Understanding the Complexities of Urban Flood Governance:

A Case Study of Ruiru, Kenya

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Abstract

Urban flooding presents a significant challenge in developing cities, where rapid urbanisation, population growth, and infrastructure development intersect with natural processes and climate change. This study examines how governance structures influence urban flood management in Ruiru, Kenya. Through thematic analysis, this study explores local experiences with flooding, evaluates existing governance structures, and examines their effectiveness. The findings reveal that weaknesses in governance structures due to poor collaboration, reactive measures, limited resources, and a lack of transparency and political imbalances hinder effective urban flood management. This study advocates for a holistic approach to urban flood governance. This approach moves beyond traditional, limited solutions and prioritises both adaptability and long-term sustainability. By embracing this comprehensive strategy, Ruiru can build the resilience necessary to confront future urban flooding.

Keywords: Urban flooding, flood management, governance, Ruiru, Kenya, community resilience

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ICLD Swedish International Centre for Local Democracy

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Abbreviations

AWWDA: Athi Water Works Development Agency

EIA: Environmental Impact Assessment

IHDP: International Human Dimensions Programme on Global Environmental Change

IPCC: Intergovernmental Panel on Climate Change

KMD: Kenya Meteorological Department

KUSP: Kenya Urban Support Program

NADMO: National Disaster Management Organization

NaMSIP: Nairobi Metropolitan Services Improvement Project

NDOC: National Disaster Operation Centre,

NDMU: National Disaster Management Unit

NEMA: National Environment Management Authority

NGOs- Non- Governmental Organisations

RUJWASCO- Ruiru- Juja Water and Sewerage Company Limited

WRA: Water Resources Authority

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Over the past few decades, the scientific community has warned of the increasing frequency of extreme weather events, including floods hazards, owing to climate change (IPCC, 1990; IPCC, 2022). Although flooding affects both rural and urban areas, its impact is particularly pronounced in urban environments. Urban flooding, a common occurrence in developing cities, presents unique challenges within the built environment and disproportionately affects vulnerable populations, particularly the urban poor (Tom et al. 2022).

In Kenya, rapid urban growth and population increase have driven many individuals, particularly those with limited resources, to settle in high-risk areas, such as floodplains within urban centres (Tom et al., 2022). This phenomenon has given rise to informal settlements or slums that are highly susceptible to flooding. Poor urban planning and unregulated land-use practices further increase the vulnerability of these communities (World Bank Group, 2021). The devastating impact of flood hazards became evident during the 1997/1998 El Niño episodes, resulting in the loss of life, destruction of property and infrastructure, and significant economic losses (Kilavi et al., 2018).

In the specific context of Ruiru, heavy rainfall often triggers severe flooding, causing extensive damage to both people and infrastructure. Past flooding incidents have resulted in human casualties, property destruction, and the displacement of families, affecting marginalised groups such as women, children, the elderly, and individuals with disabilities (Kioko, 2023).

More recently, there have been warnings from the Kenya Meteorological Department (KMD, 2023) regarding the anticipated onset of the El Niño phenomenon between 2023 and 2024 and its potential repercussions on the nation's climate; however, the existing preparedness and response mechanisms have proven

inadequate (Shamim, 2024; Magdalina Saya 2023; Ochieng, 2023). Consequently, this insufficiency has resulted in severe damage and widespread displacement.

1.2 Problem Statement

The increasing changes in climate, urbanisation, population growth, and infrastructure development in urban areas such as Ruiru in Kenya have led to mounting pressure to enhance flood risk management. Kenya has made strides in policy development and the establishment of institutional frameworks such as the National Disaster Operation Centre (NDOC), National Disaster Management Unit (NDMU), Kenya Meteorological Department (KMD), and Water Resources Authority (WRA) to enhance flood risk management systems (Kiptum et al., 2023). They share responsibilities at different agencies and administrative levels. However, despite these formal structures and policies, efficient responses, adaptiveness, and resilience at the local level remain elusive. Ruiru, Kenya, continues to grapple with urban flooding every rainy season, revealing shortcomings in flood governance across multi-level governments. The consequences are dire and include loss of life, displacement, infrastructural damage, and economic losses. As floods are projected to increase in frequency and intensity, addressing the ineffective flood risk management systems in Ruiru has become increasingly important.

1.3 Aim of the Study

This research aims to bridge this gap by understanding of how governance structures influence the management of urban flooding in Ruiru, Kenya. To achieve this, the research will explore three key areas. Using qualitative methods, the study will identify the primary causes contributing to Ruiru's flood vulnerability. It will then examine local perceptions and experiences of these flooding events, providing valuable insights into the social dynamics of the issue. Finally, the research will evaluate the effectiveness of existing governance structures in managing urban floods. By analysing these interconnected elements, the study seeks to not only inform improvements in flood management strategies and build resilience within Ruiru but also contribute to broader theoretical understandings of urban flood

governance. Furthermore, the findings hold the potential to offer valuable insights applicable to other urban environments facing similar challenges with flooding.

1.4 Research Questions

The main research question is: *How do governance structures influence the management of urban flooding in Ruiru, Kenya?*

To dissect this question, we explore the following sub-questions:

1. What are the primary causes contributing to urban flooding in Ruiru, Kenya?
2. How do the locals perceive and experience urban flooding events?
3. What are the existing governance structures and their effectiveness in managing urban flooding in Ruiru?

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

In this chapter, I conduct an examination of the current literature on flood governance in urban areas. Moreover, I provide two case studies that demonstrate the complex nature of flood governance and offer practical examples. Additionally, I carry out an assessment of the existing literature, identifying significant criticisms and gaps that warrant further investigation.

2.2 Overview of Urban Flooding

Scholarly research has identified urban flooding as a worldwide emerging concern that is influenced by both natural processes and human activities. Climate change is a significant element, as there has been an increase in extreme precipitation events, which results in overwhelmed drainage systems and overflowing rivers (Jha et al., 2012; Gigović et al., 2017). Additionally, unsustainable urbanisation practices play a crucial role in this issue. Rapid urban growth due to population expansion often leads to the transformation of natural landscapes into impervious surfaces such as roads (Huong and Pathirana, 2013). Furthermore, the loss of green spaces due to deforestation diminishes the capacity of urban areas to absorb and manage excess water. Inadequate waste management practices lead to clogged drainage channels, exacerbating flood risks (Leal & Ramos, 2017).

Urban flooding presents a diverse challenge, manifesting in various forms that demand targeted mitigation strategies. One common type is pluvial flooding, which occurs when intense rainfall overwhelms drainage systems in cities with limited infiltration due to extensive paved surfaces (Leal & Ramos, 2017). In contrast, fluvial flooding represents the classic case of overflowing rivers or streams, often exacerbated by urban development encroaching on floodplains (Merz et al., 2010). Another concern is groundwater flooding, which occurs when the water table rises above ground, damaging foundations and infrastructure (Jha et al., 2012). Coastal communities face a unique threat from coastal flooding, which results from a combination of storm surges, high tides, and rising sea levels (Hammond et al.,

2013). This scenario involves powerful waves and rising water levels inundating coastal areas.

Urban environments can also experience sewer flooding, a serious health hazard that arises when overloaded sewage systems back up into streets and buildings (Leal & Ramos, 2017). Finally, flash floods pose significant dangers in low-lying areas or steep slopes after heavy rain. These rapid-onset events can carry debris and cause mudslides (Cirella & Iyalomhe, 2018). Understanding this diverse range of urban flooding types is crucial. Different urban environments might be susceptible to some types more than others. Therefore, effective mitigation strategies require a tailored approach that considers the specific vulnerabilities of each city.

Additionally, the impacts of urban flooding can be severe, causing significant disruptions in cities and substantial harm to people, the economy, and the environment (Hammond et al., 2013). One critical area of disruption involves critical infrastructure. Flooding can disrupt essential services by damaging transportation networks, power grids, and communication systems (Jha et al., 2012). This can lead to a cascade of negative consequences, including economic losses due to business closures, and challenges in accessing essential services like healthcare and emergency response.

2.3 Understanding Urban Flood Governance

Devastating urban floods have become increasingly common in recent years, overwhelming traditional flood management efforts. This has spurred a paradigm shift, moving us away from a reactive approach of helplessness towards proactive strategies aimed at mitigating flood risks in urban areas (Evers et al., 2012). Historically, flood management focused heavily on structural measures: physical constructions like levees, dams, reservoirs, and drainage systems aimed at controlling or reducing floodwaters. However, over time, the focus has shifted towards sustainable urban water management practices. This holistic approach embraces both structural measures and non-structural measures. Non-structural measures include land-use regulations, flood forecasting and warning systems,

flood-proofing buildings, disaster prevention plans, preparedness initiatives, and robust response mechanisms (Sampurno et al., 2022).

In addition, cutting-edge technologies have been incorporated, such as Geographic Information Systems (GIS) and Storm Water Management Models (SWMM), which have facilitated more precise flood simulations and enhanced decision-making in urban flood management. (Jiang et al., 2023; Jiang et al., 2015). Although there are still considerable challenges in urban flood management, particularly in developing countries, they are under immense pressure to manage flood risks in the face of increasing flooding occurrences (Adelekan, 2016)

Urban flooding is not just about extreme weather; it is often exacerbated by poor governance. The fragmented nature of urban governance systems impedes sustainable land and water management efforts. Existing structures frequently disregard the interdependencies between spatial planning, infrastructure provision, and flood risk mitigation. This results in insufficient responses, with ineffective regulations leading to poor land-use management and low-quality drainage systems (Andreasen et al., 2022). Minimal government enforcement further undermines stakeholder engagement, including risk management agencies. Consequently, innovative flood mitigation approaches struggle to gain traction due to socio-political, biophysical, and governance barriers (O'Donnell & Thorne, 2020).

Urban flood governance faces a complex web of challenges that extend beyond technical solutions. Hutter (2016) identifies underlying issues affecting the relationship between local authorities and communities. Mismanagement, corruption, and a lack of coordination among stakeholders – including government agencies, citizens, and NGOs – create significant governance dilemmas that hinder urban flood resilience. This calls for a more inclusive and collaborative approach to urban flood governance, where all stakeholders work together to build resilient communities.

Despite growing awareness of resilience, translating theory into practical action remains a hurdle (Rözer et al., 2022). Resilience frameworks aim to shift the focus from simply managing flood hazards to building adaptable systems that can learn and transform in the face of change (Liao, 2012). However, limited understanding and application of these concepts create challenges. Current approaches may not offer equal protection for all communities, particularly those with lower socioeconomic status or marginalized groups, leaving them disproportionately vulnerable to flooding.

Furthermore, a lack of standardized data collection and assessment methods makes it difficult to compare flood risks across cities and evaluate the effectiveness of resilience strategies (Rözer et al., 2022). Climate change adds another layer of complexity. Traditional risk assessments often struggle to account for the uncertainties introduced by a changing climate, potentially leading to reactive flood management, ineffective governance, and unequal resource allocation (Rözer et al., 2022). Additionally, neglecting the benefits of green infrastructure solutions represents a missed opportunity for holistic urban development.

In conclusion, the literature review has exposed a critical need to address the weaknesses in urban flood governance. Fragmented structures, inadequate protection for vulnerable populations, rapid urbanization, and climate change all contribute to increased flood risks in urban areas. These interconnected challenges demand a holistic approach that transcends traditional models. To explore these issues further the following section will delve into case studies that illustrate the complexities of urban flood governance and provide valuable insights.

2.4 Case Studies: China and Accra

In this section, I provide case studies to aid in a better understanding of governance and urban flooding, giving a better view of how other countries and towns have handled such complex issues over the years. By examining how other countries and cities have tackled these complex issues, we can identify some of the challenges and potential solutions. The following are the two identified cases:

2.4.1 China’s Flooding Problem

China located in East Asia is the world's second most populous nation with over 1.4 billion people, facing significant water resource challenges, including frequent and severe urban flooding. The problem has become increasingly pervasive in recent years (Jiang, Zevenbergen & Fu, 2017). Widespread floods ravaged both northern and southern regions, impacting an estimated 60 million people. Over half a million were forced to evacuate, and tragically, 300 lives were lost. The economic cost of these floods reached a staggering US$44.7 billion (Shepard, 2016).

A confluence of factors contributes to China's urban flooding woes. Climate change plays a major role, with increased frequency of heavy rainfall creating new natural conditions that heighten flood risks (Jiang, Zevenbergen & Fu, 2017). Rapid urbanisation further exacerbates this issue. Densely populated cities are more vulnerable to extreme weather events (Han & Kasperson, 2011).

China's urban development patterns also play a significant role. Unsustainable land conversion and poor planning have transformed many cities into concrete jungles (Ma et al., 2014). This approach fragments natural water pathways and leads to poorly developed drainage infrastructure. The combined effect of these factors – climate change, urbanisation, and inadequate infrastructure – creates a perfect storm, leaving China highly vulnerable to urban flooding.

