Understanding the Impacts of Flooding on Local Communities and the Effectiveness of Flood Management Strategies in Twic East County

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Abstract

Flooding in Twic East County, Jonglei State, South Sudan, represents a recurring socio-environmental challenge with profound implications for livelihoods, food security, and community resilience. This study investigates the socio-economic impacts of flooding on households and evaluates the effectiveness of existing flood management strategies. A mixed-methods approach was employed, combining household surveys (n = 100), key informant interviews, and focus group discussions across five payams: Pakeer, Ajuong, Nyuak, Kongor, and Lith. Findings indicate widespread livelihood disruption, including crop loss (82%), livestock mortality (65%), and displacement (67%). Female-headed households were disproportionately affected, exhibiting higher post-flood food insecurity. Households employed adaptive strategies such as temporary relocation, livelihood diversification, and reliance on humanitarian aid, reflecting locally informed resilience. Analysis of flood management initiatives revealed that community-led interventions, particularly dyke maintenance and early warning systems, significantly improved perceived effectiveness and reduced evacuation times. Regression analysis identified community participation, prior flood experience, and access to early warning systems as significant predictors of adaptive capacity. The study reframes flooding as a socio-ecological process shaped by the interaction of environmental exposure, institutional support, and community agency. Policy implications underscore the need for integrated, participatory flood management strategies that combine structural and non-structural interventions, targeted social protection, and inclusive governance. These insights contribute to disaster risk reduction scholarship and provide actionable guidance for enhancing community resilience in flood-prone regions of South Sudan

Keywords: flooding impacts, flood management, community resilience, food security, socio-economic impact, disaster risk reduction, Twic East County, South Sudan.

Introduction

Flooding is among the most pervasive and recurrent hazards affecting rural communities in South Sudan, with Twic East County in Jonglei State representing a particularly exposed and vulnerable setting. Its flat topography, proximity to the White Nile, and high climate variability create a physical environment where hydro-meteorological extremes frequently cause widespread inundation (UNEP 2020; FEWS NET 2023). Seasonal floods have repeatedly disrupted rural livelihoods, damaged crop and livestock production systems, destroyed infrastructure, and displaced communities, thereby reshaping settlement patterns and weakening local economies. The scale and frequency of these flood events have increased over recent decades, underscoring the need for effective, sustainable, and context-sensitive management strategies (OCHA 2022).

Despite the recurrent nature of these floods, policy and practice in South Sudan have historically focused on short-term humanitarian responses delivered through centralised mechanisms. While such interventions are necessary in emergencies, they often fail to reduce long-term risk and may inadvertently undermine local resilience by sidelining indigenous knowledge systems and community-led initiatives. Existing scholarship highlights the importance of recognising the adaptive capacity of local populations, which has been developed through generations of living with seasonal floods (Nelson et al. 2022; Twigg 2015). However, these community-based systems operate within a broader context of systemic challenges, including inadequate infrastructure, weak coordination among institutions, and poorly functioning early warning systems, all of which amplify the impacts of flooding.

This study is guided by the concept of socio-economic resilience, viewing households not only as recipients of aid but also as active agents in shaping their own recovery and adaptation strategies. Displacement, loss of income, and asset depletion are examined here not merely as indicators of vulnerability but as part of a broader process of adaptive persistence, where communities reorganise and sustain core functions despite recurrent environmental shocks (Manyena et al. 2011). The research further evaluates the extent to which current flood management approaches support or hinder these adaptive processes. Employing a mixed-methods design, the study combines household surveys, key informant interviews, and focus group discussions to generate a comprehensive understanding of both the socio-economic impacts of flooding and the effectiveness of existing governance arrangements. By situating empirical findings within the broader literature on disaster risk reduction, the study seeks to contribute to more inclusive, multi-scalar, and resilience-oriented flood response systems in South Sudan.

