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Abstract
Household involvement in disaster risk reduction (DRR) has been identified as an essential foundation of resilience. However, empirical evidence on the levels and quality of household involvement is limited in terms of awareness, mobilisation and response. This study evaluated household involvement in flood disaster risk reduction (DRR) programmes in informal settlements (Kibra and Mathare) of Nairobi City County, Kenya, among state and non-state actors using a mixed-methods approach. Data were collected from 455 respondents comprising 398 household heads, 42 community leaders, ten non-state and five state actors using the use of questionnaires, interviews, focus group discussions, and photography. Findings show low levels of household involvement in six DRR activities (49.2-64.0% saying they were involved in none), preparedness kits (64.0%), and training/drills (61.4%). Slight involvement is the highest at 46.2% and active involvement is low at 8 or less than 2.0%. Qualitative insights reveal exclusion from top-down planning, loss of trust, and motivation. Correlation analysis reveals strong linkages of inter-activity (training and preparedness kits, $r=0.882$, $p<0.01$), suggesting integrated interventions, which amplify involvement. Despite the high level of flood risk awareness (61.9%), the proportion with emergency kits and adopting proactive measures is low (19.5% and 17.0% respectively), highlighting the knowledge-action gap. Preparedness is the highest in DRR performance, followed by recovery, mitigation, and response. Structural barriers, tenure insecurity, and lack of resources are barriers to involvement. The study recommends the use of participatory approaches, integration of local champions, and incentives such as technical support to build resilience in communities.

Introduction
Household involvement in disaster risk reduction (DRR) has been identified worldwide as one of the essential foundations of resilience, focusing on awareness, community mobilisation, and preparedness measures (IFRC & Save the Children, 2018). Studies from high-income countries reveal the importance of insurers as co-educators in reducing risk levels by creating dedicated DRR

messages (Seifert-Dähnn, 2018). Moreover, the emphasis on knowledge without enabling conditions is hardly transformed into preparedness (Elum & Lawal, 2022). The Global Assessment Reports from 2019 to 2025 promote inclusivity in decision-making and governance but provide minimal micro-level data on household organisation at the informal urban level (UNDRR, 2025).

Elum and Lawal (2022) demonstrate that Ghana has already preparedness and a higher risk perception through targeted communication but still has gaps in behaviour. Incoherent land management and poor urban development are setbacks to awareness efforts in Accra (Oteng-Ababio et al., 2024). There are heterogeneous barriers to mobilisation, but poorer and smaller households are limited by education, networks, and resources that are worse than those of others (Howard et al., 2024). It has weak anticipatory systems and a limited citizen organising capacity, and there is little evidence available regarding mobilisation models (Islamic Development Bank, 2024). The array of quasi-experimental and longitudinal studies that are underexploited limits information on the persistence and scalability of household DRR measures.

The analysis of the policy in Kenya reveals the risks of disunity in the dissemination of risk, and that the linkage between the state and non-state actors increased the responsibility in Kenya (KIPPRA, 2019). Although national plans focus on predictive action and knowledge management, they lack strong indicators to assess household-level awareness in informal settlements (Ministry of Interior and National Administration, 2025). It has been proven that households continue to experience high reliance on informal means of coping, and a low adoption of market-based instruments is observed, characterised by low-income volatility, low financial literacy, and high premiums (Shibia, 2018; KIPPRA, 2020). The predictive cash transfer players or suggestions on using social protection tools may enhance preparedness; however, there is relatively little evidence on this issue in informal settlements, as opposed to Kenya-specific publicity (Weingärtner & Wilkinson, 2019).

The informal settlements of Nairobi have been the setting for practice-based activities, such as co-created communal spaces and flood toolkits, potentially offering awareness and mobilisation (PreventionWeb, 2021). Nonetheless, little research has been done on the levels of household-level outcomes, such as preparedness intentions or behavioural change. Content portals are descriptions of institutional structures, but do not include evaluations on the effectiveness of last-mile communication in various literacy and language settings (Baariu, 2017). This density, insecure tenure, and decentralised power structures further complicate mobilisation. Household compliance remains inconclusive, despite hydrodynamic modelling indicating high-risk dwellings. These loopholes automatically limit responsibility and sound programme design.

