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FLOOD RISK ASSESSMENT IN NIGER STATE

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Abstract

Over the years, Niger state has been affected by erosion (gully erosion). The issue of gully erosion is of a major concern both globally and locally due to the soil texture. The focus of this study is to carry out a risk assessment of flooding in some selected areas of Niger state. The objectives are; to determine the major causes of flood in the state, and too identify the parts of the state that are most vulnerable to flood in the state. The method of data collection employed is through field work which involves the use of GPS to capture the coordinates the gully sites and tape rule to measure the width, depth, and length of the gullies. The Run-off properties of soil using curve number techniques (called Shuttle Radar Topography Mission (SRTM) is an international research effort that obtains digital elevation models on a near-global scale from 56° S to 60° N, to generate the most complete high-resolution digital topographic database of digital elevation models around the globe) was used in data analysis. The result shows that the soils in the state have more of sand, than clay and gravel. This means that infiltration and percolation is low. There is very little quantity of rainfall that percolates into the soil and a large amount flows as runoff. Considering the intensity and duration of rainfall in the state and relating it to infiltration rate, it is obvious that places with high rainfall intensity will have higher runoff. However, there are other factors that aggravate flood problems in Niger State, these factors show that making a definite assumption that places with higher rainfall intensity have higher runoff and thus experience flood more than places with low rainfall intensity may not be correct for all times and conditions.

Keywords: Flood risk, Causes of Flood.

1.0 Introduction

Gully erosion is a world-wide phenomenon. It is enormous types of environmental degradation which leads to loss of valuable land used for agricultural, domestic, industrial and aesthetic purposes, as well as loss of property and even human lives. People in developing countries are particularly vulnerable to disasters as they often

live in high-risk areas, have lower coping capacities, and have limited or no risk cover in the form of insurance or other safety nets. A cornerstone of Disaster Risk Reduction is the Hyogo Declaration. made at the World Conference on Disaster Reduction in Kobe, Hyogo (Japan). This sets out the Hyogo Framework for Action (HFA) (2005—20l5). Signed by 168 countries, its overarching goal is to build the resilience of nations and communities to disasters by achieving substantive reduction of disaster losses by 2015. Since the adoption of the HFA, many efforts have been made at the global, regional, national and local levels to address Disaster Risk Reduction systematically (UNBCPR, 2005a).

The report by Working group II of the Intergovernmental Panel on Climate Change (IPCC) examines the potential impacts of climate change and the vulnerability of natural and human systems to these impacts. One of the key adverse effects of predicted changes is a wide spread increase in the risk of flooding for many human settlements (UN, 2005). As Observed by IPCC, (2001), flooding events are not relegated to the least developed nations but can also devastate and ravage the most economically advanced and industrialized nations. In the last decade there has been catastrophic flooding in Bangladesh, China, India, Germany, Mozambique, Poland, the United States and elsewhere.

The assumption that 'natural' disasters are inherently and predominantly natural phenomena has tended to exclude the social sciences from consideration in much of the spending on disaster preparedness (Thywissen, 2006). This is despite the fact that over the last twenty years a considerable literature on disasters has emerged from human geography, environmental management and sociology. Worldwide, there is a need to enhance the understanding of vulnerability to disasters and to develop methodologies and tools to assess it. One of the most important goals of assessing flood vulnerability, in particular, is to create a readily understandable link between the theoretical concepts of flood vulnerability and the day to-day decision-making process and to encapsulate this link in an easily accessible tool (Wenger, 2012)

2.0 Literature Review

Anunobi (2013), considered housing vulnerability and resilience to flood in rural communities in Shiroro. In this study emphasis was placed on structures and the resilience of such structures and did not consider, the type of soil the houses were erected upon, the effect of Shiroro dam on such houses and the people who live in such houses.

Ojigi, et.al. (2012). carried out an analysis on Geospatial Mapping and Analysis of 2012 flood disaster in central parts of Nigeria. the research showed the places that were affected by the floods of 2012. The research did not look into the remote causes of flood in the affected states. Jinadu, (2014), also assessed rural hazards and vulnerability in the downstream sector of Shiroro Dam, the research assessed disaster and its contribution to diseases, epidemics, building collapse and land degradation.

Disasters are deeply rooted in the topographic, geographic, social structures and geo-strategic location of a country. This fact has been well established by the work of current and previous researchers (Blaikie, et.al. 1994; Adeaga, 2009; Mustafa & Wrathall, 2011; Wisner, et.al. 2011). Thus, the fight against disaster must be interdisciplinary, multi-dimensional and pro-active.

