MAKERERE UNIVERSITY

COMMUNTIY VIEWS ON TREE-BASED FLOOD MITIGATION APPROACH IN THE NYAMWAMBA CATCHMENT, UGANDA

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DECLARATION

We declare that this research dissertation is original and has never been submitted to any university or institution for any award.

We therefore submit this for the award of a bachelor's degree in Geographical Science from Makerere University.

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APPROVAL

This is to acknowledge that this research dissertation has been submitted with the approval of my supervisor.

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DEDICATION

We dedicate this dissertation to the following:

To our families; For their unwavering support throughout our pursuit of bachelor's degree in geographical science.

To our supervisor: For his patience and continual guidance in the development of this dissertation.

To the participants: To all individuals who participated in the development of this dissertation.

Truly, your support and contribution have been invaluable to this journey

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To my cherished family, I am forever grateful for your unconditional love and support. You have been my refuge, my solace, and my everything. Your encouragement has been a constant source of strength, and I am eternally thankful for each one of you.

To my dear friends, companions in laughter and learning, thank you for the times we shared, the struggles we faced together, and the victories we celebrated. Your camaraderie has motivated me to keep pushing forward, regardless of the circumstances.

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DEFINITION OF TERMS

1. Catchment Area: A region where water is collected by the natural landscape, typically drained by a river or stream. In this study, It refers to the Nyamwamba catchment.

2. Nature-Based Solutions (NBS): Approaches that utilize natural processes and ecosystems to address societal challenges, such as flood risk mitigation, by enhancing ecosystem services.

3. Afforestation: The process of planting trees in an area where there was no previous tree cover, aimed at restoring ecosystems and enhancing biodiversity.

4. Floodplain Restoration: The practice of rehabilitating floodplains to restore their natural functions, which can help mitigate flooding and improve water quality.

5. Riparian Vegetation: Plant life that grows along the banks of rivers and streams, which plays a crucial role in stabilizing banks, reducing erosion, and enhancing water quality.

6. Community Engagement: The process of involving local communities in decisionmaking and implementation of projects that affect their environment and livelihoods, particularly in flood management strategies.

7. Socio-Economic Factors: Social and economic conditions that influence individuals' and communities' behaviors and decisions, such as income, education, and cultural beliefs.

8. Perceived Risk: The subjective judgment that individuals or communities make regarding the likelihood and severity of a risk, which can influence their willingness to adopt risk reduction measures.

9. Tree Planting Initiatives: Programs or projects aimed at increasing tree cover in a specific area, often as a strategy for environmental restoration and flood risk reduction.

10. Environmental Sociology: A field of study that examines the interactions between societies and their environments, focusing on how social factors influence environmental practices and policies.

11. Community-Based Resource Management: A management approach that involves local communities in the sustainable management of natural resources, recognizing their knowledge and practices.

12. Bimodal Rainfall: A climatic pattern characterized by two distinct rainy seasons within a year, which is typical in the Nyamwamba catchment area.

13. Ecosystem Services: The benefits that humans derive from ecosystems, including provisioning services (like food and water), regulating services (like flood control), and cultural services (like recreational opportunities).

14. Siltation: The accumulation of sediments in water bodies, which can reduce their capacity and increase the risk of flooding.

15. Flash Floods: Sudden and intense floods that occur within a short period of time, often as a result of heavy rainfall, leading to rapid water level rises.

16. Livelihoods: The means by which individuals or communities secure the necessities of life, including food, shelter, and income.

17. Indigenous Knowledge: Local knowledge that is unique to a particular culture or society, often based on long-term experience and interaction with the environment.

18. Stakeholders: Individuals or groups that have an interest in or are affected by a project or
policy, including community members, local governments, NGOs, and other organizations.

19. Environmental and Social Impact Assessment (ESIA): A process used to evaluate the potential environmental and social effects of a proposed project before it is carried out.

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LIST OF ABBREVIATIONS AND ACRONYMS

ENSO: El Niño–Southern Oscillation

ESIA: Environmental and Social Impact Assessment

FAO: Food and Agriculture Organization

FGD: Focus Group Discussion

GPS: Global Positioning System

IPCC: Intergovernmental Panel on Climate Change

IWMDP: Integrated Water Management and Development Project

KII: Key Informant Interview

LULC: Land Use and Land Cover

MWE: Ministry of Water and Environment

NBS: Nature-Based Solutions

NDP: National Development Plan

NGOs: Non-Governmental Organizations

PDM: Parish Development Model PES:

Payments for Ecosystem Services

UBOS: Uganda Bureau of Statistics

UNDP: United Nations Development Programme

UNDRR: United Nations Office for Disaster Risk Reduction

WWF: Worldwide Fund for Nature

ABSTRACT

Background: The Nyamwamba catchment in Kasese District, Uganda, has experienced recurrent and severe flash flooding, which has significantly compromised local livelihoods, agricultural productivity, and public infrastructure. This ongoing environmental vulnerability forms the core problem investigated in this study, with a specific focus on understanding community engagement in tree planting as a sustainable nature-based solution for flood risk management. To provide a comprehensive assessment, the research was structured around three specific objectives: first, to characterize the existing tree planting activities within the catchment; second, to examine the socio-economic and environmental determinants that shape community perceptions and dictate active local participation; and third, to evaluate how local people experience and perceive the overall practical effectiveness of these treebased interventions in mitigating flood disasters.

Methods: The study adopted a cross-sectional research design employing a mixed-methods approach to collect and analyze both quantitative and qualitative data simultaneously. Primary data was gathered using simple random sampling to administer structured questionnaires to 73 household respondents across flood-affected zones, alongside purposive sampling to conduct interviews with 7 targeted key informants and facilitate two focus group discussions. Quantitative data obtained from the field was systematically coded and analyzed using descriptive statistical methods, specifically focusing on frequencies and percentages. Complementarily, qualitative data from the interviews and discussions was processed using manual thematic analysis to capture and contextualize detailed community narratives and institutional experiences.

Results: The results of the study, analyzed sequentially by objective, reveal that while environmental awareness is high, structural barriers heavily dictate the actual success of nature-based interventions. According to the first objective, which characterized tree planting activities, the findings showed that a significant majority (89.04%) of the respondents were highly aware of tree planting initiatives designed for flood mitigation. These activities are primarily distributed along vulnerable riverbanks, private farmland boundaries, and public institutional lands using species such as bamboo and grevillea; however, their initial growth and survival are severely threatened by poor soil quality and localized wildlife destruction. Concerning the second objective, which examined the socio-economic and environmental determinants of community participation, the study established that although community willingness and practical skill confidence were high (82.19%), actual implementation is heavily constrained by structural barriers. Chief among these determinants is limited land availability, affecting 71.43% of the targeted areas due to small-scale subsistence farming needs, alongside ongoing soil erosion (57.14%) and restricted access to high-quality, floodresistant seedlings (42.86%). Finally, under the third objective evaluating local perspectives on overall effectiveness, the community expressed highly realistic but divided experiences. While 63.01% of the respondents believe that tree planting possesses the theoretical capacity to reduce flood risks by stabilizing topsoil, 54.79% reported that intense flash flood events frequently wash away or completely destroy younger tree stands and seedlings. Consequently, the local population views tree planting as an insufficient standalone strategy, emphasizing those nature-based solutions must be integrated with hard structural engineering interventions to effectively safeguard the catchment.

Conclusion: While community members strongly recognize the potential ecological and economic benefits of tree planting for flood mitigation, significant structural barriers and environmental vulnerabilities must be addressed to enhance long-term sustainability. The study underscores the importance of integrating local knowledge and addressing socioeconomic constraints, such as land scarcity and seedling availability, to foster deeper community engagement. Based on these insights, it is recommended that policymakers and environmental managers enhance targeted education programs, introduce subsidized high quality seedlings, and crucially, combine biological tree planting methods with structural engineering measures like riverbank reinforcement and mechanical desiltation to achieve long-term catchment resilience.

Keywords: Tree planting, Community perception, Nyamwamba catchment, Flood risk management, Uganda, Community Perception, Nature-Based Solutions (NBS), Flood Risk Mitigation, Socio-Economic Determinants, Ecosystem-Based Adaptation, Kasese District.

CHAPTER ONE: INTRODUCTION

1.0 Background of the study

Globally, riverine and flash floods stand as some of the most destructive natural disasters, accounting for over 44% of all hazard events worldwide and threatening vulnerable human settlements and socio-economic infrastructure (UNDRR & CRED, 2020). Large-scale hydrological modelling demonstrates that the frequency and intensity of these extreme riverine events have drastically escalated due to climate change and increasing asset exposure within active floodplains (Jongman et al., 2012 ; Kundzewicz et al., 2014). In Sub-Saharan Africa, this vulnerability is heavily compounded by rapid population growth, widespread deforestation, and an over-reliance on biomass for energy, which strips vital upstream catchment areas of their protective vegetation cover, leading to altered stream flow dynamics (Weiland et al., 2013). Within the East African region, shifting climatic patterns have caused a surge in high-intensity rainfall events, causing steep catchment systems to regularly breach their banks and trigger downstream devastation (Mphefu et al., 2025). In Uganda, this environmental crisis is intensely felt across mountainous and steep-sloped terrain, such as the Mpanga catchment, where severe land use changes and topsoil degradation lead to catastrophic runoff velocity (Namugenyi et al., 2026). Locally, this vulnerability manifests tragically within the Nyamwamba catchment in Kasese District, where the Nyamwamba River—originating from the rugged slopes of the Rwenzori Mountains—frequently produces high-velocity flash floods that systematically wash away local businesses, destroy critical healthcare and educational infrastructure, and displace thousands of subsistence farmers.

