggling, there is no food, we did not know what we were going to eat tomorrow but we are still waiting".*
*(Group 4, 19 May 2024)*

Judging from the narratives of the participants, it is clear that this community of Thornwood, which is the study area, did not receive any form of support from the government. This find confirms with earlier findings by Islama (2018), who stated that though rarely timely, a response to this threat is inevitable. Too often, preparation is lacking, and communities, overburdened by yet another calamity, must deal with the fallout. Without adequate support, those impacted must rely on their own resources, using local knowledge accumulated over decades of fighting the forces of nature, (Islama, 2018). This has been the case in the study area. However, the indications of the participants show that people in this area were able to stand together as a community and helped each other.

According to Pasteur (2010) communities become vulnerable when their livelihood assets and options are limited, and are more prone to disasters, such as flood, drought, crop pests, livestock diseases). The same study argues that their vulnerability is worsened more when national or local policies ignore their needs. This explains why Thornwood township was more vulnerable to the 2022 flood, as almost all the participants in the study area reported that they did not receive any help from the government. This is a gap that the SL approach is willing to close by linking the micro and macro levels. UNDP (1999) pointed out that sustainable livelihood approach (SLA) aims to link the micro level livelihood systems with the macro policies, which turn to affect these livelihoods. It is important to note that these policies, institutions, and processes, often shape the livelihoods at all levels, (Mike,2002).

## 5.4 Recommendations made by Thornwood participants

### *5.4.1 Avoid building on flood-prone areas*

Avoiding building houses on the flood-prone areas was one of the recommendations made by some participants in the study area, in order to encourage other communities who might experience the same situation. The participants recommended that communities should stop building their homes on vulnerable and dangerous place. To explain this recommendation adequately, some of the participants had this to say:

*"People should avoid building their houses near the rivers because they can easily get flooded away by the floods".*
*(Participant 3, 11 May 2024)*

*"It is very important to choose wisely where you build your house. You must build house away from the rivers".*
*(Participant 13, 19 May 2024)*

*"I would say they should not build their houses near the river, or cliff".*
*(Participant 11, 18 May 2024)*

### *5.4.2 Make advance efforts*

Making advance efforts is another recommendation made by the participants of this study. To elaborate more on this recommendation, some participants had this to say:

*"What I would say is that the rain will come back, so since we saw how it affected us, we should be aware and be prepared for the flood".*
*(Participant 13, 19 May 2024).*

*"In the community, a person should think about how prone or vulnerable their area is to floods and make efforts in advance to protect themselves".*
*(Participant 3, 11 May 2024).*

### *5.4.3 Stay alert*

The participants of this study also recommended that people should stay alert. To comprehend with this recommendation, some participants had this to say:

*"I would say it is important to listen to news and watch weather news, so that if it is said that heavy rains will come then we know we are prepared for them".*
*(Group 1, 19 May 2024).*

*"I would say we should stay alert so that these floods do not repeat, and it is important to open drainage".*
*(Participant 10, 11 May 2024).*

### *5.4.4 Have a healthy relationship with your neighbours*

Some participants of this study argued that it is important to have a good relationship with the neighbours, therefore, they recommended that communities should stand together and help each other. To explain this suggestion adequately, some of the participants had this to say:

*"We encourage those communities, experiencing the same problems to stand together, because you cannot do it alone. It may happen that you may be sleeping in your house and do not hear anything and maybe your neighbour is awake, they will be able to wake you up. Without your neighbour you are nothing because sometimes your house might be burning, and your neighbour would help you. So, we encourage that you should have a good relationship with your neighbours, when these things occur, they should stay united, be one and help each other".*
*(Group 4,19 May 2024)*

*"It is very important to have a good relationship with your neighbours because at time like those ones they are the only ones who come to help before anyone else".*
*(Group 1, 19 May 2024)*

*"I would say to others, you should have a healthy relationship with your neighbours so that if your house is ruined you can sleep in your neighbour's houses".*
*(Participant 4, 19 May 2024)*

### *5.4.5 Government should intervene*

The participants also recommended that the government should make interventions to help affected communities. To elaborate further on this recommendation, some participants had this to say:
*"My opinion is that government should try to help those people with no homes because they really struggle".*
*(Participant 11, 18 May 2024)*