In response to the growing threat of urban flooding, the Chinese government has implemented a series of initiatives aimed at improving urban drainage systems nationwide. A recent strategy is to develop "sponge cities" to address urban water issues, flooding, and stormwater management (Zevenbergen & Fu, 2017). This innovative approach envisions cities functioning like sponges, absorbing rainwater during heavy storms to reduce flood risks, store it, and purify it for later use. The project emphasises water-resilient low-impact development that seamlessly integrates urban design and construction. A successful example of such a project can be found in Copenhagen, Denmark. The city planning department adopted a

process to delay and infiltrate stormwater runoff locally within the city rather than discharging it directly through sewer systems (Douglas et al., 2010).

China's "sponge city" program seeks to revolutionise traditional thinking regarding urban drainage and stormwater management by promoting sustainable rainwater retention and integration with urban planning. This holistic approach aims to accommodate urbanisation, promote sustainable development, and simultaneously tackle water and environmental challenges.

However, implementing this comprehensive strategy requires considerable effort. Coordinated cross-sector planning and stakeholder engagement are crucial; however, China's current governance structure presents a challenge (Zevenbergen & Fu, 2017). The top-down, fragmented system of government agencies at different levels with diverse interests and priorities hinders effective collaboration. This fragmented approach overlooks opportunities for sector-wide collaboration and coordination within the current policy framework. Additionally, resistance to implementation can arise from ingrained institutional and logistical management practices. These factors can exacerbate difficulties in implementing an integrated urban water management plan.

Therefore, for the "sponge city" plan to succeed, China needs to address these implementation hurdles. Strengthening governance capabilities and providing the necessary financial and technical support are essential. By overcoming these challenges, China's innovative approach has the potential to serve as a model for sustainable urban water management in the face of increasing flood risk.

2.4.2 Accra

Accra, the bustling capital of Ghana, faces a significant challenge: urban flooding. This major city, with an estimated population of 4.7 million, is no stranger to devastating floods (Gaisie and Cobbinah, 2023). Historical records reveal a grim picture: Between 1955 and 1997, floods caused an estimated US$30 million in damage, claimed over 100 lives, and displaced nearly 10,000 residents (Asumadu-Sarkodie et al., 2015).

Flooding is particularly prevalent in low-lying areas and in rivers. A key factor exacerbating this problem is the uncontrolled growth of housing development in flood-prone zones. This encroachment on riparian areas, coupled with the build-up of waste in streams, significantly hinders water flow (Andreasen et al., 2023). Several factors contribute to this uncontrolled development: the commercialisation of land by traditional landholders and lax enforcement of development regulations by municipal planning authorities.

Municipal authorities often lack the capacity or motivation to regulate housing development effectively and prevent encroachment on water bodies. Allegations of corruption further complicate this issue. Demolishing illegal housing is politically sensitive and can even worsen flood risks by displacing residents without providing alternative housing options (Andreasen et al., 2023).

The current response to urban flood risk management in Accra primarily falls under the National Disaster Management Organization (NADMO) (Andreasen et al., 2023). Their strategies focus on evicting flood-affected residents, demolishing structures deemed to obstruct waterways, and constructing new drainage infrastructure in flood-prone areas, often with funding from foreign donors (Amoako et al., 2019). More recently, interventions have included erecting flood barriers against coastal flooding, converting silted water bodies into concrete drainage channels, and widening existing drains to address flash floods.

However, the increasing frequency and severity of floods have exposed the limitations of these reactive approaches. A key weakness is the historically top-down approach to urban planning in Accra, which prioritises the implementation of global and national policies without sufficient consideration of the local context (Andreasen et al., 2023). Although Ghana's national urban policy (2012) acknowledges the importance of addressing climate change for urban sustainability, a significant gap exists between policy pronouncements and on-the-ground realities.

National policies aimed at tackling flooding, such as the National Climate Change Policy and Disaster Risk Reduction Strategy, have failed to adequately address the root causes of flooding in Accra (Andreasen et al., 2023). Moving forward, a critical shift is required. Spatial planning and transportation infrastructure must be designed for flood risk mitigation. Furthermore, there is a pressing need for more collaborative and inclusive governance practices to overcome the fragmented system that currently hinders sustainable land and water management (Andreasen et al. 2023).

2.4.3 Lessons Drawn from the Case Studies

Urban flooding poses a complex challenge, driven by a confluence of factors. Climate change plays a role, but so do inherent aspects of urban design: rapid urbanization, land-use practices, and inadequate drainage systems.

To tackle this issue effectively, a holistic approach is essential. We need integrated planning and governance that breaks down the silos in the current system. Fragmented governance hinders sustainable land and water management, leaving cities vulnerable to floods.

Effective governance demands integration and coordination across diverse sectors and levels. This involves aligning national policies with local implementation strategies. It also requires fostering collaboration among all stakeholders, including government agencies, local communities, and even international organizations, who all play a crucial role in flood risk management.

The path forward prioritizes integrated and adaptive governance approaches that champion equity, community engagement, and sustainable urban planning. By prioritizing these principles, we can enhance the resilience of our cities and better manage the risks of urban flooding.

2.5 Gap Identification

The existing body of literature does not adequately address the social dynamics of governance structures and the legal frameworks surrounding flood risk management. Although some projects have addressed these research questions, studies in these areas remain rare, fragmented, and limited in scope (Hegger et al., 2014). Regional differences in governance typologies and sociocultural diversity seem to have disregarded this. An example is the lack of research on the political context of climate adaptation policy in sub-Saharan Africa, governance quality, planning capacity, and the effectiveness of complex policies and programs has been highlighted (Habtezion et al., 2015). The complexity of governance structures in Africa, with traditional and modern layers of authority and informal institutions, further highlights gaps in understanding multilayered governance architecture and its implications for effective governance in the region (Habtezion et al., 2015).

Moreover, a research gap exists in exploring the essentials of community resilience to recurring floods, considering the impacts of climate change and other drivers on flood vulnerability (Rahayu et al., 2021). Investigating the factors that contribute to community resilience, such as stakeholder engagement, adaptive strategies, and infrastructure improvements, can provide valuable insights into enhancing urban flood governance practices.Furthermore, exploring how these strategies can be effectively incorporated into local governance practices and community development planning is crucial to bolster urban flood resilience and reduce vulnerability to flooding (Munawar et al., 2021).

Overall, the literature review highlights critical weaknesses in urban flood governance, exposing a complex and interconnected set of challenges. In the next chapter, I will delve into the Earth System Governance Framework (ESG) as a powerful conceptual tool, exploring how its emphasis on interdisciplinarity, multi-level collaboration, and stakeholder inclusion can illuminate a path towards more resilient urban flood management.

CHAPTER THREE: CONCEPTUAL AND ANALYTICAL FRAMEWORK

3.1 Introduction

In this chapter, I introduce the conceptual and analytical framework that serves as a foundation for this study. This framework not only provides a roadmap for the research by defining the key concepts, their relationships, and the overarching research question, but also functions as a lens for analysing data and carrying out the research.

3.2 The Emergence of the Earth System Governance Framework

In 2001, four major programs on global environmental change recognized a critical gap in the lack of a robust ethical framework for managing Earth's complex systems. This realization led to the establishment of the Earth System Governance (ESG) project, which builds upon the foundation laid by the International Human Dimensions Programme on Global Environmental Change (IHDP) (Biermann, Davies and Van Der Grijp, 2009).

At its core, Earth System Governance represents the convergence of two crucial academic disciplines: earth system analysis and governance theory, as explained by Biermann (2007, 2008). Earth system analysis, pioneered by scientists like Hans-Joachim Schellnhuber (1999), delves into the Earth as a unified system. It emphasizes the intricate interdependencies between the atmosphere, hydrosphere, biosphere, lithosphere, and cryosphere. This approach transcends the study of individual components, instead investigating their dynamic interactions through physical, chemical, and biological processes.

Earth system analysis is further complemented by sustainability science, which fosters collaboration between natural and social scientists across disciplines. Recognizing the inherent complexity of sustainable development, this

multidisciplinary approach encourages research designs that consider local to global scales. Additionally, it advocates for a paradigm shift in scientific inquiry, emphasizing social learning and collaborative efforts to achieve a sustainable future.

On the other hand, the concept of governance takes on new meaning in the context of Earth systems. Here, governance implies new forms of multilevel policy, collaboration between the private and public sectors to address global environmental challenges, and a certain degree of self-regulation by social actors (Lebel et al. 2006; Raik and Decker 2007; Fabricius and Cundill 2014). The 1990s witnessed a surge in the importance of governance, often accompanied by the term "good governance" in development strategies.

Building on these earlier discussions, the more recent concept of "global governance" aims to replicate these principles at an international level. As with "governance," there is no single definition of global governance, and its meaning varies among authors (Finkelstein 1995; Kersbergen & Waarden, 2004). In the global arena, the term is commonly used to refer to the dynamics of current world politics, yet a universally agreed-upon definition remains difficult to pinpoint. Notably, the concept of governance, at all levels from local to international, encompasses a wide range of public and private non-state actors participating in decision-making. This includes environmentalists, international corporations, and newly developed government agencies.

3.3 Conceptualisation of Earth System Governance Framework

The ESG Framework focuses on addressing five main problem structures, which have led to principles such as credibility, stability, adaptability, and inclusiveness. These structures can be better understood by examining the five key analytical problems, referred to as the 'five A's' of earth system governance research: the overall *architecture* of governance, *agency* beyond the state, *adaptiveness* of governance mechanisms, *accountability* and legitimacy, and modes of allocation

and access (Biermann, 2007; Biermann et al., 2010). These issues are crucial for effectively managing global environmental changes and addressing the complexities inherent in Earth system governance.

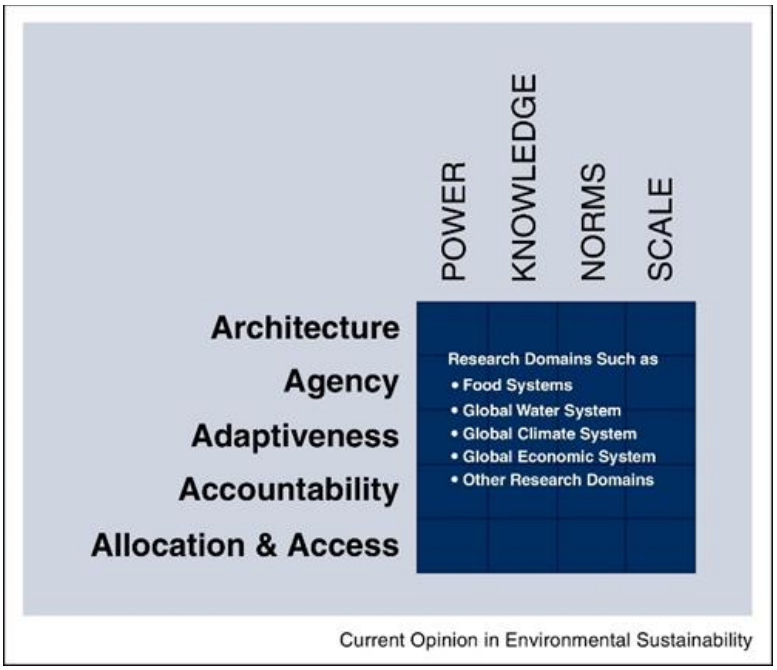

Figure 1 Earth System Governance Framework

3.3.1 Architecture

The first analytical issue pertains to the overall architecture of Earth system governance. According to Biermann et al. (2010), architecture is a complex structure of institutions, rules, legislation, decision-making processes, and organizations that operate within a particular area of global governance. This system is not static but dynamic, involving multiple actors, rather than a single architect who continuously evolves in response to internal and external pressures and governance processes.

The analysis of Earth system governance extends to all levels, including multilevel governance architectures in areas such as climate change mitigation, ocean governance, and biodiversity conservation. Research has shown that international norms and regimes can affect the efficiency of individual institutions (Mitchell, 2008). Similarly, at the national and local levels, the interconnections among various institutions were the focus of the analysis. This is evident in studies on environmental policy integration and environmental governance within federal systems, where overlapping jurisdictional competencies may be present (Chambers, 2001; Underdal and Young, 2004). Examining situations where a governance area is subject to many institutional regulations becomes feasible by the concept of governance architecture.

3.3.2 Agency Beyond the State

The second analytical problem in Earth system governance involves the issue of agency. Numerous significant institutions are now led by non-state actors operating across various levels, from local to global, which transcend traditional distinctions between public and private spheres and range from public non-state entities to private actors, such as business networks. (Andonova and Levy, 2003; Biermann et al., 2007) The activities of these non-state actors in Earth system governance extend beyond protests, advocacy, lobbying, or advising. They actively shape and implement rules that govern human interactions with the natural environment.

The evolving governance landscape of Earth systems compels us to differentiate between actors and agents (Biermann, 2010). While both participate in decision-making processes, their roles differ. Actors simply take part, influencing earth system decisions. In contrast, agents possess the authority to not only participate but also prescribe behavior and garner consent.