To combat these recurring disasters, contemporary environmental scholars have increasingly focused on nature-based solutions (NBS), evaluating the functional utility of tree-based flood mitigation approaches (Vigerstol et al., 2023). Empirical research highlights that strategic afforestation, riparian vegetation restoration, and the integration of agroforestry can significantly mitigate flood risks by enhancing the ground's hydraulic infiltration capacity, stabilizing highly erodible riverbanks, and physically slowing down surface runoff through robust root networks (Manono, 2026). Empirical findings from tropical and coastal delta catchments confirm that strategic utilization of indigenous riparian trees offers a costeffective alternative to hard engineering structures; their specialized root networks act as physical organic barriers that absorb hydrodynamic energy, enhance soil shear strength, and mitigate severe bank erosion during high-velocity flood events (Engineering et al., 2024). Furthermore, the literature documents that implementing on-farm tree planting on private agricultural boundaries not only curbs topsoil loss but also supports rural livelihoods by yielding secondary economic benefits such as timber, fruit, and sustainable fuel wood supplies.

Despite these extensive ecological insights, a significant gap remains in the existing literature regarding the human, social, and behavioral dimensions of these interventions within the Rwenzori region. While historical research heavily emphasizes technical engineering parameters, hydrological modelling, and the macro-level environmental performance of trees, it largely overlooks how local communities perceive, experience, and value these initiatives on the ground. There is a profound shortage of localized evidence detailing how structural constraints such as severe land scarcity, competing subsistence farming priorities, and the recurring destruction of new seedlings by wildlife or subsequent floods shape community willingness to participate. Current literature fails to account for the socio-ecological disconnect that occurs when community members are expected to adopt nature-based solutions without a clear institutional understanding of their socio-economic trade-offs, local land-tenure dynamics, or everyday practical challenges.

This study directly addresses these conceptual and empirical gaps by systematically assessing the community perspectives, levels of acceptance, and localized experiences regarding treebased flood management within the Nyamwamba catchment. Rather than treating tree planting purely as a spatial or hydrological tool, this research evaluates it through a socioenvironmental lens, explicitly characterizing ongoing local planting activities and isolating the socio-economic and logistical determinants that dictate active community participation. Furthermore, by evaluating how the residents themselves experience the field-level effectiveness and limitations of these biological interventions, this study provides the crucial empirical data needed to bridge the divide between top-down institutional policies and bottom-up community realities. Ultimately, these insights will guide environmental managers in designing more socially inclusive, resilient, and sustainable integrated flood mitigation strategies for the region.

1.1 Objectives of the study

1.1.1 Main objective

To understand local views on tree-based flood management strategy in the Nyamwamba catchment

1.1.2 Specific objectives

1. To characterize tree planting activities in the Nyamwamba catchment.
2. To examine the determinants of community perception towards participation in tree planting interventions for flood risk mitigation in the Nyamwamba catchment.
3. To evaluate how local people, experience the effectiveness of tree planting interventions for flood risk mitigation in the Nyamwamba catchment.

1.2 Statement of the problem

In the Nyamwamba catchment of Kasese district in western Uganda, the intensity and frequency of severe flash floods have escalated dramatically, causing catastrophic loss of life, displacement of populations, and the systemic destruction of property, livelihoods, and public infrastructure. Research attributes this increasing flood risk directly to climate change, intense mountain rainfall, and severe environmental degradation within the catchment. In particular, the loss of riparian vegetation due to human activity has destabilized riverbanks and increased surface runoff, which has intensified the impacts of flooding in the area (Jurek et al., 2016). Factors contributing to these floods include rapid population growth, reliance on biomass for energy, and unregulated timber harvesting, which have put the ecosystem under pressure, leading to rapid forest loss (MWE, 2021).This damage is further compounded by mountainous forest fires that destroy vegetation cover, as well as landslides in the upper Rwenzori Mountains, which are also potentially contributing to floods within the catchment (IPCC, 2014). Consequently, River Nyamwamba now floods nearly three to four times a year, with catastrophic floods causing the worst impacts on 1st May 2013 and July 2015, while the 2020 floods displaced over 10,000 people in Kasese (MWE, 2021).

In response to these compounding crises, institutional frameworks have prioritized naturebased solutions (NBS) to restore catchment hydrology and reduce flood risk. The Ministry of Water and Environment implemented the Integrated Water Management and Development Project, which focused on nature-based solutions (NBS) including afforestation on public land, restoration of floodplains, and on-farm tree planting on non-public land (Nuwahereza & Tumwebaze, 2025). These efforts achieved 75% of the targeted 40 km of riverbank stabilization and 100% of the 1,600 hectares of tree planting (MWE, 2021). Concurrently, the district of Kasese planned large-scale reforestation and tree planting on 30,270 hectares of land to reduce flood risks by implementing agroforestry and reforestation initiatives across the municipality and the district by planting trees in urban spaces, riverbanks, and hillsides (FAO, 2020). Results of geo-spatial analysis indicated a 70% increase in tree planting efforts between 2002 to 2022, where the total area under tree plantation increased from 2,335.05 hectares (representing 15% of the total area) to 3,969 hectares (representing 25.5% of the total area) (FAO, 2020). Backed by major actors along the tree-growing value chain such as the World Wide Fund for Nature and Eco-trust, these climate shocks and stresses have greatly contributed to tree-growing efforts from both government and non-government sectors (WWF, 2020). Structurally, government interventions are favored by the local land tenure system, where a total of 1,393 acres of open spaces for tree growing are identified and profiled, with Nyamwamba division taking the biggest portion of 96% of the available open spaces, while Central division and Bulembia division have 2% each (Kasese, 2022). This land tenure system is highly conducive for tree growing because 79% of the available space is on government land, 20% is on freehold, and 1% is on communal land (Kasese, 2022).

However, a profound socio-ecological and structural conflict undermines the long-term sustainability and local adoption of these biological interventions. The accompanying Environmental and Social Impact Assessment (ESIA) indicated that 70.7% of households mostly reliant on subsistence farming—would experience reduced land for cultivation due to these interventions (Uganda Bureau of statistics, 2016). According to the Kasese Forestry Management Plan, the major types of trees planted are exotic species, with a very minimal uptake of indigenous trees such as *Milicia excelsa*, also known as Mvule (MWE, 2021). While indigenous trees such as *Albizia coriaria*, *Melia*, and *Acacia* species are highly desirable by regulators or government and are planted with a spacing of 3 meters by 3 meters within the catchment to stabilize the soils, actual implementation remains constrained on private land (Nuwahereza & Tumwebaze, 2025). Households with small pieces of land are forced to plant trees such as Maesopsis eminii and Grevillea robusta strictly along their plot boundaries, whereas institutions such as schools, churches, and hospitals grow indigenous trees such as acacia(Nuwahereza & Tumwebaze, 2025). This creates an operational disconnect: top-down institutional mandates focus heavily on large-scale public land allocations, whereas the socio-economic realities on adjacent private smallholdings force land-constrained communities into survival strategies that limit active, widespread buy-in.

Furthermore, despite high local awareness and institutional push, newly established tree stands face immense survival challenges, with a significant percentage of community members reporting that intense flash flood events frequently wash away younger trees, a vulnerability further compounded by localized environmental stressors like wildlife and poor soil quality. While historical research in the Rwenzori region has focused extensively on macro-level hydrological modeling and technical engineering parameters, there remains a critical empirical shortage of localized knowledge regarding how these specific structural land constraints, socio-economic trade-offs, and community perceptions shape the overall acceptance and success of biological flood mitigation. If these behavioral and spatial dynamics are left unaddressed, institutional tree-planting investments will continue to suffer from low community compliance and high seedling mortality rates, leaving the Nyamwamba catchment perpetually vulnerable to unchecked hydro-meteorological hazards. Therefore, this study directly addresses this gap by investigating the socio-economic and structural determinants of community perceptions toward tree-planting interventions for flood risk mitigation in the Nyamwamba catchment.

1.3 Research questions

1. What tree planting activities are being implemented in the Nyamwamba catchment?
2. What factors influence community perceptions toward participation in tree planting interventions?
3. How do community members perceive the effectiveness of tree planting in mitigating flood risks?