Various state and non-state initiatives aim to reduce flood disaster risk (DRR) in the informal settlements of Nairobi; however, evidence is scarce regarding household interventions. The focus of literature on tenure insecurity is on structural or policy aspects, as well as household-level processes, which include tenure insecurity and tenure bridges, not to mention households with insecure tenure sources, particularly in ex-urban areas (Oteng-Ababio et al., 2024; Seifert-Dähnn, 2018). This hinders the evaluation of long-term engagement due to the lack of standardised indicators and longitudinal tracking (Elum & Lawal, 2022; Howard et al., 2024). Although community-designed areas and flood toolkits exist, there are few rigorous impact assessments (PreventionWeb, 2021).

Conceptual framework

This study used a Political Ecology Theory. This theory was first articulated by Eric R. Wolf in 1972, and it examines the interplay between environmental issues, ecological processes, socio-

economic inequalities, and political power structures. It interrogates non-political environmental narratives by situating risk and vulnerability within the context of history, institutions, and governance. In this study, the theory is applied towards analysing household involvement in state and non-state flood DRR initiatives in the informal settlements in Nairobi, recognising that the processes of awareness, mobilisation, and response are mediated by tenure insecurity, fragmented authority, and unequal resource access. By situating household flood DRR within these structural constraints, Political Ecology has aided in explaining the variation in household involvement and the need for interventions focused on responses to immediate hazards as well as the more fundamental political causes of vulnerability.

Materials and methods

This study employed a mixed-methods research design to investigate household involvement in flood disaster risk reduction (DRR) initiatives undertaken by state and non-state actors in informal settlements in Nairobi. A descriptive survey was employed to capture the characteristics of the DRR initiatives, and a cross-sectional approach was used to gain insights into community involvement.

The research focused on Kibra (~300,000 persons, 511 NGOs) and Mathare (~206,564 persons, 50 NGOs, 300 CBOs), both located along riparian corridors with poor drainage, dense populations and socio-economic vulnerabilities leading to high flood risk during the March to May and October to December rainy seasons.

The target study population included 81,667 household heads from selected wards, 42 community leaders (*Nyumba Kumi* elders, youth and women's groups). The elders of *Nyumba Kumi*, youth groups, and women's groups were purposely recruited in Kibra and Mathare to ensure representation. Using the Chiefs, the researcher was able to recruit *Nyumba Kumi* elders, women groups and youth groups. The study selected ten non-state actors (NGOs, CBOs, FBOs) who have DRR functions and five state actors with DRR functions (Nairobi City County Disaster Management Department, Kenya Meteorological Department, Water Resources Authority and National Disaster Operations Centre).

A stratified sampling strategy by sub-county was employed, utilising purposive sampling for state/non-state actors, as well as community leaders, and simple random sampling for households. Using Taro Yamane's formula, the household sample size was 398, proportionately distributed by ward. A total of 455 people participated in the survey.

Primary data collection included household questionnaires, semi-structured 30-minute interviews with state and non-state actors, and six focus group discussions (with 42 participants). The content validity of the data tools was confirmed (CVI = 0.938), and reliability was high (Cronbach's alpha = 0.955). Quantitative data were analysed using descriptive statistics and Pearson's correlation to determine associations, as determined by the Statistical Package for the Social Sciences. Qualitative data were thematically analysed using verbatim transcription and coding from the audio recordings of the interviews and FGDs.

Ethical approval was sought from the Institutional Scientific Ethics Review Committee of Masinde Muliro University of Science and Technology and NACOSTI. Informed consent, confidentiality through encrypted storage and voluntary participation were guaranteed, with local authorities being notified.