3.0 Materials and Methods

The Shuttle Radar Topography Mission (SRTM) is an international research effort that obtains digital elevation models on a near-global scale from 56° S to 60° N, to generate the most complete high-resolution digital topographic database of digital elevation models around the globe.

The Shuttle Radar Topographic Mission (SRTM) data of Niger Sate was downloaded from Global Land Cover Facility site hnp://www.landcover.org/. The Digital Terrain Model (DTM) of Niger State came in 90m resolution, so it was resampled to 50m to get a better result for the vulnerability zones. The re-sampling was done with Global Mapper.

The re-sarnpled image downloaded from the site is shown in fig 3.1.

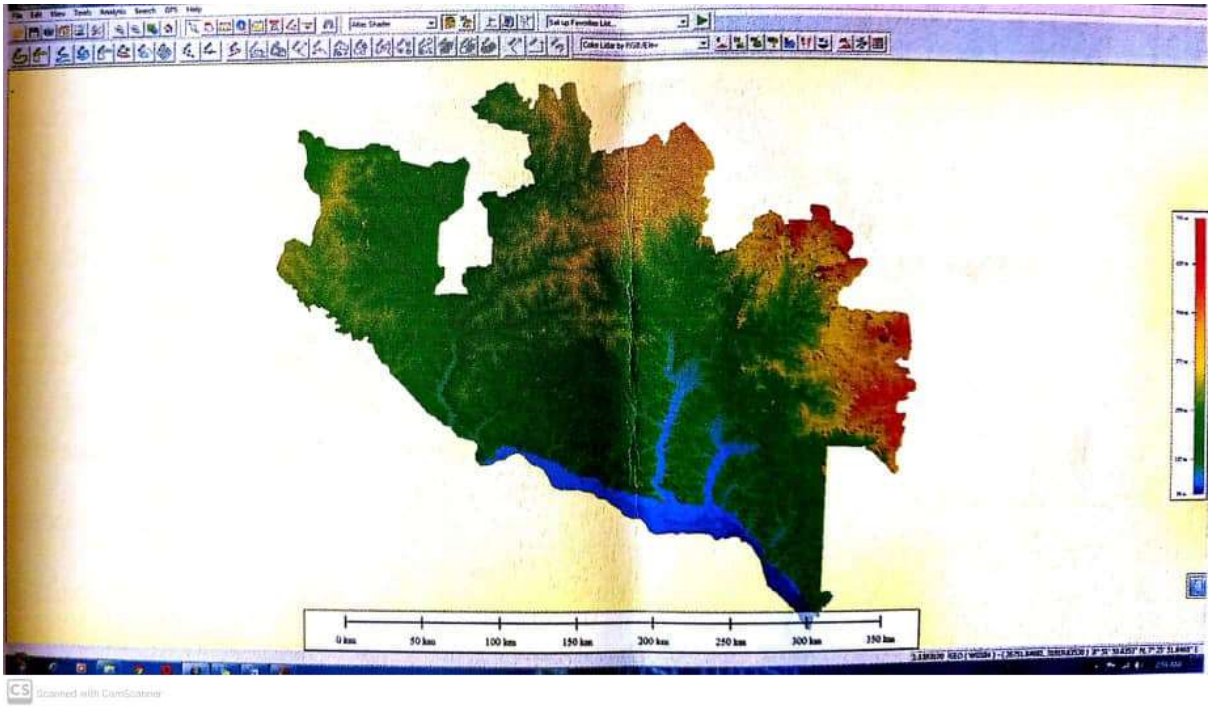

Fig 3:1: SRTM Image of Niger State

From the DEM data loaded within the Global Mapper environment a contour map was generated, the contour was generated in polygon format so as to give an impression of the Area of Interest (AOI). The Digital Elevation Model was used to classify the state into vulnerable zones using height above lowest point in Niger State and proximity to water bodies in the state as basis for classification.

4.0 Results

The survey was carried out on both state Federal Ministries saddled with responsibilities of flood management in Niger State. The results are presented below, starting with the soil texture, the Land use type, the Federal Ministry of Environment and Federal Ministry of water resources in Niger state.

4.1 The soil texture

Niger State has five mean rainfall intensity levels as shown in Fig 4.1 These places with different levels of intensity are associated with mean rainfall intensity of less than 36mm/hr, 36 -40mm/hr, 40-50mm/hr, 50 - 60mm/hr, 60 — 70mm/hr. Indeed rainfall intensity, infiltration rate of soil and topography (mainly slope) all contribute to runoff in Niger State.

