World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Social Networks as Coping Mechanisms for Floods: Evidence from Households in the Lower Nyando Basin, Kisumu County, Kenya

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World Journal of Advanced Research and Reviews, 2025, 28(01), 1735-1744

Publication history: Received on 15 September 2025; revised on 19 October 2025; accepted on 22 October 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.28.1.3614

Abstract

Flooding impacts and disrupts all aspects of lives of populations living within flood-prone areas in Nyando sub-County of Kisumu County. In spite of various mitigation measures put by in place by the County and National governments for managing floods, flooding continues to affect Nyando region. This study explored the social networks that households in Lower Nyando Basin, Kisumu County, rely on to cope with floods. The research was conducted in Nyando sub-County of Kisumu County, targeting all households residing in the area. Stratified random sampling was used to select 130 household heads and 20 key informants as the study participants. Data was collected using a questionnaire for household heads and a key informants' interview schedule. Quantitative data was analysed by use of various descriptive and inferential analysis procedures, including Social Network Analysis (SNA) using Gephi Software and descriptive statistics using SPSS. Qualitative data was organized and coded according to various set themes, after which thematic analysis was used to come up with descriptions of the outcomes. The study findings were that, to cope with floods the households mostly relied on informal social networks, especially family members, neighbours, and friends. These networks were not only the most frequently used but also perceived as the most effective in meeting immediate household needs, providing emotional support, practical assistance, and fostering a sense of community. Formal institutions such as government agencies and NGOs were used to a lesser extent. The study recommends that policy-makers, NGOs, and community leaders should integrate and support informal social networks within formal disaster risk management frameworks. Strengthening community cohesion, improving institutional trust, and enhancing communication are critical to building more resilient households in flood-prone areas.

Keywords: Social networks; Flood adaptation; Household resilience; Informal support systems; Social Network Analysis (SNA)

1. Introduction

Calamities associated with climate change and other naturally occurring tragedies cause devastation and extensive damage to ecosystems and households. Floods account for about 35 percent of the naturally occurring tragedies that are experienced around the world (UNDRR, 2015). In Kenya, flooding represents a key disaster (Rudari *et al.*, 2019) to people in areas such as the lowlands of rivers like Tana River, Nyando River and River Nzoia (Onyuro, 2020). The strategies employed to protect members of the public from flooding, and especially in the Kano plains, receive a lot of financial investment by the National and County Governments and NGOs. Such investments have led to the construction of dykes, flood protection embankments, drainage channels and diversion waterways as a way of protecting lives and the socioeconomic structure of those residing near the affected areas (Otieno, 2018).

In cases where local and national governments fail in their effort to reduce or control flooding, residents can adopt various non-farm and on-farm strategies. There are however some coping mechanisms that can lead to negative

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outcomes for residents, as was evidenced (Ochola & Akinyi, 2022), whose research revealed that young school girls and women suffered sexual exploitation in search for food during flooding. In addition, some measures currently being put in place to protect the lowlands from the harmful effects of floods may prove inadequate in providing effective protection, which can be seen through regular floods that continue to wreak havoc in Kano plains (Nyakundi *et al.*, 2010).

When traditional flood protection measures fail, households often turn to social networks to cope with the challenges posed by flooding (Fitrinitia & Matsuyuki, 2022), Social networks are groups of people who have common interests, interact regularly, and provide social support to one another (Leigh-Hunt, 2016). In the context of flooding, social networks can be a vital source of emotional, informational, and material support for households affected by floods. These networks can provide a safety net for households that have been displaced or have suffered losses due to floods. However, the function played by social networks in building resilience among households coping with floods in Lower Nyando Basin has not been adequately explored. This study aimed at filling this gap by examining the social networks that households in Lower Nyando Basin, Kisumu County, rely on to cope with floods.

1.1. Objectives of the Study

The objective of the study was to determine the social networks that households in Lower Nyando Basin, Kisumu County, rely on to cope with floods.