Results and discussion

Involvement of the household in state and non-state actors' initiatives in flood DRR

Findings from Table 1 show that most households report low levels of involvement across all six flood DRR activities. Over half of respondents (49.2–64.0%) are not involved at all, with the highest levels of non-involvement in preparedness kits (64.0%) and training/drills (61.4%). Slight involvement peaks in soil conservation efforts (46.2%) and flood risk mapping (27.7%). Moderate involvement is most observed in safe building workshops (33.0%) and the implementation of preparedness kits (27.4%). Active involvement is sporadic, never exceeding 2.0% for any activity.

Table 1: Household Involvement in Flood DRR Initiatives by State and Non-State Actors

Level of household involvement	Not involved	Slightly involved	Moderately involved	Actively involved
Attending the early flood warning system training or drills	61.4%	11.7%	24.9%	2.0%
Participating in community-level flood risk mapping or vulnerability assessments	57.9%	27.7%	14.5%	0.0%
Constructing or maintaining household-level flood protection measures	49.2%	33.5%	17.3%	0.0%
Receiving or implementing household preparedness kits/plans recommended by State and non-state actors	64.0%	8.6%	27.4%	0.0%
Engaging in tree planting or soil conservation efforts promoted by State and non-state actors for flood mitigation	52.3%	46.2%	0.0%	1.5%
Participating in workshops or training on safe building practices in flood-prone areas	59.9%	7.1%	33.0%	0.0%

Source: Researcher (2025)

The results from this study show that household involvement in key flood disaster risk reduction activities in Kibra and Mathare is low in scope and shallow in depth. In early warning trainings and drills, 61.4% of the households didn't participate, 24.9% participated moderately, and only 2.0% took an active role. This pattern is consistent with previous work, which shows that awareness alone does not lead to practice in informal settlements (Elum & Lawal, 2022). Unlike previous studies, however, the current research captures the level of household involvement, highlighting the magnitude of the gap and underscoring the need for practical incentives—such as stipends or certification—to translate awareness into sustained involvement (Islamic Development Bank, 2024). The qualitative evidence explains why: as one of the youth participants noted,

> *I joined a planning meeting last year where NGO staff drew drainage lines on a flipchart, but they never asked me to mark where water pools most. They claimed they knew the hotspots, yet I live in one of them. Youth voices are missing from decisions, so the solutions often fail to fix the real paths and shortcuts we use every day to escape rising water* (Participant Youth Group).

This exclusion from decision-making undermines the motivation to participate, even where opportunities are offered. Community-level flood risk mapping reveals a similar gap, with 58% not involved, 14.5% moderately engaged and no active leadership. This finding is consistent with the argument that mapping exercises often fail to generate buy-in when they overlook local priorities or rely heavily on outside expertise (Howard et al, 2024). A woman's group participant recalled that non-state actors would come with already printed technical maps of their place of residence and would

initiate the project without their involvement or input on what was dire, which made them feel like spectators.

> *When KDI built the gabions, they held an opening ceremony and invited a few community elders to speak, but none of us were asked where the river floods hardest. They used technical maps printed in Nairobi, and I felt like a spectator* (Participant Woman Group).

Such accounts demonstrate that technical exercises, which have no connection to lived experience, are unlikely to elicit sustained involvement. The quantification of the participation in this study helps to add precision to this understanding. It reveals where mapping activities are not engaging, suggesting that appointing trusted local champions or simplifying tools could make the process more accessible.

Household-level flood protection measures, such as raised foundations or temporary barriers, are adopted by less than half of residents (49.2% are uninvolved, 33.5% have slight involvement, and 0% are actively participating). This supports the earlier recognition that individual adaptation is often promoted without the sustained technical or material support required for effective uptake (Howard et al., 2024). The NGAO representative admitted that:

> *Community members move only when directed by authorities. There is no grassroots planning, families wait for notices, then pack up and leave on short notice. After floods, they gather at the chief's camp, receive supplies, and gradually rebuild without structured support or training on risk reduction* (Chief, NGAO representative interview).