*"My opinion is that, if floods occur, the government should make efforts to help protect vulnerable areas prior to the occurrence of the flood as they are pretty much aware of early weather warnings".*

*(Participant 2, 11 May 2024)*

## 5.5 Conclusion

This chapter provided the presentation of the findings. In line with the research objectives of this study, main themes were created, analysed and discussed in this chapter. This chapter have focused on the extent of floods (challenges) on the people in the study area, coping strategies they used to cope and recover and their effectiveness. This chapter also outlined the government responses based on the participants' indications. And lastly presented the recommendations made by the participants on the study area.

# CHAPTER 6
# DISCUSSION OF THE FINDINGS

## 6.0 Introduction

The previous chapter presented the findings generated from both the in-depth semi-structured interview and focus group discussions. This chapter presents a detailed discussion of the key findings. In line with the objectives of this study, this chapter will focus on the following sections:

first section, focuses on the challenges posed by the floods on the community of Thornwood Township. Second section focuses on the coping strategies used by the community in the study area to cope with the floods and their effectiveness. Third section focuses on government responses.

## 6.1 CHALLENGES POSED BY FLOODS ON THE COMMUNITY OF THORNWOOD TOWNSHIP

### *6.1.1 Loss of property as a flood effect*

The findings from the responses provided by the participants revealed that loss of property was one of the serious challenges posed by the floods in the study area. The findings also indicated that floods severely damaged and destroyed people's property and personal belongings in this community. This finding is in line with Nothling, Gibbs, Washington, Gigaba, Willan, and Abrahams (2024) whose study investigated the change in emotional distress, anxiety, depression and PTSD from pre-to post exposure in women residing in low income setting in South Africa. This study reported that 53,6% of their participants indicated that their furniture was damaged and 65.7 said that their homes had structural damage. This finding is also consistent with Ebhuoma, Nene, and Leonard (2024) study, which argued that the devastating effects of floods has a potential to increase the physical destruction of properties.

Similarly, the finding also aligns with Shabani et al (2024) whose study investigated the prevalence and determinants of posttraumatic stress disorder five months after the 2019 huge flooding in Iran. This study revealed that 42% of their participants experienced a serious assets/property damage due to floods, where by 74% of such damage did not receive any compensation. In addition, According to Badamosi et al (2024) The loss of life, property damage, and pollution are the most obvious effects of flooding disasters, which have resulted

in a range of environmental concerns. The extent of the damage caused by a flood is usually used to gauge its severity, (Badamosi et al ,2024).

### *6.1.2 Loss of infrastructure as a flood effect*

The findings from this study demonstrated that loss of infrastructure like roads, bridges and train railway presented a huge challenge in Thornwood community, as it has limited people's access to essential services. This finding is in line with Gunadal et al (2024) whose study assessed the effects of flood on crop and livestock production in Bagalkot district of Karnataka in India. This study revealed that floods caused a serious damage to the critical infrastructure, such as roads, bridges/culverts, electrical infrastructure, schools, hospitals and Anganwadi in the study area.

The finding is also consistent with Mensah (2020) whose study investigated the causes, impact and coping strategies of floods in Ghana. The findings of this study indicated that the damage that is caused by the floods to economic infrastructure such as electricity, bridges, roads, usually affect communities severely and also cause serious disruption to some of economic activities. In addition, According to Okaka and Odhiambo (2019) Public health and communal well-being are significantly impacted by floods. Okaka and Odhiambo (2019) study shows that Critical infrastructure was damaged, 24 cholera cases were detected, and over 60,000 people were impacted by the 2006–2007 floods period in Kenya. Nearly every year, some parts of the city flood, usually causing property damage and fatalities, for example, flooding is a recurring problem in many of Mombasa's informal communities, (Okaka and Odhiambo, 2019).

### *6.1.3 Loss of livestock as a flood effect*

This study found that loss of livestock was another flood effect experienced by some of the participants in the study area. The findings revealed that some participants depended on their livestock, therefore losing such livestock presented a challenge to these participants. This finding is in line with Gunadal et al (2024) study, which investigated the effects of flood on crop and livestock production in Bagalkot district of Karnataka in India. This study reported that in 2019, floods had severe effects not only on human beings, but also severely affected animals as well.