1.4 Significances of the study

This study provides critical empirical insights into community-based disaster risk reduction by balancing technical environmental management with bottom-up social realities within the flood-prone Nyamwamba catchment. By analyzing the determinants of local attitudes, the research directly aligns with global and national development frameworks, contributing directly to Sustainable Development Goals 13 (Climate Action) and 15 (Life on Land), while advancing Uganda's National Development Plan (NDP) priorities for climate change adaptation and environmental sustainability. Furthermore, by translating macro-level policies down to the grassroots, the findings offer a practical operational blueprint for the Parish Development Model (PDM) and the Kasese District Development Plan, providing local government authorities, parish production committees, and urban planners with contextspecific data to optimize seedling distribution, address structural barriers like land-tenure issues or soil constraints, and combine biological interventions with hard riverbank reinforcement. Ultimately, for the frontline residents of the catchment, this study serves as a platform to amplify local voices and advocate for comprehensive safety measures, while simultaneously filling a distinct academic gap in environmental geography and disaster risk science by shifting the focus from purely technical, hydrological modeling to the critical behavioral and socio-environmental dimensions of flood mitigation.

1.5 Scope of the study

1.5.1 Geographical Scope

The study was conducted in selected flood-prone communities within the Nyamwamba catchment in Kasese District, Western Uganda. Data were collected from respondents residing in Nyamwamba Division, Bulembia Division, and Central Division, particularly in villages that have experienced recurrent flooding and tree-planting interventions.

1.5.2 Content Scope

The study focused on community perceptions of tree planting as a flood mitigation strategy. It examined levels of awareness of tree-planting initiatives, beliefs regarding their effectiveness in reducing flood risks, and the extent of community participation. The study also explored factors influencing participation, including financial constraints, land availability, access to seedlings, labour requirements, and policy support. The research relied on community experiences and perceptions and did not measure actual hydrological flood reduction.

1.5.3 Time Scope

The study examined community perceptions related to tree-planting interventions implemented over a ten-year historical period between 2013 and 2023. Operationally, the primary field data collection phase was successfully conducted in August 2025, capturing a precise empirical cross-section of community attitudes and environmental realities immediately following this implementation period.

1.6 Conceptual framework

Community perception of tree-based flood mitigation in the Nyamwamba catchment is influenced by socio-demographic, economic, cognitive, and institutional factors. However, this relationship is affected by environmental, external, and logistical barriers that limit participation. These interactions determine the effectiveness of tree planting, reflected in participation levels, perceived flood reduction, and improved community resilience.

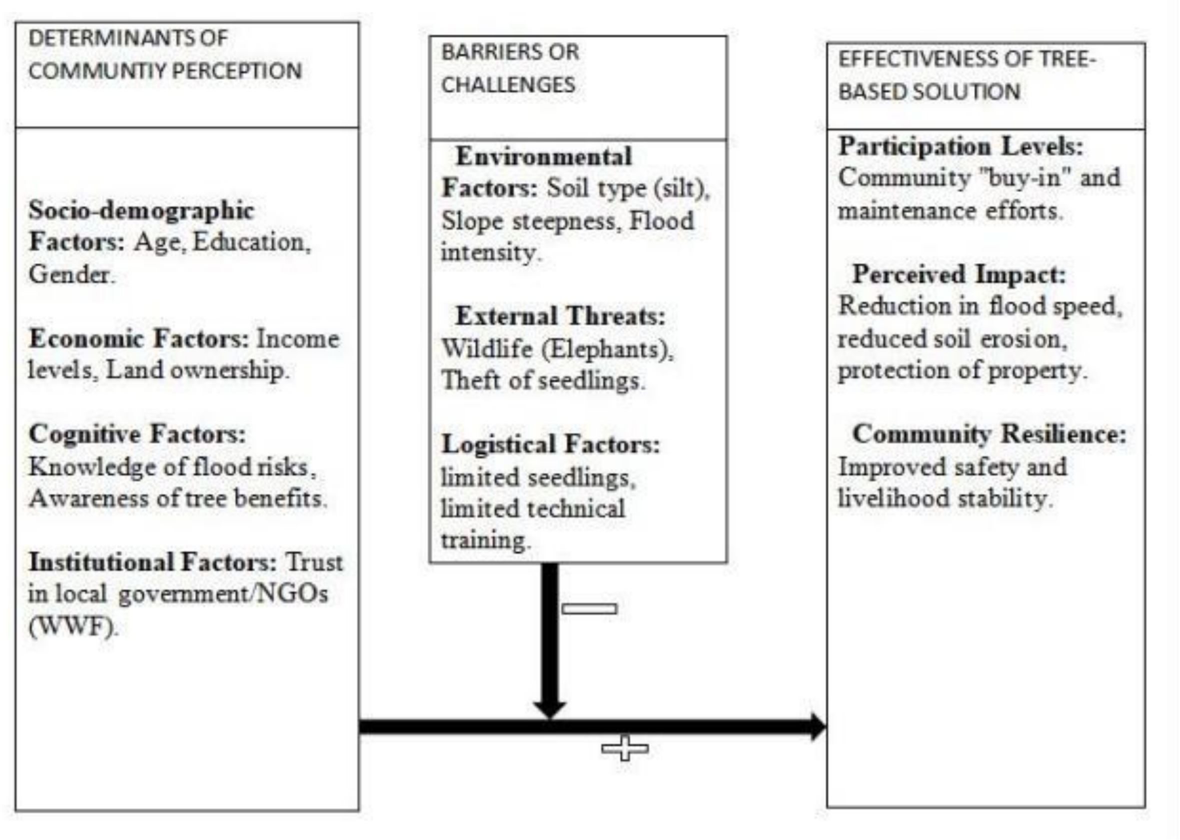

Figure 1 conceptual framework of the study

CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This chapter reviews the existing literature relevant to the study on community views on treebased flood mitigation approaches in the Nyamwamba Catchment. The review provides the theoretical and empirical foundation for understanding the role of tree-based interventions in reducing flood risks and the factors that shape community perceptions, acceptance, and participation in such approaches. It examines the concept of tree-based flood mitigation as a nature-based solution, the hydrological functions of trees in flood regulation, and the importance of local communities in the planning, implementation, and sustainability of these interventions. The chapter further reviews empirical studies on community perceptions of tree planting and other nature-based flood mitigation measures in different contexts, with particular emphasis on sub-Saharan Africa and Uganda. It also identifies the key knowledge gaps in the existing literature that justify the present study in the Nyamwamba Catchment. Finally, the review presents gaps in current knowledge that this study seeks to address. Flood mitigation through forests and other nature-based solutions is increasingly recognized as an effective strategy, but its success depends not only on biophysical performance but also on community acceptance, participation, and local socio-economic conditions.

2.1 Characterizing tree planting

Globally, tree-planting interventions are conceptualized under the framework of Nature-Based Solutions (NBS) to mitigate severe catchment-scale hydrological hazards (CohenShacham et al., 2016). Scholarly discourse originating from the Global North strongly focuses on the quantifiable biophysical performance of these interventions, evaluating how targeted afforestation manipulates subsurface hydrology through canopy rainfall interception and soil infiltration (Ellison et al., 2017). Quantitative models in these regions frequently rely on computerized hydrodynamic modelling to simulate how mature forest stands structurally lower peak discharge volume (Dadson et al., 2017). However, international environmental scientists note that evaluating these strategies strictly through biophysical parameters creates a narrow baseline that fails to reflect operational realities across developing regions (Seddon et al., 2020).

In Sub-Saharan Africa, tree-planting interventions shift from purely mechanical engineering alternatives into highly complex socio-ecological systems that interact heavily with rural landscape dynamics (Duguma et al., 2014). Regional African scholarship emphasizes that tree-based flood mitigation is fundamentally constrained by structural land-tenure vulnerabilities, household resource requirements, and direct dependency on forest biomass for energy security (Yin et al., 2019). Rather than implementing state-managed, large-scale industrial forests, successful interventions across the continent are typically characterized by decentralized, community-led initiatives that plant trees along private farm boundaries to balance multi-functional ecosystem services (Sinare et al., 2015). Furthermore, spatial and disaster risk scientists in East Africa highlight that these localized interventions face critical environmental disruptions, where aggressive flash floods, rapid topsoil erosion, and landslide susceptibilities are highly controlled by steep topography and extreme localized rainfall events (Jacobs et al., 2018). Consequently, comprehensive African scholarship argues that characterizing tree-planting requires an integrated analytical lens demonstrating that agroforestry systems effectively reduce runoff, improve infiltration rates, and maintain vital regulating ecosystem services while simultaneously supporting smallholder crop yields (Kuyah et al., 2019).

2.2 Drivers of community perceptions toward participation in tree-based flood mitigation strategies

In the Nyamwamba catchment, fostering community engagement in tree-planting initiatives can lead to increased ownership and responsibility for flood mitigation efforts (Sarzynski & Cavaliere, 2018). Empirical insights from mountain watersheds in Southeast Asia and Latin America, alongside vulnerable river basins across East Africa, confirm that project sustainability relies heavily on incorporating local community views rather than enforcing top-down mandates (FAO, 2006). Consequently, this study aims to identify the specific key determinants such as socio-cultural beliefs, environmental knowledge, economic incentives, and institutional trust that influence community perceptions regarding participation in treeplanting initiatives in the Nyamwamba catchment (Nuwahereza & Tumwebaze, 2025).

Cultural Beliefs and Values: The objective includes examining how cultural attitudes towards trees and land use affect community willingness to participate in tree-planting programs. In the Rwenzori region, local communities may have varying beliefs about the significance of trees, which can influence their engagement (Stage, 2010). Understanding these cultural contexts is essential for designing effective interventions.

