Assessing The Role of Land Use Change in Flood Risk and Community-Based Preparedness in Mitigating Disaster Risk in Dilimi Catchment

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Abstract- *Urban communities in sub-Saharan Africa are becoming increasingly vulnerable to persistent and growing flooding due to the rapid changes in land use as well as the lack of disaster preparedness. The research paper analyses land use/land cover change and the dynamics of flood risk coupled with community-based disaster preparedness in the Dilimi catchment of Jos North, Plateau State, Nigeria, with reference to the susceptible communities of Rikkos and Gangare. The mixed-methods research design was adopted and combined the geospatial analysis of satellite imagery (20032023), hydrological catchment modeling, quantitative survey of 195 households, secondary data analysis on floods (20122024), and qualitative focus group discussions. The analysis of land use/land covering showed the following changes in the landscape during the 20-year period: the built-up territories grew by 141.8% (32.24 km 2 to 13.33 km 2), and the vegetation cover has also decreased by 64.8% (40.14 km 2 to 14.14 km 2). This urbanization continued to gravitate along riparian systems, with urbanized zones closely bordering river lines by 2023 and this change fundamentally changed the hydrology of catchments and increased the risk of floods. A drainage density study found main river channel high-concentration areas as being especially prone to flood. The secondary flood information recorded a significant jump in community outcomes between the years 2012 and 2024, as the number of people affected decreased to 1,647 to 15 in Rikkos and 839 to 15 in Gangare, respectively, and no fatality, displacements or property damage were recorded by 2024. Although a small percentage (33.8) of the respondents attended formal simulation exercises, the two communities showed high levels of preparedness (5070%), which were attributed to experiential learning due to local community floods, local knowledge, and awareness campaigns as well as community-based initiatives such as monthly community sanitation and drainage clearance. A statistically significant correlation between the participation in the simulation exercise and the increased preparedness was confirmed by chi-square analysis (p = 0.001). Nevertheless, there are still critical issues such as the lack of technical training (38.9%), the lack of flood control facilities (35.4%), loss of disaster management equipment, and the intergenerational knowledge transfer. The research finds that although the practice of experiential learning has a major positive impact on the resilience of a community, sustainable management of the flood risk should incorporate synergistic strategies that comprise the restoration of riparian zones, urban planning, institutionalized training and delivery of disaster management infrastructure. It is suggested to employ an integrated catchment management framework that will balance scientific hydrological analysis and community based knowledge in an effort to govern flood risk akin to a more effective flood risk management in watersheds which are rapidly urbanizing.*

Index Terms- Land Use Change, Flood Risk, Community Preparedness, Simulation Exercises, Urban Flooding, Disaster Risk Reduction, Riparian Encroachment

I. INTRODUCTION

Floods are one of the worst and most recurrent natural disasters in the world, causing massive destruction of lives, population displacement, and economic loss, especially in rapidly urbanising countries in sub-Saharan Africa (Douglas et al., 2008; Malgwi et al., 2021). The increase of flood frequency in recent decades has been closely associated with the increase of land use and land cover changes induced by population growth, urban sprawl and agricultural expansion, as well as degradation of natural ecosystems (Abass et al., 2020; Andrianjakamisy et al., 2021). As natural landscapes are continuously replaced by impervious surfaces, the hydrological balance of catchments is fundamentally altered,

which includes the reduction of the capacity to infiltrate, the increase of surface runoff volumes and the reduction of the time of concentration of storm water into river channels (Mejia and Moglen, 2010; Miller et al., 2014). These transformations, coupled with poor urban planning and poor drainage facilities, have made many communities in developing cities highly vulnerable to recurring and more intense flooding disasters, which threaten the sustainable and human security development (Jha et al., 2012; Herslund et al., 2016).

Within the Nigerian context, the problem of urban flooding has taken frightening proportions with Cities of various ecological zones struggling with the effects of ill-managed urban growth and environmental degradation (Akukwe et al., 2018; Ogunwumi and Ihinegbu, 2025). Jos, the capital of Plateau State is especially vulnerable in of the unique topographic location on the Jos Plateau with its steep gradients, thin soils and network of catchments which drain rapidly in intense rainfall events. The Dilimi catchment, which falls under Jos North Local Government Area, is subject of decades of unabated urban expansion and massive amounts of vegetation clearence and systematic encroachment on the riparian corridors has led to some extreme changes in the natural hydrological functioning of the watershed. Low-lying communities that are located within and around the catchment have felt the impact of these changes most significantly in the form of recurrent flood inundations that destroying homes, uproot livelihoods, contaminate water sources and take lives with increasing regularity (IOM, 2022; GRMI, 2023), most notably Rikkos and Gangare.

Despite the worsening flood crisis in the Dilimi catchment, there is still a gap in the scientific and policy literature over the actual nature and extent of land use-driven hydrological change relationship to flood risk in this particular watershed. Equally under explored is the dimension of community-level disaster preparedness which is a critical but often neglected component of effective flood risk management (Okunola et al., 2024; Tietjen et al., 2023). While physical mitigation infrastructure such as drainage channels and embankments received a lot of attention, the capacity of affected communities to anticipate, respond and recover from flood events remain poorly understood and inadequately supported (Akintunde et al., 2022). This disconnect between technical approaches to flood management and community-based approaches to preparedness has made vulnerable populations in the catchment overall less resilient and there is an urgent need for an integrated and locally responsive assessment of flood risk and mitigation within the Dilimi watershed (Sayers et al., 2013; NIHSA, 2024).

