

Journal of Agriculture & Environmental Sciences



ISSN Online: 2616-8456



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Peer Reviewed Journals & books

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Henriette Ishimwe, Dr. Richard MIND'JE & Joseph Singirankabo

ISSN: 2616-8465

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Henriette Ishimwe¹, Dr. Richard MIND'JE¹ (PhD), Joseph Singirankabo¹

¹*Faculty of Environmental Studies, University of Lay Adventists of Kigali, Kigali, Rwanda*

How to cite this article: Ishimwe H., MIND'JE R., & Singirankabo J. (2026). Assessing Local Community Awareness and Practices Toward Flood Risk Mitigation in Rwanda: A Case Study of Burera District. *Journal of Agriculture & Environmental Sciences Vol 10(1) pp. 15-32.* <https://doi.org/10.53819/81018102t2550>

Abstract

Flooding remains a significant hazard in Rwanda, particularly in Burera District, where steep volcanic terrain, intense rainfall, and heavy dependence on agriculture heighten vulnerability. This study examined community-based flood risk mitigation by analyzing local attitudes, indigenous knowledge, and practices. A mixed-methods design was applied, involving 400 household surveys, 17 semi-structured interviews, and five focus group discussions. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data underwent thematic analysis. Findings indicate moderate flood risk awareness, with mean scores ranging from 2.98 to 3.12. The results showed 233 (58.2%) respondents recognized flooding as a serious problem, 250 (62.5%) reported inadequate information from authorities, and 221 (55.2%) expressed willingness to engage in mitigation efforts. This distribution indicates awareness exists but is constrained by limited institutional communication. Community mitigation practices were uneven, with 200 (50.1%) maintaining drainage systems, while other strategies such as nature-based solutions and early warning systems recorded lower mean scores (2.37–2.81), indicating limited adoption. Furthermore, strong agreement on the awareness–action relationship was observed (means = 3.47–3.77), suggesting communities understand the importance of knowledge in driving action. However, a statistically significant positive relationship ($p < 0.05$) between awareness and mitigation practices (mean = 2.48, SD = 0.57) confirms that awareness alone is insufficient without resources and institutional support.

Keywords: *Flood Risk Mitigation, Community Awareness, Community Practices, Disaster Risk Reduction, Burera District, Rwanda.*

1. Introduction

Flood risk reduction is a major global concern, as floods remain among the most frequent and catastrophic natural disasters, causing significant loss of life, property damage, and environmental degradation (Winsemius et al., 2016). In response, governments and communities worldwide have adopted both structural measures, such as dams and levees, and non-structural approaches, including community-based risk management and awareness initiatives (Zevenbergen et al., 2013). Non-structural strategies such as land-use planning, public education, and early warning systems are particularly important in contexts with limited resources. As climate change and rapid urbanization intensify flood events, flood risk management has increasingly shifted toward proactive and participatory approaches (Green, 2010).

Globally, floods account for a substantial proportion of disaster-related impacts, representing 44% of all disaster events between 2000 and 2019. Their economic consequences are profound, often disrupting national development and stability (Noy, 2009). Countries such as Bangladesh, India, China, and the United States have experienced devastating floods, illustrating the growing scale and frequency of such disasters. These trends highlight the urgent need for effective and sustainable flood risk management strategies.

In Africa, flood risks are exacerbated by rapid population growth, unplanned urbanization, deforestation, and limited disaster management infrastructure (Hirabayashi et al., 2013; Manja et al., 2022). Many countries, including Nigeria, Mozambique, and South Africa, have experienced severe flood events with significant human and economic losses. As a result, community-based approaches have gained prominence, enabling local populations to actively reduce vulnerabilities and strengthen resilience (Douglas et al., 2008). Increasing awareness of flood risks among communities further underscores the importance of local engagement (Opere, 2013; Patel & Burke, 2009).

In Rwanda, flood risks are intensified by mountainous terrain, heavy rainfall, and land-use practices that increase surface runoff and erosion. Local communities often act as first responders, making their knowledge, attitudes, and practices essential in mitigating flood impacts (Mukarurinda, 2019). Burera District is highly vulnerable due to its topography and proximity to water bodies. A recent flood event affected 1,919 households and approximately 9,595 people, demonstrating the severity of the problem (ReliefWeb, 2023).

Despite government interventions, flood mitigation efforts often rely on top-down approaches that inadequately incorporate local perspectives (UNDRR, 2019). This creates a gap between policy and practice, limiting effectiveness and sustainability. Furthermore, indigenous knowledge and community practices remain under-documented, while barriers to community participation are insufficiently understood (Nsengiyumva, 2017; MIDIMAR, 2012). Therefore, this study examines community awareness, attitudes, and practices toward flood risk mitigation in Burera District to inform context-specific and sustainable strategies.