Knowledge and Awareness: The objective also encompasses assessing the level of awareness regarding the benefits of tree-planting for flood mitigation. Research indicates that communities with higher levels of environmental education are more likely to engage in treeplanting activities (Rose et al., 2019). Tailored educational programs in the Nyamwamba catchment can enhance community understanding of the role of trees in reducing flood risks.

Economic Incentives: The study aims to explore how economic factors, such as the potential for income generation from tree products, motivate community participation. (Silwal et al., 2019) highlights that financial incentives can significantly enhance community involvement in reforestation efforts. In the Nyamwamba catchment, promoting agroforestry practices could provide both economic benefits and contribute to flood mitigation (Long'or Lokidor et al., 2024).

Trust in Institutions: The objective includes evaluating the role of trust in local government and NGOs in shaping community perceptions. If communities in the Nyamwamba catchment perceive these institutions as reliable and supportive, they are more likely to participate in tree-planting initiatives (Nuwahereza & Balaba, 2025). Building trust through transparent communication and community involvement is essential for successful implementation.

Therefore, the objective of this study is to examine the determinants of community perceptions towards tree-planting interventions for flood risk mitigation in the Nyamwamba catchment. By addressing cultural beliefs, enhancing knowledge, providing economic incentives, and building trust in institutions, stakeholders can foster greater community participation in tree-planting initiatives, ultimately contributing to effective flood risk mitigation in the region.

2.3 Local Perspectives on the Effectiveness of Tree Planting for Flood Mitigation

Floods are considered as hazards that cause risks to human life as well as impacting community livelihood. Floods are intricate events that cause a range of human exposures including loss of lives, property and damage to infrastructure of communities (UNDP , 2014). The most important issue is to reduce these floods using the local strategies for long term flood control focused on improving community livelihood (Sharafati et al., 2021). Members of the community devised some of the strategies like planting trees and bamboo along the Nyamwamba catchment aimed at preventing floods from breaking the banks and destroying their gardens (Graziosi et al., 2020). If they had not devised these methods majority of the farmer's crops would be destroyed leading to food scarcity within the community. The presence such strategies such as tree planting have enabled community members to improve on their livelihood (Bertocci, 2022).

The past flood experiences, access to flood risk information and the number of household members have increased the effectiveness and adoption of tree planting for flood risk mitigation in the river Nyamwamba catchment. This was explained by (Scolobig et al., 2012) that adoption of flood risk mitigation strategies is significantly higher among flood plain residents who have been affected by floods at first. There is a positive perception and wide adoption of tree planting for flood risk reduction in the river Nyamwamba catchment and there is high willingness among the non-adaptors to adopt tree planting (UNDP , 2014). The rituals and planting of cultural plants inform of trees illustrate how the local people in the community have a strong attachment to the invisible world. A clear link appears with indigenous tree that are planted to immunize against floods, the belief that flood disaster would subside indigenous tree and plants such as bamboo are planted along river (Bwambale et al., 2018)

In case tree planting is found to reduce the risk of flooding by the local people in the community, it would be easily incorporated and adopted to address the impact of flood events. Tree planting can be proven to be effective when it appears as belief. As belief systems indicate that when it appears as beliefs. Therefore, belief system indicate that communities are likely to adopt. (IPCC, 2014)

2.4 Research gap

Several studies have examined flooding in the Rwenzori region and the Nyamwamba catchment, focusing mainly on hydrological causes, deforestation, and environmental degradation. Reports by the United Nations Development Programme and the Ministry of Water and Environment emphasize technical and ecological interventions such as afforestation and riverbank restoration.

However, most of this literature concentrates on the environmental performance of tree planting rather than on how local communities perceive these interventions. Limited attention has been given to community-level experiences, participation, and acceptance of tree-based flood mitigation strategies.

In addition, although factors such as education, income, cultural beliefs, and institutional trust are known to influence environmental participation, there is limited localized evidence showing how these determinants shape perceptions within the Nyamwamba catchment.

Therefore, there remains a gap in understanding how tree planting activities are characterized at community level, what influences local perceptions and participation, and how residents evaluate the effectiveness of tree planting in reducing flood risks. This study addresses that gap.

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND METHODOLOGY

3.0 Introduction

This chapter describes the study area and the methodology employed to investigate community views on tree-based flood mitigation in the Nyamwamba catchment. It begins with a detailed description of the study area, including its geographical location, physical characteristics, and the flood risk context that necessitates mitigation interventions. The chapter then outlines the research design, target population, sampling techniques, data collection instruments, and data analysis methods used in the study. Ethical considerations observed during the research process are also presented. The methodological choices were guided by the need to capture both quantitative patterns and qualitative insights into how communities in the Nyamwamba catchment perceive and engage with tree planting as a strategy for flood risk reduction.

3.1 Study Area

The study was conducted in the Nyamwamba catchment located in Kasese District in southwestern Uganda. The catchment lies within the Rwenzori region and is highly prone to recurrent flooding due to steep slopes, high rainfall intensity, and environmental degradation.

The Nyamwamba River originates from the Rwenzori Mountains and flows through several communities before joining River Mubuku. The area has experienced repeated flash floods that have caused destruction of property, loss of livelihoods, and displacement of residents.

Figure 2 Location of the study area and sites

3.1.1 Location

River Nyamwamba Catchment is located in Kasese District, south-western Uganda, and is characterized by verdant hilly environment of Rwenzori Mountains, with steep slopes and stones and boulders filling the valleys. The catchment consists of the following administrative units: Bulembia Division, Kilembe sub county, Nyamwamba Division, Central Division, Rukoki, Kyarusandara, Kyarumba, Bugoye, and Mahango sub-counties. These sub counties are traversed by River Nyamwamba, which has its source in the Rwenzori Mountains (MWE, 2021).

River Nyamwamba Catchment covers an approximate total area of 257.2 km2 (7 % of Kasese District). The catchment is located within the Greater Semliki catchment which is approximately 33,487 km2. The Greater Semliki catchment is shared between Uganda and the Democratic Republic of Congo and lies within the Albertine Rift Montane Eco-region of African Rift Lakes Priority Place. It lies in the Albert Water Management Zone under the decentralized water resources management in Uganda. Nyamwamba catchment is therefore a sub-catchment within the Greater Semliki catchment (MWE, 2021).

3.1.2 Climate

Rainfall: The district experiences a bimodal rainfall pattern. The first rains are short but fall with high intensity and occur during March-May season, and the longer rains from August to November with a low intensity. Annual rainfall ranges from 800mm to 1600mm, and is greatly influenced by altitude. In terms of total annual rainfall, the extreme southern to southeastern part of the district receives slightly less than 800mm. The savannah area in Queen Elizabeth National Park and Lake George and Edward, receive 800- 1000mm. In the central part of the district stretching diagonally in the south-western to the northeast direction, annual rainfall ranges from 1000-1200mm. At the foothills of the Rwenzori Mountains the amount is 1200-1400mm. From the foothills to the mid-slopes rainfall received is 1400-1600 mm; and for the mid- slopes to the summit, the minimum rainfall amount is 1600mm (Kasese, 2019).

The district experiences wide temperature variations due to altitude. Temperatures can be extreme, from very high in the plains to below zero at the summit. From 1991 to 1995 annual average was 23.9 degrees centigrade, with minimum and maximum averages of 17.7 and 30.2 degrees centigrade, respectively (Kasese, 2019). Recent records have shown that from 19992001 the annual average maximum temperature was 29.8 degrees centigrade and average minimum temperature was 17.5 degrees centigrade (Kasese, 2019).

3.1.3 Vegetation

The sites within the Mountain Rwenzori National Park are well covered with vegetation. Along and within the river course and catchment, grasses, shrubs, and herbs predominantly comprise of Setaria megaphylla and Pennisetum purpureum (Grasses), Aframonum sanguineum, Impatiens burtonii, impatiens nana, Aneilema peduncolusum and Tragia insuavis as dominant herbs and Rubus pinnatus var afrotropicus and Acalypha bipartite as dominant shrubs. Secondary forest mainly surrounds this section of the catchment with trees ranging between 2 – 25 m height. Predominantly, the catchment is covered by Bridelia micrantha, Maesa lanceolala, Polyscias fulva, Ficus vallis choudae; Erythrina abyssinica, Newtonia buchananii, Spathodea campanurata, Sapium ellipticum, Solanecio mannii, Albizia graberrima, Myrica salicifolium and Faurea salignam. Together, these trees with profound rooting systems supported by the shrubs, herbs and grasses form a formidable compact and robust catchment with intact banks providing an adequate breaking system and holding water volumes to slow down despite the steep topography of the Rwenzori mountain ranges (MWE, 2021).

3.1.4 Drainage

Kasese District has two major drainage basins; Lakes George and Edward. Rivers Nyamugasani and Lhubirihawith their tributaries whose origin lies in Rwenzori bogs feed the Lake Edward system. The Lake George system is fed by rivers Muhokya, Nyamwamba, Rukoki, Mubuku, Sebwe, Hima, and Rwimi with their associated tributaries. The Edward system has various wetlands most of which are riverine that include; Lhubiriha, Nyamugasani valleys and the Northern parts of Lake Edward. The edge of Lake George is occupied by wetlands containing a very rich ecosystem that has attracted international attention in line with the Ramsar Convention of 1988 (Kasese, 2019).