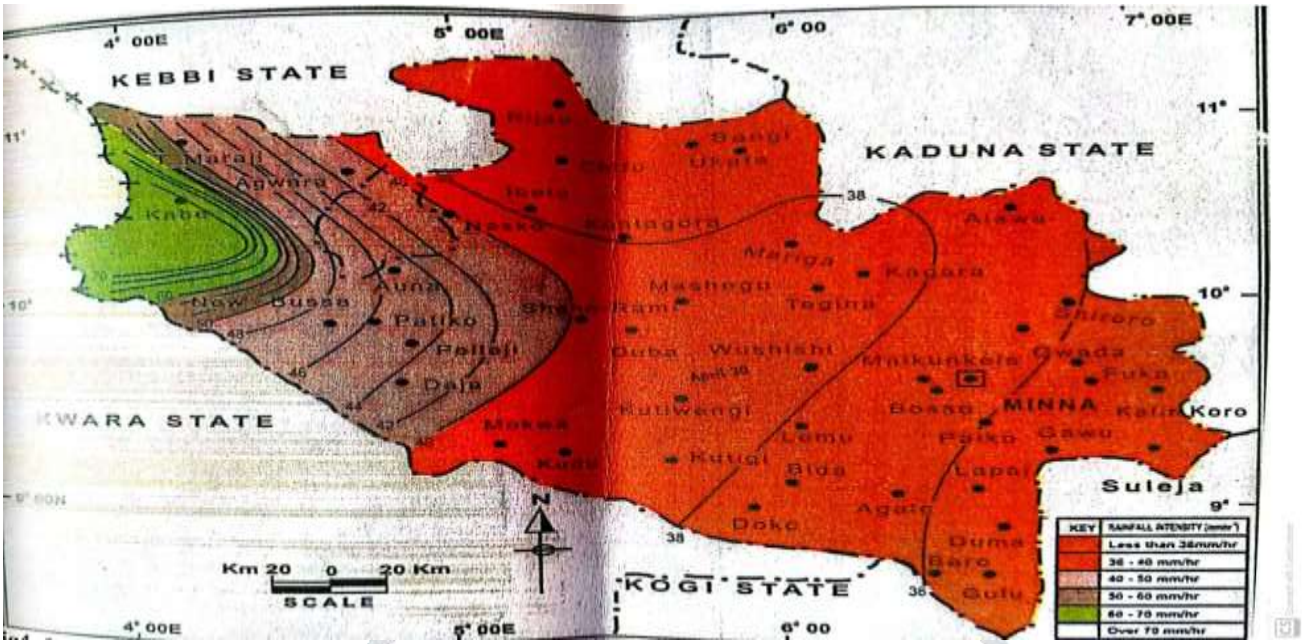

Fig4. 1: Rainfall intensity for Niger State (Source: Adapted from CCCFWR, 2009)

The result of the soil tests undertaken to determine the texture of the soils in the study area is given in Table 441. Soil texture is modelled after United States Department of Agriculture soil textural classification.

Table 4.1 Soil Texture in the Study Area

Rainfall Intensity Area (mm/hr)	0-35	36-40	40-50	50-60	60-70	
Gravel (Laterites %)	14	0	11	0	0	
Sand(%)	52	95	10	98	72	
Silt%	13	5	18	2	13	
Clay(%)	21	0	61	0	15	
Soil textural class (USDA textural triangle	GSC	S	GC	S	LS	
GSC- Gravel, sand and clay						
S-Sand						
GC-Gravel and Sand						
LS – Loam and sand						

Source: Field work, 2013

Table 4.1 shows that the soils in the state have more of sand, than clay and gravel. This means that infiltration and percolation is low. There is very little quantity of rainfall that percolates into the soil and a large amount flows as runoff. Considering the intensity and duration of rainfall in the state and relating it to infiltration rate, it is obvious that places with high rainfall intensity will have higher runoff. However, there are other factors that aggravate flood problems in Niger State, these factors show that making a definite assumption that places with higher rainfall intensity have higher runoff and thus experience flood more than places with low rainfall intensity may not be correct for all times and conditions. Some secondary factors aggravate flood beyond the primary causes. These factors are land use type, construction of residential buildings on flood plains and reservoir operations. These secondary factors are products of the primary factors and thus cannot be studied in isolation, hence the need to establish the secondary causes of flood in Niger State.

4 2 Land use type

The major land use types in Niger State are residential, commercial, agricultural and open land. The residential area is further divided into two based on population density. There is no place in Niger State with high population density, what is obtainable is medium and low population density. Soil type that was collected from each land use type in each rainfall intensity stratum is analyzed using the curve number model, the results are presented in Fig 4.2.