1.2. Literature Review

Social networks can be considered as a type of social capital, which involves building relationships between individual persons, families, and communities as a resource to collaborate for shared purposes and advantages (Behera, 2021). Social capital is also characterized by information sharing, trust, and teamwork among individual persons, families, groups, and social networks (Ha & Doan, 2021). According to (Keeley, 2007), social capital is defined by networks, connections, and clusters characterized by shared values and mutual comprehension within a society. This framework facilitates individuals and groups in cultivating trust and fostering productive collaboration. The formation of social capital arises through familial bonds, shared norms, values, and mutual understanding, which in turn cultivate assistance and cooperation among individuals, families, groups, and various networks (Behera, 2021). Furthermore, Siegler (2014) asserts that social capital nurtures networks, associations, and human principles that culminate in forbearance, unity, and reliance, yielding noteworthy advantages.

Social networks can play a critical role in supporting individuals and communities in coping with the effects of disasters, such as floods. Social networks refer to the webs of relationships and interactions that individuals have with others in their social environment, including family, friends, neighbours, and community groups (Borgatti & Halgin, 2011). In the context of disaster management, social networks can serve as a source of emotional and practical support, providing resources and assistance that can help individuals and communities to cope with the aftermath of disasters (Worsley, Harrison & Corcoran, 2021).

Research has shown that social networks can be an important factor in disaster resilience, and can help to mitigate the negative effects of disasters on individuals and communities. One key way in which social networks can support disaster resilience is by providing emotional support to those affected by disasters. Emotional support can help to reduce stress and anxiety, and can improve overall mental health outcomes for disaster survivors. For example, a study conducted by (Bui, Anglewicz & Van Landingham, 2021) showed that social support was positively associated with the mental health outcomes of individuals affected by Hurricane Katrina, and that social networks played a critical role in providing this support.

Social networks not only offer emotional support but can also provide practical assistance, such as shelter, food, and clothing, to those affected by disasters (Maghsoudi & Moshtari, 2021). This kind of aid is especially vital in the immediate aftermath of a disaster when access to basic necessities may be limited. Typically, relief and response efforts occur in the wake of a disaster, including search and evacuation operations, providing food, water, clothing, shelter, medical care, and services to affected community members (Behera, 2021). Those impacted by disasters receive support and cooperation from individuals, groups, family members, and communities to help relieve them from being trapped in dangerous areas (Poteyeva, Denver, Barsky, & Aguirre, 2007).

Social capital plays a critical role in disaster management by facilitating communities in making effective decisions related to evacuation, searching and rescuing of victims, and the provision of instant as well as lasting relief and recovery measures (Behera, 2021). In addition, social capital is vital in provision of essential goods and services such as foodstuff, initiating removal of trash, removing blockages on the drain ways, providing refuge for those whose homes have been

destroyed, caring for children, assisting with finances, and immediate emotional and psychosocial assistance during disasters (Twerefou, Adu-Danso, Abbey & Dovie, 2019). Furthermore, the relationship between social capital and disaster risk management can bring communities closer and improve their resilience to disasters.

2. Material and methods

2.1. Research design

The study used a mixed-methods design, combining both qualitative and quantitative methods (Williams & Shepherd, 2017). The integration of both methods facilitated triangulation (Schoonenboom & Johnson, 2017). The quantitative component employed Social Network Analysis (SNA) technique to quantify the structural attributes of social networks (O'Malley & Marsden, 2008). On the other hand, the qualitative aspect entailing in-depth interviews captured the qualitative elements of social networks, uncovering the nature of relationships, the types of support exchanged, and the informal mechanisms that contribute to resilience.

2.2. Study population

This study was conducted in Nyando sub-County of Kisumu County. The area covers 248.2 Area $Km^{2,}$ 1 Division, 5 Wards, 6 locations and 17 Sub-locations. The sub-County has five political administrative units and 36 sub-locations. The study targeted all households residing in Nyando sub-County with a population of 141,037 persons. The study was focused on the lower Nyando River basin that is frequently affected by flooding.