1.2 Objectives of the Research

1.2.1 General objective

The general objective of the study was to investigate awareness of local community on flood risk mitigation in Burera District.

1.2.2. Specific objectives

- i. To assess the existing flood mitigation techniques adopted by local communities.
- ii. To evaluate the level of community awareness on flood risk mitigation.
- iii. To determine the relationship between the local community awareness and practices and flood risk mitigation.

2. Research Methods

2.1 Description of the Study Area

Burera District, in Rwanda's Northern Province bordering Uganda, is part of the Virunga volcanic region, characterized by rugged, rocky terrain. The district receives heavy rainfall during its two rainy seasons, increasing the risk of flash floods and landslides. Administratively, it comprises 17 sectors, subdivided into cells and villages, with a population of 387,729 (NISR, 2022). The local economy is predominantly agricultural, with residents relying on subsistence farming of crops such as potatoes, beans, maize, and wheat, making livelihoods highly vulnerable to climate-related disruptions.

The district's landscape is defined by Lakes Burera and Ruhondo, which can both mitigate and exacerbate flooding. Burera experiences both riverine and flash floods, often causing significant damage to infrastructure, homes, and farmland. Many settlements are located on slopes or near water bodies, increasing flood susceptibility. Access to basic social services is uneven, with limited road networks, poor drainage, and restricted access to piped water and electricity in remote areas, further weakening resilience.

Local communities combine traditional flood management practices with modern adaptation strategies, supported by strong social cohesion. Government and NGO-led initiatives are promoting climate-resilient construction and land-use planning. This combination of indigenous knowledge, community networks, and external support is critical for implementing effective, community-based flood mitigation strategies

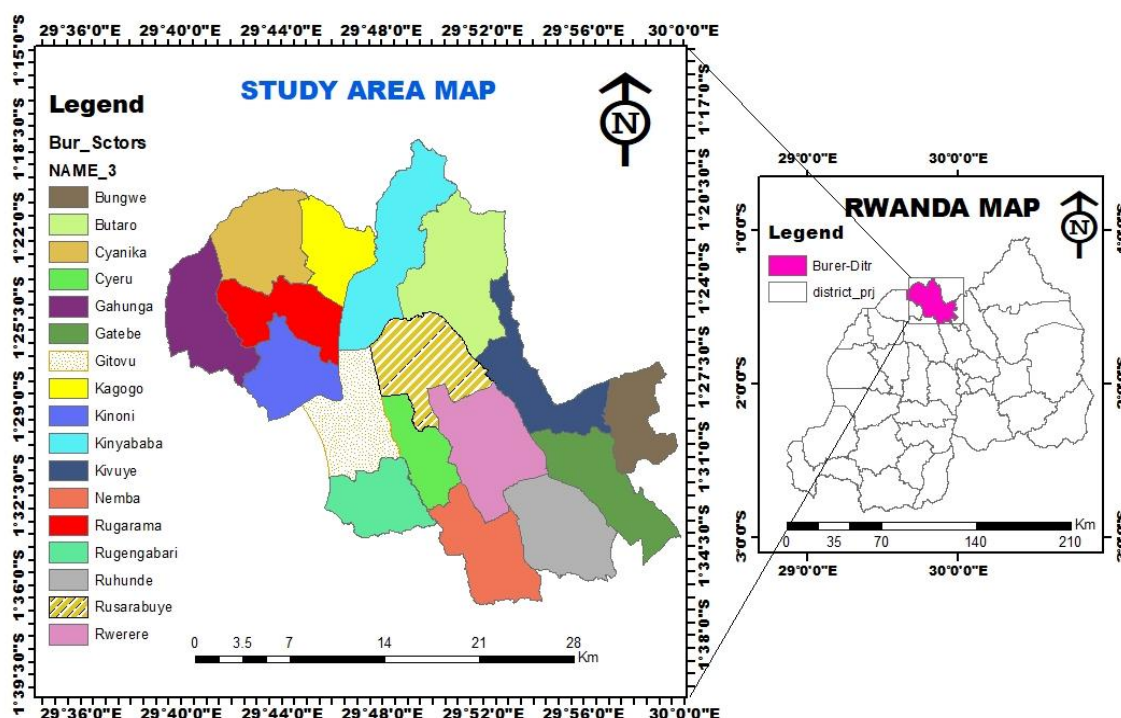


Figure 1: Geographical Location Map of the Study Area

Source: Researcher mapping in Arc GIS 10.8, 2025

2.2. Research design and data collection methods

This study employed a mixed-methods research design to comprehensively examine community awareness and practices related to flood risk mitigation in Burera District, Rwanda. The design combined quantitative and qualitative approaches to provide both generalizable insights and context-specific understanding. Quantitative data were collected through structured questionnaires administered to a representative sample of 400 respondents, including 378 local residents, 17 local leaders, and 5 disaster management representatives. The questionnaires captured measurable information on awareness, preparedness, and mitigation practices, allowing statistical analysis of trends across demographic groups.