The result from Fig 4.2 shows that land use type is one of the secondary factors that affect runoff. Remember that the primary causes of flood in Niger State are identified as rainfall and soil type. Relating rainfall intensity and soil type with land use types, shows rate of infiltration and runoff for each land use type.

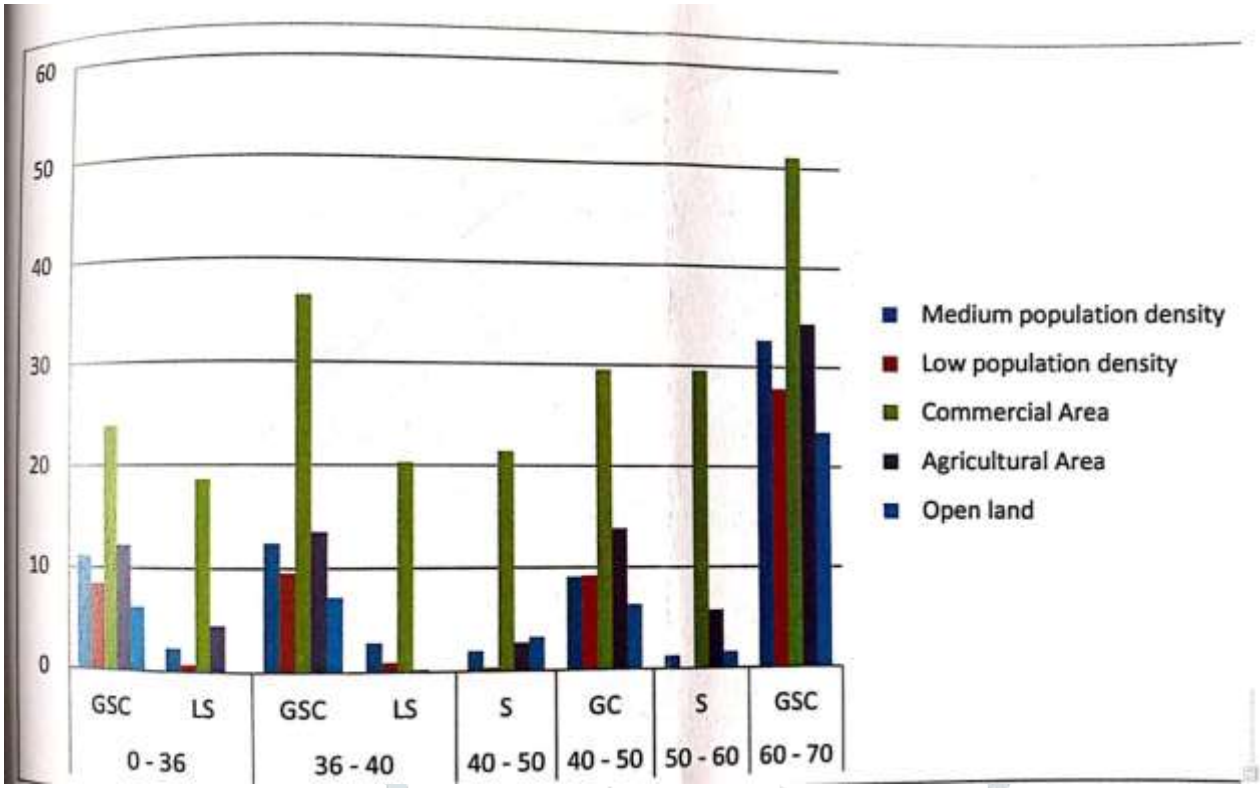

Fig 4.2 shows the difference in runoff for types;

Fig 4.2 shows the difference in runoff for types; firstly, there is difference in runoff for places with the same soil type and same rainfall intensity but different land use types. Areas with rainfall intensity of between 0-36mm/hr soil type characterized by a mixture of gravel, sand and clay and infiltration of between 0-l.27mn1/hr are places with actual runoff of 1l.l3mm/hr, while places with low population density even though they are both residential areas, have actual runoff of 8.44rnm/hr. Commercial area, have the highest amount of 23.78m/hr, while open land has the lowest amount of runoff of 6.25mm/hr. The low amount of runoff for open land is because the flow pattern and drainages on the soil have not been tampered with. Agricultural area is next in high amount of runoff; this is caused by regular cultivation which has loosened the top soil thereby making the flow of water on the surface free especially along slopes. In contrast, places with soil type characterized by of gravel, sand and clay to areas with loam and sand within the zone of 0-36mm/hr of rainfall intensity have different runoff rates. Though soil type in the commercial area has the highest runoff rates, the runoff is less than that of the Medium Population Density areas. This expressly shows that land use type affects runoff in Niger State.

ln other places in the state with different rainfall intensity and soil type, commercial areas have the highest runoff; places with medium population density area are next, while open area have the least runoff incidence. Agricultural land and low population density areas have runoff greater than open land. This is in tandem with the findings of Swaroop (2005), Munich Reinsurance (2002), NIOSH (2003) and Ologunorisa (2006), which states that land use type is a major factor that contributes significantly to flood problems in Nigeria and around the world.