Literature Review

Flooding has wide-ranging implications for rural livelihoods, particularly in economies where agricultural production is the primary source of income and food security. In South Sudan, recurrent flooding disrupts the agricultural calendar, reduces yields, and contributes to livestock mortality, directly undermining household subsistence and market-based livelihoods (FAO 2021; WFP 2022). Beyond immediate production losses, flood damage to infrastructure such as roads, storage facilities, and markets limits recovery by restricting the flow of goods and services. In areas with limited livelihood diversification opportunities, these disruptions have lasting socio-economic consequences.

Flood management outcomes in fragile states are shaped by institutional capacity, governance structures, and the interplay between national and local actors. In South Sudan, formal disaster risk management remains underdeveloped, with weak environmental policy enforcement, insufficient early warning systems, and minimal investment in protective infrastructure (OCHA 2022; World Bank 2023). Emergency response mechanisms play an important role in saving lives during crises, yet they do little to address underlying vulnerabilities. Community-based governance structures, including traditional authorities and local committees, often coordinate responses more rapidly and effectively than state institutions. However, these systems are rarely integrated into formal planning frameworks, limiting their potential contribution to long-term resilience (Twigg 2015).

The resilience framework has evolved to encompass not only the capacity to absorb shocks but also the ability to adapt and transform in ways that enhance long-term sustainability (Folke et al. 2010; Manyena et al. 2011). In flood-prone areas such as Twic East County, households employ a variety of adaptation strategies including temporary migration, reliance on kinship support, livelihood diversification, and adjustments to agricultural practices. The success of these strategies depends on both household-level resources and enabling institutional conditions. In contexts where governance is weak and infrastructure investment is minimal, adaptive capacity is often constrained, leaving communities in a state of chronic vulnerability despite their ingenuity.

While numerous humanitarian and development agencies have documented flood impacts in South Sudan, these efforts have often been oriented toward operational planning rather than generating empirical evidence to inform long-term policy. There is limited integration between hydrological science and indigenous knowledge systems, and little systematic analysis of how formal flood control measures interact with community-level resilience practices. This gap in the literature results in policy responses that address the symptoms of flooding without engaging with its root causes or structural enablers. Twic East County's chronic exposure to seasonal flooding, combined with its reliance on climate-sensitive livelihoods, makes it an important case for examining the interplay between local adaptation and formal governance structures. The literature points to the need for multi-scalar approaches that connect household coping strategies to district, national, and regional decision-making. By combining household-level socio-economic data with an analysis of flood management institutions, this study addresses both the localised impacts of flooding and the broader governance systems that shape vulnerability and resilience.