This study links the low household involvement in flood disaster risk reduction (DRR) to structural shortages, prompting calls for technical assistance and small-scale grants to enhance households' skills and capabilities (Baariu, 2017). Their preparedness kits and plans are poorly implemented; 64% of households are unprepared to use them, while 27.4% are somewhat prepared. Contrary to previous researchers who considered kit distribution effective, this study highlights inadequate follow-up caused by grassroots planning failures (Shibia, 2018). Environmental mitigation efforts, such as soil conservation and tree planting, show somewhat broader coverage but limited adoption (Oteng-Ababio et al., 2024). Similar patterns appear in safe building workshops, with attendance as low as 60%, and it is noted that lecture-based methods to modify ingrained construction practices are uncommon (PreventionWeb, 2021). The *Nyumba Kumi* elder's reflection was that:

> *As an elder, I was asked to bless a new drainage channel but was not invited to discuss its location or construction method. The community trusts my advice, yet I remain outside the technical planning. I believe if we sat together from the start - community members, NGOs, and county officials - we could design safer channels that match our alleys and avoid homes.*

The study revealed that household low involvement in flood DRR is systemic. Conversely, focus groups revealed that households often played a ceremonial role, typically blessing new infrastructure or attending an infrastructure opening, but with no impact on design or hazard mapping. This finding aligns with survey results, which indicate less than 2% active involvement. The study addressed a research gap in the initial studies that failed to consider uptake and impact due to the measurement of intensity of involvement (Howard et al., 2024; Baariu, 2017). Results emphasised that unless interventions are comprehensively and actively rooted in the community at a young age, they will remain disjointed and unsustainable. Implementing reliable, locally based actors, co-creating resilience tools, and constructing incentives that do not conflict with households' considerations can create sustainable community-based resilience (PreventionWeb, 2021; Shibia, 2018).

Correlation Analysis of household Involvement Variable

This sought to evaluate the association between the household involvement variable how they influence each other.

Table 2: Correlation Analysis of household Involvement Variable

	Correlations		1	2	3	4	5	6
1	Attending the flood early warning system training or drills	*r*	1					
		p						
		N	394					
2	Participating in community-level flood risk mapping or vulnerability assessments	*r*	.786**	1				
		p	.000					
		N	394	394				
3	Constructing or maintaining household-level flood protection measures	*r*	.706**	.302**	1			
		p	.000	.000				
		N	394	394	394			
4	Receiving or implementing household preparedness kits/plans recommended by State and non-state actors	*r*	.882**	.670**	.689**	1		
		p	.000	.000	.000			
		N	394	394	394	394		
5	Engaging in tree planting or soil conservation efforts promoted by State and non-state actors for flood mitigation	*r*	.640**	.664**	.417**	.596**	1	
		p	.000	.000	.000	.000		
		N	394	394	394	394	394	
6	Participating in workshops or training on safe building practices in flood-prone areas	*r*	.843**	.754**	.607**	.861**	.600**	1
		p	.000	.000	.000	.000	.000	
		N	394	394	394	394	394	394

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

Correlation analysis revealed that participation in one activity of flood disaster reduction (DRR) was significantly and strongly correlated with involvement in others (p = 0.01). The connection between early warning system training or drills and adoption of preparedness kits or plans was the strongest (r = .882), which implies that more than preparedness promotes complementary protective behaviours (Elum & Lawal, 2022; IFRC & Save the Children, 2018). Discussion with focus groups affirmed this, as residents stated that drills helped them understand the goal of the kits and made them use them, emphasising the role of experience in narrowing the awareness-meaning gap (Islamic Development Bank, 2024).

Safe building practice workshops also showed a high correlation with early warning training (r = .843). Subjects told them that after participating in preparedness efforts, they were open to learning how to mitigate the impact of floods by improving a wall or increasing the floor height, rather than using concrete (PreventionWeb, 2021). Equally, the map of community flood threat was associated with secure construction workshops (r = 0.754) and the implementation of mitigation measures in the environment (r = 0.664). The residents claimed that home mapping of hazard areas made them reflect on the structural and environmental remedies. However, the correlation between mapping and the consumption of household-level protection was less (r = .302), indicating that physical adjustments without technical assistance would not accompany spatial awareness alone (Howard et al., 2024).