2.3. Sample size and sampling procedure

Out of the target population of 141,037 people in Nyando sub-County, a representative sample was computed using the Fischer formula (Jung, 2014). This gave a sample size of 150 respondents. The sampling frame was obtained from both IEBC and the KNBS (2019) census data. The study employed a non-probability sampling technique for all selected levels, except the selection of the primary sampling units which are the households. The sample population was composed of 130 household heads and 20 key informants drawn from NGOs, local women groups and County Government representatives in charge of disaster preparedness and response.

2.4. Data collection and analysis

Quantitative data were collected using a survey questionnaire for the household heads, while qualitative data were collected using interview schedules for the key informants'/opinion leaders. Data analysis was conducted using IBM SPSS Statistics version 21 and Gephi software, Version 0.10.1, which is a Social Network Visualizer software application used for social network analysis and visualization. The data were analysed using descriptive statistics such as frequency distributions, percentages, and the mean. In addition, social network analysis was performed to enable visualization and examination of the structure of these social networks. Key metrics such as network density, centrality, and connectivity were assessed to understand the extent and nature of the relationships among households within these networks.

3. Results and discussion

3.1. Types of social networks utilised by households

The objective of this study was to determine the social networks that households in Lower Nyando Basin, Kisumu County, rely on to cope with floods. The household heads were asked to identify the social networks that they actively interact with in the periods before, during, and after floods. The identified networks are those that could help the households through the various phases of disaster by providing emotional, informational, and material support. Table 1 shows the various networks that the households interacted with during floods.

Table 1 Social networks households interact with during flooding

Social Network	Frequency	Percentage (%)
Family members	103	91.2
Neighbours	94	83.2
Friends	81	71.7

Religious groups	68	60.2
CBOs	57	50.4
Local leaders/chiefs	54	47.8
Government agencies	39	34.5
NGOs	36	31.9
Media (TV, radio, etc.)	44	38.9
Internet/Social media	29	25.7
Others (e.g., SACCOs, SHGs)	11	9.7

Note: (n = 113; Multiple responses allowed)

The results in Table 1 show that family members (91.2%) were the most relied upon social network, followed by neighbours (83.2%) and friends (71.7%). Other key sources of support included religious groups (60.2%), community-based organizations (50.4%)), and local leaders/chiefs (47.8%). Formal institutions such as government agencies (34.5%) and non-governmental organizations (31.9%)) were also used by households. There were a few household heads who stated using mainstream and social media platforms as sources of information and support.

From the results in Table 1, it emerges that there was a dominance of informal networks like family, neighbours, and friends. These networks emerged as the most accessible and trusted sources of assistance, especially during the immediate response phase. The results of interviews with key informant revealed more insights regarding the types of social networks most commonly utilized by households during flood events. The key informants emphasized on the centrality of kinship and neighbourhood ties as the first line of support during disasters. For instance, one NGO official noted that:

"During flooding, you will always see that the first people to respond are the family members, the neighbour, the church group. These groups respond earlier than coordinated support can come from the government or NGOs. These are the people households turn to immediately." (KI-03, NGO Official)

This finding is supported by Ombati (2017), whose study established that community participation and social networks play a major role in flood mitigation efforts within the Nyando flood plains. Similarly, Masese, Neyole and Ombachi (2016) documented how households in Nyando Plains often rely on their immediate social networks for support mechanisms such as temporary relocation and the construction of simple flood barriers. The importance of community-based support systems was also emphasised by Nyakundi (2013) whose study established that residents of Nyando Basin actively draw on indigenous knowledge and peer support to prepare for and respond to floods. Such support networks are particularly important in areas where formal government assistance is delayed or insufficient.