Qualitative data were gathered using key informant interviews with local leaders, environmental officers, and disaster management personnel, as well as five focus group discussions with community members from flood-prone sectors. These explored local experiences, traditional coping mechanisms, social dynamics, and institutional challenges influencing flood management. Field observations assessed the effectiveness of physical mitigation measures such as drainage systems, terracing, and reforestation.

Sampling included simple random selection for community members, purposive sampling for knowledgeable key informants, and convenience sampling for focus group participation. Inclusion criteria ensured participants were adults (18+), long-term residents

(minimum three years), and actively involved in flood management where applicable.

Secondary data from government records, policy documents, and prior research complemented primary data, providing historical, policy, and contextual perspectives. The combination of surveys, interviews, focus groups, observations, and document reviews ensured a comprehensive, reliable, and context-sensitive assessment of community-level flood risk awareness and mitigation practices in Burera District.

2.3. Data analysis and processing

The study employed both quantitative and qualitative data analysis to assess community awareness and practices regarding flood risk mitigation in Burera District. Quantitative data from 400 structured questionnaires were analyzed using SPSS 30.0, while qualitative data from interviews and focus groups were analyzed thematically. Descriptive statistics—including frequencies, percentages, means, and standard deviations—summarized commonly adopted mitigation techniques and awareness levels across demographic groups. Likert-scale responses were converted into mean awareness indices. Inferential analyses, including Pearson correlation and multiple linear regression, determined relationships between awareness and mitigation practices.

Data processing involved editing for accuracy, coding responses into sub-variables, and tabulating results for descriptive and inferential analysis. Qualitative data were coded and categorized into key themes reflecting community experiences, attitudes, and indigenous knowledge. Reliability was ensured through standardized, pre-tested instruments, clear coding procedures, and consistent analysis methods. Validity was addressed via content, construct, internal, and external considerations, including cross-checking observed behaviors and ensuring representative sampling.

Ethical considerations included informed consent, confidentiality, voluntary participation, and respect for local cultural norms. Data were securely stored and anonymized, and participants were informed of their right to withdraw. Researcher reflexivity minimized bias, and findings were shared with the community to support local flood mitigation efforts. Limitations included potential respondent hesitancy, language and literacy barriers, and accessibility challenges, which were mitigated using local assistants, translated materials, and alternative transportation methods. These measures ensured credible, comprehensive, and ethically grounded findings

3. Results

3.1. To determine the relationship between the local community awareness and practices and flood risk mitigation

Table 1 explores the relationship between the local community awareness and practices and flood risk mitigation.

Table 1. Relationship between community awareness, practices and effective flood risk mitigation

Statement	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	Std. Dev.
People who understand flood risks are more likely to take action.	5.8	10.2	15.3	42.7	26.0	3.73	1.02
Community awareness leads to effective early warning responses.	7.2%	14.0	21.8	38.5	18.5	3.47	1.08
Strong community participation improves flood preparedness.	6.5	12.0	18.0	40.3	23.2	3.62	1.05
Lack of knowledge limits effective implementation of flood mitigation strategies.	4.7	9.8	16.5	41.7	27.3	3.77	1.00
Awareness without resources does not lead to effective flood mitigation.	5.5	11.3	18.2	39.0	26.0	3.68	1.03
People are willing to support flood efforts if they are informed and involved.	6.0	9.5	17.3	41.0	26.2	3.72	1.02

The assessment of the relationship between community awareness, practices, and effective flood risk mitigation reveals strong consensus on the interconnected nature of these factors, while highlighting critical gaps that explain the implementation challenges observed in previous results. Community members demonstrate clear understanding that flood risk knowledge drives action, with 42.7% agreeing and 26.0% strongly agreeing that people who understand flood risks are more likely to take action, while only 5.8% strongly disagree and 10.2% disagree, with 15.3% neutral (mean = 3.73). This strong recognition of the knowledge-action relationship validates the earlier findings showing moderate awareness levels but inconsistent mitigation practices. The implication is that the community understands the theoretical importance of awareness, yet the previously observed gaps in actual flood knowledge (where over one-third lacked adequate understanding) directly explain why mitigation adoption remains limited despite this recognition.