This study therefore aims to fill in these interrelated gaps, with a complete and multidimensional study of land use change, flood risks and community preparedness in the Dilimi catchment. Specifically, there is a need to evaluate the temporal and spatial evolution of land use and land cover from 2003 to 2023 and to investigate the hydrological relevance of these changes to flood risk in Jos North to provide a two-decade long perspective on how transformation of the landscape has gradually increased the flood generation processes playing out in the area (Güneralp et al., 2015). The study further seeks to evaluate the level of preparedness for flood disaster among the Rikkos and Gangare communities and the effectiveness of simulation exercises in strengthening disaster response capacity which was as essential to flood risk reduction as physical infrastructure (Ogunwumi and Ihinegbu, 2025; Sendai Framework, 2015). Finally, the purpose of the study is to identify main challenges and strengths in existing flood mitigation strategies and propose an integrated catchment management as a framework gathering results of both scientific analysis and community knowledge in order to inform flood risk governance on a more sustainable, inclusive and effective approach in the Dilimi catchment (Andrianjakamisy et al., 2021; Abass et al., 2020).

II. METHODOLOGY

2.1 Study Area

Geographic Extent and Location

The geographic extent of the study area spanning from longitude 8°49'0"E to 8°57'0"E and latitude 9°53'0"N to 10°1'0"N, encompassing an approximate east-west and north-south span of 14.8 kilometres. The Dilimi is situated within the Jos

North Local Government Areas of Plateau State, Nigeria. The Dilimi River, which serves as the primary drainage system for this area, flows through Jos city and is a key hydrological feature of the region.
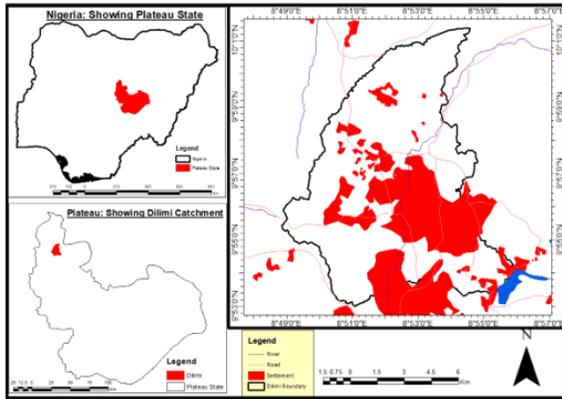

Figure: Map of Dilimi catchment in Plateau state of Nigeria

Multiple stream tributaries are visible across the catchment. These channels run broadly in a north-south alignment along the western portion of the catchment, with additional tributaries flowing in a northwest-to-southeast direction through the central zone. These streams appear to converge toward the southern boundary of the catchment, forming what is consistent with a dendritic drainage pattern typical of plateau-edge terrain. The overall flow direction show that water drains southward off the Jos Plateau, consistent with the topographic characteristics of the area.

2.2 Research Design

The research design used in this study was a mixed-methods research design where geospatial analysis, quantitative survey techniques, and qualitative data collection techniques were combined to achieve a holistic evaluation of land use change, flood risk, and community-based disaster preparedness. The mixed-method design was deemed to be the most adequate since the research aim was dual, and both the spatial and socioeconomic aspects of flood vulnerability had to be addressed at the same time (Creswell and Creswell, 2023). This was due to the fact that a strong triangulation of the findings was achieved by the combination of remote sensing analysis and primary field data which strengthens the reliability and validity of the final results.

2.3 Geospatial Data Acquisition and Land Use/Land cover Mapping.

Geographic Information System (GIS) and remote sensing were used to collect and analyse multi-temporal satellite images as part of the measurements of spatiotemporal dynamics of land use and land cover (LULC) alterations in the 2003 and 2023 of land use in the Dilimi catchment. The Earth Explorer site offered by the United States Geological Survey (USGS) also produced satellite images of three time periods 2003, 2013, and 2023. The images were also taken through the conventional pre-processing functions such as radiometric, atmospheric, and geometric rectification to ascertain spatial accuracy and temporal comparable among the three periods (Rwanga and Ndambuki, 2017; Abass et al., 2020).

A maximum likelihood classification algorithm was utilized in ArcGIS software to do supervised image classification. It determined five categories of land use, land cover, which include Built-up, Vegetation, Bare Surface, Rock Outcrop and Water Body. The samples used in training samples of each class were collected using a mixture of ground-truthing fieldwork, and visual retrieval of high-resolution imagery at Google Earth. A confusion matrix and Kappa coefficient were used to assess the post-classification accuracy to ensure that the classified maps were reliable (Rwanga and Ndambuki, 2017). The change detection analysis was then applied to measure the areal extent of each LULC category in the three time periods and the rate of change was calculated to determine the trend of the urban growth and loss of vegetation over the period of study which spanned two decades.

2.4 Catchment Delineation and Drainage Density Analysis.

The process of catchment delineation and sub-basin mapping was performed with the help of a Digital Elevation Model (DEM) received on the basis of the Shuttle Radar Topography Mission (SRTM) with the spatial resolution of 30 metres. The tools of hydrological analysis in ArcGIS, the Hydrology toolset of the Spatial Analyst extension to be precise,

were applied to calculate flow direction, flow accumulation, stream networks, and watershed boundaries of the Dilimi catchment and its sub-basins (Msabi and Makonyo, 2021). The density of the drainages calculated was the sum of the length of stream channels per unit area of the catchment which was then grouped into five categories of very low drainage concentration areas to very high drainage concentration areas. The identification of flood prone regions and high run off accumulation regions in the catchment were made using these outputs.