Community-based self-help-groups also emerged as important social networks that the residents rely on. From the interviews, one key informant from the local administration highlighted the importance of informal savings groups and self-help associations, noting that:

"Many people, especially women, are members of *chamas,* and this enables them to support each other during times of flooding. The *chamas* collect money, cook together, and help those whose homes are destroyed." (KI-07, Women's Group Leader)

The results also show that there were cases of engagement with mass media and digital platforms for flood-related information. Households reported receiving early warnings and safety instructions via radio, television, and mobile phones. This shift signifies an awareness among the households and reliance on technology-enhanced disaster communication. This is in line with a study by Raburu, Ouma, Awuor and Ajode (2024) on indigenous knowledge in the region, which found that 73.5% of respondents cited radio and TV as their main sources of climate-related information. This trend is supported by developments like the new flood forecasting system introduced in Nyando Sub-County, which utilizes satellite and internet data to send alerts to local residents (Ojina, 2024). Such digital tools play an important role in improving preparedness and minimizing flood-related losses.

3.2. Extent of use of social networks to cope with floods

The household heads were asked to indicate the extent to which they interacted with various social networks during floods. Their responses were measured on a five-point Likert scale ranging from 1 = Not at All and 5 = To a Very Great Extent. Table 2 shows their responses.

Table 2 Extent of use of social networks during floods

Item	5	4	3	2	1	Mean
Communicate with family members	66 (58.4%)	30 (26.5%)	10 (8.8%)	5 (4.4%)	2 (1.8%)	4.36
Rely on neighbours	60 (53.1%)	32 (28.3%)	12 (10.6%)	6 (5.3%)	3 (2.7%)	4.24
Seek help from community leaders	38 (33.6%)	29 (25.7%)	26 (23.0%)	12 (10.6%)	8 (7.1%)	3.68
Use social media to get information	19 (16.8%)	22 (19.5%)	26 (23.0%)	25 (22.1%)	21 (18.6%)	2.94
Participate in community meetings	30 (26.5%)	35 (31.0%)	24 (21.2%)	14 (12.4%)	10 (8.8%)	3.54
Engage with community-based organizations	28 (24.8%)	31 (27.4%)	30 (26.5%)	15 (13.3%)	9 (8.0%)	3.48
Communicate with friends outside the community	18 (15.9%)	25 (22.1%)	27 (23.9%)	20 (17.7%)	23 (20.4%)	2.96
Trust information from social networks	36 (31.9%)	34 (30.1%)	24 (21.2%)	12 (10.6%)	7 (6.2%)	3.71
Rely on extended family	41 (36.3%)	30 (26.5%)	20 (17.7%)	12 (10.6%)	10 (8.8%)	3.7
Believe social networks help in coping with floods	52 (46.0%)	33 (29.2%)	15 (13.3%)	7 (6.2%)	6 (5.3%)	4.05

Key: **5** – To a very great extent; **4** – To a great extent; **3** – To some extent; **2** – To a little extent; **1** – Not at all

The study established that communication with family members (M = 4.36) and reliance on neighbours (M = 4.24) received the highest ratings from the respondents. This suggests that family and neighbours constituted the networks that were most frequently utilized during floods. This finding is supported by previous research by Ombati (2017) whose findings showed that community participation and collaboration significantly influenced household livelihoods in the Nyando flood plains with networking among community members being a key factor in effective flood mitigation strategies.