The connection between awareness and emergency response receives substantial support, with 38.5% agreeing and 18.5% strongly agreeing that community awareness leads to effective early warning responses, compared to 7.2% who strongly disagree and 14.0% who disagree, with 21.8% neutral (mean = 3.47). This understanding contrasts sharply with the previous finding that 61.5% of respondents reported inadequate early warning information from authorities. The implication is that while communities recognize the value of awareness for emergency response, the institutional failure to provide timely warnings undermines this potential, creating a disconnect between community readiness and system delivery that could prove dangerous during actual flood events.

Community participation's role in flood preparedness receives strong endorsement, with 40.3% agreeing and 23.2% strongly agreeing that strong community participation improves flood preparedness, while 6.5% strongly disagree and 12.0% disagree, with 18.0% neutral (mean = 3.62). This aligns with the earlier finding that 55.2% expressed willingness to participate in mitigation activities and 50.1% showed actual participation in drainage

<https://doi.org/10.53819/81018102t2550>

maintenance. The implication is that communities possess the theoretical understanding and practical willingness for collective action, but the previously observed weak community prioritization (mean = 2.41) suggests that this participation potential remains underutilized due to inadequate coordination and leadership structures.

The critical role of knowledge in strategy implementation receives the strongest consensus, with 41.7% agreeing and 27.3% strongly agreeing that lack of knowledge limits effective implementation of flood mitigation strategies, while only 4.7% strongly disagree and 9.8% disagree, with 16.5% neutral (mean = 3.77). This finding directly explains the implementation gaps observed in mitigation techniques, where nature-based solutions and flood-resistant construction showed poor adoption rates (means of 2.75, 2.81, and 2.49 respectively). The implication is that the moderate awareness levels found earlier are insufficient for complex mitigation implementation, suggesting that current educational efforts must be significantly enhanced to bridge the knowledge-implementation gap.

The resource constraint recognition shows strong agreement, with 39.0% agreeing and 26.0% strongly agreeing that awareness without resources does not lead to effective flood mitigation, while 5.5% strongly disagree and 11.3% disagree, with 18.2% neutral (mean = 3.68). This understanding helps explain why communities showed high willingness to participate (mean = 3.43) but limited actual mitigation adoption in areas requiring significant resources, such as flood-resistant housing construction. The implication is that the previously observed institutional support gaps (mean = 2.43) create a critical barrier where community awareness and willingness cannot translate into effective action without adequate resource provision and government backing.

Finally, the conditional nature of community support receives strong validation, with 41.0% agreeing and 26.2% strongly agreeing that people are willing to support flood efforts if they are informed and involved, compared to 6.0% who strongly disagree and 9.5% who disagree, with 17.3% neutral (mean = 3.72). This finding bridges the apparent contradiction between high individual willingness to participate and weak community prioritization observed earlier. The implication is that the information dissemination gaps (62.5% reported insufficient information) and lack of meaningful involvement opportunities prevent the translation of individual willingness into collective community action. This suggests that addressing communication and participation mechanisms could unlock the significant community engagement potential identified in the previous assessments, transforming individual awareness and willingness into effective collective flood risk management.

Table 2: Correlation analysis between community awareness, practices and flood mitigation measures

		Community awareness and practices	Flood mitigation measures	Relationship
Community awareness and practices	Pearson Correlation	1	0.241	0.041
	Sig. (2-tailed)		<0.001	0.416
	N	400	400	400
Flood mitigation measures	Pearson Correlation	0.241	1	0.079
	Sig. (2-tailed)	<0.001		.113
	N	400	400	400
Relationship	Pearson Correlation	0.041	0.079	1
	Sig. (2-tailed)	0.416	0.113	
	N	400	400	400

Correlation is assessed at the 0.01 level (2-tailed).

The Pearson correlation coefficient between community awareness and flood mitigation strategies is 0.241, not significant at the 0.01 level (p -value < 0.001). This positive connection suggests a moderate relationship between community awareness, practices and the adoption of flood mitigation measures. As the community becomes more aware of flood dangers and mitigation options, the possibility of implementing these tactics improves. This shows that raising knowledge may lead to increased use of flood prevention methods in the community.