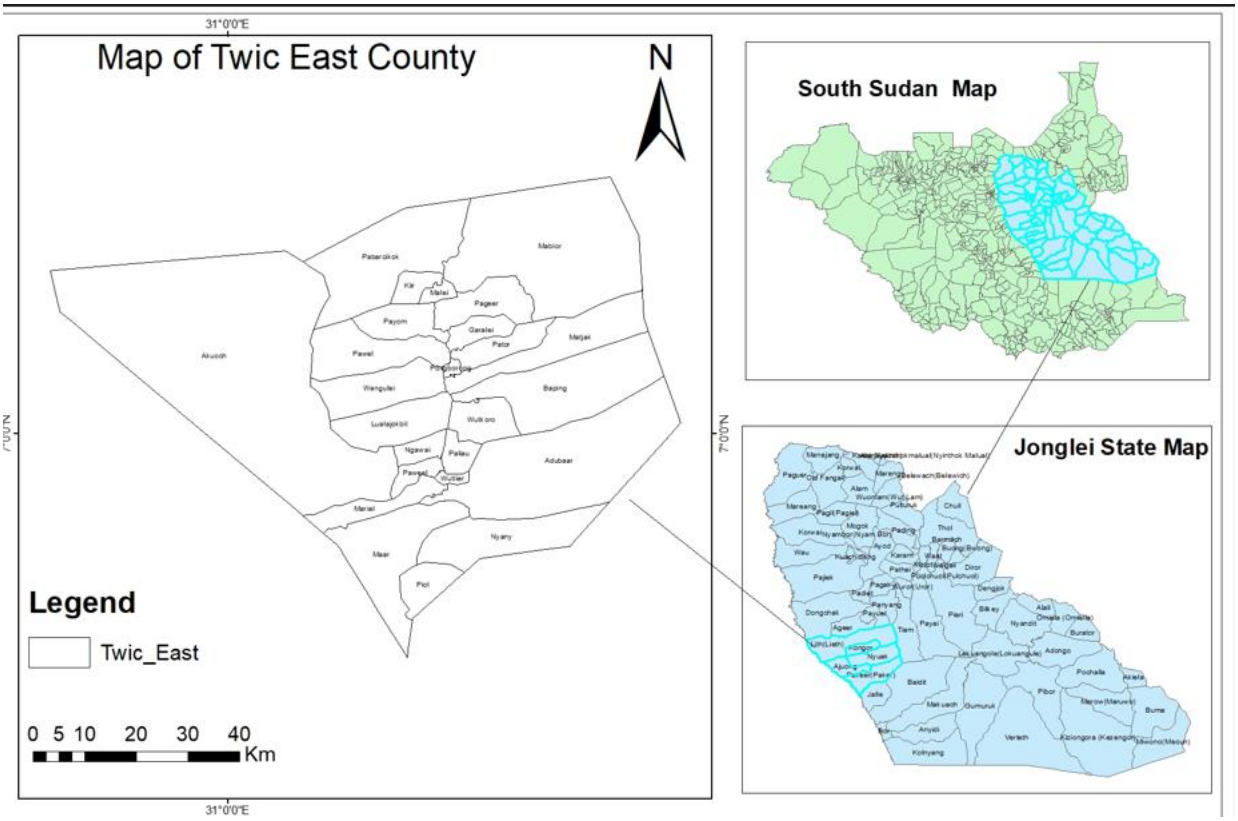
Methodology

This study adopts a mixed-methods research design to generate a comprehensive understanding of the socio-economic impacts of flooding and the effectiveness of flood management strategies in Twic East County. The use of both quantitative and qualitative approaches allows for triangulation of data, thereby enhancing the validity and depth of the analysis. Quantitative data provide measurable indicators of livelihood losses, displacement patterns, and access to basic services, while qualitative data capture the nuanced perceptions, coping strategies, and institutional dynamics that underpin community responses to flooding.

Study Area

Twic East County, located in Jonglei State, South Sudan, is characterised by flat terrain, seasonal riverine flooding, and a predominantly agro-pastoral economy. The county's proximity to the

White Nile and exposure to high climate variability result in frequent hydro-meteorological hazards that disrupt agricultural production, damage infrastructure, and displace populations. The socio-economic profile of the area is defined by subsistence farming, cattle herding, and fishing, with limited access to formal markets and public services. These characteristics make Twic East County a critical case for studying the intersection of environmental hazards, rural livelihoods, and governance in fragile contexts.



Source**:** Created by author using GIS data from ArcMap

Population and Sampling

A multi-stage sampling procedure was employed to ensure representativeness of the study population. In the first stage, five payams Pakeer, Ajuong, Nyuak, Kongor, and Lith(administrative divisions) within Twic East County were purposively selected based on historical exposure to severe flooding and reported livelihood impacts. In the second stage, villages within each selected payam were randomly chosen to capture spatial variation in flood effects. In the final stage, households within each village were selected using systematic random sampling, with the sampling interval determined by household listing data provided by local authorities. A total of 100 households participated in the survey, which represents a statistically sufficient sample for estimating household-level impacts within a 95 per cent confidence interval.