The distinction between power and authority is also crucial. Power is the ability to influence outcomes, whereas authority implies the legitimate right to do so. Whether an agent can definitively claim unquestioned authority is debatable, as

power and authority often intertwine (Biermann, 2007; Biermann *et al.*, 2010). Agents can contribute to steering collective responses to Earth system transformations. This steering can be indirect, influencing other actors' decisions, or direct, through their own authoritative rulings. Regardless of the method, agents play a critical role in our collective efforts to prevent, mitigate, or adapt to changes in the Earth's system (Biermann, 2007; Biermann *et al.*, 2010).

3.2.3 Adaptive Governance

The third analytical problem is adaptiveness, which encompasses to the collaborative, flexible, and adaptable management and distribution of resources by political, economic, social and administrative institutions in order to foster resilience (Adger, 2006; Folke, 2006; Gallopín, 2006; Smit and Wandel, 2006). Within the context of Earth system governance, the notion of adaptiveness encompasses the internal processes of adjustment and transformation within governance frameworks, as well as the management of adaptation to social and environmental modifications.

It emphasises the importance of understanding connections and interactions across various scales and levels of governance. Additionally, adaptive governance recognises that individuals possess imperfect and unevenly distributed knowledge despite being rational social actors, which can result in different evaluation criteria based on communication and transparency levels.

3.3.4 Accountability and Legitimacy

The fourth analytical problem of the ESG framework is accountability and legitimacy. Although the terms legitimacy and accountability may have many different interpretations, they are conceptually and practically similar to the idea of democratic governance. (Biermann and Gupta, 2011).

Within Earth system governance, accountability and legitimacy are two intertwined concepts crucial for effective decision-making. Accountability essentially refers to

holding actors responsible for their actions (Mason, 2008). Similar to being held accountable, legitimacy signifies the justification and acceptance of authority.

Legitimacy hinges on adhering to established standards, norms, and legal frameworks (Bernstein, 2005). It involves two key aspects: acknowledgement and justification. Acknowledgement refers to the degree to which an organization or regulation is considered authoritative within a society. Justification, on the other hand, focuses on the arguments that support the legitimacy of those authorities and regulations.

3.3.5 Allocation and Access of Resources

The final analytical problem of the ESG framework is the allocation and access. Access is defined as people's capacity to preserve a minimal number of resources and environmental space allocation; on the other hand, it considers how best to distribute the remaining resources among individuals and nations, in addition to addressing the issue of providing fundamental necessities (Biermann, 2007; Biermann *et al.*, 2010). Accordingly, allocation has three dimensions: (a) resources, (b) risks and liabilities, and (c) accountability for creating environmental issues (Gupta & Lebel, 2010).

The impact of global change poses additional challenges, for instance, in the way environmental risks are distributed across people and places. Research on moral and ethical issues will be necessary to address the tangled details of both goals and procedures to achieve fair allocation and access, making the pursuit of these goals and the un-doing of perceived injustices challenging (Biermann, 2007; Biermann *et al.*, 2010).

3.3.6 Crosscutting Themes

The five analytical problems are the basis of earth system governance research and share a few crosscutting themes, which are essential for the understanding of each problem (see Figure 1) and provide a starting point for advancing and integrating

many different strands and disciplines of research (Biermann, 2007; Biermann *et al.,* 2010).

These themes include:

- Power: Drawing on Weber (2007), the traditional definition of power is the ability to persuade others to act despite their own interests and even resistance. It may be used or conveyed in a variety of ways, which is where subtleties and complexity come in. Therefore, understanding power dynamics within the context of governance determines who participates, whose interests are represented, and whose perspectives are prioritised in decision-making.
- Knowledge: It revolves around understanding how scientific knowledge about the Earth system is produced, communicated, and ultimately used in environmental decision-making. Production of scientific knowledge plays a crucial role and requires reflexivity to improve on the underlying theories and concepts.
- Norms: Researchers must consider the impact of prevailing norms, values, and broader ideological frameworks, which have been a subject of considerable scholarly interest. This involves comprehending not only individual institutions but also the integration of norms and the confluence of rules and practices that shape these institutions.
- Scales: The geographical, chronological, quantitative, or analytical dimensions that are utilized to quantify or rank any phenomena are referred to as scales. However, level is the analytical unit that is positioned at various locations on a scale. (Gibson, Ostrom and Ahn, 2000). It is crucial to determine whether findings or hypotheses are applicable across all scales or a single scale and to evaluate the extent to which scale influences their findings.

3.4 Why the Earth System Governance Framework?

The decision to apply the ESG framework to my research on Ruiru was based on the similarity between the research problem and the problem characteristics of the ESG framework. The issue of flooding in Ruiru involves complex interactions between Earth system factors, such as climate change, urbanisation, land use practices, and inadequate infrastructure, which contribute to an increased vulnerability to urban flooding hazards. Unlike traditional approaches to flood governance, such as structural measures, the ESG framework offers a more comprehensive approach that considers the social, economic, and environmental dimensions of the problem.

Furthermore, this framework recognises the involvement of various actors beyond just states and governments, including a diverse array of public and private non-state actors at different scales and levels, allowing for analysis at multiple scales. Given that ESG has been applied in various empirical contexts worldwide, it is relevant to study the governance challenges in diverse socio-environmental settings. By adopting this framework, one can draw upon existing research and methodologies to analyse governance dynamics in Ruiru and contribute to the broader literature on Earth System Governance.

Lastly, the ESG Framework offers a beneficial structure for analysing the complex challenges of urban flood governance. This framework will aid my research by helping me formulate questions for my interview guide, I can probe stakeholder perspectives and the analytical problems and function as pre-defined codes for thematic analysis, enabling me to identify essential patterns within the data.

3.5 Operationalising the Earth System Governance Framework

This study aims to understand how governance structures influence urban flood management in Ruiru, Kenya. To achieve a comprehensive understanding, I operationalise the ESG framework, focusing on its key concepts to analyse the existing structures and processes that influence how this issue is addressed.

3.5.1 Applying the Concepts

Each ESG analytical problem is applied to analyse specific aspects of urban flood governance in Ruiru.

- Architecture: I examine the formal and informal institutions involved. This includes national and local government structures responsible for urban flood management, relevant laws and policies, and the potential role of regional and international organisations.
- Agency: I explore the actors involved (individuals, groups, and organisations) and their decision-making processes. These include government officials, NGOs, community leaders, and vulnerable communities.
- Adaptiveness: The focus is on how existing governance structures adapt to the challenges of climate change and urban flooding. This includes the flexibility of policies to accommodate changing needs and unforeseen circumstances and the potential for local communities to innovate and develop new approaches.
- Accountability: The focus is on mechanisms for ensuring transparency and participation throughout policy development and implementation. This includes how local communities hold their government officials accountable for effective flood response and the role of civil society organisations.
- Allocation and Access: This concept will be used to examine how resources urban flood management are allocated across different levels of government and community. Additionally, I will investigate equitable access to resources and support for those affected by flooding in Ruiru.

3.6 Critiques of the Earth System Governance Framework

The ESG framework presents both promise and challenges in its practical implementation, particularly in integrating institutional and governance research with more model-driven approaches. One of the primary challenges is the complexity of integrating diverse disciplines within the framework, which can hinder effective communication and collaboration among experts from different fields. The interdisciplinary nature of ESG research demands innovative methods to foster exchange and collaboration across disciplinary boundaries (Biermann et al., 2019).

The ESG framework is designed to be adaptable and encourage participation from various communities (Biermann et al., 2019). This informality fosters collaboration and exchange of ideas. However, the flip side is a lack of clear structures for enforcement and accountability. It becomes difficult to hold actors responsible for actions or ensure adherence to international agreements championed by platforms like Future Earth.

Another challenge lies in potential bias. Despite efforts to be inclusive, the ESG framework might still be dominated by Western perspectives and interests (Biermann et al., 2019). This could marginalize the voices of the Global South and indigenous communities. To achieve truly equitable governance, the framework needs to address these biases and ensure greater representation from diverse stakeholders. Only then can the ESG framework be truly effective and legitimate on a global scale.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

In this chapter, the methodology used in this study is outlined. This chapter details the research design, philosophy, sampling strategy, data collection methods, ethical considerations, and analysis employed in the research. This study also presents its limitations and challenges.

4.2 Research Strategy and Design

My research strategy adopts a qualitative approach to understand how governance structures influence the management of urban flooding in Ruiru, Kenya. Qualitative research offers a robust strategy for investigating complex social phenomena and can capture the diverse perspectives and lived experiences of different stakeholders. Furthermore, qualitative research is well-suited for understanding the nuances of power relations, social norms, and cultural factors influencing governance processes, contributing to a more nuanced and holistic understanding of the phenomena under investigation (Denzin & Lincoln, 2018; Creswell & Creswell, 2018). Qualitative research provides rich, context-specific insights that quantitative approaches may overlook (Braun & Clarke, 2021). Furthermore. This approach aligns with previous studies that have highlighted the importance of qualitative research to understand the multifaceted nature of governance challenges and their impact on vulnerable populations in the context of climate change (Biesbroek et al., 2020).

A research design serves as a blueprint for conducting a study, aiming to maximise control over factors that could potentially interfere with the validity of the findings (Creswell, 2018). It provides a framework for both the collection and analysis of data, effectively linking the data to be collected and the conclusions to be drawn back to the initial research questions. Therefore, a case study research design was applied in this research. A case study involves a detailed and intensive exploration of an issue within a bounded system. According to Stake (2005), case study research is not a methodology but a choice of what is to be studied, while others present it

as a strategy of enquiry, methodology, or a comprehensive research strategy. (Denzin & Lincoln, 2005; Yin 2019), and I chose to share this view.

I chose the case study approach as the preferred methodology compared to other forms of social science research because it offers a compelling approach for qualitative enquiry owing to its ability to facilitate in-depth exploration of specific phenomena within their natural contexts. (Yin,2019). Through careful analysis and interpretation, case study research contributes to theory building by uncovering patterns, relationships, and the underlying mechanisms. Additionally, the flexibility and adaptability of the case study methodology allow for iterative data collection and analysis, leading to a refined understanding of the case (Yin,2019). In this research, I opted specifically for an exploratory single-case study design, focusing on a single case rather than multiple cases. This approach allows for a deep dive into the specific context of Ruiru, Kenya, without the need for a comparative analysis with other cases.

A common critique of case studies is that these do not produce generalizable findings (Bryman 2021). While it is true that case studies may not always yield findings that are readily generalisable to broader populations or contexts, it is essential to recognise the distinctive contributions they offer to qualitative research. As articulated by Yin (2019), the strength of case studies lies in their ability to provide analytical rather than statistical generalisations. In this context, the objective of my research is to thoroughly analyse the governance challenges in addressing flood-displacement in Ruiru and draw conclusions on this particular case rather than to generalise.

4.3 Research Philosophy

My research philosophy is centred on interpretivism, which emphasises the importance of understanding social phenomena through the subjective interpretations and experiences of individuals within their unique contexts (Creswell, 2018). Grounded in the belief that reality is socially constructed and subjective, interpretivism highlights the significance of human agency and the role of language, culture, and social interactions in shaping our understanding of the

world (Denzin and Lincoln, 2018). As a researcher, I acknowledge the multifaceted nature of reality and strive to explore the intricacies of human behaviour, beliefs, and interactions within their social and cultural frameworks. Embracing interpretivism, my research approach involves engaging with participants in a collaborative and empathetic manner and valuing their perspectives and lived experiences as valid sources of knowledge (Braun & Clarke, 2021). This philosophical orientation guided my dedication to generating nuanced insights, fostering dialogue, and contributing to the advancement of knowledge in my field.

4.4 Selection of Case Study Site (Ruiru, Kenya)

Selecting a case study site is a crucial aspect of qualitative research as it impacts the depth and quality of the data collected. Several factors were considered when conducting the research in Ruiru, Kenya. First, Ruiru, as the case study site, is intricately linked to overarching research objectives and questions, forming a critical foundation for addressing the research gap and advancing knowledge in the field of urban flooding and governance. Second, its topography makes it particularly susceptible to flooding during heavy rainfall events. Third, Ruiru has undergone rapid urbanisation and population growth, intensifying the challenges related to land use, infrastructure, and social cohesion in the face of climate change (IPCC, 2021). Furthermore, Ruiru features a variety of governance structures and stakeholders involved in climate governance, such as local government authorities, non-governmental organisations, community groups, and international agencies (Biesbroek et al., 2020). This diversity provides an opportunity to examine governance dynamics and interactions between different actors to address urban flood management. Finally, my prior knowledge of the country, including its cultural nuances and language, enables a more nuanced understanding of the local context, ultimately enhancing the depth and quality of the research outcomes.

4.5 Sampling Strategy

To ensure I gathered in-depth information from individuals most relevant to my research question, I utilized a combination of purposive and snowball sampling techniques. Purposive sampling allowed me to identify participants with specific

characteristics and experiences directly connected to the study's objectives (Creswell & Creswell, 2018). This method offers researchers the justification to draw theoretical, analytical, or logical generalizations from the chosen sample (Creswell & Creswell, 2018). Mugenda and Mugenda (2003) further highlight that purposive sampling empowers researchers to select cases that possess the information vital to their study's goals.