2.5 Collection of Secondary Data Flood Trends.

The National Emergency Management Agency (NEMA), North Central Zonal Office, Jos retrieved secondary data on flood trends, comprising frequency of floods, number of persons affected, displaced people, fatalities, and damaged buildings in Rikkos and Gangare communities. Data were used to determine how floods have occurred and impacted people over time and also to determine how resilience and vulnerability of the community to floods has changed over time. Relevant published reports on government agencies and disaster risk management organizations were used to complement the secondary data that aimed at providing contextual validation of the field findings (NIHSA, 2024).

2.6   Primary Data Collection

2.6.1   Questionnaire Survey

Structured questionnaire was used to determine preparedness of the household respondents in Rikkos and Gangare communities to the flood disaster, community participation in the simulation exercises (SimEx), and effectiveness of the existing flood mitigation measures. The questionnaires were filled using systematic random sampling where 195 questionnaires were distributed among the respondents who were chosen among the households in the two communities. The questionnaire was structured into demographic types, attending flood simulation drills and training sessions, communal scale flood management actions adopted, and assumed strong and ineffective aspects of the current disaster preparedness systems. The questions were formulated based on the Likert scale, dichotomous, and multiple-choice options to respond to both the quantitative and qualitative aspects of preparedness (Tietjen et al., 2023).

2.6.2   Checklist Assessment

Standard preparedness checklist (see Appendix C) was used to evaluate the general state of the flood disaster preparedness in both communities. Key preparedness indicators such as early warning systems, access to emergency supplies, the household evacuation plan, and coordination structures in the community were assessed using the checklist. The checklist has offered a systematic way of measuring preparedness levels without considering self-reported survey data to enable a more objective understanding of community readiness (Ogunwumi and Ihinegbu, 2025).

2.6.3   Focus Group Discussion (FGD)

An immediate discussion with the eight community representatives delegated by Christian Aid in the form of Focus Group Discussion (FGD) was held right after the questionnaire was administered. The FGD was modeled to draw profound qualitative information on the experiences of community members on flood disasters, the obstacles that restrict the effectiveness of disaster response, perceived effectiveness of training and simulation exercises on flood management with NEMA and CAID, and priority areas of the community in enhancing their future management of floods. A semi-structured FGD guide was used to facilitate the discussion, which was audio-taped with the consent of the participants and transcribed and analyzed in thematic format to determine recurring patterns and critical issues (Creswell and Creswell, 2023).

III.   RESULT AND DISCUSSION

3.1 Catchment Analysis

The topography of Jos North is the drainage system because it comprises of high lands and valleys. The different sub-basins depicted in Fig 1 below are identified by different colors, which depict different watersheds. These basins play a critical role in distributing water in the basin. One of the rivers in the region, which is the subject of the current research, is the Dilimi catchment which is a major

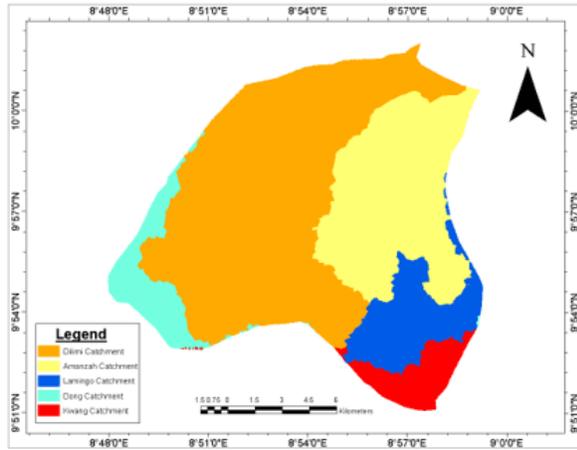drainage line that influences both urban and peri-urban water transport.

Fig 1: the drainage basins found in Jos North Local Government.

Dilimi Catchment Area is a total of 108.47 km 2 that is also a rough half of Jos North that occupy the entire landmass of 261.99 km 2. This area is connected to the river which drains the highland areas of Jos and it acts as the main drainage stream in the basin. Topography influences the runoff, erosion and sediment transportation therefore the catchment is critical in the urban water management. The issues that are affecting the hydrological balance of the region are however, urbanization, deforestation of rivers edge to facilitate settlement development, and poor disposal of wastes that are putting the region at a greater risk of floods.

3.2 Urban Expansion Along River Channels: A Two-Decade Trajectory of Riparian Encroachment (2003–2023)
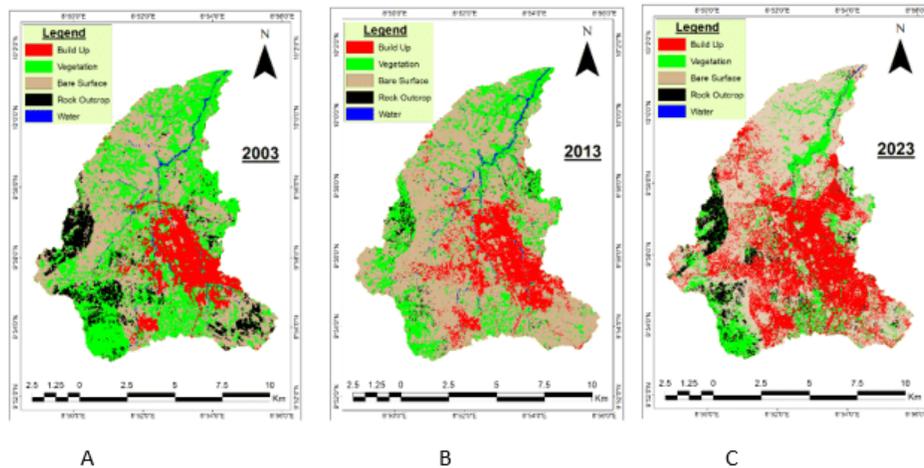

Figure 2: Land Use/Land Cover (LULC) of Dilimi Catchment

In 2003, the river channels (indicated in blue) are reasonably clear and recognizable, and the green (vegetation) buffers on either side of the waterways are significant as indicated by fig 2 A. Built-up areas (red) are concentrated on the central, and southern, part of the study area and are not in physical contact with the river corridors. The riparian zones seem to be rather untouched, with the urban development penetrating the channels to a very slight extent at this stage. Figure 2B reflected a significant change in the year 2013; with Built-up areas spreading outwards and starting to creep along the river channels.