The correlation coefficient between community awareness and attitudes and the association between community attitudes and practices is 0.041, which is not statistically significant (p -value = 0.416). This very little positive correlation implies that there is no substantial relationship between the community's awareness of flood hazards and how their opinions influence the actual practices they use. It means that even if the community is aware of the risks, it may not take meaningful steps to alleviate them. The connection between community awareness, practices and flood mitigation measures is weak (0.079) and statistically insignificant (p -value = 0.113), suggesting that factors like financial resources, technology access, or external support may have a stronger influence on adopting flood mitigation techniques than attitudes. While there is a moderate positive correlation between community awareness and the use of flood mitigation techniques, awareness alone does not guarantee the implementation of these measures. The relationship between community beliefs, behaviors, and actual flood mitigation practices is weak and non-significant, indicating that awareness and positive attitudes do not always lead to consistent or widespread adoption of flood mitigation strategies. Additional interventions may be needed to bridge the gap between awareness, attitudes, and action.

Table 3: Community awareness and flood mitigation measures

Dependent Variable	R	R ²	Adj. R ²	F (df1, df2)	P-value	Std. Beta	Unstd. B	Significant level	Interpretation
Drainage Maintenance	0.202	0.041	0.038	16.98 (1, 399)	< 0.001	0.202	0.476	Significant	Small but significant positive effect; awareness explains 4.1% of variance in drainage actions.
Flood-Resistant Housing Design	0.050	0.002	0.000	0.995 (1, 399)	0.319	-0.050	-0.106	Not Significant	No meaningful relationship; other factors like finances likely drive housing design choices.
Early Warning Systems	0.210	0.044	0.042	18.50 (1, 399)	< 0.001	0.210	0.466	Significant	Statistically significant positive impact; community awareness improves timely warning receipt.
Sustainable land practices	0.110	0.012	0.010	4.91 (1, 399)	0.027	0.110	0.295	Not significant	No significant relationship; awareness is a minor factor among others influencing land practices.

Significant were assessed at 0.01

The regression analysis examined the relationship between community awareness and four key flood mitigation measures, revealing varying degrees of association across different types of interventions. The results demonstrate that community awareness has a statistically significant positive impact on three out of four flood mitigation measures, though the overall explanatory power remains modest.

Early warning systems showed the strongest relationship with community awareness ($r = 0.210$, $p < 0.001$), explaining 4.4% of the variance in warning system utilization. This suggests that increased community awareness significantly improves timely warning receipt and response, with each unit increase in awareness leading to a 0.466 unit increase in early warning system effectiveness. Similarly, drainage maintenance activities demonstrated a significant positive relationship ($r = 0.202$, $p < 0.001$), with awareness explaining 4.1% of the variance in drainage actions. Sustainable land practices, particularly terracing, showed a weaker but still significant relationship with community awareness ($r = 0.110$, $p = 0.027$), explaining only 1.2% of the variance. This indicates that while

awareness contributes to land management decisions, it represents a minor factor among other influences. In contrast, flood-resistant housing design showed no meaningful relationship with awareness ($r = 0.050$, $p = 0.319$), suggesting that financial constraints and structural factors dominate housing design choices rather than awareness levels.

The findings reveal that community awareness more effectively influences behavioral adaptations and information-dependent activities than resource-intensive structural investments. The strongest relationships occur with collective action items such as drainage maintenance and warning systems, while individual structural investments like housing modifications remain largely unaffected by awareness levels. These results suggest that while awareness campaigns can be valuable for promoting certain flood mitigation behaviors, they should be coupled with financial support and infrastructure development for comprehensive flood risk reduction, as awareness alone explains only a small portion of the variance in mitigation measure adoption.

4. Results

4.1 To assess the existing flood mitigation techniques adopted by local communities

Table 4 outlines the existing flood mitigation techniques adopted by the community. The data reveal mixed levels of implementation across various strategies.

Table 4: Existing flood mitigation techniques adopted by the community

Statement	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	Std. Dev.
My community has taken measures to reduce flood risks.	13.5	22.7	24.3	28.0	11.5	3.02	1.14
My community has adopted afforestation/reforestation to prevent flooding.	19.2	27.5	21.5	22.8	9	2.75	1.18
Soil conservation techniques such as terracing are widely used here.	17.3	26	25	21.0%	10.7	2.81	1.16
Flood-resistant housing structures are being constructed in this area.	24.8	30.2	22.0	16.3	6.7	2.49	1.15
Community members participate in cleaning and maintaining drainage systems.	11.2	18.7	20.0	32.8	17.3	3.26	1.16
We receive timely flood early warning information from authorities.	28.5	33	18	14	6.5	2.37	1.12
The local government supports the implementation of flood mitigation measures.	26.8	31.3	20.2	15.5	6.2	2.43	1.11

The assessment of existing flood mitigation techniques reveals a mixed picture of community efforts with significant implementation gaps and institutional challenges. Regarding general mitigation measures, 28.0% of respondents agree and 11.5% strongly agree that their community has taken measures to reduce flood risks, while 13.5% strongly disagree and 22.7% disagree, with 24.3% remaining neutral (mean = 3.02). This moderate level of perceived action suggests that while some flood risk reduction efforts exist, they may be limited in scope or visibility. The implication is that current mitigation efforts may

be insufficient or poorly communicated, potentially leaving substantial portions of the community inadequately protected and unaware of existing protective measures.