Following the initial purposive selection, I employed snowball sampling to expand the participant pool (Creswell & Creswell, 2018). This technique involves requesting participants to recommend others who share the desired characteristics. Combining these methods ensured I recruited individuals with the most relevant experiences and knowledge, making them particularly effective for this case study.

It's important to acknowledge that both purposive and snowball sampling have limitations. Purposive sampling's reliance on researcher judgment can introduce bias if unconscious favoritism towards specific characteristics sways participant selection (Berndt, 2020). Similarly, snowball sampling can lead to selection bias because the sample is built on existing connections, potentially resulting in a group with similar backgrounds or experiences (Berndt, 2020). This non-random selection also makes generalizing the findings to a broader population challenging, as the sample may not reflect the population's full diversity. Additionally, snowball sampling might not be ideal for reaching marginalized groups who lack strong social networks or connections to previous participants (Berndt, 2020).

4.6 Data Collection Methods

To achieve the objectives of this research, I chose to use both primary and secondary data sources. This approach allows for a comprehensive analysis and interpretation of the findings.

4.6.1 Primary Data

Primary data refer to data collected directly from the original source for the purpose of a specific research project (Salam et al., 2022). For this study, primary data were collected through observations, key informant interviews, semi-structured

interviews, and focus group discussions. These methods were chosen to gather in-depth and rich information from participants who had first-hand experience and knowledge related to the research objectives.

i) Observations and Informal Discussions

I conducted field observations of the area by walking through the most affected wards which included Kiuu, Gatongora, and Mwihuko wards affected by flood displacement. I received support from local gatekeepers, who facilitated connections with ward representatives in the affected areas. I chose this method to gain firsthand insights into the context of the research setting, providing a valuable context for understanding governance challenges in addressing climate displacement in Ruiru and Kenya. Additionally, I actively participated in Ruiru sub-county government official meetings to gain insights into their day-to-day operations and better understand local government structures. These observations provide valuable context and understanding of the governance mechanisms at play within the community.

Furthermore, informal discussions were conducted to complement field observations by facilitating informal interactions and conversations with key stakeholders, community members, and local experts. These discussions provided an opportunity for me to engage directly with community leaders and members, building rapport and trust while eliciting their perspectives, experiences, and insights on the research topic (Rubin & Rubin, 2012). During field observations and informal discussions. I took field notes of the observations about the physical area, such as topography, land use practices, nature of developments within the area, and drainage use points, for further research and reflection. Photographs were obtained to visually document the physical characteristics of the sites and the factors contributing to flooding.

ii) Semi- Structured Interviews

Semi-structured interviews were conducted with 16 individuals from the community to understand the lived experiences, perceptions, and concerns of those

directly affected by flooding displacement. The selection of semi-structured interviews as the data collection method allowed for a flexible and open-ended approach, enabling participants to share their experiences and perspectives in-depth while allowing for the exploration of emergent themes and issues (Fontana & Frey, 2005). Moreover, this helps the interviewer avoid being limited to a predetermined and static interview guide (Mason, 2017).

Most of the interviews were conducted in English, and a few interviews were conducted in Swahili based off their preference. I conducted interviews in a neutral place such as outdoor fields, school playgrounds and community meeting offices. I strived to capture different groups in terms of location, gender, and age to ensure the proper representation of all groups.

iii) Focus Group Discussions

I conducted two focus group discussions with community leaders from the Kiuu and Mwihuko wards. Focus group discussions have been utilised to explore diverse perspectives, experiences, and opinions within a group setting (Krueger & Casey, 2014). By bringing together participants from various backgrounds, I have provided a platform for engaging in dialogue, sharing insights, and uncovering multifaceted viewpoints on the research topic. The interactive nature of focus group discussions allowed me to observe group dynamics, non-verbal cues, and consensus-building processes, providing additional insights into the reliability and credibility of the data collected (Krueger & Casey, 2014).

I initially intended to conduct separate female and male focus groups, but, unfortunately, I was not successful in obtaining a separate female focus group, resulting in a predominantly male group in the discussions. Focus group discussions followed the interview guide (see Appendix 2) and began with an introduction to the scope of the search and obtaining informed consent. The discussions were recorded on a Dictaphone and took about 40-60 minutes long.

iv) Key Informant Interviews

I conducted key informant interviews with six experts who had extensive knowledge of the subject matter, including policymakers, county and sub-county government officials, and an NGO representative. I chose these individuals strategically, as they possess a deep understanding of the local context, governance structures, and flood displacement-related issues. Their insights offer a unique perspective that cannot be easily obtained through other means (Rubin and Rubin, 2012). To ensure diversity in selecting informants, participants with different professional expertise and demographic characteristics were selected to obtain a well-rounded understanding of the issue at hand. Semi-structured interviews were conducted using an interview guide (see Appendix 2) that outlined the topics, themes, and questions to be covered during the 30–60-minute interview, which was recorded on a Dictaphone with the participant's informed consent.

4.6.2 Secondary Data

For this research, secondary data used to supplement primary data were obtained through a review of the literature related to urban flooding as well as governance structures relevant to the research issues. Additional support was provided through the analysis of government documents and internet sources.

4.7 Data Analysis Techniques

I conducted a thematic analysis for my qualitative data, which enabled me to focus on the meaning of the entire dataset while also examining specific aspects in depth. Thematic analysis is a technique for meticulously identifying, categorising, and providing insight into patterns of meaning (themes) in a dataset (Kuckartz and McWhertor 2014). This approach was suitable for my research objectives because it allowed me to interrogate peoples' experiences and capture both surface-level and deeper semantic codes. By utilising this method, I gained a better understanding of the underlying meaning of the data.

After transcribing the interviews, I uploaded them all to NVivo, a data analysis software. To begin the thematic analysis, I followed the six-step guide by Braun and

Clarke (2006). This involved thoroughly reading the transcripts and meticulously highlighting sections relevant to my research question. To ensure impartiality, I randomly selected two transcripts for initial coding. I scanned the raw data, identifying crucial parts and noting pertinent observations.

The research framework for this study draws inspiration from the Earth Systems Governance framework (Biermann, 2007). This framework, with its five key aspects – architecture, agency, allocation, adaptiveness, and accountability – provided predefined categories for a deductive coding process. This approach allowed the analysis to be grounded in established concepts while also remaining open to discovering new insights or subtleties within the data. Following Yin's (2018) suggestion on internal validity, I looked for consistency between the empirical patterns found and the predicted patterns based on the framework. This consistency strengthened the validity of my results and prompted me to continue examining the text extracts, categorizing specific segments into the predetermined framework categories.

To complement the initial framework, I employed inductive coding alongside deductive coding. This allowed new themes, insights, and patterns to emerge directly from the data itself. After thoroughly re-reading and analysing the transcripts iteratively, I incorporated emergent codes into the data for each individual case. As coding progressed, I compiled a list of all codes and analysed them to identify similarities and overlaps. By clustering these codes around broader topics or concerns, I was able to generate themes and sub-themes that represented coherent and relevant patterns within the data. Throughout this process, I documented any questions, analytical notes, thoughts, or impressions in brief memos.

NVivo proved to be an invaluable tool. It not only facilitated data management and swift theme identification, but also helped me develop connections between these themes – crucial aspects for addressing my research question. The software's automated features significantly reduced the time and effort required for thematic

analysis while minimizing errors. This allowed for a more rigorous coding process, ultimately leading to more reliable and valid data.

4.8 Positionality and Ethical Considerations

As a researcher, my background shapes how I conduct and interpret research. My education in Development Studies and prior research experiences equip me with knowledge, skills, and theoretical frameworks that influence my approach. This background may predispose me to certain perspectives and methodologies, potentially impacting how I frame research questions, collect data, and analyse it (Bourassa, 2017).

Furthermore, my subjective experiences, values, and cultural background (being born and raised in Kenya) influence how I interact with participants and interpret data. This unique perspective can shape the questions I ask, how I engage with participants, and the conclusions I draw. While this background offers valuable insights, it also introduces potential biases. To mitigate these, I reflexively examined my positionality throughout the research, maintaining transparency (Bourassa, 2017). This involved critically reflecting on my assumptions, biases, and preconceptions, while acknowledging the power dynamics inherent in the researcher-participant relationship.

Ethical research requires anticipating and managing potential issues. Since interviews involve on-the-spot decision-making, I prepared thoroughly beforehand by reviewing literature and developing an interview guide and time budget (Mason, 2017). Informed consent was obtained before all interviews, and participants were assured of safety, respect, anonymity, and confidentiality. They were informed of their right to withdraw and to skip questions they felt uncomfortable with (Mason, 2017). Data was securely stored on an encrypted USB drive.

When interviewing vulnerable populations affected by flooding, I prioritized minimizing harm and distress. This included meeting participants in convenient locations to avoid travel costs (Israel, 2015). Moreover, ethical considerations also extend to research validity and reliability. To ensure the accuracy and completeness

of data, I employed multiple data collection methods – key informant interviews, focus group discussions, and field observations – allowing for cross-verification of findings (Creswell & Creswell, 2017). Member checking, where participants reviewed and validated my interpretation of their responses, further enhanced the research's credibility by ensuring the findings resonated with their lived experiences (Lincoln & Guba, 1985).

Additionally, standardized protocols were followed throughout the research process, specifically designed for case studies, to minimize researcher bias and ensure consistency (Bryman, 2021). Having established a robust methodological framework, the next chapter delves into the contextual background of the study.

CHAPTER FIVE: CONTEXTUAL BACKGROUND

5.1 Introduction

This chapter lays the groundwork for understanding the case study site of Ruiru, Kenya. It delves into the city's topographic and geographical characteristics, historical background, socioeconomic conditions, and relevant policies and programs.

5.2 Description of the Case Study Site

Ruiru Sub- County, situated within Kiambu County, spans an area of 292 km2 and comprises eight wards: Biashara, Kahawa Wendani, Kahawa Sukari, Mwihoko, Kiuu, Gatongora, Githothua, and Mwiki (ASWB 2016). As the most densely populated urban center in Kiambu County, Ruiru is situated on the southeastern fringes of the Aberdare Range, within the Athi River drainage area. The land mostly slopes gently towards the Athi River in the east, but the northwest has rugged terrain with many streams and ridges, while the southeast consists of low-lying areas with fewer streams and wider valleys. (ASWB 2016).

The geology of Ruiru is characterized by tertiary volcanic rocks, notably the Nairobi Stone, a volcanic tuff utilized for building blocks. Soils resulting from these volcanic rocks are typically dark reddish brown, well drained, and calcareous, although patches of black cotton soils can also be found (Kamamia *et al.*, 2021). Poorly drained soils are prevalent in low-lying areas, particularly along riversides, making these regions more susceptible to flooding.

The rainfall pattern in Ruiru is bimodal, with long rains occurring from March to May and short rains from October to December, averaging between 600mm to 1100mm annually (Kamamia et al., 2021). Generally, the temperature is high, with a mean maximum temperature of 26 degrees Celsius and a mean minimum temperature of approximately 14 degrees Celsius. The average annual temperature is around 21 degrees Celsius with potential evaporation varying from 1550mm to

2200mm per annum (Kamamia *et al.*, 2021). The equatorial climatic conditions in the region are influenced by altitude and proximity to the Aberdare Forest, with rainfall occurring in two seasons as described. The population of Ruiru Sub-County was approximately 490,088 according to the 2019 Census (KNBS), though it is likely much higher presently due to new settlements and urbanisation resulting from infrastructure developments such as the expansion of Thika Road into a Superhighway.