Vegetative buffer that had formerly safeguarded the riparian corridor has scrawnily faded away in various sections in its place is bare surface (tan/beige). It is now being marked by an ever-growing presence of red (built-up) and bare surface patches in-between the blue river lines as opposed to a green vegetation, thus showing that urban development did start to follow the drainage network as a growth corridor.

This has escalated significantly in 2023 (Fig 2C). Constructed red lands now crowd at very close quarters with the blue river channels and in some

places touching them directly. The vegetative buffers which border the rivers in a green manner have reduced or vanished entirely in most of the areas. This trend indicates that the river channels are currently playing the role of urbanization axes where the settlement sprawl is progressing in a linear direction along the two banks. The areas of rock outcrop (black) have also risen in the northwest which may be attributed to land degradation that is attributed to vegetation clearance related to the expansion.

Table 1: Land Use/Land Cover total area covered in Dilimi Catchment

S/N	Land Use/Cover	2003 Area (Km^2)	2013 Area (Km^2)	2023 Area (Km^2)
1	Build Up	13.33386	15.62294	32.2382
2	Vegetation	40.14004	22.54549	14.13972
3	Bare Surface	43.29929	66.67794	53.79741
4	Rock Outcrop	10.30004	2.196923	8.09457
5	Water Body	1.268161	1.303229	0.10959

The 20-year assessment indicates that there is massive landscape change in the Dilimi catchment that is marked by the high rate of urbanization as indicated in table 1 and figure 2. The built-up areas increased more than 13.33 km 2 (12.3% of the total area) in 2003 to 32.24 km 2 (29.7%) in 2023, which is an increase of 141.8% with an annual rate of 0.95 km 2/year. Spatially, this urban growth is concentrated around the central, and southern parts of the catchment and this can be readily seen in the comparative maps of figure 2. The vegetation cover suffered extreme losses of 64.8 percent of the original area between 40.14 km 2 and 14.14 km 2. This amounts to a loss of 1.30 km 2/year annually which means a lot of deforestation and conversion of land to areas where urban development will take place. The spatial pattern indicates that vegetation loss has taken place only in the regions directly surrounding growing urban cores to produce a unique pattern of urban-induced land cover change.
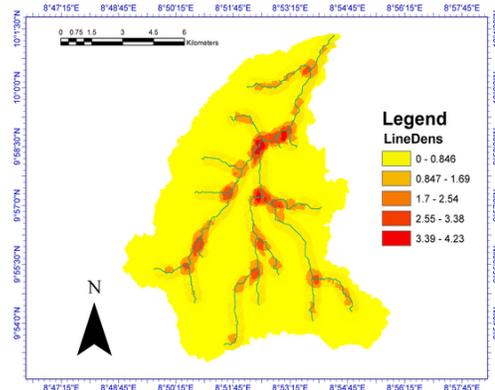
3.2 River Channels Density

Fig 3: Lines Density of Dilimi Catchment

Figure 3 shows areas in Dilimi catchment that have different drainage densities. Areas with very low density of drainage, i.e., sparse water channels are shown in the yellow regions with a density between 0 and 0.846. The areas are located at lower runoff areas. Regions with a density between 0.847 and 1.69 exhibit a minor upward shift in the drainage concentration, which is an indication of a change of areas between upland and lowland. The orange regions had density of 1.7 to 2.54, which means medium drainage density. In such areas, streams and tributaries are more common implying moderate amounts of run off. Dark orange zones (2.55 -3.38) are a sign of the high drainage concentration areas, which are close to the major river channels or areas of the elevated runoff. The red areas (3.39 - 4.23) are the most densely populated areas, and they are the coming together points of several streams or the main river channel. These are flood prone areas and major channels of drainage of runoff. As can be seen in Figure 3, the dense points (red and dark orange) are concentrated along the main drainage channels of the Dilimi River and its tributaries. This trend illustrates that these areas are largely influenced by the major river courses and areas of heavy runoff.

3.4.0 ANALYSIS ON FLOOD TRENDS

The trends on floods in Rikkos and Gangare were determined using the secondary data accessed in NEMA, North Central Zonal Office Jos. The data indicated the flood events that occurred between the years 2012 to 2024 and it was seen that there was

great variation in the effects and preparedness by the areas throughout the year. Rikkos and Gangare communities recorded tremendous flood disaster preparedness between 2012 and 2024. In 2012, both communities experienced severe effects; Rikkos documented 1,647 cases of affected persons, 143 displacement cases, 18 deaths, and extensive destruction, whereas Gangare documented 839 affected people, 102 displacement cases, 20 deaths and extensive destruction. The effects gradually reduced with time. As of 2024, there were little impacts on the two communities, and 15 individuals were affected in each of the communities and there were no reported cases of deaths, displacements, and damages. This enhancement is an indicator of increased disaster preparedness and mitigation, which makes the two regions less vulnerable and resilient to disasters.