### *6.1.4 Financial issues as flood effect*

It was discovered in this study that floods presented serious financial effects in the study area, whereby people lost their jobs and there was no longer income coming in. The findings indicated that this presented a huge challenge in this community, because as they lost their jobs, on the other hand they had to fix all the damage caused by the floods. This finding is in line with Ebhuoma et al (2024) whose study investigated urban households' s preparedness and municipal interventions to build flood resilience in Durban. The findings of this study pointed that 26% of their participants suffered a huge financial loss due to severe damage caused by floods, and 18% of their participants lost their livelihood sources between 2010 to 2020, because of floods.

### *6.1.5 Psychological issues as flood effect*

This study found that some participants in the study area also experienced psychological effects of floods such as shock and trauma. This finding is in line with the Nothling et al (2024) study, which argues that that floods occur frequently and many result into serious psychological effects such as, emotional distress, anxiety, depression and PTSD. In addition, Golitaleb, Mazaheri, Bonyadi, and and Sahebi (2022) also adds that flood has devastating short, medium and long-term effects on the welfare, relationships and physical and Mental health of its victims.

### *6.1.6 Health issues as flood effect*

The findings from the study indicated that floods also presented health issues in the study area. The findings also demonstrated that people in the study area were also exposed to some illnesses related to floods. This finding is in line with Shabani et al (2024) whose study investigated the prevalence and determinants of post-traumatic stress disorder, five months after the 2019 huge flooding in Iran. This study argued that floods can have a negative impact on individual's health, such as immediate, short-term physical infections, chemical family and residential consequences, and limit their access to medical and mental services.

In addition, Zainudini (2024) adds that floods often pose a huge challenge to the healthcare system and its efficacy. Additionally, According to Burton et al (2016) Floods are often followed by increases in waterborne infections. According to Okaka and Odhiambo (2019) Public health and communal well-being are significantly impacted by floods. In addition, Anthoj et al (2015) add that the floodwaters made 41 health facilities and 179 outreach health

locations inaccessible, cutting off access to vital services like schools, health clinics, and other community facilities.

### *6.1.7 Hunger as a flood effect*

The findings from the participants' responses pointed hunger as another serious challenge posed by floods in the study area. The findings also indicated that people in the study area could not make any form of movement because their infrastructure was damaged severely and on other hand, there was no electricity for months, therefore cooking was a challenge. The finding is in line with Nothling et al (2024) study, conducted in South Africa. The findings of this study revealed that approximately 46.3% of their participants lacked access to fresh food, and where 17.3% of them were unable to travel and even worse lost their income due to floods. According to Anthoj et al (2015) Floods worsen already-existing poverty by increasing the spread of diseases, reducing access to clean water, and causing food shortages.

### *6.1.8 Water shortages as flood effect*

This study discovered that water shortages was also another flood effect that presented a huge challenge in the study area. The findings also indicated that people in the study area had to be out of their comfort zones, by travelling long hours in search of water, especially in the rivers. This finding is in line with Zainudini (2024) whose study investigated the flood risk and flood management in Zarabad and Konarak districts in Iran. This study revealed that floods often reduce people's access to the water that is clean, healthy and drinkable as it infiltrates the aquifers and increase the waterborne diseases transmission. This finding is also consistent with Boroujeni, Mohammadi, Navabakhsh, and Mehrdad (2023) study, which argues that water plays a vital role in people's lives, but on the other side of the coin, can have a negative effect on economic, civil, industrial, and environmental is not managed.

### *6.1.9 Electricity crisis as flood effect*

This study found that after floods people in the study area were left without electricity for months. Again, the findings demonstrated that this presented a huge challenge in the study area. This finding is in line with Nothling et al (2024) whose study investigated change in emotional distress, anxiety, depression and PSTD from pre- to post exposure in women residing in low-income setting in South Africa. The findings of this study revealed that approximately 75.4% of their participants reported that during the floods they did not have access to electricity for at least 7 days.