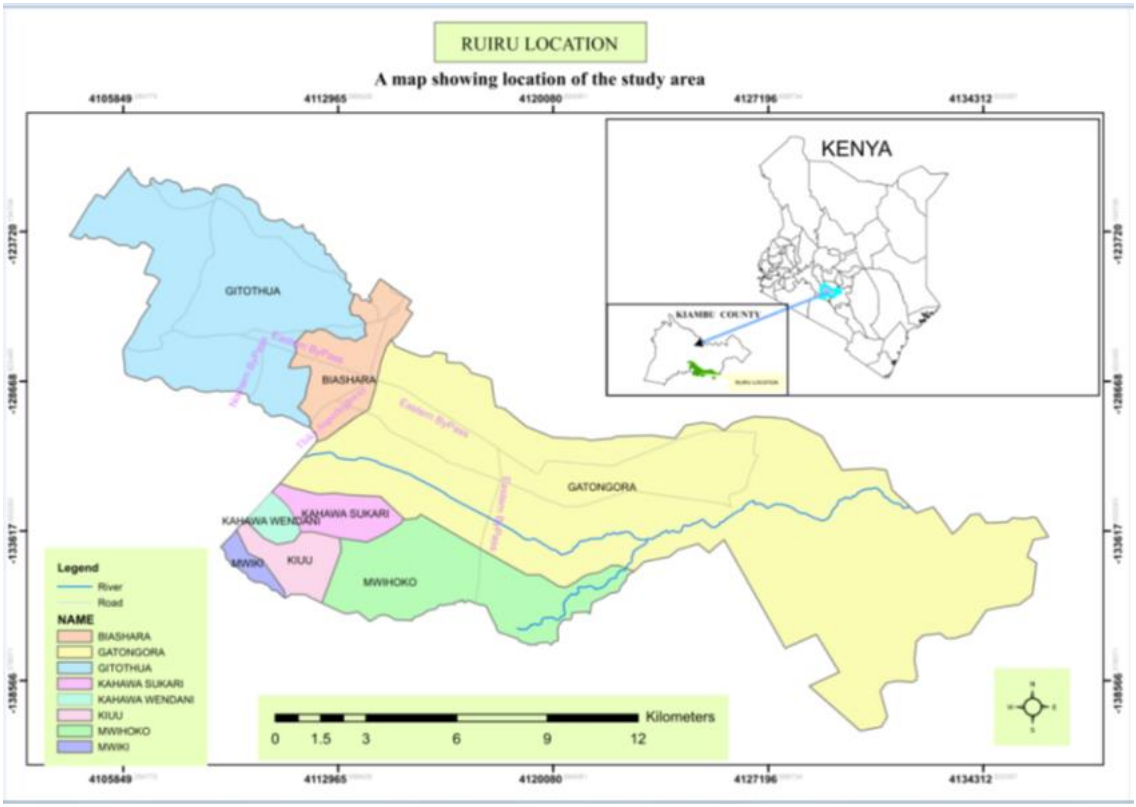

Figure 2 Ruiru Sub- County Map

5.3 Historical Background

The historical background of Ruiru sub-county traces its journey from a rural agricultural enclave to a bustling urban center teeming with diverse economic activities and a growing population. Originally inhabited by indigenous communities, notably the Kikuyu people who remain predominant, Ruiru's trajectory was significantly influenced by British colonial rule. The establishment of critical infrastructure such as the road in 1908, connecting the capital city with

key administrative centers like Thika, Murang'a, and Nyeri, along with the opening of a railway sub-station in 1913, marked pivotal moments in its development. These infrastructure projects facilitated European settlement and the introduction of commercial farming ventures like coffee and sisal, transforming Ruiru into a bustling service center catering to both settler communities and the surrounding hinterlands.

Following Kenya's independence in 1963, Ruiru experienced a rapid shift towards urbanisation and population growth, fueled by rural-to-urban migration and government-led economic initiatives. Its strategic proximity to Nairobi further enhanced its economic importance, fostering the growth of diverse industries spanning manufacturing, agriculture, and commerce. This period witnessed a flurry of infrastructural advancements, including the construction of residential estates, commercial hubs, schools, and healthcare facilities. The expansion of transportation networks, accompanied by the introduction of public transit services, bolstered connectivity within Ruiru and its neighboring urban centers.

However, alongside its progress, Ruiru grapples with a host of challenges, including urban sprawl, inadequate infrastructure, environmental degradation, and socio-economic disparities. Balancing the imperatives of economic growth with the imperatives of environmental sustainability and social equity necessitates comprehensive planning and governance strategies. Addressing these challenges effectively is crucial for ensuring the continued prosperity and well-being of Ruiru's residents and the sustainable development of the sub-county.

5.4 Relevant Policies and Programs

Ruiru Sub- County, situated in Kenya, falls under the jurisdiction of the Constitution of Kenya, which serves as the supreme law of the land and was enacted in 2010, replacing the previous constitution of 1969. This constitutional framework has brought about significant changes in policies and strategies, particularly in the areas of environmental and water management. For the purpose of this study, we will focus on these specific policy areas related to the study issue.

The Constitution of Kenya guarantees the right to a clean and healthy environment for all its citizens. (Gok, 2010). Furthermore, The Constitution of Kenya also provides for the devolution of powers from the central government to the 47 counties, including Kiambu County, where Ruiru Sub-County is located. As such, Kiambu County oversees the planning and development of the region, including other services. Furthermore, the county has the authority to enact legislation that may have implications for ongoing and planned projects. Recent reforms have also led to the establishment of key administrative and legislative bodies that regulate the environment and water development in Kiambu County.

These organisations have developed a roadmap for their activities during the planning period, which has been aligned with the national development framework, the Kenya Vision 2030 and its Medium-Term Plan. Additionally, the plan has incorporated the Governor's manifesto, the aspirations of regional development frameworks, such as the continental Agenda 2063, and international commitments and obligations, including the 2030 Agenda and Sustainable Development Goals (SDGs), the Paris Agreement on climate change, and the Sendai Framework, among others. I will now briefly expound upon certain legal frameworks that are pertinent to the issue under investigation.

5.4.1 Department of Water, Environment, Energy Natural Resource and Climate Change

The primary aim of this department is to ensure good governance in the management, conservation, restoration, development, and protection of the environment and natural resources for equitable and sustainable growth. Its main sub-sectors of operation include water and sanitation, environmental and waste management, natural resources and forestry, renewable energy, and climate change.

The Athi Water Works Development Agency (AWWDA) is a state-owned corporation within the Ministry of Water, Sanitation & Irrigation (national- level) that licences local level service water providers to manage, develop, and maintain water and sewerage infrastructure (AWSB, 2016). The specific provider

responsible for Ruiru area is Ruiru- Juja Water and Sewerage Company Limited (RUJWASCO).

5.4.2 National Environment Management Authority

The National Environment Management Authority (NEMA) is the agency in Kenya responsible for coordinating environmental management activities and implementing environmental policies. NEMA is also the principal government authority for granting Environmental Impact Assessment (EIA) approvals and monitoring and assessing activities to ensure they do not degrade the environment.

To comprehend the legal structure at both the national and county levels regarding the research problem, kindly refer to the summary provided below:

Table 1 Key Policies and Legislations

Policies and Legislations	Description
Kenya Vision 2030 (2010)	A long-term development plan for the nation that aims to establish a globally competitive and prosperous society with a superior quality of life by 2030. The plan is founded on three primary pillars, namely economic, social, and political governance.
National Policy for Disaster Management in Kenya (2009)	A full continuum from preparedness, relief and rehabilitation, mitigation, and prevention.
The Water Act, (2002) and subsidiary legislation contained including the Water. Resource Management Rules (2007)	The purpose of this Act is to oversee the management, preservation, utilization, and regulation of water resources, as well as to acquire and regulate the rights to use water. Additionally, it aims to regulate and manage water supply and sewerage services.

County Government Act No.17 of 2012.	An Act of Parliament has been implemented to enforce Chapter Eleven of the Constitution, which grants county governments the authority, responsibilities, and functions to provide services for specific purposes.
The EMCA (Waste Management) Regulations (2006)	The following guidelines set rules for managing both general waste and specific types of waste, including solid waste, industrial waste, hazardous waste, biomedical waste, radioactive waste, toxic waste, and pesticides.
Physical and Land Use Planning Act of 2019	An Act of Parliament designed to facilitate the formulation and execution of physical development plans, as well as related objectives.
The Kiambu County Water and Sanitation Services Act, 2015 (No. 2a of 2015)	An Act of County Assembly of Kiambu to provide for development, regulation and management of county public works related to water and sanitation services, storm water management systems and water conservation and for connected purposes.
The Kiambu County Climate Change Act, 2021	The purpose of this Act by the Kiambu County Assembly is to establish a framework and mechanisms for addressing the consequences of climate change and facilitating the county's shift towards a low-carbon development pathway.
County Integrated Development Plan (CIDP) 2023-2027	A guide for land use planning, infrastructure development, and environmental conservation efforts within Kiambu.

Kiambu County Enforcement Act	A legal framework for enforcement of County and other relevant Legislation and for connected purposes

CHAPTER SIX: CASE STUDY FINDINGS

6.1 Introduction

This chapter presents the findings of a thematic analysis carried out to investigate how governance structures influence the management of urban flooding in Ruiru, Kenya. Drawing on the qualitative data derived from observations, key informant interviews, semi-structured interviews, and group discussions this chapter builds on that to provide a deeper understanding into the complexities of urban flood governance.

The findings are organized thematically, with each section focusing on key themes and their constituent sub-themes that emerged from the data analysis. Two core themes are explored: (a) local perceptions and experiences of flooding, and (b) the existing governance structures.

Within the theme of governance structures, sub-themes were categorized using the ESG framework, specifically focusing on the five "A's": *architecture, adaptiveness, agency* beyond the state, *allocation*, and *access* to resources. Additionally, cross-cutting sub-themes like *power* and *knowledge* distribution provided crucial insights into how governance operates, and shapes decision-making processes related to flood management.

To enrich the analysis, findings are supported by quotes from participants and photographs taken during fieldwork. Ultimately, this chapter concludes by summarising the main findings of the study.

Prior to delving into these findings, it is essential to reiterate the primary objective of the research, which is to address the overarching question: *How do governance structures influence the management of urban flooding in Ruiru, Kenya?*

To dissect this question, we explore the following sub-questions:

1. What are the primary causes contributing to urban flooding in Ruiru, Kenya?
2. How do the locals perceive and experience urban flooding events?
3. What are the existing governance structures and their effectiveness in managing urban flooding in Ruiru?

6.2. Theme 1: Local perceptions and experiences of flooding

This overarching theme captures lived in experiences of flooding, the perceived causes and impacts as reported by both community and government respondents.

6.2.1 Factors Contributing to Flooding

Thematic analysis of interview data revealed a range of factors contributing to urban flooding in Ruiru. These factors were categorized into two primary sub-themes: natural factors (earth systems) and anthropogenic (human-caused) factors.

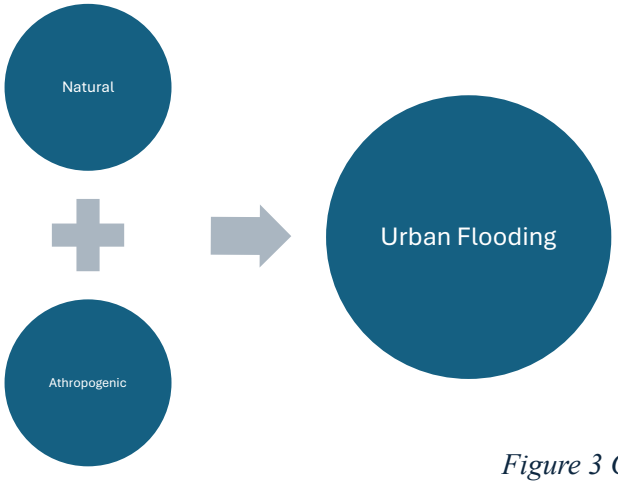

Figure 3 Causes of Flooding

Climate Change and Extreme Rainfall

A common view amongst interviewees was that extreme rainfall is a significant factor contributing to flooding in the area. They noted a concerning trend of increasingly frequent extreme rainfall events, exacerbated by the effects of climate

change. Specifically, the respondents highlighted occurrences such as the El Niño rains with the most recent one taking place in 2023.

'That's why according to my observation for the few numbers of years I've moved around. I've observed that the areas that normally flood, there is repeat flood whenever it rains. So, the frequency, the intensity is determined by the amount of rainfall The higher the rainfall the higher the intensity of the flood"- Government representative 3, March 4, 2024

Topography

Factors related to the topography of the area such low lying terrain and presence of red clay soil was another view that was expressed by respondents as increasing flooding issues. They serve as a collection point for excess water, leading to prolonged inundation and increased flood depths.

"Flooding started basically in the 90s because of the topography of our area." – Community activist, Feb 20, 2024

"Where most flooding happens especially in Ruiru sub county to be specific on Githurai side, that is Mwiki,Mwihoko and Kiuu the soil type is clay soil (...) So, the soil type equally, accelerates the situation"- Government representative 2 March 3, 2024

Wetland ecosystem

Another factor mentioned by respondents was how Ruiru area ecosystem is a wetland ecosystem that has swampy vegetation. I also observed presence of waterlogged areas with swamps and marshes in all the three wards. They also mentioned as a result, when it rains, water remains on the surface for longer periods and takes a considerable amount of time to be completely absorbed into the soil. This prolonged surface water retention can exacerbate flooding issues by increasing runoff and prolonging the duration of flooding.

Figure 4 Development structures on Swamp.

Urbanisation

Experts among the interviewees highlighted urbanisation as a key driver of increased flood risk in Ruiru. Rapid population growth has led to significant changes in land use patterns. Notably, development has encroached upon wetlands and riverine areas (See Figures 4 and 5). According to respondents the developments are typically constructed with minimal consideration for drainage systems or the needs of the growing population. In some instances, they have even diverted natural waterways, further disrupting natural drainage patterns and exacerbating flooding risks.

"The rapid urbanisation has also seen people develop in wetlands." - Government representative 4 March 4, 2024

To me, I would request the government to come and look at the issue of encroachment. because most of this problem it's all about encroachment like you have gone there and seen the river people have encroached - Focus group 1 February 20, 2024

Figure 5 Development along Kiuu River

Poor Sewerage Systems

A concerning issue raised by many interviewees was the lack of proper sewage systems or the poor condition of existing ones within Ruiru. The general perception is that owners of commercial and residential developments often fail to invest in adequate sewage infrastructure. This leads to a reliance on improper waste disposal practices, particularly during the rainy seasons. Residents suspect that these developers release untreated wastewater directly onto streets or properties, contributing to flooding and posing potential health risks.