3.1.5 Land Use

The vegetation is made up of montane forests in the section of mountain Rwenzori national park, cassava and banana gardens as well as Pine and Eucalyptus plantations on the mountain slopes in the project area. The river itself has heavy boulders through which the water flows while the banks are dominated by Pennisetum polystachion, banana and coffee gardens in various sections. *The riverbank area*: This area is predominantly comprised of grass amidst huge boulders of rock interspersed with herbs, shrubs and trees. *The forested area:* This area comprised of rocks with an undergrowth of herbs and shrubs interspersed with grasses. *The farmland area*: Pennisetum purpureum, Digitaria scalurum, D. velutina, Sporobolus pyramidalis and Panicum maximum were dominant grasses here.(MWE, 2021)

3.1.6 Geology

The geology of the catchment is mainly built up of Precambrian metamorphic rock which consists of gneisses, quartzites, schists and varying amounts of mafic igneous rocks. Gneiss dominates in the northern part of the mountain range, while gneiss with schists of the Kilembe prevails in the southern part. Kilembe copper mineralisation occurs within an amphibolite unit of the Kilembe Series rocks that are part of the Ruwenzori fold belt (MWE, 2021).

Concerning rock strength characteristics, the schists are considered to have a medium erodibility, the gneisses a low erodibility, while the amphibolites have a very low erodibility. As to the weathering of the bedrock, the weathering rates in the Rwenzori Mountains are low, leading to weathering-limited slope evolution dominated by physical erosion processes. The catchment area is covered with Argilites with basal quartzites and amphibolites locally. Along the river, the site general lithology consists of granitized or high to medium grade metamorphic formations. The Argilites, including elements of phylites and Schists and metamorphosed formations are present in this region (MWE, 2021).

There are four geological features in the Kasese district: partly granitized and metamorphosed formations, pleistone to recent rock formations, wholly granitized or high to medium grade metamorphosed formations and the rift valley geological features and formations (MWE, 2021).

3.1.7 Economic Activities

The main economic activities within the catchment include farming, trade, agricultural produce, transportation, fish enterprises (capture fisheries and farm fisheries), mining, brick baking and laying, livestock keeping (cattle, chicken, piggery and goats), Craft making, Carpentry, Bakery, Alcohol distillation, Charcoal burning, Bee keeping, tree planting and commercial tree production, Mountain climbing, Lumbering, Tourism, Hydro power production. The various crops grown include; Bananas, Coffee, Fruits, Cassava, Beans, Avocados, Vanilla, Vegetables (tomatoes), ground nuts, maize, cotton, sugar canes, Irish potatoes, yams, vegetables (cabbages, tomatoes, onions, carrots, eggplant) (MWE, 2021).

3.1.8 Population

The population of Kasese is 694,084 people (Uganda Bureau of Statistics, 2016). Of this 51.7% (363,233) are females and 48.3% (338,796) are males. The population growth rate in 2014 was 2.45% down from a growth rate of 3.6% between1991-2002. The national growth rate is 3.03%. There are 140,697 households in the district with an average household size of 4.9 persons which is higher than the national average of 4.7. The rural population consists of 529,976 or 75.5% of the population while the urban population is 24.5%. (Uganda Bureau of

Statistics, 2016). The population density of Kasese in 2014 was 235 persons Km2 (642 persons per Km2 in the area actually occupied by people) and the population growth rate is 2.45% per annum (Uganda Bureau of Statistics, 2016).

3.2 Materials and Methods

3.2.1 Research Design

The study adopted a cross-sectional research design using a mixed-methods approach. This design was chosen because it allows the researcher to efficiently capture a real-time snapshot of community attitudes at a single point in time across different areas. Both quantitative and qualitative data were collected to obtain comprehensive information on community perceptions of tree-based flood mitigation strategies.

3.2.2 Data Types and Sources

The study utilized both primary and secondary data. Primary data was collected from community members through questionnaires and interviews. Secondary data was obtained from reports, journal articles, and government publications related to flood management and tree planting initiatives.

3.2.3 Target Population

The target population for this study comprised residents within the Nyamwamba catchment who have direct experience with local flooding events and awareness of tree-planting interventions. This population included household heads, local farmers, community leaders, and institutional representatives. A total sample size of N = 73 respondents was actively surveyed across Kasese Municipality.

Geographically, the target population was distributed across three administrative divisions: Nyamwamba Division, Bulembia Division, and Central Division. To ensure localized representation across the catchment, participants were drawn from six distinct parishes, including Kanyangeya , Nyakabingo 3, Base Camp, Nyakabingo 1, Nyakasanga 1, and Katiri.

3.2.4 Sampling Framework, Sampling Technique and Sample Size

This study employed both probability and non-probability sampling techniques. Simple random sampling was used to select household respondents in order to minimize selection bias and ensure representativeness. Purposive sampling was used to select key informants, including local leaders and environmental officers, due to their knowledge and involvement in tree-planting and flood mitigation activities.

The sample size for household respondents was determined using the Yamane (1967) formula:

$$n = N/(1 + Ne^2)$$

Where, n = required sample size N =

Total population size which is 28000 e =

margin error, usually (e = 0.10)

$$\boldsymbol{n} = \frac{\mathbf{28000}}{\mathbf{1+28000*0.10^2}} = 99.996 \approx 100$$

To ensure proportionate representation across the catchment area, the calculated target sample size of 100 was mathematically allocated across the six selected administrative parishes based on their baseline population distribution. The localized planned targets based on this framework were established as follows: Kanyangeya ($n = 32$), Nyakabingo 3 (n = 27), Base Camp (n = 21), Nyakabingo 1 (n = 13), Nyakasanga 1 (n = 5), and Katiri (n = 2).

Although the initial target framework aimed for 100 respondents, a final total of 73 household respondents were successfully interviewed during fieldwork. Out of these 73 completed questionnaires, the realized sample achieved across the parishes consisted of 23 respondents in Kanyangeya, 20 in Nyakabingo 3, 15 in Base Camp, 9 in Nyakabingo 1, 4 in Nyakasanga 1, and 1 in Katiri. This variance from the initial targets was primarily due to tight logistical constraints, as data collection was strictly limited to a three-day period. Additionally, field exercises faced low respondent availability, with fewer people present at households during daytime visits due to farming and other economic engagements away from home. Despite this adjustment, the final achieved sample of 73 provided a highly representative 73% response rate, yielding sufficient data saturation and meaningful insights into community perceptions within the study area.

3.2.5 Methods and Tools for Data Collection

Data was collected using a combination of quantitative and qualitative methods to obtain comprehensive information on community perceptions of tree-based flood mitigation strategies.

3.2.5.1 Structured Questionnaires

Structured questionnaires were administered to household respondents to collect quantitative data. The questionnaires contained both closed-ended and open-ended questions aligned with the study objectives. This tool was selected because it is the most efficient method for gathering standardized, quantifiable data from a large sample size (n = 73) within a limited time frame, allowing for statistical analysis. This method enabled the collection of standardized responses from a large number of participants, ensuring comparability of data.

The questionnaire used in this study is provided in Appendix I.

3.2.5.2 Key Informant Interviews

The study involved key informants selected based on their knowledge, experience, and involvement in tree planting and flood mitigation activities within the Nyamwamba catchment. These included local leaders, community mobilizers, environmental actors, and individuals engaged in tourism and community-based organizations such as Rwenzori Trekking Services. This tool was used because it allowed the study to gather specialized institutional insights and expert community perspectives that standard household respondents could not provide.

Key informants were purposively identified during fieldwork due to their relevance to the study objectives. In total, 7 key informants were interviewed. These included village leaders, community health workers, guides, and residents with practical experience in tree planting initiatives. The interviews were conducted using a semi-structured key informant interview guide, which allowed flexibility for probing deeper into emerging issues. This guide was selected because it provided a flexible framework to ask follow-up questions on unexpected local issues while keeping the discussion focused on the research objectives. Each interview lasted between 25 to 30 minutes, providing sufficient time to explore all relevant themes. To support the findings, a photograph was taken during the key informant interview presented by figure 4 in the results section.

3.2.5.3 Observation

Observation was used to assess environmental conditions (presented by figure 5 in the results section), tree planting activities, and flood-prone areas within the Nyamwamba catchment. This method allowed us to directly verify information obtained from respondents and to capture real-life conditions on the ground.

3.2.5.4 Focused Group Discussions (FDG)

Focus Group Discussions (FGDs) were conducted to obtain diverse, interactive community perspectives on tree planting as a flood mitigation strategy. The discussions helped capture shared experiences, collective beliefs, and social attitudes regarding flooding and environmental management in the Nyamwamba catchment. A total of two focus group discussions were conducted, with each session comprising between 4 to 6 participants. The sessions were guided using a semi-structured focus group discussion guide to ensure thematic consistency while allowing participants to freely interact and debate views. Participants were purposively selected based on their firsthand experience with flood impacts and involvement in tree-planting initiatives, ensuring a representative cross-section of age categories (youth and adults), gender (both men and women), and local livelihoods (primarily local farmers). The group interaction during Focus Group Discussions is illustrated in figure 3 in the result section.