Conclusion

The survey was carried out on both state Federal Ministries saddled with responsibilities of flood management in Niger State. The results are presented below, starting with the Federal Ministry of Environment and water resources.

4.3 Federal Ministry of Environment efforts in flood management in Niger State.

A summary of the assessment of the Federal Ministry of Environment's efforts in flood management in Niger State is presented in the table 5.1

Table 5.1 Federal Ministry on Environment Efforts in Flood Management

	Effort/activity	No, not, at all	To a very limited extent	Significant, with scope for improvement	Yes, but with limitations in capacities and resources	Satisfactory, sustainable and effective measures
Feaster Risk, reduction factorization	Frameworks and structures					
	Planning					
	Financial resources					
	Human resources					
Risk assessment monitoring and farming	Disaster risk assessment					
	Early warning systems					
	Risk management systems					
	Disaster databases					
Knowledge and education	Information management and exchange					
	Formal education (staff training)					
	Community training					
Underlying risk factors.	Environmental resource management					
	Adaptation to climate change					
	Protection of facilities					
Preparedness and response cross cutting issues.	Disaster preparedness					
	Disaster response					
	Disaster preparedness and response					
	Disaster response and recovery					
	Emergency resources					
	Coordination and information exchange					
Cross cutting issue	Community participation and information					
	Cultural sensitivity					

The table show that the efforts of the FME in flood management have not been satisfactory.

There have been activities, but these have been limited because of stress on financial and human resources. Towards risk assessment monitoring and warning, early warning systems, disaster risk assessment and disaster databases are provided and/or undertaken for flood in Niger State. However, these are not satisfactory. Activities on knowledge and education, preparedness and response, cross-cutting issues and underlying risk factors are significant, but they have much scope for improvement.

Also, the activities of the Federal Ministry of environment in flood management in Niger state are seriously constrained by financial and human

resources challenges. There results indicate that Disaster Risk Prioritization by the FME in Niger State is not satisfactory.

Indeed, it seems that Disaster reduction is not given the seriousness it deserves.

The survey carried out on the Federal Ministry of Water Resources, as shown in Table 5.2 shows that efforts of the Ministry in Flood Management have not been satisfactory. The activities have been limited because of stress on financial and human resources. Although there are activities relating to, early warning systems, disaster risk assessment and compilation of towards risk assessment monitoring and warning on flood in Niger State, they are not satisfactory. Also, activities on knowledge and education, preparedness and response, cross-cutting issues and underlying risk factors are significant, but they have much scope for improvement. Like the FME, the efforts of the FMWR also indicate an unsatisfactory disaster Risk prioritization.

4.4 Federal ministry of water resources efforts in flood management

The summary of the assessment of the FMWR's efforts in flood management in the state is illustrated in Table 5.2

Table 5.2 Federal Ministry on water resource's efforts in flood management

	Effort/Activity	No, not, at all	To a very limited extent	Significant, with scope for improvement	Yes, but with limitations in capacities and resources	Satisfactory, sustainable and effective measures
Feaster Risk, reduction factorization	Frameworks and structures		*			
	Planning		*			
	Financial resources		*			
	Human resources		*			
Risk assessment monitoring and farming	Disaster risk assessment		*			
	Early warning systems		*			
	Risk management systems		*			
	Disaster databases					*
Knowledge and education	Information management and exchange	*				
	Formal education (staff training)		*			
	Community training		*			
	Adaptation to climate change		*			
Preparedness and response cross cutting issues.	Disaster preparedness		*			
	Disaster response		*			
	Emergency resources		*			
Cross cutting issue	Community participation and information		*			
	Cultural Sensitivity		*			

5.0 Conclusion

The results of this study indicate a rationale for integrating adaptation into development strategies and practices into flood management in Niger State and that many interventions would be required to increase the resilience of places and

people to flood problems as development objectives. Adaptation requires the development of human capital, strengthening of institutional systems, and sound management of public finances and natural resources. Such processes build the resilience of countries, communities, and households to all shocks and stresses, including climate variability and change, and are good development practices in them. Adaptations are successful if they reduce the vulnerability of poor communities and poor people to existing climate variability, while also building in the potential to anticipate and react to further changes in climate in the future.

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