Other forms of interaction such as trust in social networks (M = 4.05), participation in community meetings (M = 3.54), and engagement with CBOs (M = 3.48) were also utilized to a great extent by most households. These interactions reflect the communities' reliance on traditional knowledge and collective action in managing flood risks. The research by Nyakundi (2013) found that local communities in the Nyando basin possess indigenous knowledge and coping mechanisms that can be crucial for effective flood response. However, use of social media platforms (M = 2.94) and communication with friends outside the community (M = 2.96) received lower mean scores, which indicates that these networks were not frequently used by the households to cope with floods. This suggests the presence of a digital divide, where access to and utilization of digital platforms for disaster management are limited. Researchers such as Ramakrishnan, Ngamassi and Rahman (2022) have demonstrated how urban poor communities are excluded from digital advancements, increasing their vulnerability to shocks. Disparities in digital access and literacy can also hinder the effective use of social media for disaster management. The study by Ramakrishnan et al. (2022) showed that underserved communities are characterised by lack of requisite skills for effective utilisation of social media during disasters, and this can impede timely information dissemination and response.

3.3. Social network analysis of support structures during floods

The study aimed at establishing how communities mobilize support during flooding in order to improve disaster preparedness and response strategies. To do this, the study carried out a Social Network Analysis (SNA) of support structures accessed by households during flood events in in Lower Nyando Basin, Kisumu County. The goal of the SNA was to identify the key actors, relationships, and the overall network structures. For this analysis, the data collected from 113 households was translated into a two-mode network consisting of households and the social support nodes they accessed. The network was analyzed and visualized using Gephi software, version 0.10.1. The data captured the types of social support networks accessed during floods, including family members, neighbours, friends, government agencies, NGOs, and other institutions. Table 3 provides the summary of the network structure as obtained from household disaster support linkages. The network includes both formal and informal support sources. The table shows the summary of the network metrics derived from the Gephi analysis.

Table 3 Network structure summary

Measure	Value
Number of Nodes	124
Number of Edges	616
Average Degree	9.935
Network Diameter	4
Modularity (Community Detection)	0.099
Graph density	0.081
Statistical inference	1560.838

The network structure values as shown in Table 3 indicate a moderately sparse network with short paths between nodes. This suggest that there were strong interconnectivity and a potential for rapid information or resource dissemination. Each node in the network represented either a household or a support source. Edges between nodes signified a support-seeking or support-providing relationship. Nodes such as 'Family Members', 'Neighbours', and 'Friends' had the highest number of connections, which is an indication that these sources played a major role in disaster support. The sources that were mentioned less frequently included NGOs and Internet/Social Media. These sources had fewer links even though they still served unique roles in resilience building.

A network graph was generated using Gephi version 0.10.1 with a Fruchterman-Reingold layout. In the Graph (Figure 1), each node represents either a household or a social actor, and edges denote connections, that is, the household reported accessing support from that actor. The graph shows the structure of social relationships and support channels among the surveyed households during floods. Larger nodes represent more connected entities, and coloured edges denote different types of ties.