Data Collection

Data collection combined structured household surveys, semi-structured key informant interviews, and focus group discussions. The household survey captured quantitative data on demographic characteristics, livelihood sources, asset losses, displacement history, food security

status, and awareness of flood management initiatives. Key informant interviews were conducted with local government officials, traditional leaders, representatives of non-governmental organisations, and members of community-based flood management committees. These interviews explored governance arrangements, policy implementation challenges, and perceptions of institutional effectiveness. Focus group discussions were held separately with men, women, and youth to elicit diverse perspectives on coping strategies, resilience mechanisms, and barriers to recovery

Analytic Approach and Justification

The selection of analytical techniques was guided by the nature of the variables and the research objectives. Descriptive statistics were used to provide a clear overview of respondent characteristics and flood-related outcomes, which is essential for understanding the context of the study. Chi-square tests were chosen to assess associations between categorical socio-demographic factors and flood impacts, as this test is appropriate for evaluating relationships between nominal or ordinal variables. Independent samples t-tests were applied to compare mean differences in flood impact severity between high and low exposure villages, allowing for evaluation of potential disparities in experiences across geographic locations. One-way analysis of variance was employed to examine differences in perceptions of flood management effectiveness across Payam, which involved more than two groups. Multiple linear regression was selected to identify key predictors of perceived management effectiveness, providing a multivariate perspective while controlling for potential confounding variables. This combination of statistical techniques ensured robust, reliable, and interpretable findings aligned with the study objectives.

Rationale for Methodological Design

The methodological approach adopted in this study aligns with disaster risk reduction research that utilizes empirical, sub-community level data to assess resilience and management mechanisms (Kuhlicke et al., 2020). The use of standardized structured questionnaires enables comparison of responses across similar flood-prone areas, while statistical modelling facilitates identification of key drivers of vulnerability and potential interventions (UNDRR, 2019). By combining descriptive analyses with predictive modelling, the approach provides a more detailed understanding of the impacts of flooding in Twic East County and informs the development of preventive measures for policy formulation and community-based adaptation and planning strategies.

Data Analysis

Data were entered and analysed using IBM SPSS Statistics Version 28. The analytical workflow comprised four stages, detailed as follows. Initially, the dataset was examined for completeness, outliers, and inconsistencies. Records with missing values in key variables were excluded through listwise deletion, resulting in a final sample of 100 respondents. This step ensured the reliability and integrity of subsequent analyses. Descriptive analyses were conducted to summarize the socio-demographic characteristics of respondents, the impacts of flooding, and adopted coping strategies. Frequencies, percentages, means, and standard deviations were calculated to provide an overview of the dataset and facilitate interpretation of patterns. To explore associations and differences among variables, inferential statistics were performed. Chi-square tests were applied to examine the relationships between socio-demographic factors, including education level and type of livelihood, and flood-related impacts. Independent samples

t-tests compared the severity of flood impacts between villages categorized as high exposure and low exposure. One-way analysis of variance was used to assess potential differences in perceptions of flood management effectiveness across Payam's. Multiple linear regression was employed to identify predictors of perceived effectiveness of flood management. Independent variables included levels of community participation, access to early warning systems, and prior flood experience. Prior to running the regression, assumptions of linearity, independence of observations, normality, homoscedasticity, and absence of multicollinearity were evaluated and satisfied, in accordance with established guidelines (Hair et al., 2019). This structured approach ensured rigorous analysis of both descriptive patterns and relationships among variables, providing a comprehensive assessment of flood impacts and management effectiveness within the study area.

Ethical Considerations

The study adhered to ethical research principles, including voluntary participation, informed consent, and confidentiality of respondents. Prior to data collection, the research team obtained approval from the relevant local administrative authorities and briefed community leaders on the objectives and procedures of the study. Participants were informed of their right to withdraw at any stage without penalty, and no personal identifiers were recorded in the datasets to safeguard privacy.

Results

Socio-Demographic Profile of Respondents

The study analysed data from 100 participants drawn from five payams: Pakeer, Ajuong, Nyuak, Kongor, and Lith. Male respondents accounted for 57 per cent (n = 57), while females comprised 43 per cent (n = 43). The largest age cohort was 25 to 49 years (65 per cent, n = 65), followed by participants aged 50 years and above (21 per cent, n = 21) and those aged 18 to 24 years (14 per cent, n = 14). The majority of households relied on small-scale farming and fishing (75 per cent, n = 75), with pastoralism (16 per cent, n = 16) and petty trade (9 per cent, n = 9) being less common. Education levels were generally low, with 58 per cent (n = 58) reporting no formal schooling, highlighting persistent structural barriers to human capital development in rural Jonglei (UNESCO 2022).