Energy is essential to the continuation of life. Since its first use, electricity has grown in significance due in part to how easily it can be produced and transformed into different types of energy, (Gunduz et al,2017). The same study argues that electrical power has become more and more integrated into almost every aspect of daily life over time, increasing both the economic and cultural reliance on it.

## 6.2 COPING STRATEGIES USED BY THE COMMUNITY OF THORNWOOD TOWNSHIP

According to Twum and Abubakari (2019), a flood hazard is any potentially harmful flood event brought on by human or natural activity that may cause property damage, social unrest, economic disruption, or environmental impact in informal urban communities. Informal inhabitants suffer from the rise in disasters associated with urban informality, which leads them to use "indigenous" techniques to prevent and deal with floods, (Twum and Abubakari,2019). Based on the empirical evidence and qualitative findings analysed in this study, the researcher found that there were several coping strategies that were adopted by the community in the study area during the floods. These coping strategies have been listed and discussed below:

### *6.2.1 Opening the ditch as a coping strategy*

Montanaa and Dasb (2017) argue that in the immediate aftermath of a natural disaster, coping is just as important as adaptation for survival and reducing the impact of shocks. It is evident from the findings of this study that opening ditch is one of the dominating coping strategies that was used in this community by the majority of the participants. This study discovered that opening ditches as coping strategy played a vital role in saving many participants during the floods, especially their homes from being flooded away. However, based on the indications of the participants, this strategy had some limitations and weaknesses, such as the fact that floodwater was too strong, and somehow those ditches were becoming weak.

### *6.2.2 Not sleeping as a coping strategy*

Mahantaa and Dasb (2017) argue that the degree of coping can vary even among households. People who are wealthy might not need to use numerous coping mechanisms, (Mahantaa and Dasb,2017). This study discovered that that not sleeping as a coping strategy did help some participants in the study area, as they were able to make a plan by working throughout the night to control floodwater. However, this coping strategy also had some limitations and challenges.

### *6.2.3 Running away as a coping strategy*

According to Mahantaa and Dasb (2017) local people's experiences, social structures, and capacity to integrate these resources all influence coping mechanisms. This study found that running away was also used as a coping strategy by some participants in the study area, The narratives of the participants show that for some of them this coping strategy save them somehow. On the other side of the coin, this coping strategy was also regarded as having some limitations and disadvantages.

### *6.2.4 Using blankets as a coping strategy*

Coping mechanisms help deal with current problems in the short term and frequently cause little to no long-term harm, (Mahantaa and Dasb, 2017). This study discovered that some participants in the study area used blankets as a coping strategy to try and control water. This coping strategy was used by few participants in this community. Based on the indications of the participants, using blankets as a coping strategy did not really help much.

### *6.2.5 Seeking help from neighbours*

Coping techniques are complicated, and it is impossible to implement a standard set of reactions for every community in the event of a disaster, (Montanaa and Dasb,2017). Therefore, in order to lessen vulnerability to poverty in the wake of disasters, it is crucial to comprehend the elements that influence coping techniques, (Montanaa and Dasb, 2017). It was also discovered that in this study that seeking help from neighbours was another coping strategy used in this community. The indications of some participants indicated that this coping strategy was useful and helpful.

This finding is in line with Danso and Addo (2017) whose study investigated the coping strategies of households affected by flooding in Sekondi-Takoradi Metropolis in Ghana. This study found that approximately 50% of their participants used seeking temporary refuge from their neighbours as a coping mechanism. In addition, Danso and Addo (2017) add that approximately 44% of these participants also took their belongings such as electrical gadgets, clothing, mattresses and documents to their friends and family who lived on higher grounds.

## 6.3 GOVERNMENT RESPONSES

It was discovered in this study that there was no response from government in the study area. From the narratives of the participants, it can be argued that Thornwood community did not receive any support from the government. Nevertheless, this study also found that there is a strong sense of community spirit in Thornwood township, where community members in this area helped each other.

### 6.4 Conclusion

This chapter provided an in-depth discussion of the key findings of this study. This chapter discussed in detail the challenges experienced by the participants in the study area during floods. The chapter also outlined several coping strategies used in this community and their effectiveness. Government responses was discussed in this chapter.