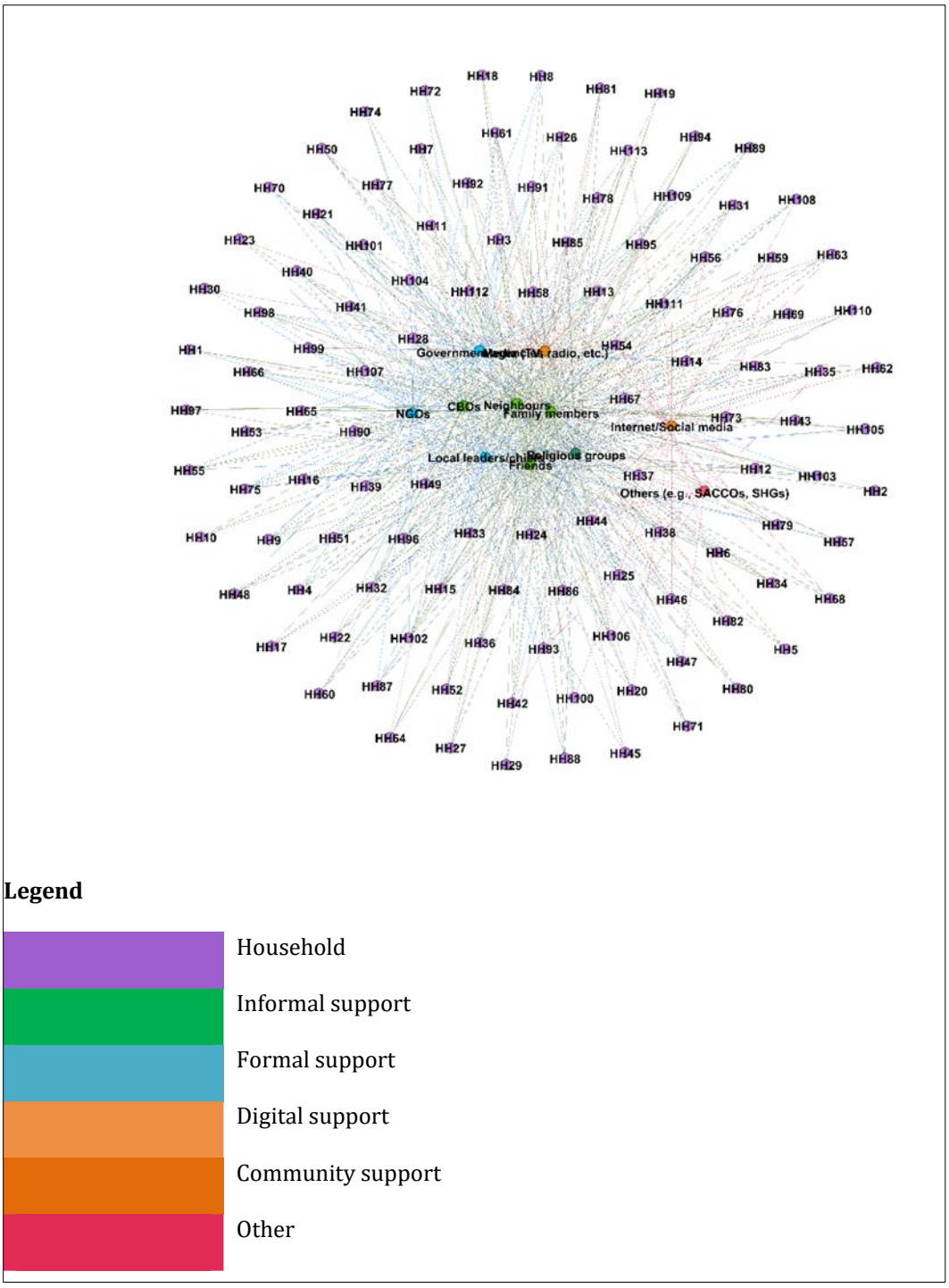

Figure 1 Map of relationships between households and support networks

The social network graph illustrates a pronounced centrality of informal support systems, namely, family, neighbors, and religious groups, as primary sources of assistance for households in the Lower Nyando Basin during flood events. These nodes exhibit high degree centrality, signified by numerous edges connecting them to individual households. This suggests both their accessibility and the strong social ties that reinforce reliance on these actors (Norris et al., 2008). The prominence of these informal networks aligns with past findings on disaster research that emphasize the important role of kinship, community proximity, and faith-based institutions in facilitating immediate and culturally contextualized responses to hazards (Zaman & Raihan, 2023).

In contrast, formal institutions such as government agencies and non-governmental organizations occupy more peripheral positions within the network. The relatively low number of connections to these nodes indicates limited

household interaction or perceived reliability, which may be due to bureaucratic inefficiencies, resource constraints, or a historical mistrust in institutional responses (Manyena et al., 2011). This spatial marginality within the network graph reflects their diminished role in localized disaster support, which reinforces the notion that top-down interventions often fail to effectively engage grassroots actors. This finding was confirmed by results from interviews with key informants. For instance, a representative from the Lake Victoria Water Board noted that:

"We provide data on water levels and rainfall forecasts, but the uptake by members of the public is low. Households prefer to rely on their social circles and social media to make decisions." (KI-05, LVWB Official)

The presence of nodes such as "Internet/social media" and "media (TV, radio, print)", even though less central, suggests a diversification in the channels used by households to access flood-related information and assistance. Their emergence reflects an incremental shift toward digital and mass media platforms as supplementary tools for disaster preparedness and response. This trend is in line with global patterns of increasing digital engagement during crises, as communities make use of mobile phones and social platforms to share warnings, coordinate support, and access early warnings (Gkeredakis, Lifshitz-Assaf & Barrett, 2021).