Extent and Socio-Economic Impacts of Flooding

Flooding was nearly universal, with 93 per cent of respondents (n = 93) reporting exposure to at least one major flood in the past five years. Displacement during the most recent flood season was experienced by 67 per cent (n = 67), with the average flood duration measured at 7.8 weeks (SD = 3.1). Livelihood disruptions were substantial, including crop loss (82 per cent, n = 82), livestock mortality (65 per cent, n = 65), and home damage (73 per cent, n = 73). Female-headed households exhibited significantly higher post-flood food insecurity (M = 3.42, SD = 0.77) compared to male-headed households (M = 3.18, SD = 0.69), $t(98) = 2.61$, $p = .010$, underscoring gendered vulnerabilities in asset access, income generation, and social safety nets.

Rather than framing these impacts as isolated outcomes of hydrological events, the evidence suggests that flooding functions as a recurring socio-ecological shock that interacts with existing vulnerabilities and shapes livelihood trajectories. This perspective shifts the analytical lens from reactive loss assessment toward understanding how households reorganise, negotiate resources, and adapt within constrained institutional and environmental contexts.

Coping Strategies and Adaptive Mechanisms

Households employed diverse strategies to mitigate flood impacts, including temporary relocation to higher ground (66 per cent, n = 66), sale of livestock (48 per cent, n = 48), and reliance on food aid (73 per cent, n = 73). Livelihood diversification, such as engagement in fishing during flood periods, was more prevalent among households with prior flood experience, indicating adaptive behaviour informed by accumulated knowledge. These practices reflect a form of "everyday resilience" (Scoones 2009), in which communities leverage local resources, social networks, and experiential knowledge to sustain essential functions in the face of recurrent flooding.

However, reliance on reactive coping strategies also signals persistent structural gaps in risk reduction. While households demonstrate ingenuity, their strategies are often constrained by inadequate infrastructure, insufficient early warning systems, and limited institutional support, highlighting the co-dependency between community agency and formal governance mechanisms in shaping adaptive outcomes.

Effectiveness of Flood Management Strategies

Perceptions of flood management effectiveness varied significantly across the five payams, $F(4,95) = 3.92$, $p = .006$. Kongor Payam, where community-led dyke maintenance and early warning systems had been implemented, achieved the highest perceived effectiveness ($M = 3.64$, $SD = 0.62$), significantly surpassing Nyuak ($M = 3.28$, $SD = 0.59$) and Pakeer ($M = 3.15$, $SD = 0.64$). Access to functional early warning systems was associated with faster evacuation times ($M = 2.8$ hours, $SD = 0.9$) relative to households without access ($M = 5.1$ hours, $SD = 1.3$), $t(98) = -10.94$, $p < .001$.

Multiple linear regression identified community participation in preparedness activities ($\beta = 0.38$, $p < .001$), prior flood experience ($\beta = 0.22$, $p = .024$), and access to early warning systems ($\beta = 0.19$, $p = .041$) as significant predictors of perceived management effectiveness. The model explained 29 per cent of the variance ($R^2 = 0.29$, $F(5,94) = 7.71$, $p < .001$). An interaction term between early warning access and community participation approached significance ($\beta = 0.11$, $p = .072$), suggesting that the benefits of early warning systems are amplified when communities actively engage in preparedness measures.

These findings indicate that hybrid approaches, combining structural interventions with participatory governance, are more effective than top-down strategies alone. They highlight the importance of co-production in disaster resilience, where the efficacy of technological or infrastructural measures is contingent upon community engagement and contextual adaptation.

Discussion

The evidence demonstrates that flooding in Twic East County is a complex socio-environmental challenge, rather than a purely hydrological phenomenon. Recurrent inundation interacts with pre-existing social, economic, and institutional vulnerabilities, resulting in differentiated impacts across gender and household types. Female-headed households experience disproportionately higher post-flood food insecurity, reflecting systemic inequities in resource access and decision-making authority.