# CHAPTER 7
# LIMITATIONS, RECOMMENDATIONS AND CONCLUSIONS

## 7.0 Introduction

The previous chapter provided a brief discussion of the key findings of this current study. Therefore, the present chapter have provided a summary of the entire thesis, outlined the limitations of this study, as well as provided the recommendations.

## 7.1 Summary of thesis

The overall aim of this study was to to explore and examine community's response to flood. In which a particular focus was paid to the flood that occurred in 2022. The first chapter provided a brief introduction about the study, by firstly telling the reader about the significance of the study. Secondly, by providing a brief background on the issue of floods in South Africa and globally. Thirdly, this chapter also presented the problem statement of the current thesis, the research aim, objectives and research questions. The second chapter provided a brief overview of the relevant and existing literature on the issue of flood, where it was highlighted, that flood is a global threat . Third chapter presented the Sustainable Livelihoods Approach(SLA) as a suitable theoretical framework for this thesis. The fourth chapter provided a brief hint on how the data was collected in this study. This chapter presented the study methodology, methods and tools used by the researcher of the current study to collect data from the participants. The fifth chapter presented the findings of this the current study. In line with chapter 5, chapter 6 provided a brief discussion of the key findings of this study. The last chapter, which is chapter 7 provided the summary of the entire thesis, presented limitations of this study and provided recommendations.

## 7.2 Limitations of the study

Obtaining a gate-keeper's letter was a huge drawback. The reason being that the researcher requested a gate-keeper's letter few weeks before the 2024 elections. Judging from the researcher's experience, it can be argued that that Thornwood is a highly politicized township, as it was thought that the researcher might have come with some hidden political agenda to turn the residents against the ruling party before the elections, so that they do not vote for that party. This presented a huge challenge to the researcher, and as a result the researcher had to consistently explain that the researcher is just a student and that the research is only done for academic purposes only. Then after some time, the gate-keeper's letter was finally granted.

Another limitation of this study was that the researcher was strictly forbidden from interviewing community leaders in the study area. The researcher was only granted a permission to only interview the community residents. As a result, this limited the intentions of this study, as the researcher wanted to also include the community leaders' experiences and views.

### 7.3 Recommendations

This section represents the recommendations which were drawn from both the key findings, conclusions of this thesis, and from interesting suggestions made by some of the participants in the study area. The following are the recommendations:

**●Adapt the SLA' Perspectives**

Judging from the findings of this study, which revealed that people in the community of Thornwood township did not receive any form of support from the government, therefore it can be argued that there is a huge gap between the micro-level, which is the community's realities, challenges and experiences and the macro-level, which are the policy makers. To close that gap, it is recommended that the policy makers should involve community members in decision-making process by electing few members to represent the entire community in order to best understand the expectations, experiences and realities of the community.

**●Build 'trust' and relationship with local communities**

The indications of the participants revealed that the government only made empty promises that remained unfulfilled till this day. Based on this finding, this study recommends that local governments build health relationships with their local communities by fulfilling all their responsibilities and promises and help local communities in disasters like this. In that way people will freely share their challenges, experiences and realities, which can help the same policy makers a lot in future decision-making process.

**●Use traditional ways to inform local communities about the early weather warning**

From the findings of this study, it can be argued that almost all the participants were not fully prepared for the disaster, maybe because they were not aware of the early weather warnings or maybe because they did not take the warnings seriously. So, in order to avoid this in future, it is therefore recommended that after receiving early weather warnings, the local government authorities must immediately use traditional ways that they normally use to pass

important/urgent messages the people in their local communities. For example, this can be done by moving around the whole community shouting with a speaker, like how local municipalities use to pass a message about important meeting to be held. The local government should make sure that everyone in the community receive early warnings.

**●Efforts should be made prior to the occurrence of disasters (by government authorities)**
It is recommended that the government authorities should not wait for the disaster to take place, then act, rather they should start taking advance measures prior to the occurrence of the hazard. For instance, by equipping strong critical infrastructure in Thornwood community. Also, by visiting the local communities to inspect their places/area and help those who are located on more flood-prone areas.