"(...) *I will state the main reasons why there is a lot of flooding is because development structures don't have sewerage systems. So, most of that they're water waste flows directly into the river, into public utilities, and on the road." -Community activist February 20, 2024*

Poor drainage infrastructure

Respondents consistently identified inadequate management of drainage systems as a major contributor to flooding in Ruiru. Clogged culverts, caused by a lack of proper maintenance, significantly hinder the free flow of water, leading to flooding even during minor downpours. Furthermore, concerns were raised regarding the effectiveness of a recent drainage project. Residents reported that the project's capacity is insufficient to handle large volumes of water, exacerbating flooding issues.

"There is a big problem of drainage There is a lot of water. This water is so much, enough to carry and drown you to the nearby river."- Community member 5, February 15, 2024

"They dug the trenches, but they built very narrow culverts, Now, when the water comes it's blocked by the garbage disposal so it can not flow out of the narrow culverts. This causes the water to overflow, causing flooding in the area". - Community member 11, February 21, 2024

Figure 6 Clogged drainage system.

Figure 7 Narrow drainage culverts.

Poor Waste Management

Another major issue that respondents pointed out was the problem of waste management. A common occurrence was waste being thrown along the roadside and in the culverts. This waste ends up blocking the drainage systems hindering free flow of storm water.

"In this area people blocking their ways with garbage. Water floods on the roads and this causes flooding in the entire area." - Community leader 13 February 21, 2024

"When it rains these culverts block and garbage from the markets blocks them from draining so the water starts to spill over."- Focus group 2, February 25, 2024

Figure 6 Garbage disposed off in drainage.

6.2.2 Impact of Flooding

Environmental

Respondents highlighted the severe environmental challenges triggered by flooding in Ruiru. The release of untreated wastewater and plastic debris during flood events significantly exacerbates existing pollution levels. This contaminated water poses a serious health risk to the population, increasing the likelihood of waterborne diseases such as cholera and typhoid. Additionally, exposure to floodwaters can contribute to respiratory illnesses and the spread of mosquito-borne diseases like malaria.

"There were issues with typhoid and cholera. It really, really affected the people in Ruiru"- Community member 15, February 22,2024

Infrastructure Disruptions

Flooding events inflict significant damage on Ruiru's infrastructure, as reported by many interviewees. This damage includes blocked drainage systems due to debris accumulation, and roads rendered impassable due to floodwaters. These disruptions severely limit mobility within the city, hindering residents' ability to access essential services and further complicating their daily lives. The cascading effects of infrastructure damage exacerbate the challenges faced by the community during and after flood events.

The last serious flood was last year, early March, between March and May (...) And children were unable to go to school. Community member 8, February 16, 2024

Social- Economic Impact

The economic toll of flooding in Ruiru is substantial, as reported by respondents. Residents experience significant losses due to property damage, destruction of livestock and crops, and disruptions to livelihoods. These losses disproportionately affect vulnerable populations and further strain the already fragile economic fabric

of the community. The cycle of flood damage and economic hardship exacerbates existing inequalities and creates a significant barrier to long-term recovery.

"When it starts raining, people start to vacate. Like the people who do rental businesses always encounter losses because the tenants usually vacate (...)" Focus group 1 February 20, 2024

The impact of flooding extends far beyond tangible losses. Respondents highlighted the profound psychological distress and emotional toll inflicted on individuals and families affected by floods. The cycle of recurring flood events exacerbates feelings of uncertainty and insecurity among residents, fostering a constant fear about the future.

When I see it's cloudy and about to rain, I really get very stressed I can't even eat (..) Even my children are stressed out. – Community member 5, February 15, 2024

6.3 Theme 2: Existing governance structures

Architecture

The sub-theme of architecture groups findings related to the complex structure of institutions, regulations, legislation, decision-making processes, and organizations that govern flood management within Ruiru. Respondents identified a dedicated department, the Department of Water, Environment, Energy, Natural Resources, and Climate Change, as the primary body tasked with addressing flooding challenges in the study area. Within this department, environmental officers manage flood-related issues alongside other environmental concerns specific to Ruiru sub-county. To ensure a comprehensive approach to flood management, this department collaborates with other relevant entities such as the Department of Roads, Transport, Public Works, and Utilities, as well as the water service provider, Ruiru- Juja Water and Sewerage Company Limited (RUJWASCO).

"One of the mandates of an environmental officer is to make sure that all the wards are okay. (...) If there is clogging, the drainage is unclogged as you know drainage, is directly related to flooding."-Government representative 4, March 4, 2024

My observations and participation in two sub-county planning meetings provided valuable insights into the decision-making processes related to flood management in Ruiru. These daily meetings, held both in the morning and evening, appear to indicate a structured approach to daily planning and problem-solving. Each department presents and discusses their current issues and challenges, facilitating interdepartmental collaboration and potentially streamlining decision-making.

According to respondents within the government there is a legal framework in place from the national government to the local government as discussed in Chapter 5 of the Contextual Background. Local governments are legally obliged to follow national policies, and policies developed at the county level must align with national directives. In the process of policy making various stakeholders are invited and before any adoption, there will be a call for public participation.

"And as the County Government, we are constitutionally obligated to implement all National Government Policies." – Government representative 6, March 5, 2024

"But remember finally, before forwarding the document for adoption by the County Assembly, there will be a call for public participation."- Government representative 6, March 5, 2024

While some respondents acknowledged the existence of formal governance structures for flood management in Ruiru, many highlighted persistent issues with coordination and communication between various government levels. These challenges hinder effective collaboration between national and county authorities, resulting in gaps and inconsistencies within flood management initiatives.

"So county government, national government, they don't work in tandem. They are not very in sync when it comes to working on issues like this flooding issue."- Government representative 1, February 21, 2024

A critical cross-cutting sub-theme emerged from the analysis: the issue of *knowledge.* Interview responses revealed a significant knowledge gap regarding existing flood management structures and legal frameworks. This gap pervades

various levels of government, with officials across different administrative sectors demonstrating a lack of understanding of these crucial elements. Furthermore, the issue extends to the community level, where residents often express uncertainty about the department responsible for flood management and the existence of relevant legal frameworks.

"Umm policy? If already in place that may have been adopted by the County Government regarding flooding. I'm not quite aware of any, but I'm aware that the Department of Environment deal with the flooding issues very routinely." -Government representative 6, March 5, 2024

"I haven't heard of any policy, but only how the county has helped to construct the trenches up to the river to drain water."- Community member 12, February 21, 2024

Adaptiveness

The sub-theme of adaptiveness explores approaches to adaptation and resilience within Ruiru's flood management strategies. Respondents reported government initiatives aimed at mitigating flooding, such as the construction of new drainage systems. These projects are reportedly funded through collaborative efforts. One source of funding is the Nairobi Metropolitan Services Improvement Project (NaMSIP), a US$330 million metro-wide urban development initiative spearheaded by the State Department for Housing and Urban Development. Additionally, the Kenya Urban Support Program (KUSP), another collaborative initiative with an estimated budget of US$330 million, aims to strengthen urban institutions responsible for infrastructure and service delivery in participating Kenyan counties, including Ruiru. These projects exemplify the government's attempts to leverage resources and collaborate with external institutions to develop and implement effective flood management strategies.

"In this area, I would say that there has been an attempt to do very large storm drainages, which are not effective."- Government representative 1, February 21,2024

"We now have additional municipalities, the World Bank Program, KUSB, did a lot, especially in the areas of environmental disaster management. Issues to do with sanitation and utilities." Government representative 4, March 4, 2024

Respondents highlighted instances of collaboration between different government levels during the 2023 El Niño rains. The process began with pre-warnings issued by the Kenya Meteorological Department. Based on these warnings, the National Government urged County governments to take proactive measures in their respective areas. At the county level, Ruiru mobilised a disaster management committee that included community members hired as casuals to unclog drainage systems, collect waste, and clear trees in anticipation of potential flooding. When heavy rains did occur, the sub-county administration sprang into action, deploying machinery to clear pathways and unclog drainages. Additionally, essential supplies were distributed to individuals affected by the flooding.

"First, a committee was formed, and number two, there were funds that were released specifically, uh, to hire casuals to help with, uh, the unclogging of the drains and any other activities that were related to the El-Nino rains. Um, number two, there was food aid. Number three, uh, there was alarm and information."- Government representative 3, March 4, 2024

The theme of adaptiveness extends to the legal frameworks and policies governing flood management in Ruiru. Based on respondent insights, these policy frameworks incorporate a process of continuous evaluation and monitoring. When challenges or inadequacies are identified, deliberations are initiated to explore revisions or updates to the policies.

"Evaluation generally is through implementation (...) And where there are challenges in any policy document, there will always be a cause for policy review."- Government representative 6, March 5, 2024

Respondents offered mixed views on the government's response to the 2023 El Niño flooding compared to previous years. While some perceived an improvement in the

response efforts, others felt it remained largely reactive rather than proactive. This perception was potentially heightened by a lack of communication or official updates from the response committee, leaving some respondents unsure about its effectiveness or even its status.

"There was not that closure. Uh, until now, we don't know whether the committee is still operational (...)We don't know what they did with the report that I submitted, or the reports that were submitted." -Government representative 3, March 4, 2024

A cross-cutting sub-theme that emerged here is *power.* Several respondents highlighted a perceived lack of strong political will to ensure the effective implementation of existing legal frameworks and policies. This discrepancy underscores the challenges stemming from the alignment of policy intent with actual governmental action, revealing a significant power dynamic at play.

"If you ask me, I don't think there is a concrete policy in effect when it comes to the flooding because it doesn't make sense. You have flooding every November at the same place for more than 10 years. It does not make sense if there is a policy in place."- Community activist February 20, 2024

Another critical cross-cutting sub-theme that emerged is *knowledge.* While interview responses revealed a deep understanding among community members of their local environment, they expressed disappointment at being overlooked in flood management interventions. Specifically, residents voiced frustration over the apparent disregard for their valuable local knowledge when it came to flood management strategies. This perception of exclusion was further heightened by a lack of effort, as reported by some respondents, to engage with long-term residents and incorporate their knowledge and perspectives into decision-making processes. This oversight not only hinders the potential for adaptive solutions but also undermines the sense of agency felt by the community.

"According to the law any government development project must have something called public participation so the community can be aware and get involved but truth is it's not being done."- Focus group 2, February 25, 2024

Accountability and Legitimacy

The sub-theme of accountability and legitimacy explores mechanisms within the governance framework that assign and justify responsibility for flood management. Respondents indicated that the government acknowledges its primary responsibility for addressing flooding in the area. This commitment is potentially bolstered by the existence of the Kiambu County Enforcement Act, 2018, which serves as the legal framework for enforcement within the county. This Act among the analysed government documents in this study.

My observations, however, revealed a potential disconnect between stated priorities and observed practices. While sub-county officials were actively engaged in enforcement activities, the majority of their efforts seemed directed towards revenue generation through activities like license and permit verification.

Despite entrusting the government with flood management, a significant level of public distrust persists. Based on the respondents they lack confidence in government actions and decisions, citing factors like unfulfilled promises by officials, repeated visits without concrete action, and concerns about corruption and mismanagement of funds.

"(...) The county government of Kiambu was able to get funding for the El Nino. Unfortunately, I cannot state where that funding went."- Community activist, February 20, 2024

"And to be honest, the governor of this county has been to the flooded areas three times. Yet, there is nothing that I can say for sure is in the works that is tangible."- Community member 5, February 15, 2024

Some respondents highlighted a potential gap in community accountability regarding flood risks. This includes the observed practice of littering and disposing of garbage in drainage systems, with the expectation that the government agency, known locally as "Kanjo", will be solely responsible for cleanup. This behaviour suggests a limited recognition of shared responsibility for flood risk mitigation.

"Some people as they are walking after drinking water, they throw the bottles in that drainage and other waste which block the flow of water and damages the roads, also causing floods and then we start complaining about the contractors while it's our own fault. It's the area people blocking their ways with garbage."- Government representative 2 March 3, 2024

Agency Beyond the State

The sub-theme of agency explores how actors beyond the state participate in flood management within the study area. Respondent insights revealed that beyond the realm of state institutions, a network of community groups plays a significant role. These groups, such as the Nyumba Kumi initiative (a neighborhood welfare program), and local youth leaders actively engage in addressing urban flooding challenges. While formal entities like NGOs focused on flood management may not be as visible in the area, grassroots actors play a crucial role.

Respondents highlighted various coping strategies employed by the community to address flooding. These measures, while providing temporary relief, may not necessarily tackle the root causes of the issue. Examples of these self-help initiatives include hiring machinery to dig temporary trenches for water redirection, using sandbags to protect individual properties, elevating homes to minimise flood damage, and organizing river clean-up efforts.