4. Conclusion

This study set out to determine the social networks that households in the Lower Nyando Basin, Kisumu County, rely on to cope with floods. The findings revealed that informal networks, particularly family members, neighbours, and friends, constituted the most critical and frequently accessed sources of support during flood events. These actors provided immediate emotional, informational, and material assistance. This reflects their accessibility, trust, and embeddedness within community structures. Religious groups, community-based organizations, and local leaders also played significant complementary roles, and this reinforces the importance of community-based solidarity in times of crisis.

The results further showed that while formal institutions such as government agencies and non-governmental organizations were part of the support landscape, they were accessed less frequently and often occupied more peripheral roles in the social network structure. This suggests that although these institutions can provide technical and large-scale assistance, their timeliness and perceived reliability remain limited when compared to household-centered and community-level support. The Social Network Analysis confirmed the dominance of informal support systems in the disaster response architecture of the Lower Nyando Basin. Nodes representing family, neighbours, and religious groups exhibited the highest degree centrality, and this indicates their importance in mobilizing rapid and trusted assistance. In contrast, nodes for formal agencies and NGOs displayed lower connectivity, which reflects their marginal position within household coping strategies. At the same time, the inclusion of mass media and digital platforms within the network, albeit with fewer connections, points to a gradual diversification of information and support channels. This emerging reliance on digital tools underscores both an opportunity for improved early warning dissemination and a challenge, given the digital divide that limits equitable access.

The findings of this study therefore provide evidence of the resilience-building capacity of informal networks in disaster-prone contexts. These networks form the backbone of household coping mechanisms, bridging immediate gaps in formal disaster response systems. Strengthening their role, while simultaneously enhancing the linkages with formal institutions and digital platforms, is critical for building more inclusive and robust flood management strategies in the Lower Nyando Basin.

Recommendations

Based on the findings of the study, it emerges that informal social networks play an important role in helping households cope with and recover from flooding events. Consequently, government agencies and policy-makers should recognize and strengthen these informal structures by integrating them into formal disaster risk management plans. This can be achieved through training local leaders, supporting community-based disaster response teams, and facilitating regular coordination meetings that include both formal institutions and grassroots actors. Bridging the gap between formal and informal systems will enhance the responsiveness and reach of flood adaptation efforts.

Non-governmental organizations and community-based organizations should focus their interventions on building and reinforcing the social capital that already exists within communities. Since networks of family, neighbours, and friends were found to be the most utilized and effective during floods, NGOs can utilise these networks to disseminate early warning messages, deliver aid more efficiently, and support psychosocial services during and after disasters. Programs

that promote collective action, such as savings groups, disaster preparedness forums, and participatory planning workshops, should be scaled up to further embed resilience at the community level.

The study also found that communication through internet and social media platforms, as well as institutional actors such as government agencies, were perceived to be less effective. This points to a need for these stakeholders to enhance trust, responsiveness, and communication strategies. Government agencies, in particular, should invest in building local presence and credibility through consistent community engagement, transparency in aid distribution, and timely communication during emergencies. Improved digital literacy and use of mobile platforms could also make online communication tools more accessible and relevant for flood-prone areas. Academic and research institutions should conduct further studies to assess the evolving role of social networks in disaster adaptation. There is also a need for deeper exploration into how digital tools can complement traditional networks in enhancing household resilience.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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