**●Efforts should be made (by local communities)**
As suggested by some of the participants that communities should make advance preparations before floods occur. This study also recommends that local communities must start adapting the paving-yard technique, because paving the yards help a lot in preventing floodwater from causing damage to people's homes. It is a valid fact. One out of 35 participants in the study area revealed that they used this strategy, and that is why they were not affected by the flood. To comprehend with this finding, this particular participant had this to say:

*"When the floods occurred, I was protected enough because I acted early by paving my whole yard before to protect my house from floods. I decided to do this so that I don't face challenges caused by floods. That's how I protected myself and my house. When I realized that the flood situation was getting worse in my area, since this area is more like flood-prone area with houses built on high area. Then I decided to pave my whole yard even on the sides as well and I also opened the drain so that the water can flow away and not affect my house". It worked perfectly because my house was not affected by flood water, it was just flowing along the drain that I opened".*
*(Participant 3, 11 May 2024).*

This study, therefore, highly recommend that local communities use this strategy, especially those people who are situated in more flood-prone areas.

**●Improve employment opportunities**

Based on the study findings of this current research most participants reported that they lost their jobs due to floods, and some of them also indicated that they have not yet fully recovered from the damage caused by the floods. Therefore, this study recommends that the government authorities should open more stable employment opportunities, in such communities, especially for the youth.

### 7.4 Conclusion

The researcher, in this chapter have reflected upon the entire thesis. This chapter outlined the summary of the entire thesis. The study limitations of this study and recommendations were discussed in this chapter. The main aim of this study was to explore and examine the community's response to floods. The particular focus of this study was paid on the flood that occurred in 2022. The research objectives of this study were achieved through the major findings and conclusions drawn from the interview's responses of the participants in the study area. Firstly, the study began by interrogating the extent to which flood affected community of Thornwood township. The findings of this study revealed that floods severely affected people in the study area by posing serious challenges in this community such as: loss of property, loss of infrastructure, loss of livestock, health issue, psychological effects, financial problems, hunger, water shortages, electricity outage. Secondly, the study explored the strategies used by the community of Thornwood and their effectiveness. The findings of this study, shows that there were numerous strategies used in this community in attempt to cope and recover from the disaster, such as opening the ditches, not sleeping, running away, used blankets to stop water, seeking help from neighbours. In addition, the findings also demonstrated that these strategies helped this community a lot to some extent, but they had some limitations and disadvantages. Lastly this study also interrogated the government interventions and effectiveness. In other words, a combined community's and government responses were interrogated to see how such effort helped or hindered this community from coping and recovering from the effects of flood. The findings of this study pointed that the community in the study area did not receive any support from the government. This simply means that there were no interventions made by the government to help this community. However, what is evident from the findings is the fact that the community had to find their own means to survive on their own and by helping each other as a community. This demonstrated the community spirit, which represent the spirit of Ubuntu.

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UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

**19 April 2024**

**Nteboheleng Annastarsia Taunyane (218055520)**
**School of Social Sciences**
**Howard College Campus**

**Dear NA Taunyane,**

**Protocol reference number:** HSSREC/00006573/2023
**Project title: Community's responses to floods: Case study of Thornwood township in Mariannhill, KwaZulu-Natal, South Africa.**
**Degree:** Masters

## Approval Notification – Full Committee Reviewed Protocol

This letter serves to notify you that your response received on 16 April 2024 to our letter of 05 February 2024 in connection with the above, was reviewed by the Humanities and Social Sciences Research Ethics Committee (HSSREC) and the protocol has been granted **FULL APPROVAL**

**Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment/modification prior to its implementation. In case you have further queries, please quote the above reference number.**

**PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.**

**Incidents of adverse events and serious adverse events (AEs and SAEs) should be reported in writing to HSSREC, the study sponsors, and any regulatory authority (where appropriate), within 7 working days of the occurrence for local sites and 14 days for all other South African sites.**

**This approval is valid for one year until 19 April 2025**
To ensure uninterrupted approval of this study beyond the approval expiry date, a progress report must be submitted to the Research Office on the appropriate form 2 - 3 months before the expiry date. A close-out report to be submitted when study is finished.

HSSREC is registered with the South African National Health Research Ethics Council (REC-040414-040).

Yours faithfully,

[redacted]

.....
Professor Dipane Hlalele (Chair)/dd

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