"They have been using sandy soil put in bags to block the water from getting into their compounds and doing some trenches just to remove water from your own compound." - Focus group 1 February 20, 2024

Respondents highlighted the valuable role played by community agents in flood management. These agents leverage various channels to advocate for change and raise awareness about flooding issues within Ruiru. This includes meeting with county officials such as chiefs, Members of County Assembly (MCAs), and even the Governor. Through phone calls and personal meetings, these agents relay the concerns of the community and seek targeted assistance for affected areas. In essence, they act as intermediaries, bridging the gap between the community and government on flood-related issues.

"Actually, we have visited the county government and seen the governor himself."- Focus group 1 February 20, 2024

Beyond official channels, respondents highlighted the community leverages WhatsApp groups for resident communication. These digital groups facilitate grievance sharing, information exchange, and community support during floods. This digital tool empowers residents and fosters collective action.

"In this area there is a WhatsApp group to act on disaster management(...)Through this group we can share information and use this group as a means of assistance to those who are struggling and homeless due to flooding."- Focus group 2, February 25, 2024

Furthermore, respondents shared how they utilized media platforms like television and social media to share their flood experiences. These narratives aimed to raise public awareness, garner support, and pressure authorities to take action.

"On the other side we have tried the Media houses to come and capture and they usually broadcast it."- Focus group 1 February 20, 2024

A critical cross-cutting sub theme emerged of *power* dynamics. While respondents indicated that grassroots actors actively voice their frustrations regarding flood management, their concerns appear to be disregarded due to a lack of political backing. This highlights the complex interplay of power within flood governance, where marginalised voices struggle to gain traction.

"So sometimes we even wonder, if really our government cares about us? Do they know that there are human beings who stay in this area? Community member 8, February 16, 2024

"It's basically if you're not known, no one will hear you. If no one knows you or you don't work with an organisation that is known, you won't be heard."- Community activist February 20, 2024

Allocation and Access of Resources

The sub-theme of allocation and access groups experiences related to resource management for flood mitigation in Ruiru. Several key findings emerged from respondent insights. First, a dual challenge is evident: limited overall resources and potential mismanagement of existing resources allocated for flood management. My observations revealed insufficient staffing and equipment within the sub-county. For instance, only two environmental officers, supported by a small team, are responsible for managing both flood risks and other environmental concerns. Furthermore, respondents highlighted perceived inequities in resource allocation, suggesting that some neighbourhoods receive more attention and resources from government agencies compared to others.

"Um, the limiting factor is usually the budget, number two the County is understaffed."- Government representative 3, March 4, 2024

"The county has got funds for emergency works, emergency mobilization, though they don't use. We've never seen audited accounts showing that they have been used." Government representative 3, March 4, 2024

Respondents highlighted a significant disparity in access to essential infrastructure and public amenities, particularly in low-income neighborhoods and informal settlements. These areas often lack crucial facilities such as drainage systems, proper roads, and sanitation infrastructure.

This lack of investment underscores a recurring sub-theme which is *power* dynamics. As suggested by respondents, political interests play a significant role in shaping resource allocation and access to basic services. Consequently, government priorities may be skewed by these power dynamics, potentially overlooking sustainable solutions proposed by the community. Even well-intentioned initiatives can become entangled in political agendas, hindering their effectiveness in mitigating flood risks and fostering community resilience.

"So we, we felt like this report that we are doing, is in futility, um the process was also politicized uh, because, uh, the hiring of the casuals was based on who is more powerful."- Government representative 3, March 4, 2024

Compounding the challenges of resource allocation is the limited budgetary autonomy of the sub-county government according to respondents. Reliance on funding allocated by the county government restricts the sub-county's ability to independently initiate flood management projects. This multi-layered bureaucratic structure can lead to inefficiencies and delays, ultimately hindering effective flood risk mitigation efforts.

"The county must be involved, because you see, the sub-county does not have resources. We depend so much on the county, we generate resources, but the resources will go to the county (...)So anything that you want to be assisted, to be facilitated as far as resources are concerned (...) you have to write a budget proposal for support." -Government representative 6 March 5, 2024

6.4 Summary of findings

The thematic analysis in this chapter reveals several significant insights into urban flood management in Ruiru and Kenya. The theme of local perceptions and experiences highlights the complex interplay between natural factors, such as extreme rainfall, and human activities that contribute to flooding's impact on the environment, society, and infrastructure.

The theme of existing governance structures highlights complex multilevel institutional structures that appear to lack effective collaboration and coordination, both within the government and with the community. This hinders their ability to actively address flooding. Therefore, their efforts tend to be reactive, which leads to recurring problems. The community plays a vital role by relying on self-help measures and informal groups to address concerns. However, their participation in decision-making and implementation processes is limited.

Resource allocation is thus a critical challenge. Uneven distribution, insufficient financial and human resources, and potential mismanagement, particularly in disadvantaged areas, hinder flood management. Additionally, a lack of transparency in resource allocation and the limited enforcement of regulations compromise the accountability and legitimacy of the state. Power dynamics further influence political will for adaptation and equitable resource allocation. Knowledge gaps within the government regarding adaptive strategies also pose barriers.

Through these themes and sub-themes, this chapter provides a comprehensive understanding of urban flooding in Ruiru and its local management. The following chapter examines the broader implications of these findings, particularly in the context of urban flooding governance.

CHAPTER SEVEN: DISCUSSION AND CONCLUSION

7.1 Introduction

This chapter presents an interpretation of the results obtained from the research study, followed by a synthesis of their significance within the context of the research objectives. Additionally, the chapter includes a reflection on the limitations of the study and identifies potential areas for future research. The chapter concludes with a summary of the findings and their contribution to knowledge.

7.2 Interpretation of Findings

The thematic analysis revealed a complex interplay between natural and human-induced factors contributing to urban flooding in Ruiru. Residents' experiences (Section 6.2) highlight that flooding is not simply caused by extreme rainfall events. Jha et al. (2012) support this notion, recognizing climate change as a factor influencing flood frequency. Uncontrolled urban expansion, as cities sprawl to accommodate population growth, often leads to unplanned development in flood-prone areas. Furthermore, Huong and Pathirana, 2013 state that this in turn, increases impervious surfaces and deforestation, reducing water absorption and exacerbating flood risks. The multifaceted nature of urban flooding leads to significant environmental, social, and economic consequences, including the spread of waterborne diseases, displacement of communities, and disruption of livelihoods.

This collaborates with the ESG framework, which underscores the interconnectedness of natural processes and human activities in shaping ecological systems (Biermann et al., 2010). The framework is founded on the integration of research disciplines in earth systems sciences and social sciences which factor in the human aspect. Therefore, by using the ESG framework the study considers the social, economic, and environmental dimensions of the problem. Overall, these insights directly address the sub-questions: *What are the primary causes that contribute to urban flooding in Ruiru, Kenya*? And *how do the locals perceive and experience urban flooding events?*

The analysis of existing governance structures (Section 6.3) revealed both strengths and weaknesses. While Kenya's decentralized system empowers local authorities fragmented governance persists, hindering efficient flood management. Legal frameworks exist to delineate flood management responsibilities, but enforcement remains a challenge, particularly concerning waste management and land-use practices. This aligns with the work of Andreasen et al. (2022) who highlight how fragmented governance in African cities often neglects sustainable spatial planning and flood risk mitigation, leading to insufficient responses and ineffective regulations. Our research emphasizes the need for strengthened enforcement mechanisms and enhanced coordination between different government levels.

In addition, the findings suggest a reactive approach to flood management, focusing primarily on preparedness and response, rather than proactive measures encompassing the entire disaster management cycle. This aligns with criticisms of reactive disaster management by Wisner et al. (2004). The Hyogo Framework for Action (2005) emphasizes the importance of proactive measures for building long-term resilience. Furthermore, the research identified a lack of transparency, equitable resource allocation, and inclusive participation mechanisms, eroding trust in government institutions. This aligns with Pelling & High (2005) who emphasize the importance of these factors in rebuilding trust and empowering communities. The current approach, where communities are excluded from decision-making processes (as evidenced by infrastructure projects undertaken without their knowledge), creates a barrier to effective flood management.

Moreover, the findings highlight the need for all-inclusive flood management methods that go beyond traditional engineering solutions. Successful plans, as advocated by Zevenbergen et al. (2008), Sampurno et al. (2022), and others, should incorporate community participation, environmentally friendly urban planning practices, and ecosystem-focused approaches. An integrated strategy that utilizes both structural and non-structural measures is crucial for achieving a balance between effectiveness and sustainability.

The analysis also identified cross-cutting sub- themes of *power* and *knowledge.* Unequal power distribution in decision-making processes, as discussed by Bryant (2008) in his work on political ecology, can lead to decisions that prioritize certain groups over others, exacerbating existing inequalities in vulnerability. The ESG framework (Biermann et al., 2010) emphasizes the need to acknowledge power structures and their influence on decision-making, resource allocation, and access to environmental benefits and burdens. Addressing these power imbalances requires inclusive participation mechanisms that empower marginalized communities to have a voice in flood management strategies.

Furthermore, the research identified knowledge gaps within governance structures. This could be due to limited access to accurate data on flood risks, vulnerabilities, and potential adaptation measures. The ESG framework highlights the importance of co-creating knowledge through participatory processes that involve diverse stakeholders (Biermann et al., 2010). This approach recognizes the value of different forms of knowledge, including traditional and indigenous knowledge, which can complement scientific knowledge. Therefore, to bridge these knowledge gaps, investments in research, data collection, and knowledge sharing, as well as efforts to promote interdisciplinary collaboration, are essential.

A noteworthy finding was the vulnerability of affluent neighborhoods like Gatongora, challenging the assumption that flooding primarily affects marginalized communities. This underscores the need for inclusive flood management that considers diverse vulnerabilities across the city. African cities, often characterized by high-density populations with inadequate infrastructure, are particularly susceptible to flooding, with a high proportion of informal settlements and substandard housing. This in-depth analysis sheds light on current flood governance mechanisms in place, directly addressing the sub-question: *What are the existing governance structures and their effectiveness in managing urban flooding in Ruiru?* By synthesizing key insights from each theme, I have addressed the sub-research questions and answered the main research question: *How do governance structures influence the management of urban flooding in Ruiru, Kenya?*

This study has achieved significant progress in filling knowledge gaps related to urban flooding in Ruiru. Despite this, it has certain limitations that warrant discussion as elaborated in the following section.

7.3 Limitations and Areas of Future Research

This study employed a qualitative case study approach to analyse urban flood governance in Ruiru, Kenya. While this approach offers valuable insights into the local context, it is essential to acknowledge several limitations that warrant careful consideration.

Data Collection and Interpretation:

The primary method of data collection employed was qualitative interviews. This approach is susceptible to social desirability bias, as participants may provide responses that are perceived as socially acceptable rather than reflecting their experiences fully. Furthermore, thematic analysis, which was used to identify key themes and patterns in the qualitative data, involves coding and interpretation processes that may be influenced by the researcher's biases. This potential subjectivity could impact the resulting themes and the conclusions drawn from the study.

Scope and Generalizability:

Limited time and resources necessitated focusing my research on a specific area While Ruiru is extensive (292 km² with eight wards), I concentrated on the three wards most affected by urban flooding. This focus limits the generalizability of the findings to the entire Ruiru population or other Kenyan urban areas.

The representativeness of the results hinges on two factors: sample size and participant selection methods. While I aimed for diversity by including participants of various ages, genders, and livelihoods, I encountered a gender imbalance with more male participants. This underrepresentation of female voices could potentially skew the data and limit the comprehensiveness of our analysis.

Comprehensiveness of Governance Analysis:

The research scope may not have encompassed all aspects of urban flood governance in Ruiru. Factors such as the specific roles of government agencies, available financial resources, or the differential impacts of existing policies on various population segments may not have been fully explored. These potential gaps can limit the understanding of the complete urban flooding governance landscape in Ruiru.

Future Research Directions:

Despite certain constraints, the research contributes significant insights into urban flood governance in Ruiru, thereby providing a basis for future investigations. To increase the representativeness of findings, I recommend the expansion of the sample size to ensure greater diversity, particularly in gender representation. Furthermore, a more in-depth examination of the functions and interactions of various governmental agencies at both county and national levels can offer a more intricate understanding of decision-making processes and policy effects on flood management.

Future research could concentrate on identifying specific gaps in flood management knowledge and exploring innovative methods for knowledge generation, dissemination, and translation. This could involve participatory action research, interdisciplinary research collaborations, capacity-building initiatives, and the creation of decision-support tools tailored to the requirements of policymakers and practitioners.

Additionally, longitudinal studies would be beneficial in tracking this issue over time, which could yield valuable knowledge about urban flood governance, enabling a long-term assessment of intervention effectiveness and identification of emerging challenges and opportunities. As of writing this Kenya including the case study location Ruiru has been hit by devasting floods caused by Elnino rains therefore further research in this area is imperative.

Lastly, comparative studies examining flood governance across diverse contexts, such as vulnerable neighborhoods and affluent areas, could prove particularly insightful. By analysing these contrasting environments, we can not only identify best practices but also extract valuable lessons learned. This knowledge would be instrumental in enhancing flood governance strategies for a wider range of communities.