For nature-based solutions, community adoption of afforestation and reforestation shows concerning gaps, with 19.2% strongly disagreeing with and 27.5% disagreeing that such measures are adopted, compared to 22.8% who agree and 9.0% who strongly agree, with 21.5% neutral (mean = 2.75). Similarly, soil conservation techniques like terracing face limited implementation, with 17.3% strongly disagreeing with and 26.0% disagreeing about their widespread use, while 21.0% agree and 10.7% strongly agree, with 25.0% neutral (mean = 2.81). These results indicate inadequate adoption of ecosystem-based flood management approaches, which has significant implications for long-term flood resilience. The limited use of nature-based solutions suggests missed opportunities for sustainable, cost-effective flood control that could provide multiple environmental benefits while reducing flood risks.

Infrastructure development shows particularly weak performance, with flood-resistant housing construction receiving the lowest support. A substantial 24.8% strongly disagree and 30.2% disagree that flood-resistant structures are being constructed, compared to only 16.3% who agree and 6.7% who strongly agree, with 22.0% neutral (mean = 2.49). This critical infrastructure gap implies that the community remains highly vulnerable to flood damage, as existing buildings may not be designed to withstand flooding. The lack of flood-resistant construction suggests that future flood events could result in significant property damage and potential loss of life, particularly affecting the most vulnerable community members.

Community participation in maintenance activities shows more encouraging results, with 32.8% agreeing and 17.3% strongly agreeing that community members participate in cleaning and maintaining drainage systems, while 11.2% strongly disagree and 18.7% disagree, with 20.0% neutral (mean = 3.26). This relatively high level of community engagement in drainage maintenance suggests strong social capital and collective responsibility for flood management. The implication is that communities are willing to take direct action when they understand how to contribute, indicating potential for expanding community-based flood management initiatives. However, nearly 30% who disagree or are neutral suggests that participation could be more widespread and systematic.

Early warning systems face significant challenges, with 28.5% strongly disagreeing and 33.0% disagreeing that they receive timely flood early warning information from authorities, compared to only 14.0% who agree and 6.5% who strongly agree, with 18.0% neutral (mean = 2.37). This critical communication failure has severe implications for community safety and emergency preparedness. Without timely early warning information, residents cannot make informed decisions about evacuation or protective actions, potentially leading to increased casualties and property damage during flood events. The lack of effective early warning systems undermines the entire flood risk management framework and leaves communities reactive rather than proactive in flood response.

Local government support also shows substantial deficiencies, with 26.8% strongly disagreeing and 31.3% disagreeing that local government supports flood mitigation implementation, while only 15.5% agree and 6.2% strongly agree, with 20.2% neutral (mean = 2.43). This perceived lack of institutional support has far-reaching implications for comprehensive flood management. Without adequate government backing, communities may struggle to implement large-scale mitigation measures, access technical

expertise, or coordinate regional flood management efforts. The institutional gap suggests that flood risk reduction efforts may remain fragmented and under-resourced, potentially limiting their effectiveness and sustainability over time.

4.2 To evaluate the level of community awareness on flood risk mitigation

Table 5 presents respondents' levels of awareness regarding flood risk in the community. The responses reflect varying degrees of understanding, concern and willingness to engage in mitigation activities.

Table 5: Community awareness toward flood risk

Statement	SD (%)	D (%)	N (%)	A (%)	SA (%)	Mean	Stdv
I am aware of the causes of flooding.	12.0	23.5	27.0	26.3	11.2	2.98	1.14
I understand the potential risks and damages caused by flooding.	10.3	21.	25.8	29.5	12.7	3.12	1.09
The community receives sufficient information on flood risk mitigation.	28.0	34.5	19.2	13.8	4.5	2.32	1.08
Flooding is a serious problem in my area.	8.5	12.3	21	35.2	23	3.52	1.09
I believe floods can be controlled through community efforts.	11.8	19.5	24.0	28.7	16.0	3.18	1.14
I am willing to participate in flood risk mitigation activities.	9.3	14.7	20.8	34.5	20.7	3.43	1.10
Government and NGOs provide adequate support for flood mitigation.	31.0	29.8	20.5	12.3	6.4	2.34	1.11
My community prioritizes flood risk reduction.	27.5	30.2	21.7	14.5	6.1	2.41	1.10