3.2.6 Reliability and Validity

The research instruments were pre-tested before actual data collection to ensure clarity and consistency. Necessary adjustments were made to improve reliability. Validity was ensured by designing questions directly based on the study objectives and conceptual framework.

3.2.7 Research Procedure

An introductory letter was obtained from the university to facilitate data collection. Permission was sought from local authorities before engaging respondents. Respondents were informed about the purpose of the study, and informed consent was obtained. Data collection was conducted systematically across selected communities within the catchment.

3.2.8 Data Processing and Analysis

To comprehensively evaluate community views on tree-based flood mitigation, primary data was processed and analyzed using a parallel mixed-methods framework. Quantitative data from the 73 household questionnaires was cleaned, coded, and entered into statistical software for descriptive analysis, while qualitative data from the 7 key informant interviews (KIIs) and 2 focus group discussions (FGDs) was transcribed and processed using manual thematic analysis. To achieve the first objective of characterizing tree planting activities, descriptive statistics specifically absolute frequencies and percentages presented in summary tables were paired with inductive thematic coding of narratives from community members and local guides. Frequencies and percentages were required to establish the baseline proportions of community awareness (89.04%) and confidence levels regarding planting practices. Complementarily, thematic analysis was used to identify and contextualize localized field realities, such as the specific spatial distribution of tree species like bamboo and grevillea along riverbanks, alongside distinct physical ecological threats including poor soil quality, flash floods, and wildlife destruction that statistical numbers alone could not adequately describe.

For the second objective, which examined the determinants of community perception toward participation, the analysis utilized quantitative frequency distribution ranking and descriptive percentage analysis alongside deductive thematic analysis aligned with the structural framework of socio-economic, spatial, and logistical barriers. Quantitative ranking was necessary to isolate and weigh the leading structural constraints impacting local buy-in, directly establishing that limited land availability was the primary determinant affecting 71.43% of the targeted areas. Concurrently, thematic analysis of KII and FGD transcripts was utilized to explain the underlying socio-economic and structural mechanics of these limits, uncovering how smallholder subsistence farming priorities and poor seedling access create an operational disconnect between top-down institutional mandates and bottom-up household survival strategies.

Finally, to address the third objective of evaluating how local people experience the effectiveness of interventions, the study employed descriptive statistics using frequencies and percentage breakdowns of Likert-scale agreement data, combined with comparative thematic analysis to capture divergent community narratives. Percentage breakdowns were necessary to mathematically capture the divided consensus within the community, revealing that while 41.10% believe trees possess long-term mitigation capacity, a larger 54.79% experienced direct structural failure where younger trees were destroyed by subsequent floods. Comparative thematic analysis was then employed to integrate these mixed human experiences, capturing the community's critical assessment that biological nature-based solutions are structurally insufficient as standalone measures and must be integrated with hard structural engineering interventions, such as riverbank reinforcement and mechanical desiltation, to ensure sustainable catchment resilience.

3.2.9 Ethical Considerations

Ethical principles were observed throughout the study. Participation was voluntary, confidentiality was maintained, and respondents were assured that the information provided would be used strictly for academic purposes. Respondents had the right to withdraw from the study at any time.

CHAPTER FOUR: PRESENTATION OF RESULTS

4.0 Introduction

This chapter presents and analyzes the findings of the study on community views regarding tree-based flood mitigation approaches in the Nyamwamba catchment. The results are organized according to the study objectives and are presented using tables, figures and descriptive explanations to facilitate interpretation. The chapter begins by describing the demographic characteristics of the respondents including age, gender and level of education. It then presents findings on community awareness and perceptions of tree planting as a flood mitigation strategy, the extent of community participation in tree-based interventions and the factors influencing local views on the effectiveness and sustainability of these approaches. Data was collected from 73 respondents and are presented using frequency, tables, percentages and descriptive narratives from both quantitative and qualitative responses.

4.1 Demographic characteristics of study participants

This section presents the demographic characteristics of the respondents, including age, gender, and level of education.

Table 1 Demographic Characteristics of Respondents(n=73)

Characteristic	Category	Frequency	Percentage (%)
Age (Mean = 37.11 years)	18–25 years	10	13.70
	26–35 years	15	20.55
	36–45 years	20	27.40
	46–55 years	12	16.44
	56 years and above	16	21.92
Gender	Male	35	47.95
	Female	38	52.05
Education Level	Primary	44	60.27
	Secondary	24	32.88
	Tertiary	5	6.85

Source: Field Data (2025)

The findings in Table 1 shows that the mean age of respondents was 37.11 years, with the largest proportion (27.40%) aged between 36–45 years. Respondents aged 56 years and above constituted 21.92%, while those aged 26–35 years accounted for 20.55%. This indicates that the majority of participants were economically active adults with experience in farming and environmental activities.

In terms of gender, females constituted 52.05% of the respondents, slightly higher than males (47.95%), indicating balanced gender representation.

Regarding education level, the majority (60.27%) had attained primary education, followed by 32.88% with secondary education, and only 6.85% with tertiary education. This suggests that most participants had basic formal education, which may influence awareness and understanding of tree planting initiatives.

4.2 Characterizing tree planting activities in the Nyamwamba catchment

This section presents findings on awareness, nature, and participation in tree planting activities for flood mitigation.

Table 2 Awareness and Perception of Tree Planting Initiatives (n=73)

Statement	Yes	No	Yes (%)
Aware of tree planting for flood mitigation	65	5	89.04
Believe planting trees reduces flood risk	46	10	63.01
Confident in skills to participate in tree planting	60	11	82.19

Source: Field Data (2025)

Table 2 shows that a large majority of respondents (89.04%) were aware of tree planting initiatives aimed at flood mitigation. Additionally, 63.01% believed that planting trees reduces flood risk, while 82.19% expressed confidence in their ability to participate in tree planting activities. These findings indicate high awareness and relatively positive attitudes toward tree planting in the catchment.

Findings from Focus Group Discussions further revealed that tree planting activities are conducted along riverbanks, farmland boundaries, and institutional land such as schools and churches. However, participants highlighted challenges affecting tree survival.

One participant noted:

―We plant trees, but they dry up due to poor soil quality.‖

Another stated:

―Wild animals like elephants destroy the trees we plant.‖

Figure 3 focused group discussion

Key informants indicated that species such as bamboo and grevillea are planted to reduce water speed and stabilize soil along riverbanks. However, they reported that floods often wash away newly planted seedlings.

4.3 Determinants of Community Perception Toward Participation in Tree Planting Interventions

This section presents the factors influencing community participation and perceptions toward tree planting for flood risk mitigation. To comprehensively evaluate what drives or limits local community buy-in, the analysis examines the socio-demographic determinants captured in the household survey (n = 73) as detailed in *Table 1*, alongside the institutional and environmental challenges identified by key informants (n = 7).

Socio-demographic characteristics heavily dictate community perceptions and individual willingness to participate in tree-planting interventions. Gender dynamics play a significant role; while females constitute the majority of the surveyed population (52.05%), qualitative field observations indicated that active participation in tree planting and land-use decisionmaking remains predominantly male-dominated due to local customary land tenure systems. Age also emerged as a critical determinant of perception. Younger respondents (18–35 years, comprising 34.25% of the sample) demonstrated high awareness of climate risks but lower active participation due to a lack of secure land ownership. In contrast, older community members (36 years and above, comprising 65.76%) possessed greater land authority but frequently reported physical labor constraints when implementing active riverbank planting. Furthermore, formal education levels directly influence strategic understanding. With 60.27% of respondents limited to a primary education, the perception of tree planting is largely viewed through an immediate economic or agricultural lens rather than a long-term flood mitigation strategy. Conversely, the minor percentage of respondents with secondary (32.88%) and tertiary (6.85%) education levels demonstrated a significantly higher structural understanding of how nature-based interventions buffer flash floods.

Beyond these individual demographic determinants, overarching institutional, structural, and environmental barriers further shape local perceptions and constrain community-wide participation. These challenges, as identified and ranked by the key informants, are outlined in Table 3.

Table 3 Challenges Affecting Tree Planting(Key Informants, n=7)

Challenge	Frequency	Percentage (%)
Limited land availability	5	71.43
Soil erosion and flooding	4	57.14
Lack of awareness	4	57.14
Destruction by wild animals	3	42.86
Limited access to quality seedlings	3	42.86

Source: Field Data (2025)

As shown in Table 3, the major challenge affecting tree planting participation was limited land availability (71.43%). Soil erosion and flooding (57.14%) were also significant constraints, followed by lack of awareness (57.14%). Destruction by wild animals and limited access to quality seedlings were reported by 42.86% of key informants.

Key informants emphasized that environmental conditions and resource limitations strongly influence community perceptions. One informant observed that trees are often washed away by floods due to silty soils. Another noted that tree planting alone cannot effectively control floods without proper riverbank maintenance. These findings indicate that while awareness is relatively high, structural and environmental barriers limit effective participation.

Figure 4 key informant interview

4.4 The Effectiveness of Tree Planting Interventions for Flood Risk Mitigation

This section presents community experiences and perceived effectiveness of tree planting interventions.