7.4 Practical Implications

This study's findings offer valuable insights for stakeholders involved in urban flooding governance in Ruiru, Kenya. Let's explore some key practical implications:

Policy and Planning

The Kenyan government has established a framework for flood risk management through national and local regulations, which address factors such as waste management and urban planning practices that contribute to flooding. However, a crucial gap exists between policy design and implementation, as lax enforcement, often fuelled by political interference and corruption, undermines the effectiveness of these regulations. Moreover, limited resources further hinder enforcement capacity. Unless these existing policies are fully implemented, significant improvements in flood risk management strategies are unlikely.

In addition, a static legal framework might not be adequate in the face of a changing environment and evolving flood risks. Therefore, Kenya's legal system needs to be more adaptive, incorporating mechanisms for regular review and updates to ensure regulations remain relevant and effective in mitigating flood risks.

Government authorities can use the insights gained from community perceptions and experiences of flooding to inform the development of more effective policies and urban planning strategies. This may involve incorporating residents' input into decision-making processes and ensuring that policies address the diverse impacts to enable ease of implementation and adherence of the laws hence contributing to flood management.

Kenya's disaster management approach, which may be fragmented across multiple government departments, may struggle to effectively address complex challenges such as urban flooding. Establishing a dedicated Disaster Management Authority could offer a compelling solution. An independent agency could streamline operations, enhancing efficiency and speeding up response times. Staffed with specialists, the independent agency could leverage its concentrated expertise to develop and implement evidence-based disaster preparedness, mitigation, and response strategies. Furthermore, separation from political influence could ensure that decisions prioritize technical expertise and the needs of vulnerable communities, leading to more effective and equitable disaster management across Kenya.

Infrastructure Development

Effective infrastructure development is critical for managing urban flooding. Understanding the root causes and impacts allows for targeted investments in projects that minimize flood risks. The research findings clearly indicate an awareness of these causes. Therefore, a crucial step is upgrading drainage systems with increased capacity, improved efficiency, and regular maintenance. Construction of these systems should consider the area's topography. Strategic flood barriers like levees, seawalls, and floodgates can offer protection in specific locations. However, careful planning is essential to avoid unintended consequences.

Beyond drainage, sewage lines are the silent work horses of urban infrastructure. They play a vital role in public health, environmental protection, and safely transporting wastewater. RUJWASCO should prioritize improving sewer line infrastructure and implementing regular maintenance. Enforcing regulations that mandate new residential and commercial buildings to connect to sewer lines during construction is also crucial.

The research highlights land-use practices as a significant contributor to flooding. Sustainable land-use planning offers a long-term solution. Implementing structural measures like green roofs, permeable pavements, and urban green spaces allows for

better rainwater infiltration and reduces runoff. Preserving natural drainage channels and restricting development in floodplains further minimizes risks.

Solid waste management is critical, as blocked drains are a major cause of flooding. Improvements can be made by providing easily accessible waste collection points, especially in areas like markets with high waste generation. Effective waste management goes beyond collection. Implementing recycling initiatives and promoting garbage separation are essential for long-term sustainability.

By adopting a multi-pronged approach that integrates infrastructure development with community-based initiatives and prioritizes sustainable solutions, Ruiru can significantly improve its ability to manage the growing challenges of urban flooding.

Collaboration and Coordination

Effective flood management requires enhanced coordination and collaboration across different government levels and stakeholders. This is because flood risks encompass a complex interplay of political, socio-economic, technological, and environmental dimensions. Managing these challenges effectively necessitates a multi-level approach that draws upon a wide range of knowledge and expertise.

Residents, as the direct victims of flooding, are crucial stakeholders. However, the research indicates they often feel excluded from past interventions. Flood management needs to move beyond temporary solutions like seasonal drain cleaning. Instead, it requires engaging various stakeholders in developing sustainable, long-term solutions. This can involve establishing mechanisms for regular communication, shared resource allocation, and joint decision-making. Such collaborative efforts are key to addressing governance challenges and improving flood management efforts.

Transparency and Accountability

To address concerns about accountability and legitimacy, measures to enhance transparency and public participation in flood governance are essential. This involves strengthening mechanisms for monitoring and evaluation, ensuring proper utilization of allocated funds, and fostering greater public involvement in decision-making.

Transparency is key. Making information readily available to the public is crucial. This includes flood risk assessments, budget allocations for flood management projects, and progress reports on implemented initiatives. Public forums and regular briefings can further facilitate open dialogue and address community concerns.

Capacity Building and Knowledge Sharing

Closing the knowledge gap between government officials and communities, as well as within different government departments, is essential for effective flood management. Capacity-building initiatives and knowledge-sharing platforms can empower all stakeholders.

For residents, this means equipping them with the information and skills needed to make informed decisions and take action. Non-structural measures such as educational programs on flood-adaptive behaviors, early warning systems with real-time monitoring, and robust alert mechanisms can significantly improve preparedness and response.

For government officials, workshops can address effective community engagement and the importance of incorporating local knowledge into flood management plans. Knowledge-sharing platforms, in the form of forums, information portals, and media campaigns, can further bridge the gap. These platforms facilitate discussions, provide clear information to residents, and raise public awareness – all crucial steps towards a more collaborative approach to flood management.

7.5 Conclusion

In conclusion the thesis has examined the multifaceted nature of urban flood governance in rapidly urbanising African cities, using Ruiru, Kenya, as a case study. By investigating the interplay between social, economic, and environmental factors, it illuminates the complex challenges and opportunities for building resilience. The findings presented here offer valuable insights not only for Ruiru but also contribute to a broader understanding of effective flood governance within the Earth System Governance framework. Crucially, this research emphasizes the critical role of knowledge sharing and collaboration among all stakeholders, from residents to government officials. Moving forward, effective flood management requires a multi-pronged approach that addresses governance challenges, strengthens infrastructure development and maintenance, prioritizes sustainable land-use planning, and fosters collaboration across all levels of society. By embracing these considerations, rapidly urbanising African cities can build resilience and navigate the complex challenges of urban flooding in the face of a changing environment.

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Appendix 1: Interview Guide

Introduction

Hello, my name is Angela Gathoni, and I am a student at Lund University in Sweden. As part of my master's thesis in Development Studies, I am conducting research which aims to understand how governance structures influence the management of urban flooding in Ruiru, Kenya.

I would like to request your voluntary participation in an interview that will take less than an hour. The interview will be recorded with your consent to ensure accuracy in capturing your responses. Please note that you have the right to withdraw from the study at any time without consequence, and you are not obligated to answer any questions that you are not comfortable with. If you decide to withdraw, any data provided during the interview will be deleted. Your responses will be kept confidential, and no information that identifies you as the respondent will be included in the report or thesis. The thesis will be completed in the summer of 2024 and can be sent to you via email if you wish.

Is there anything that you need me to clarify or elaborate on regarding what I just explained?

And are you interested in taking part in this interview? (verbal consent on recorder)

Interview Questions

Focus Group Discussion- Community Members

Background

1. Please begin by telling me about you. (Where do you live? How long have you lived here? How does a normal day in your life look? What do you work with?)
2. Are you a member of any organisations or local groups in the community?
3. Tell me about your experience with flooding in this area?
4. Could you tell me about the last serious flood that affected your community?
5. When was it? (Time, season, location)
6. What happened? / What did you, personally, do or what did your family and your community do when the flooding happened. What were the impacts?
7. Do you know if your community/village/municipality has a climate policy?
8. From your experience what organizations or people could you say have been involved in helping you during and after flooding? Could you elaborate what they did?
9. How do you voice your concerns about these issues?
10. Do you feel your opinions are included in the decision-making process?
11. In your opinion what do you think needs to happen to address the situation?
12. How do you envision your role in addressing this issue within your community?
13. If the issue is not addressed, what are some of the concerns you have regarding its long-term impacts?
14. Are there any local initiatives that have been started by the community members to raise awareness and provide aid?

Closing

15. Is there anything else related to what we talked about that we have not touched on that is important for me to know?
16. Is there anyone else you would recommend I speak to?
17. Do you have any questions for me?

Key Informant Interviews -Government Officials (County and Subcounty)

Background

1. Please tell me a bit about your role in X
2. How long have you worked with X?
3. Are you aware of the flooding and displacement problem in Ruiru? Please can you elaborate more about it? Have you dealt with this directly in your role?
4. How has the government been involved terms of in disaster prevention, preparedness, response, and recovery in the Ruiru Community?
5. What current local policies (disaster prevention, preparedness, response, and recovery) exist that address this problem? What are your thoughts on these policies?
6. What difficulties does the county/ sub-county government face in the implementation of existing policies?
7. How does the sub county government collaborate with other levels of government, such as the county and national government?
8. Do you have collaborations with other institutions outside the government to help manage the flood displacement issue? What role do they play?
9. What is the role of international partnerships and funding in supporting local initiatives and disaster management efforts?
10. From your assessment, has the flooding situation in the Ruiru community been receiving adequate management in terms of prevention, preparedness, response, and recovery? What would you say are the hinderances?
11. Could you share any examples of innovative approaches or pilot projects that have effectively reduced flooding impacts and strengthened community resilience in your area? Any initiatives led by the community?
12. What do you think needs to happen to address the situation?

Closing

13. Is there anything else related to what we talked about that we have not touched on that is important for me to know?
14. Is there anyone else you would recommend I speak to?
15. Do you have any questions for me?

Key Informant Interviews – Government Official - Policies

Background

1. Please tell me a bit about your role in X
2. How long have you worked with X?
3. Are you aware of the flooding and displacement problem in Ruiru? Please can you elaborate more about it? Have you dealt with this directly in your role?
4. How has the government been involved terms of in disaster prevention, preparedness, response, and recovery in the Ruiru Community?
5. What current local policies (disaster prevention, preparedness, response, and recovery) exist that address this problem? What are your thoughts on these policies?
6. How does the government monitor and evaluate the effectiveness of its policies and interventions?
7. What difficulties does the county/ sub-county government face in the implementation of existing policies?
8. How does the county government collaborate with other levels of government, such as the sub-county and national government and neighboring counties, to better address the cross-cutting nature of governance challenges in climate change displacement by flooding in Ruiru county?
9. Do you have collaborations with other institutions outside the government to help manage the flood displacement issue? What role do they play?
10. What is the role of international partnerships and funding in supporting local initiatives and flood management efforts?
11. From your assessment, has the flooding situation in the Ruiru community been receiving adequate management in terms of prevention, preparedness, response, and recovery? What would you say are the hinderances?
12. Could you share any examples of innovative approaches or pilot projects that have effectively reduced flooding impacts and strengthened community resilience in your area? Any initiatives led by the community?
13. What do you think needs to happen to address the situation?

Closing

14. Is there anything else related to what we talked about that we have not touched on that is important for me to know?
15. Is there anyone else you would recommend I speak to?
16. Do you have any questions for me?

Key Informant Interviews – NGOs/CSOs

Background

1. Please tell me a bit about your role in X
2. How long have you worked with X?

3. Could you please share your understanding of the flood displacement issues in Ruiru and how they affect the community?
4. How is your entity involved in disaster management, particularly flooding in the community?
5. In your view, which groups or populations in the community are most vulnerable to flooding, and how are they affected?
6. Are you aware of the current policies (disaster prevention, preparedness, response, and recovery) that exist to address this problem?
7. From your perspective, what are the main challenges hindering the effective implementation of existing policies aimed at addressing flooding displacement?
8. Are you aware of any local initiatives led by the community to address the issue? What role do they play?
9. Do you have any cooperation with other institutions/ actors? How is that cooperation working in relation to this issue?
10. Could you share any examples of innovative approaches or pilot projects that have effectively reduced flooding impacts and strengthened community resilience in your area? Any initiatives led by the community?
11. What do you think needs to happen to address the situation?

Closing

12. Is there anything else related to what we talked about that we have not touched on that is important for me to know?
13. Is there anyone else you would recommend I speak to?
14. Do you have any questions for me?

Key Informant Interviews – Community Leader

Background

1. Please begin by telling me about you. (Where do you live? How long have you lived here?)
2. Please tell me about your role in the community.

3. Please tell me about the history of flooding in this area.
4. Please tell me about the most recent flooding what happened?
5. How did the community respond to the flooding and try to reduce the effects of it after?
6. In your opinion, which populations are most vulnerable to these floodings? Who in the community is most affected.
7. Are you aware of any climate policies at the local or municipal level that address flooding and other related issues?
8. In your experience, which organizations or individuals have been actively involved in providing assistance and support to the community during and after flooding events?
9. Could you describe the strategies or platforms used to gather and communicate community concerns regarding this issue?
10. How do you navigate power dynamics and negotiate with government agencies and NGOs to address community needs effectively.
11. What do you think needs to happen to address the situation?

Closing

12. Is there anything else related to what we talked about that we have not touched on that is important for me to know?
13. Is there anyone else you would recommend I speak to?
14. Do you have any questions for me?