3.4.1 Flood Trends in Rikkos Community

Table 4.3 Data on flood trends in Rikkos

Community	Year	Frequency	No. of affected persons	No. of displaced people	No. of death	Houses damaged	Infrastructures damaged
Rikkos	2012	2	1,647	143	18	66	6
Rikkos	2018	1	1,200	200	3	11	1
Rikkos	2022	2	150	150	0	4	2
Rikkos	2023	1	15	0	0	3	2
Rikkos	2024	1	15	0	0	0	0

Source: NEMA, Jos.

Figure 4.6: Flood impact on Rikkos community
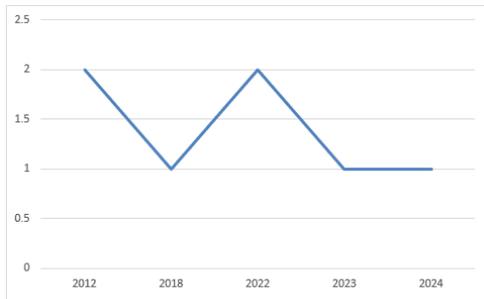
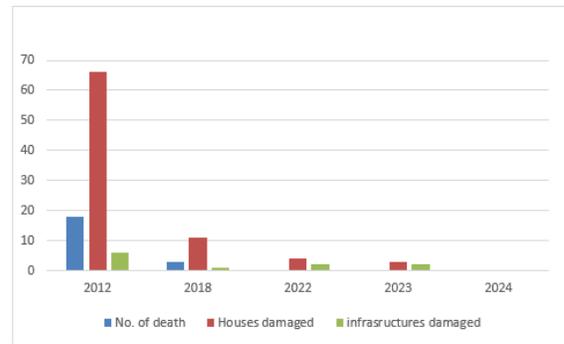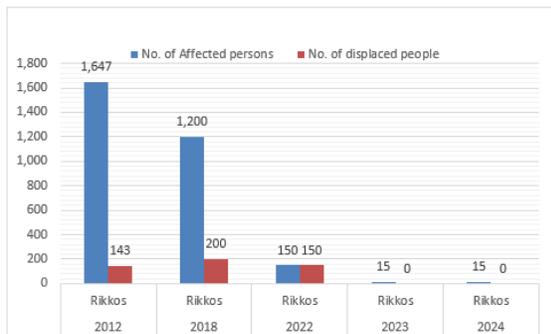Figure 4.5: Frequency (No. of flood occurrence in Rikkos community)

Figure 4.7: Magnitude of flood disaster in Rikkos community

3.4.2 Flood trends in Gangare community

Table 4.4: Data on flood trends in Gangare community

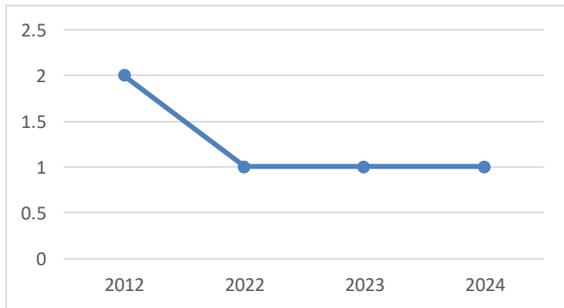| Community	Year	Frequency	No. of affected persons	No. of displaced people	No. of death	Houses damaged	Infrastructures damaged
Gangare	2012	2	839	102	20	134	3
Gangare	2022	1	95	95	0	5	0
Gangare	2023	1	19	0	0	5	1
Gangare	2024	1	15	0	0	0	0

Source: NEMA, Jos.

Figure 4.8: Frequency (No. of flood occurrence in Gangare community)
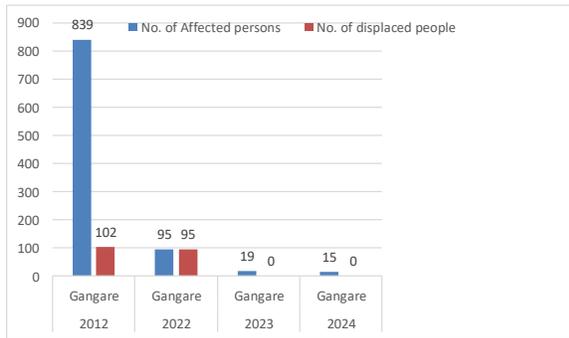

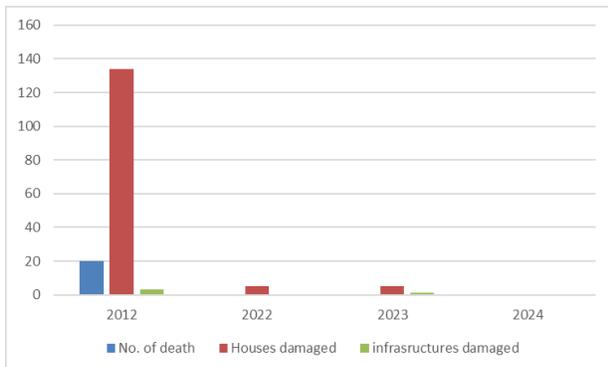Figure 4.9: Flood impact on Gangare community