Table 4 Community Perspectives on Effectiveness of Tree Planting(n=73)

Perspective	Frequency	Percentage (%)
Believe trees can reduce flood	30	41.10
Trees are affected or destroyed by floods	40	54.79
Trees provide economic benefits	25	34.25

Source: Field Data (2025)

Table 4 indicates that 41.10% of respondents believed that trees can reduce flooding. However, a larger proportion (54.79%) reported that trees are often affected or destroyed by floods. Additionally, 34.25% acknowledged economic benefits from tree planting, such as selling timber or using tree products.

Focus group participants shared mixed experiences. One participant explained that after floods, the community received grevillea seedlings from supporting organizations, but the trees were still affected by subsequent floods. Others noted that trees help in stabilizing soil and reducing water speed, especially along riverbanks.

Overall, the findings suggest that while tree planting is perceived as beneficial, its effectiveness is limited by environmental challenges and recurrent flooding. Community members recognize its potential but express skepticism about its ability to function as a standalone flood control measure.

Figure 5 Observed environmental conditions

CHAPTER FIVE: DISCUSSION OF FINDINGS

5.0 Introduction

This chapter discusses the findings presented in chapter four in relation to existing literature and theoretical framework underpinning the study. The discussion is organized according to the research objectives, examining community views on tree based flood mitigation approaches in the Nyamwamba catchment. It critically interprets the results on community awareness, perceptions and participation in tree planting interventions while drawing comparisons with findings from similar studies conducted in other flood-prone regions.

The chapter further explores the socio-demographic and institutional factors that shape community engagement with tree-based approaches and highlights the implications of these findings for policy and practice in flood risk management within the Nyamwamba catchment.

5.1 Characterizing Tree Planting Activities in the Nyamwamba Catchment

The study findings revealed a high level of community awareness (89.04%) regarding tree planting initiatives for flood mitigation, alongside active participation in planting trees along vulnerable riverbanks, farmland boundaries, and institutional land. Commonly adopted species included bamboo and *Grevillea robusta*. These findings are consistent with *FAO (2020)* and *MWE (2021)*, which report increasing tree planting efforts in Kasese District as a direct grassroots and institutional response to rising flash flood risks and severe environmental degradation. The expansion of agroforestry systems and target reforestation initiatives across riverbanks and hillsides supports the observed widespread engagement in tree planting within the catchment. Additionally, the findings align with *Nuwahereza & Tumwebaze (2025)*, who note that tree planting in the Nyamwamba catchment is promoted through a mix of top-down institutional programs and bottom-up community-level initiatives, particularly under the framework of nature-based solutions (NBS).

However, despite this high level of general awareness and localized activity, the study identified significant environmental challenges, including seedling destruction by flash floods, poor soil quality, and damage from wild animals. These constraints suggest that while tree planting is widely practiced, its operational sustainability is severely limited by ecological volatility. This slightly contrasts with *Kasese District local government reports (2022)*, which generally indicate favorable land availability for environmental conservation. In practice, this study demonstrates that household-level constraints, such as fragile riverbank soil and environmental instability, significantly reduce the practical survival rate of these trees. Therefore, while tree planting activities in the Nyamwamba catchment are well established, they face acute biophysical limitations that undermine their long-term success.

5.2 Determinants of Community Perceptions and Participation in Tree Planting

The study established that community perception and active participation are determined by a complex interplay of individual socio-demographic factors and institutional barriers. On an individual level, gender dynamics, age, and formal education emerged as primary determinants. The demographic profile revealed that females constitute the majority of the community population (52.05%), yet qualitative field insights indicated that active landmanagement choices remain heavily male-dominated due to traditional customary land tenure systems. This nuance strongly supports *Sarzynski & Cavaliere (2018)*, who argue that community participation in environmental initiatives depends heavily on localized structural conditions and resource ownership.

Age distribution also functioned as a key determinant; while younger respondents (18–35 years, making up 34.25% of the sample) possessed high conceptual awareness of climate interventions, they demonstrated lower active participation due to limited land security. This aligns with *Rose et al. (2019*), who emphasize that environmental behavior is shaped by the intersection of knowledge and physical capacity. Older community members possessed more land authority but faced physical labor constraints. Furthermore, with 60.27% of the community limited to a primary level of education, tree planting was predominantly perceived through immediate economic lenses rather than long-term hydrological mitigation. This directly echoes arguments by *Silwal et al. (2019)* and *Long'or Lokidor et al. (2024)* regarding the primacy of economic incentives. Respondents with secondary (32.88%) or tertiary (6.85%) education displayed a more sophisticated structural understanding of naturebased watershed management.

On an institutional level, key informant data highlighted that limited land availability (71.43%) and structural flood damage (57.14%) act as severe external determinants that suppress community confidence. This reveals a stark divergence from *UNDP (2014)* frameworks, which suggest that institutional presence alone drives community buy-in. In the Nyamwamba catchment, the recurring loss of seedlings to high-velocity floodwaters weakens local trust in institutional mandates. Ultimately, awareness alone is insufficient to drive sustained engagement when socio-demographic barriers and land constraints restrict community capacity.

5.3 Effectiveness of Tree Planting for Flood Mitigation

The empirical findings indicate highly divided local perceptions regarding the actual effectiveness of tree planting as a standalone flood mitigation tool. While 41.10% of respondents believe trees possess long-term mitigation capacity, a larger 54.79% reported experiencing direct structural failures where young tree interventions were entirely destroyed by subsequent flood events. These polarized results are highly consistent with *Sharafati et al. (2021)*, who note that while nature-based solutions structurally contribute to flood mitigation, their real-world efficacy varies drastically depending on local environmental extremes. Similarly, the findings support *Graziosi et al. (2020)*, which highlights that vegetation barriers stabilize riparian soils and reduce overland water velocity but fail to prevent catastrophic inundation during severe peak-flow events in high-risk catchments.

The study further aligns with *Scolobig et al. (2012)*, which emphasizes that past experiences with natural disasters heavily shape community skepticism or acceptance of risk-reduction measures. In the Nyamwamba catchment, continuous exposure to destructive flash floods has simultaneously driven the adoption of tree planting out of necessity and fueled deep skepticism regarding its standalone capability. Additionally, the integration of bamboo and specific indigenous trees reflects the findings of *Bwambale et al. (2018*), which highlight how cultural beliefs and traditional ecological knowledge influence localized adaptation strategies.

However, these findings directly challenge the optimistic conclusions of *Nuwahereza & Tumwebaze (2025)*, who reported generally positive, uncritical community perceptions of tree-planting effectiveness in the region. This study reveals a far more balanced and critical community assessment. While local residents recognize the socio-economic and ecological benefits of agroforestry, they explicitly acknowledge its physical limitations. The consensus within the Nyamwamba catchment indicates that tree planting is beneficial but structurally insufficient on its own, meaning its ultimate success depends on integration with hard structural engineering measures, such as mechanical riverbank desiltation and stone-pitch reinforcement

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.0 Introduction

This chapter presents the conclusion and recommendations drawn from the study on community views regarding tree-based flood mitigation in the Nyamwamba catchment. It synthesizes the key findings from the preceding chapters, highlighting major themes that emerged regarding community awareness, perceptions, participation and the sociodemographic and institutional factors that influence the adoption and sustainability of tree planting interventions for flood risk reduction. The chapter concludes by offering practical recommendations directed at policy makers, local government, development agencies and community stakeholders to enhance the effectiveness of long term viability of tree based flood mitigation strategies in the Nyamwamba catchment and similar flood prone environments.

6.1 Conclusion

The study examined local views regarding tree planting interventions for flood risk mitigation in the Nyamwamba catchment. It concludes that while tree planting initiatives are widely known and practiced with high community awareness and active planting of species like bamboo and Grevillea robusta along riverbanks and farmlands with their long-term operational sustainability is severely constrained by local ecological realities, including recurrent flooding, soil instability, and wildlife destruction. Furthermore, community perception and active participation are not driven by awareness alone, but are heavily determined by individual socio-demographic factors and institutional barriers. Specifically, while females make up the demographic majority, land-use choices remain highly maledominated due to customary tenure systems; meanwhile, younger residents face land insecurity, and a lower level of formal education limits the community's capacity to view tree planting beyond immediate subsistence or economic needs. These socio-demographic constraints interact with acute institutional challenges, particularly severe land scarcity and the continuous physical destruction of seedlings by flash floods, which ultimately undermines local confidence in standalone nature-based solutions. Consequently, local perspectives on effectiveness remain highly divided; while the community acknowledges that trees provide essential soil stabilization and livelihood benefits, they recognize that biological interventions are structurally insufficient on their own. The study ultimately concludes that while tree planting plays a vital supportive role in catchment restoration, it cannot independently prevent catastrophic flood events and must be integrated with hard structural engineering measures, such as mechanical riverbank reinforcement and stone-pitching, to achieve true watershed resilience.

6.2 Recommendations

Based on the study findings, the following recommendations are proposed:

6.2.1 Policy and Institutional Recommendations

Government and district authorities should formally integrate biological tree-planting interventions with hard structural engineering measures, such as mechanical riverbank stabilization and drainage infrastructure improvements.