Other relationships, such as those between household protection and resilience preparedness kits (r = .689) and between environmental mitigation and resilience coping and building workshops (r = .600), exhibited interrelations among resilience strategies (Oteng-Ababio et al., 2024). Overall, the results indicated that reinforcement patterns, rather than randomness, influenced household engagement, and that integrated and participatory approaches enhanced engagement in DRR activities (IFRC & Save the Children, 2018; UNDRR, 2025).

Impact of Household Involvement in state and non-state actors' initiative towards Flood Disaster Risk Reduction in Informal Settlements in Nairobi

Figure 1 shows the level of flood disaster risk reduction according to households' opinion as an aggregate of preparedness, response, recovery and mitigation.

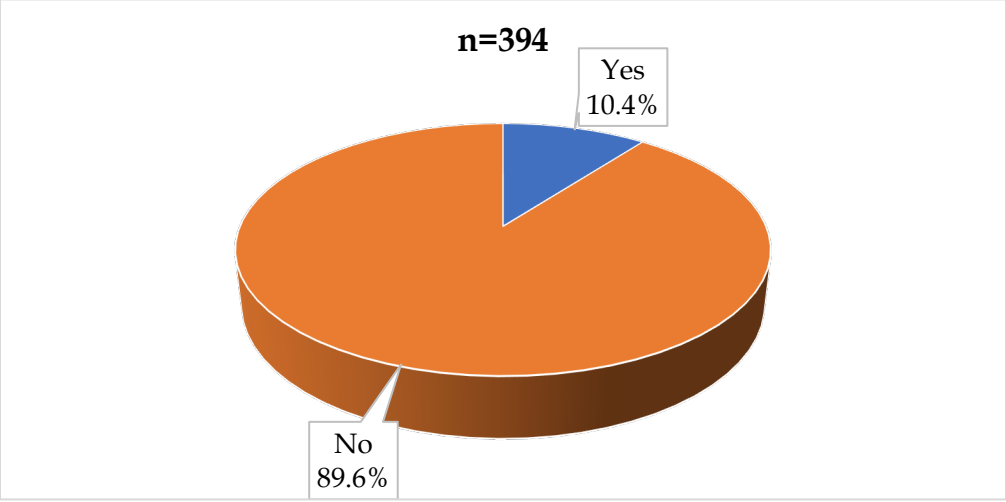

Figure 1: Level of Flood Disaster Risk Reduction According to Household Heads

Source: Researcher (2025)

The results indicate that only 10.4% of households reported active involvement in flood disaster risk reduction (FDRR) measures, while an overwhelming 89.6% reported no such involvement. This stark involvement gap underscores a critical weakness in community-level resilience, particularly in informal settlements where household-level action is often the first line of defence against flood impacts. Disaster risk reduction literature consistently emphasises that household involvement is a cornerstone of effective preparedness, response, recovery, and mitigation (IFRC & Save the Children, 2018; UNDRR, 2025). The present findings corroborate this position, while also revealing the scale of disinvolvement that must be addressed through targeted interventions.

The qualitative evidence from state actors provides concrete illustrations of the benefits realised by the small proportion of engaged households. The National Disaster Operations Centre (NDOC) observed that:

> *Where households have been part of our evacuation drills, the loss of life and property during floods has been significantly reduced.*

This directly connects to the quantitative minority who participate, demonstrating that even limited involvement can yield measurable protective outcomes — a point reinforced in Kenyan policy analyses that identify drills as critical for embedding risk knowledge into practice (KIPPRA, 2019). Similarly, the Kenya Meteorological Department (KMD) noted that:

> *When households receive and act on our seasonal forecasts, they can move valuables and livestock early, which cuts their recovery time in half.*

This aligns with the literature's emphasis on anticipatory action as a determinant of resilience (Ministry of Interior and National Administration, 2025). The Nairobi City County Disaster Management Department's statement that:

> *Areas where households take ownership of drain maintenance experience fewer blockages and less severe flooding.*

This further illustrates how local stewardship translates into tangible hazard reduction, echoing findings that community-led maintenance enhances the longevity of mitigation measures (Oteng-Ababio et al., 2024).