Figure 4.10: Magnitude of flood disaster in Gangare community

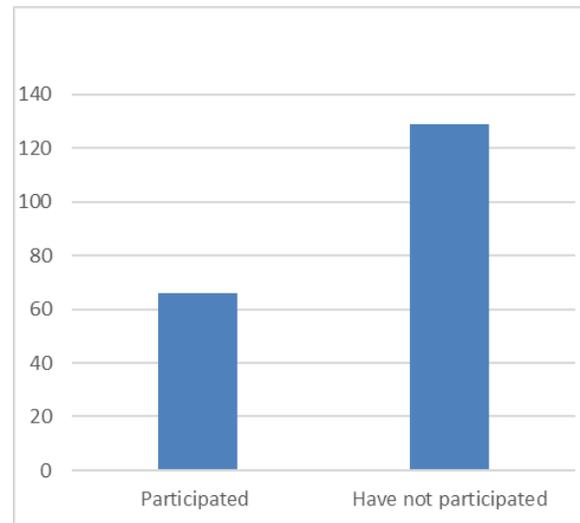## 3.5 ANALYSIS ON LEVEL OF PREPAREDNESS IN THE COMMUNITIES

Figure 4.1: Participation in Flood SimEx

The flood preparedness analysis of Rikkos and Gangare communities- figure 4.1 indicated that a substantial part of the respondents (66.2) has not attended flood simulation exercises or any form of organized training whereas, 33.8% have attended. This implies that more community participation in such preparedness activities or training exercises is necessary to make more residents available to deal with flood disasters.
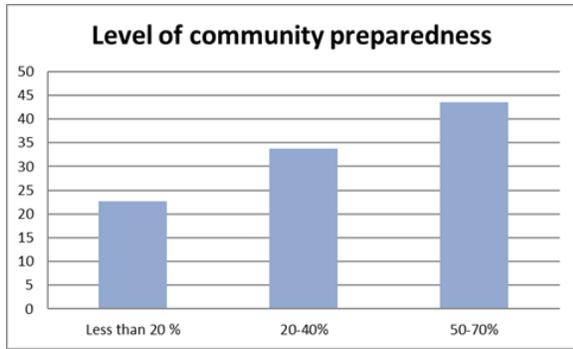
Figure 4.2: Level of community preparedness

Checklist (Appendix C) was used to assess the level of preparedness of the communities. Although figure 4.2 showed that only 33.8 percent of the community members have attended trainings/SimEx both communities had a high level preparedness (50-70) as shown in figure 4.2. This implies that, with the exception of SimEx that led to the heightened awareness and preparedness among the communities, the community overtime through experience, local knowledge, teachings (particularly in religious meetings) and awareness program designed by NEMA/CAID has been able to prepare to disaster of floods, to know the cause of this disaster and take appropriate mitigation measures to curtail the effects of the disaster. Some of the respondents view the effectiveness of flood simulation exercise positively as 40.5% believe that it was an effective tool according to improvements they have seen in the community with a significant percentage of respondents (26.7) not giving a response as they do not know whether or not their preparedness as a community is as a result of its simulation exercise and training. It implies that the society might require more clarity and belief in the simulation processes to increase their efficacy.
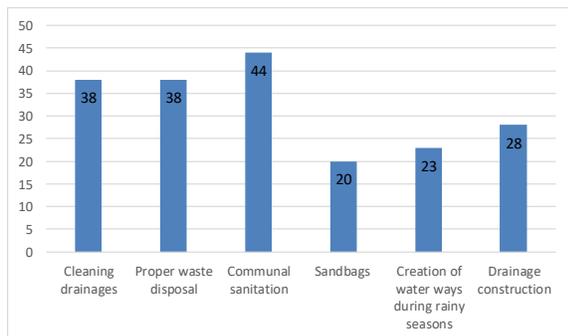

Figure 4.3: Flood Control Measures

The figure 4.3 above data shows that there are different community efforts directed towards enhancing preparedness, and better management practices. Communal sanitation, which is conducted on every first Saturdays of the month, is one of the main mitigation measures used by 44 of the respondents, 38 of respondents clean their drainages or practice proper waste management, 28 respondents uses structural measure (drainage construction), and 20 and 23 other respondents use local means (use of sandbags and repetitive digging of waterways). The variety of initiatives implies an active response to the development of resilience against flooding. The two communities have diverse mitigation to manage the flood risks (the mitigation measures act as coping mechanisms to the two communities).

3.6 ANALYSIS ON THE EFFECTIVENESS OF SIMULATION EXERCISE

Table 4.2: Chi-square

Variables	Value	Df	Sig
Chi-square	45.906	20	0.001
Likelihood Ratio	26.146	20	0.161
Linear by linear relationship	11.855	1	0.001
No of cases	195		

* Significant at 0.05

According to Table 4.2 above, Chi-square value of 45.906, p-value of 0.001 shows that the relationship between the involvement in simulation exercises and disaster preparedness levels is statistically significant. This is an indication that the level of preparedness of the people who were involved in the simulation exercises varied with the ones that were not. The p-value is significantly smaller than the common value of 0.05, so we can reject H 0 and say that the effects of the simulation exercises on disaster preparedness are presumably positive. Further, likelihood ratio test had a value of 26.146 with p-value of 0.161, which means that there was no significant association between the variables using this technique. This inconsistency indicates that the Chi-square can show that there is a strong relationship, but the likelihood ratio can indicate a more specific interpretation of the impact of the simulation exercises on the preparedness.
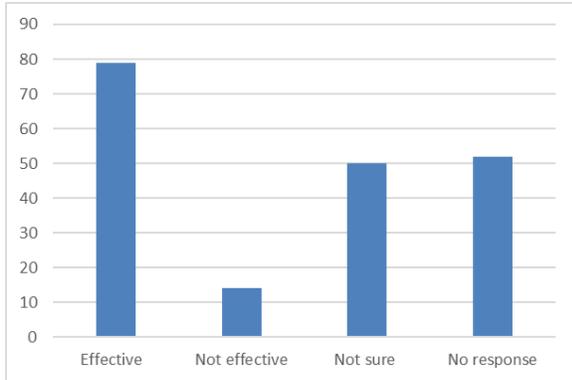
Figure 4.4: Effectiveness of Simulation Exercise