Local governments, non-governmental organizations (NGOs), and line institutions should establish robust, long-term monitoring and maintenance frameworks to enhance post-planting seedling survival rates.

Environmental policies should prioritize and incentivize the propagation of deep-rooted indigenous and flood-resistant species specifically suited for riparian zone stabilization.

6.2.2 Community-Level Recommendations

District environmental offices should scale up targeted community sensitization programs to enhance local technical capacity regarding appropriate species selection, silvicultural management, and conservation practices.

Agroforestry models should be actively promoted to concurrently deliver household economic returns and community-wide environmental protection.

Collaborative, community-led monitoring and protection committees should be established to safeguard newly planted trees against wildlife destruction and conflicting human activities.

6.2.3 Economic Recommendations

Stakeholders should introduce tangible incentive-based mechanisms such as seedling subsidies or operational frameworks for payments for ecosystem services (PES) to stimulate community-wide participation.

Sustainable livelihood diversification programs should be implemented to complement nature-based solutions, thereby mitigating survival-driven economic pressures on local forest resources.

6.3 Areas for Further Research

Future empirical studies should model the long-term hydrological impacts of mature tree stands on peak flow discharge and flood intensity within the Nyamwamba catchment.

Controlled field assessments should be conducted to evaluate the survival, growth performance, and soil-binding mechanics of diverse tree species under recurrent flash flood conditions.

Further research should investigate practical frameworks for integrating local indigenous ecological knowledge systems with modern, engineered flood mitigation strategies.

A comparative socio-economic study should be undertaken between participating and nonparticipating households to isolate the underlying behavioral, institutional, and demographic determinants of conservation adoption.

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APPENDICES

APPENDIX 1: HOUSEHOLD INTERVIEW GUIDE

Confidentiality and consent

Thank you for the opportunity to speak with you. We are Bachelor of Geographical Sciences students from Makerere University conducting a study on community views on tree-based flood mitigation approaches in the Nyamwamba catchment, Uganda. This study seeks to understand community perceptions, participation, and the effectiveness of tree planting in reducing flood risks.

Your household has been selected to participate in this interview, which includes questions on your background, awareness of tree planting activities, factors influencing participation, and challenges faced in implementing these interventions. The discussion will also explore your experiences regarding the effectiveness of tree-based flood mitigation.

Some photographs may be shown at an appropriate time to guide the interview. With your permission, photographs related to environmental conditions or tree planting activities may also be taken. The interview will take approximately 30 minutes to complete, and your participation is voluntary. You are free to respond or not respond to any question. All responses will be treated with strict confidentiality.

Section A: Demographic Information

1. What is your age?

(Please specify in years) __________

2. What is your gender?
   1) Male
   2) Female
   3) Other __________
3. What is your marital status?
   a. Single
   b. Married
   c. Divorced
   d. Widowed
4. What is your primary occupation?

____

5. How many years have you lived in this community?
    1) Less than 10 years
    2) 10-20 years
    3) More than 20 years
6. What is your highest level of education completed?
    1) Primary
    2) Secondary
    3) Diploma or Certificate
    4) Degree
    5) Uneducated

Section B: Awareness and Perceptions of Tree Planting

7. Prior to this survey, were you aware of any tree-planting initiatives for flood mitigation in Nyamwamba?
    1) Yes
    2) No
8. Do you believe that planting trees will significantly reduce flood risk in our community?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree
9. Are you confident that you have the skills and knowledge to participate in tree-planting events?
    1) Yes
    2) No
10. Do you face financial constraints that hinder your ability to take part in tree planting?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree

5) Strongly Disagree

11. Do you have access to the necessary equipment or quality seedlings to plant trees?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree

Section C: Effectiveness of Tree Planting Interventions

12. Since tree-planting began in your area, has the number of flood events decreased?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree

13. Has the peak water level during floods been lower now than before tree planting?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree
14. After heavy rains, do floodwaters recede more quickly than before planting?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree
15. Have streams and rivers appeared cleaner since planting?
    1) Strongly Agree
    2) Agree

3) Neutral
4) Disagree
5) Strongly Disagree

16. Are riverbanks and slopes less prone to washing away now?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree

Section D: Community Engagement and Support

17. Do you actively participate in tree-planting or maintenance activities?
    1) Strongly Agree
    2) Neutral
    3) Disagree
    4) Strongly Disagree
18. Are you satisfied with how the tree-planting program has been implemented?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree
19. Do you believe that local policies adequately support tree-planting for flood mitigation?
    1) Strongly Agree
    2) Agree
    3) Neutral
    4) Disagree
    5) Strongly Disagree
20. Do you trust the organizations/government agencies managing the tree-planting efforts?
    1) Strongly Agree
    2) Agree

3) Neutral
4) Disagree
5) Strongly Disagree

APPENDIX 2: KEY INFORMANT INTERVIEW GUIDE

Thank for the opportunity to speak with you. we are bachelor of geographical sciences students from Makerere university. we are conducting a study on community views on treebased flood mitigation approach. This study seeks to gather in-depth insights from individuals with specialized knowledge about tree planting and flood mitigation in the catchment.

Thank you for taking the time to participate in this questionnaire. your insights as an opinion leader are crucial for understanding the flooding dynamics and the role of tree planting along the catchment thus informing policy decisions in sustainable restoration and conservation of Nyamwamba catchment. please provide your thoughts and perspectives on the following questions.

Background Information

Sub county / Village...

Location..

GPS Location..

Sample Questions:

1. Can you describe the current tree planting initiatives in the Nyamwamba catchment?
2. What types of trees are most commonly planted for flood mitigation?
3. How do you perceive the effectiveness of tree planting in reducing flood risks?
4. What challenges do you face in implementing tree planting initiatives?
5. How do local government policies support or hinder tree planting efforts?
6. What role do community organizations play in tree planting activities?
7. How are tree planting activities funded in this region?
8. What socio-economic factors do you think influence community participation in tree planting?

9. How do you assess community awareness regarding the benefits of tree planting for flood mitigation?

10. Can you share any success stories related to tree planting in the Nyamwamba catchment?

12. What are the main barriers to community engagement in tree planting?

13. How do you think education and awareness programs could improve participation?

14. What is the role of traditional knowledge in tree planting practices?

15. How do you envision the future of tree planting as a flood mitigation strategy in this region?

APPENDIX 3: FOCUSED GROUP DISCUSSION

Focus Group Discussions

Thank for the opportunity to speak with you. We are bachelor of geographical sciences students from Makerere university. We are conducting a study on community views on treebased flood mitigation approach. This study seeks to explore community perceptions and experiences related to tree planting.

Welcome, everyone, and thank you for allowing to participate in this focus group discussion on using your view on tree-based flood mitigation approach. Your insights and experiences are invaluable in understanding how tree planting as a flood mitigation strategy is effective along the Nyamwamba catchment.

Background Information

Sub county / Village..

Location..

GPS Location...

Sample Questions:

1. What are your thoughts on the current tree planting initiatives in the Nyamwamba catchment?
2. How do you think tree planting can help mitigate flooding in your community?
3. What types of trees do you believe are most effective for flood mitigation?
4. Can you share any personal experiences related to flooding and tree planting?
5. What challenges do you face as a community in implementing tree planting initiatives?
6. How do socio-economic factors influence your community's participation in tree planting?
7. What role do you think education plays in promoting tree planting?
8. How do you perceive the impact of tree planting on your community's environment?

9. What suggestions do you have for improving community engagement in tree planting?

10. How do you think local government and NGOs can better support tree planting effort?

APPENDIX 4: OBSERVATION CHECKLIST

This study is focusing on community views on tree-based flood mitigation approaches in the Nyamwamba catchment, Uganda. The study seeks to analyze tree planting activities, community participation, and the perceived effectiveness of these interventions in reducing flood risks within the catchment.

This tool will be administered in selected flood-prone areas within the Nyamwamba catchment to gather information aligning to tree planting practices, species composition, tree health conditions, site management, and the spatial characteristics of planting sites. It will also capture data on community involvement, sensitization efforts, and the existing challenges affecting the implementation and sustainability of tree-based flood mitigation measures.

NO.	Observation Category	Specific Indicators	Findings / Quantitative Data	Qualitative Notes / Remarks
1	Site Inventory	Total number of tree planting sites observed (GPS points where possible)		
2	Species Composition	Proportion of indigenous vs. exotic species; list dominant species present		
3	Tree Maturity Level	Age/size classes of trees (<1 year, 1–3 years, >3 years)		
4	Tree Health Condition	Percentage of healthy, stressed/damaged, and dead trees		

5	Site	Evidence of		
	Maintenance Practices	watering, weeding, mulching, staking, or pruning		
6	Location & Environmental Context	Distance from riverbanks, wetlands, or floodprone zones		
7	Community Participation	Number and categories of people involved (youth, women, farmers, groups)		
8	Awareness & Sensitization	Presence of signposts, posters, training/demo plots		
9	Constraints & Conflicts	Evidence of grazing, land-use conflicts, encroachment, or vandalism		
10	Community Engagement Activities	Ongoing or recent meetings, trainings, or workshops observed		