The community flood risk awareness assessment reveals a nuanced picture of awareness levels and systemic challenges. Regarding basic knowledge, 26.3% of respondents agree and 11.2% strongly agree that they are aware of flooding causes, while 12.0% strongly disagree and 23.5% disagree, with 27.0% remaining neutral (mean = 2.98). Similarly, for understanding flood risks and damages, 29.5% agree and 12.7% strongly agree, compared to 10.3% who strongly disagree and 21.7% who disagree, with 25.8% neutral (mean = 3.12). These moderate awareness levels suggest that while a reasonable portion of the community has basic flood knowledge, there remains a significant knowledge gap affecting over one-third of residents. This implies that targeted educational programs are needed to reach those with limited understanding, as inadequate awareness can lead to poor preparedness decisions and increased vulnerability during flood events.

In addition, the community clearly recognizes flooding as a local threat, with 35.2% agreeing and 23.0% strongly agreeing that flooding is a serious problem in their area, while

only 8.5% strongly disagree and 12.3% disagree, with 21.0% neutral (mean = 3.52). This high level of concern indicates that the community has likely experienced flooding impacts or witnessed its effects firsthand. The implication is positive for risk management efforts, as communities that recognize threats are more likely to support mitigation investments and behavioral changes. However, the 21% neutral response suggests some residents may not fully grasp the local risk, potentially creating pockets of unpreparedness.

However, significant gaps exist in information dissemination, as 28.0% strongly disagree and 34.5% disagree that the community receives sufficient flood risk information, with only 13.8% agreeing and 4.5% strongly agreeing, and 19.2% neutral (mean = 2.32). This critical information deficit has serious implications for community preparedness and response capacity. Without adequate information flow, residents cannot make informed decisions about flood preparedness, may lack awareness of evacuation procedures, and are unlikely to adopt appropriate risk reduction measures. This communication gap could significantly undermine the effectiveness of any flood management initiatives and leave the community vulnerable to preventable losses.

Despite information gaps, community engagement potential appears promising. For flood control through community efforts, 28.7% agree and 16.0% strongly agree, while 11.8% strongly disagree and 19.5% disagree, with 24.0% neutral (mean = 3.18). Participation willingness is even higher, with 34.5% agreeing and 20.7% strongly agreeing to participate in mitigation activities, compared to 9.3% who strongly disagree and 14.7% who disagree, with 20.8% neutral (mean = 3.43). These results suggest strong social capital and community spirit that could be leveraged for flood risk reduction. The implication is that community-based flood management approaches could be highly effective if properly organized and supported. However, the substantial neutral responses indicate that many residents may need additional motivation or clearer understanding of how they can contribute to flood control efforts.

However, institutional support faces criticism, with 31.0% strongly disagreeing and 29.8% disagreeing that government and NGOs provide adequate support, while only 12.3% agree and 6.4% strongly agree, with 20.5% neutral (mean = 2.34). This perception of inadequate institutional support has significant implications for community resilience and flood risk management effectiveness. When communities feel unsupported by formal institutions, they may lose confidence in official flood management efforts, potentially leading to reduced compliance with regulations and decreased participation in formal mitigation programs. This institutional gap could also result in communities taking inadequate or inappropriate individual actions that may not align with broader flood management strategies.

Community prioritization also shows weakness, with 27.5% strongly disagreeing and 30.2% disagreeing that their community prioritizes flood risk reduction, compared to 14.5% who agree and 6.1% who strongly agree, with 21.7% neutral (mean = 2.41). This lack of perceived community prioritization implies that despite individual awareness and willingness to participate, there may be insufficient collective action and coordination at the community level. The implication is that flood risk reduction may remain fragmented and ineffective without strong community leadership and organized priority-setting. This could result in missed opportunities for comprehensive flood management approaches and may leave the community reactive rather than proactive in addressing flood risks.

4.3 Discussion

The average score for community understanding and attitudes towards flood threats reflects a moderate to poor level of awareness among the residents of Burera District. The findings demonstrate a wide disparity in awareness, where a minority of individuals demonstrates high levels of understanding, while a significant portion appear uninformed or disengaged. This result aligns with prior studies indicating that low awareness levels impede the community's ability to respond effectively to flood risks. For instance, Wachira et al. (2014) found that low levels of community knowledge in Kenya significantly delayed evacuation and increased vulnerability during flood events. Similarly, Pelling (2003) emphasizes that community participation, a critical component of effective disaster risk reduction, is highly dependent on adequate knowledge and awareness. The implication here is that educational interventions are vital. Without targeted awareness programs, especially for vulnerable and marginalized populations, flood risk mitigation efforts are likely to remain ineffective. UNDRR (2015) further supports this, stating that risk knowledge is a foundational pillar of community resilience.