3.7 ANALYSIS ON THE PERCEIVED STRENGTH AND WEAKNESS

3.7.1 Weakness of Disaster Preparedness

Table 4.5: Weakness of disaster preparedness

Challenges of disaster preparedness	Frequency	Percentage
Inadequate training	76	38.9
Inadequate flood structure	69	35.4
Inadequate funds	26	13.3
Others	24	12.3

Source: Field Work (2024)

The evaluation of the flaws on the disaster preparedness to floods in the community indicates that there are a few serious challenges such as;

Weak training (38.9%): the biggest problem of the respondents is poor training, which influences almost 39 percent of subjects. This means that a large number of community members have not been trained, since with the initial training exercises, much attention was paid to community representatives and only a small number of community members, which creates a large pool of untrained individuals who would not effectively respond to the occurrence of floods. This raises the need to have education and training programs regarding disaster preparedness.

Poor flood structure (35.4%): also closely placed in the second position, 35.4% of the respondents mentioned poor flood control structures as one of the greatest challenges. The majority of the buildings in the community had no proper drainage systems, in fact others excavated grounds to act as drainage and help in guiding the flow of running water during the heavy rains using sandbags to channel the running water. This is indicative of the fact that there is an urgent necessity to invest in infrastructure that ensures drainage, barriers, etc. because the latter is not long-lasting and efficient enough to better handle floodwaters and safeguard the community.

Poor finances (13.3%): 13.3% of the respondents cited poor finances as a barrier to development and implementation of effective flood preparations, it means that insufficient funds are a hitch to the development and implementation of effective flood preparedness measures. It is also significant to have the government support in the acquisition of funds in training and in improving the infrastructure. This will also help the community members particularly victims to recover within a short duration of time in any form of disaster.

Other challenges (12.3%): the 12.3% will include a variety of challenges that will add to the weaknesses in flood preparedness. These encompass personal perception, poverty, interaction or even environmental influence on preparedness.

The high proportion of replies associated with low levels of training and poor infrastructure demonstrates that specific interventions in the of these spheres might have a significant effect on making the community less vulnerable to flood events.

3.7.2 Strengths of Disaster Preparedness

The apparent preparedness with regard to flood disaster in the two communities is only:
Community partnership with NEMA: The community partnerships with NEMA/CAID have seen the communities get access to professional advice, assistance in disaster management services as well as coordinated response plans during the catastrophe. This collaboration improves the readiness by means of co-ordinated action and mutual responsibility.

Promotion: awareness campaigns help the community members to be prepared of the possible dangers, disaster management methods and preparedness measures. Emergencies can be responded to swiftly and efficiently by trained people, decreasing the effects of disasters and enhancing the general resilience of the community.

Large Youth Population: there is a great deal of youths that offer an active and efficient workforce that can be used in response efforts, volunteer work, and preparedness efforts. The youngsters are usually energetic, flexible and can learn and adopt new technologies, which are great resources in the preparedness efforts as well as in a real emergency.

All these combined will create a proactive, informed, and responsive community and disaster response will be more effective and dramatically improve the resilience of the community to future disasters.

3.8 ANALYSIS ON FOCUS GROUP DISCUSSION (FGD)

The FGD was an ordeal that came right after the administration of the questionnaire. It was comprised of eight community representatives who were sent on behalf of Christian Aid. These representatives expressed a number of issues regarding the frequent flood disasters they have been facing in their communities. One of the members was very much emotional about the fact that their communities have been affected by recurring floods although these floods have been predominantly caused by two factors; dumping of waste in rivers leading to blockage and building of structures in water courses. The other member gave a further explanation that this situation was aggravated by the fact that the government had taken away large community waste bins that were initially placed in strategic locations where temporary pieces of waste were to be collected. This waste was collected through trucks which took the waste to the dumping sites.

The general consensus of all the participants in the discussion was that they had been trained on their communities to protect against flooding and evacuation plans by NEMA (National Emergency Management Agency) and Christian Aid (CAID). They also received flood evacuation kit, first-aid kit, rain boots, microphones, rescue rope, headlamps, raincoats, aqua-blocks and rain gauges to inform the community once floods had risen. Although initially, there were representatives who tried to utilize the equipment personally, NEMA and CAID were able to charge them and keep the equipment within the community. The individual who maintained the equipment however died a few years ago and the community is now left without disaster management equipment.

3.8.1 Challenges Limiting Effective Disaster Response

Some of the challenges to effective response to disasters in both Rikkos and Gangare include;

Poor Technical Knowledge: The training of individuals on the use of the disaster equipment that was availed at the time was limited and therefore the community was not able to deal with floods efficiently. Despite the willingness of the youths to contribute to the disaster rescue mission, they do not have technical skills to use the equipments hence their efforts are ineffective.

Absence of Cooperation: The whole situation has little collaboration with the trained representatives and the community members particularly the youth. The youths at times require money as a reward to their efforts in the collaboration process and this has made collaboration to be more difficult.

Equipment Deficiency: The community is currently not well equipped to respond to floods due to the lack of equipment used in the management of the disaster. Nevertheless, the challenges do not affect the representatives of the organizations who attended simulation exercises, awareness, and training programs and are sure of their theoretical preparedness to flood disasters. They know what to anticipate, how to act and how to use any equipments in place to manage any flood. The representatives of the community are urgently demanding the government to assist in provision of flood management equipment once more. They also encourage training and retraining of more members of the community and in this case the youth to enhance their workforce in responding to disasters.