Non-state actor perspectives reinforce these connections. International NGO said that,

> *Households trained in basic flood response are the first to rescue neighbours and salvage belongings before our teams arrive.*

This demonstrates how household capacity complements formal emergency services, a relationship widely recognised in DRR scholarship (Weingärtner & Wilkinson, 2019). The CBO experience that *"when residents co-design drainage solutions, they maintain them better"* supports the argument that participatory design fosters ownership and sustained functionality of infrastructure (PreventionWeb, 2021). Likewise, another NGO representative said:

> *Household-level involvement in post-flood needs assessments ensures that aid matches real priorities.*

This offers a direct mechanism for addressing the low trust in recovery programmes reflected in the quantitative data, aligning with calls for locally defined recovery priorities in the literature.

The quantitative evidence reveals the magnitude of the involvement deficit, while the qualitative insights explain both the benefits of involvement and the mechanisms through which it enhances resilience. The convergence between this study's findings and established DRR research strengthens the case for scaling household-centred interventions. At the same time, the divergence signals the need for context-specific strategies that lower barriers to involvement and institutionalise cooperation between households, state agencies, and non-state actors.

Ranking of flood Disaster Risk Reduction performance

This study ranked the flood DRR performance using four levels from the disaster cycle: preparedness, response, recovery and mitigation. The rank was based on means from a categorical data type, where Yes was assigned a value of 1 and No was assigned a value of 2.

Table 3: Ranking of Flood Disaster Risk Reduction Phases Performance

Rank	Flood DRR Phase	Mean
1	Preparedness	1.6543
2	Recovery	1.6964
3	Mitigation	1.7259
4	Response	1.8076

Source: Researcher (2025)

The results indicate the highest relative household involvement in preparedness, which is also reflected in the highest relative household involvement in recovery. Mitigation has the third-highest level of household involvement, followed by response, with the highest mean score indicating the highest percentage of "No" responses. This pattern suggests that during flood events, while some anticipatory and post-event activities are being adopted, households are least engaged in immediate emergency actions.

From a disaster cycle perspective, this imbalance is significant - low response involvement can undermine the effectiveness of preparedness and recovery efforts, as timely action during an event is crucial to minimising losses. The findings support wider DRR literature highlighting the need to build community-level response capacity alongside preparedness and mitigation to achieve a balanced and effective disaster management cycle (IFRC & Save the Children, 2018; UNDRR, 2025).

This study deployed political ecology to demonstrate how flood DRR failures were premised on power inequalities, with state and non-state actors prevailing to the exclusion of the households, which accelerated inequality. Political ecology, in contrast to technical proposals, attributed low household participation to larger socio-political structures of urbanisation, poverty, and failure of government in postcolonial societies. It supports the idea of redesign and co-design as ways to achieve equitable, bottom-up resilience, thereby closing the perilous awareness gap in Nairobi's informal settlements.

Limitations based on the findings included mistrust among evicted respondents, which the researcher addressed through confidence-building measures and the involvement of *Nyumba Kumi elders*, who helped foster trust.

Conclusion

The study concludes that household involvement in flood DRR initiatives in the informal settlement areas of Nairobi is still low in scope and depth, with household involvement focused on preparedness and recovery, and weakest in response. The association accounts for the fact that household involvement in one activity often feeds into others, but there are structural, resource, and participatory deficiencies that block uptake by households. Therefore, bridging the awareness gap on flood DRR requires integrated, community-driven approaches, institutional commitment and enabling conditions to ensure household voices are embedded throughout the disaster cycle to achieve sustainable, place-based resilience.

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