The relatively low mean awareness also suggests that people may recognize the presence of flood hazards but lack actionable knowledge on how to mitigate them. This is consistent with the knowledge-action gap discussed by Cutter et al. (2003), who argue that awareness alone is often insufficient to prompt proactive behavior. A perceived lack of urgency, limited local resources, or a fatalistic mindset may prevent individuals from adopting protective behaviors even when they are aware of the risks. These findings imply that interventions should go beyond simply raising awareness they must also address motivational and structural barriers. As Paton and Johnston (2001) highlight, perceived self-efficacy, response effectiveness, and social support are equally important in translating knowledge into preparedness actions.

The mean score of 2.48 for the relationship between community attitudes and behaviors indicates a moderate alignment between what individuals think and how they act with respect to flood mitigation. This partially supports Kloos et al. (2019), who found that awareness and attitudes do influence behavior, but behavioral adoption is frequently hindered by external constraints. In many cases, even when individuals have a positive attitude toward preparedness, financial limitations, lack of technical capacity, or absence of institutional support make implementation difficult. As Grothmann (2006) suggest, adaptive behavior is shaped by both internal motivational drivers and external enabling conditions. In the Burera context, this moderate score may indicate that while communities are somewhat willing, they lack the institutional backing or material means to act fully on their knowledge and beliefs.

The moderate standard deviation in awareness and behaviors reflects heterogeneity in community engagement, pointing to inequities in flood preparedness. Some individuals or groups are clearly more engaged and proactive than others. This finding aligns with the concept of social vulnerability as discussed by Blaikie et al. (1994) in their Pressure and Release (PAR) Model, which explains how marginalization, poverty, and lack of access to resources create differentiated levels of risk. The implication is that flood mitigation cannot be addressed uniformly it must be tailored to local socio-economic and demographic contexts. For example, women-headed households, the elderly, or informal settlers may be more vulnerable and less prepared, necessitating targeted interventions that bridge these gaps. According to Wisner et al. (2012), furthermore reducing disaster risk requires

understanding and addressing the root causes of vulnerability, not just hazard exposure.

Regarding community flood mitigation strategies, the mean score suggests that implementation is occurring, but only at a basic level. The community is engaging in activities such as clearing ditches or constructing simple physical barriers, which are low-cost and locally driven measures. This observation is in line with Schipper et al.(2006), who found that in resource-constrained settings, local populations often rely on incremental and reactive strategies rather than transformative or preventive approaches. These measures, while valuable, may not be sufficient to cope with increasing flood risks due to climate variability and urbanization. Therefore, community strategies need to be integrated with long-term structural solutions, technical guidance, and institutional coordination to be sustainable. The standard deviation of 0.59 in flood mitigation strategy use suggests that while some individuals or groups are utilizing more advanced or diverse techniques, others are heavily reliant on traditional or rudimentary approaches. This disparity may reflect differences in education, income, access to extension services, or exposure to external training and awareness campaigns. According to Lumbroso et al.(2011), blending indigenous knowledge with scientific flood risk management practices offers a powerful approach, but it requires structured platforms for knowledge exchange and capacity building. The implication here is that government and NGO-led programs should aim to standardize training, provide equitable access to resources, and encourage knowledge sharing between more and less experienced community members. Additionally, integrating local leaders and community-based organizations in flood risk education could enhance uptake and legitimacy of these practices, as noted by Mercer et al. (2010).

5. Conclusion

In conclusion, this study assessed community awareness and practices regarding flood risk mitigation in Burera District, Rwanda, revealing a moderate level of awareness but limited adoption of effective mitigation strategies. While basic measures like drainage maintenance were practiced, participation in advanced and sustainable approaches remained low. The findings showed a moderate relationship between community attitudes and mitigation behaviors, highlighting those external factors such as resources, institutional support, and technical knowledge significantly influence the implementation of effective measures. The study emphasizes the need for comprehensive education and training programs that provide practical tools and guidance, alongside strengthened institutional support, to bridge the gap between awareness and action. Enhancing community engagement, policy assistance, and access to resources will improve Burera District's resilience to floods, safeguarding livelihoods, infrastructure, and overall community well-being.

6. References

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