IV.   DISCUSSION

A 20-year analysis of land use/ land cover (2003-2023), as shown in fig 2, indicates an increasing worrying trend of urban encroachment in the study area along the river channels. The riparian zones in 2003 were mostly in their natural state with clearly defined river channels being flanked by healthy vegetation cover and the built up areas being located towards the central-southern region and well separated in space to the waterways. This has, however, started to lose ground in 2013 with the urban development spreading farther and farther along the river corridors pushing away the vegetative buffers used to protect the river and replacing them with bare surfaces indicating that the drainage network was being increasingly utilized as a steering tool in settlement development. This trend gained momentum by 2023, as built-up areas were discovered to border the river channels directly in a number of locations, with riparian vegetation in most areas removed substantially. The waterways had long since become urban growth paths, as the rivers were now efficiently turned into naturally buffering waterways, settlement sprawl running on a linear progression on both sides. The simultaneous growth in the size of rock outcrops in the northwestern region of the study area is another indicator that there has been land degradation in the region which could be due to the clearing of vegetations to build more space. All these developments lead to a process of urbanization, which is accelerating and poorly controlled and has systematically undermined the ecological integrity of the riparian corridor, with far-reaching consequences to flood risk, hydrological functionality, and environmental sustainability in the watershed.

This is because such land cover alterations as observed in table 1 have a big impact on catchment hydrology such as amplified surface runoff, lowered infiltration ability, augmented flood hazard and decreased water retention. Development of impervious surfaces, which replace vegetation, changes the natural water balance and could be one of the reasons of the observed reduction in water bodies. The results justify the direst necessity of sustainable urban planning strategies and integrated catchment management strategies to reduce environmental degradation in the Dilimi catchment.

Table 4.1 showed that the population of Rikkos and Gangare is relatively young (31.8) and educated population (both secondary and tertiary education). A youthful and educated society will greatly affect the capacity of a community to plan and react to a flood disaster. Youths tend to be more flexible and open to new ideas and technologies, which have the potential to make the community resistant to flooding in general. Their education probably provides them with the knowledge of efficient disaster management practices and the significance of preparedness measures, and they can be used in terms of planning and responding efforts. All in all, the availability of a young and highly educated population in Rikkos and Gangare provides a promising base on which the preparedness towards the flood disaster can be improved. Nevertheless, the young and educated population has some gaps because of the lack of infrastructure, resources and the government support. The unexpected demographic trend may mean that although there might be potential in flood management, there might be hindrances that might be preventing the society to utilize the potential to the maximum.

The data on Figure 4.1 demonstrated that the lower percentage of the population in the community has been included in the simulation exercise but community has 50-70% rate of preparedness. This observation comes as no surprise. It is thus the experience which is attained by individuals at flood prone regions that has a positive impact on the degree of preparedness. After experiencing previous floods themselves, these people tend to be more compliant with the possible risks, as well as with the effective response strategies, which in the end predisposes the general preparedness. Such experience not only makes them more resistant to preventive measures, e.g. locking their homes or knowing evacuation routes, but also allows them to approach the risks of flood in a proactive manner, which eventually leads to stronger resilience of the communities. This finding correlates with the claim put forward by Izang and Agbaje (2024) since members of the community are more likely to be prepared and knowledgeable about flood disaster since the

previous years have exposed the communities to high level of preparedness. Izang and Agbaje (2024) note that experiences acquired in a flood-prone area is also a characteristic of flood disaster preparedness, that is, the extent of exposure and the aftermath of flood disaster occurrence is effective to enhance the preparedness to manage the disaster that will minimize or eliminate the risks of floods.

The information presented in table 4.2 and figure 4.4 illustrates clearly that a simulation exercise improves disaster preparedness. The outcomes of Chi-square test show that the relationship between the involvement in such exercises and the better levels of preparedness is statistically significant with the p-value of 0.001. This close relationship implies that those who volunteer in simulation exercises will tend to have a greater perception of disaster preparation and response and thus have the skills and knowledge that they can use to come out successfully in disaster incidents. According to the data presented in the field and substantiated by the secondary one, the SimEx in 2019 has greatly contributed to effective disaster preparedness in Rikkos and Gangare. The results of the present work correspond with those of Wijaya et al. (2022) as the participants of the 2019 SimEx possess a more comprehensive and well-structured knowledge about the process of preparedness and response to the flooding disaster that has resulted in proactive attitude in both communities. Wijaya et al. (2022) also state that simulation has had a significant impact on raising community awareness and attitudes towards disaster. It is possible to explain the positive influence of simulation exercises on disaster preparedness with the help of several factors. To start with, the exercises present realistic situations that enable the participants to rehearse their responses in a controlled setting. This type of learning is experiential and encourages teamwork and builds confidence and competence, which is essential in action in the event of a real disaster. As well, during training exercises, it is possible to identify any gaps and strengths of preparedness or response plans. The result aligns with the research conducted by Garnett (2019), who emphasized the importance of simulation in the context of making sure that an individual is able to intuitively implement the acquired skills and knowledge in a real-life situation. Garnett stresses that the effectiveness of learned responses will be reduced in case the learner is not able to apply those responses in the real situation, intuitively. Thus, simulations can be discussed as a key to disaster preparedness since they provide the bridge between theory and practice. The fact that there is a strong linear by linear correlation is another factor that testifies to the effectiveness of simulation exercises. The current tendency that demonstrates that the higher the level of participation and practice in simulations, the higher the level of preparedness is proves the need to be constantly involved and practicing. By practicing these exercises, individuals are bound to learn the necessary concepts and become skilled in them and better prepared to the disaster with time.

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