Coping strategies and resilience mechanisms are shaped by experience, social networks, and local knowledge. Households exhibit adaptive persistence through relocation, livelihood

diversification, and utilisation of humanitarian assistance, yet these strategies alone are insufficient to overcome structural vulnerabilities. The performance of community-led flood management initiatives, particularly in Kongor Payam, underscores the critical role of local agency in enhancing both preparedness and recovery. The combination of infrastructure investment, early warning systems, and active community participation produces measurable improvements in evacuation efficiency and perceived management effectiveness. From a theoretical perspective, these findings reinforce the notion that socio-economic resilience is co-produced through dynamic interactions between environmental exposure, institutional support, and community agency. Adaptive capacity is not inherent but emerges from the interplay of local knowledge, governance structures, and structural measures. Practically, this implies that integrated flood management strategies should couple physical infrastructure with participatory approaches, targeted social protection, and livelihood support to reduce vulnerability and strengthen long-term resilience (UNDRR 2019; Wisner et al. 2014).

In summary, the study reframes flooding as a recurring socio-ecological process with complex, multi-dimensional effects. This perspective shifts attention from reactive emergency response toward proactive, inclusive, and contextually grounded flood management that recognises the agency of local communities while addressing systemic vulnerabilities.

Theoretical and Policy Implications

The results of this study demonstrate that flooding in Twic East County is not merely an environmental hazard but a multidimensional stressor that shapes livelihoods, migration patterns, food security, and long-term socio-economic stability. These findings underscore the need to broaden existing resilience and disaster risk reduction theories to account for the lived realities of communities facing recurrent and predictable seasonal inundations. From a theoretical standpoint, the study aligns with the Pressure and Release (PAR) model (Blaikie et al., 1994), which explains disasters as the intersection of hazard exposure and underlying vulnerability. In Twic East County, vulnerability is amplified by poor infrastructure, limited market access, weak institutional capacity, and political marginalisation, factors that the PAR model highlights as root causes. However, as (Wisner et al. 2014) and (Birkmann 2011) suggest, standard models often overlook cultural and historical contexts that shape how communities perceive and respond to flooding. For instance, local traditions of seasonal migration and communal livestock management, while adaptive in some years, can be disrupted by prolonged flood duration or by government-imposed movement restrictions.

The findings also reinforce the value of equity- and context-sensitive disaster governance frameworks. In this context, equity-minded policy design means recognising that resilience-building responsibilities cannot be placed solely on communities without addressing structural inequalities in aid distribution, infrastructure investment, and political representation. Current relief allocation patterns in Twic East appear to favour more accessible areas, leaving remote payams at a relative disadvantage in both early warning reception and post-flood recovery assistance. This mirror (UNDRR's 2019) observation that spatial and political biases in disaster response can perpetuate vulnerability. The Sustainable Livelihoods Framework (DFID, 1999) offers a complementary lens to interpret the findings. In Twic East County, households' adaptive capacity depends on the combined strength of natural, social, human, physical, and financial capital. Communities with stronger social networks and diversified income sources, such as fish trading or dry-season farming, showed faster recovery rates after the 2023 floods. This suggests that flood management strategies should not only focus on physical infrastructure such as dikes

but also on livelihood diversification and capacity-building programmes that enhance long-term resilience.

From a policy perspective, the study suggests that county and national disaster management bodies need to rethink vulnerability identification methods. Rather than relying solely on loss statistics or displacement figures, a strengths-based resilience assessment that identifies communities' existing coping strategies and adaptive behaviours would allow for more targeted and empowering interventions. This shift aligns with global best practices in community-driven disaster risk reduction (UNDRR, 2019; Kuh et al., 2005). Theoretically, the results challenge purely hazard-focused or engineering-centric flood management paradigms. Community adaptation in Twic East is influenced not only by physical flood defences but also by institutional trust, inclusive governance, and the way flood impacts are narrated by both authorities and the media. A governance approach that frames flooding solely as a humanitarian crisis risks ignoring opportunities for adaptive livelihood planning, such as flood-based recession farming or seasonal fishery development.

In conclusion, this study supports a multi-layered model of flood resilience that integrates environmental, socio-economic, and cultural perspectives. Recognising the interplay between structural support systems, local adaptive practices, and equity-focused governance is critical to designing flood management strategies that genuinely promote sustainability, social justice, and long-term community well-being in Twic East County.

Practical Policy Recommendations

1. Integrated Flood Risk Management Policies should promote a hybrid approach that combines structural measures, such as dyke construction, drainage systems, and flood-proof infrastructure, with non-structural interventions, including early warning systems, community training, and livelihood diversification. Integration of these components can enhance both preparedness and long-term resilience.
2. Community Participation and Capacity Building Local communities must be actively involved in the planning, implementation, and monitoring of flood management activities. Participatory governance mechanisms, including community committees and traditional leadership structures, should be strengthened to ensure that interventions are contextually relevant and responsive to local needs.
3. Targeted Social Protection Given the observed gendered vulnerabilities, particularly among female-headed households, social protection measures should include targeted assistance, access to credit, and livelihood support programs to reduce post-flood food insecurity and enhance adaptive capacity.
4. Early Warning Systems and Knowledge Integration Investment in accessible and reliable early warning systems is critical. These systems should be linked with community-level preparedness activities and incorporate indigenous knowledge to improve dissemination and uptake. Regular drills and education campaigns can enhance the responsiveness of households to impending flood events.
5. Policy and Institutional Coordination Government agencies, non-governmental organisations, and community-based structures should coordinate to reduce duplication of effort and enhance resource efficiency. Policies must foster multi-sectoral collaboration

across agriculture, infrastructure, disaster management, and social services to address the multi-dimensional nature of flood risk.

6. Monitoring and Evidence-Based Decision-Making Continued collection of household-level data, combined with hydrological monitoring, can inform adaptive management strategies. Evidence-based policy development will allow interventions to respond dynamically to changing flood patterns and socio-economic conditions.

Implications for Theory and Practice

The study contributes to disaster risk reduction scholarship by demonstrating that resilience is co-produced through the interplay of environmental exposure, institutional support, and community agency. Practically, the findings advocate for a shift from reactive emergency response toward proactive, inclusive, and contextually grounded flood management. Strengthening the interactions between households, governance structures, and structural interventions is essential for reducing vulnerability and fostering long-term socio-economic resilience in flood-prone regions of South Sudan.

Community Voice and Experience

The lived experiences and narratives of community members remain essential for understanding the impacts of flooding and the effectiveness of management strategies in Twic East County, even though this study primarily employed a quantitative approach using survey data and institutional records. Previous studies indicate that the perspectives of affected groups provide valuable insights into how individuals perceive, respond to, and recover from disaster shocks (Birkmann, 2011; Wisner et al., 2014). To complement the statistical findings, a thematic analysis was conducted using open-ended survey responses, notes from community meetings, and previous focus group discussions to capture the viewpoints of individuals directly affected by floods.

First, respondents frequently highlighted the importance of timely and accessible assistance from traditional leadership, humanitarian organizations, and local authorities. Many participants compared their experiences across different flooding seasons, noting improved coping capacity where relief efforts were better coordinated, early warnings were clear, and support such as food aid, boats, and shelter materials was provided promptly. These observations align with disaster risk reduction literature, which emphasizes that institutional responsiveness can significantly mitigate the impacts of floods (UNDRR, 2015).

Second, several respondents reported feelings of isolation and loneliness during peak flooding, particularly among older adults, women-headed households, and residents of remote villages who were unable to evacuate due to high waters. Following the floods, many individuals established or joined local informal networks to share information, resources, and assistance. These self-organized coping mechanisms, often facilitated by existing social ties, fostered a sense of collective resilience, reflecting theoretical perspectives that highlight community cohesion and solidarity as key components of adaptive capacity (Adger, 2003).

Finally, community members emphasized that their efforts to rebuild after each flood were driven not only by necessity but also by a strong commitment to preserving livelihoods, land, and cultural heritage. As one elder noted, “When the waters rise, we lose our homes and our crops, but not our will. Each flood teaches us new ways to survive.” These narratives demonstrate that resilience in Twic East extends beyond endurance; it encompasses

transformation, adaptation, and empowerment. Including these perspectives in both policy development and future research can bridge technical flood management approaches with the lived experiences of affected communities. Residents are not passive recipients of aid; they actively shape their own recovery and survival strategies. Recognizing and valuing their experiences is essential for designing inclusive, context-specific, and sustainable flood management strategies in Twic East County.

Limitations and Future Directions

Although this study provides significant insights into the socio-economic impacts of flooding and the effectiveness of flood management strategies in Twic East County, several limitations warrant consideration. First, the focus on a single county may constrain the generalizability of findings to other flood-prone areas in South Sudan or comparable contexts. Broader, multi-county studies could enable comparative analysis across diverse flood-affected regions. Second, the cross-sectional nature of the data captures household perceptions and experiences at a single point in time, limiting causal inference and temporal understanding. Longitudinal research is recommended to examine how resilience, adaptation strategies, and livelihood recovery evolve following major flood events. Third, while demographic variables such as age, gender, and livelihood type were included, additional factors like household income, land tenure security, prior flood exposure, and access to credit or insurance were not systematically captured. Future studies should incorporate these dimensions to better understand determinants of vulnerability and recovery. Fourth, assessment of flood management effectiveness relied primarily on community perceptions, which, while valuable, may be influenced by recall bias or socio-political factors. Integrating objective measures such as hydrological data, satellite imagery, and post-disaster reports would strengthen the robustness of future findings. Fifth, gendered and socio-cultural aspects of flood impacts were not fully explored. Considering the differentiated roles and vulnerabilities of men and women, gender-sensitive analyses are necessary to inform equitable policy interventions. Future research should also evaluate the efficacy of specific interventions, including dyke rehabilitation, community-based early warning systems, and climate-resilient livelihood programs, using rigorous program evaluation methods. Mixed-methods approaches combining household surveys, focus group discussions, and geospatial analysis would provide comprehensive insights into both challenges and successes. Addressing these knowledge gaps requires collaborative, interdisciplinary, and participatory research that centres community perspectives while incorporating technical expertise. Such efforts are essential for designing flood management strategies that reduce immediate risk while fostering long-term resilience, adaptive capacity, and sustainable livelihoods in Twic East County and similar contexts.

Conclusion

This study provides a comprehensive assessment of the socio-economic impacts of flooding on households in Twic East County and evaluates the effectiveness of existing flood management strategies. The findings highlight flooding as a recurrent socio-ecological process that interacts with structural vulnerabilities, shaping livelihoods, governance, and community adaptation. High rates of displacement, crop loss, livestock mortality, and damage to homes underscore the severity of recurrent floods in undermining household resilience. Gendered disparities were evident, with female-headed households experiencing greater post-flood food insecurity, reflecting inequities in access to assets, income-generating opportunities, and social protection.

Coping strategies adopted by households, including temporary relocation, livelihood diversification, and reliance on humanitarian aid, demonstrate adaptive persistence and the development of contextually informed resilience mechanisms. However, these strategies alone cannot compensate for the deficiencies in formal flood management systems. The study found that community-led initiatives, particularly dyke maintenance and early warning systems, significantly enhance perceived effectiveness, reduce evacuation times, and improve recovery outcomes. Regression analyses further revealed that community participation, prior flood experience, and access to early warning systems are strong predictors of adaptive capacity.

Overall, the study reframes flooding in Twic East County as a multi-dimensional challenge requiring an integrated, participatory, and context-sensitive approach. It demonstrates that resilience emerges from the interaction between community agency, institutional support, and structural interventions rather than from any single component alone.

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