A Post-Disaster Assessment of Riverine Communities Impacted by a Severe Flooding Event

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Abstract

This study adopts a post-disaster analysis of the 2012 flood event in the riverine communities of Lokoja, Nigeria. It focuses on the perceived causes and impacts of the disaster and coping mechanisms adopted by the affected populations. The study was based on a survey of 193 randomly selected households in five neighbourhoods: Felele, Adankolo, Lokongoma Estate, Sarkin Noma, and Ganaja in Lokoja Metropolis, Nigeria. This was complemented by a focus group discussion that involved one representative each of the sampled neighbourhoods. It was observed that 61.3% of the household heads rated the last flood event as extremely severe while another 20.0% rated it as severe. Losses arising from the flood disaster were pervasive as 11.7% of the households reported loss of lives, 53.3% loss of farmlands, 64.0% damage to roads and 68.0% loss of valuable properties. There were significant inter-neighbourhood variations in quantified losses incurred by households in terms of farm produce ($F_{4,31}=3.027$; $p=0.032$), lives ($F_{4,27}=5.737$; $p=0.002$), properties ($F_{4,48}=2.581$; $p=0.049$), income ($F_{4,55}=3.405$; $p=0.019$) and number of displaced people ($F_{4,35}=3.043$; $p=0.025$). Variations in losses of farm produce, lives, properties and income were significantly different in Sarkin Noma (a poor neighbourhood) from other neighbourhoods, while Lokongoma (a planned, middle income neighbourhood) accounted for a significant difference in the number of displaced persons. Households generally relied on individual and community based coping mechanisms to manage the effect of the disaster as victims lacked institutional support and government interventions were limited in depth and scope. The government should develop policies that mitigate the vulnerability of people living in flood-prone areas.

Key words: Riverine communities, flood risk, vulnerability, resilience, Lokoja, Nigeria

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Introduction

One of the major consequences of climate change is the fluctuation in the rainfall regime which increases the probability of occurrence of extreme events in the form of excessive rainfall in certain areas and drought in others. Increased urbanisation with attendant land use and land cover change and concentration of human population and infrastructure in the urban centres has increased the quantum of loss sustained in the event of flood disasters. In some cases, especially in the context of developing countries, poor planning has also increased the exposure of urban centres to flood risk. Flooding has remained a recurrent natural hazard throughout human history, but available statistics show that the frequency, severity, extent and level of destruction are consistently on the increase globally (UNISDR, 2013; Samuel et al., 2014). Between 1980 and 2008, it has been estimated that 2,887 flood events occurred globally, accounting for about 200,000 deaths, affecting about 2.8 billion people and resulting in economic loss of USD397 billion (UNISDR, 2013).

African cities are more prone to flooding not only because of their vulnerable locations but also because they lack requisite infrastructure or physical planning and are peopled largely by the poor who live in vulnerable locations and lack the capacity to anticipate, cope, resist, and recover from flood events (Adelekan, 2010). Oftentimes, urban development occurs at exponential rates, thereby putting enormous pressure on the environment and available infrastructure, and increasing the risk of flood events (Hardoy et al., 2001; Douglas et al., 2008).

Communities have varying degrees of risk exposure based on their location relative to hazard source and their socio-economic circumstances. The inhabitants of these communities are likely to differ in their perception, not only of risk, but also of the resultant disaster events and possibly their impacts. Apart from flash flooding which normally results from excessive rainfall and is prevalent in many areas, riverine cities are further exposed to flood-inducing natural and human activities upstream such as poor watershed management and dam failure.

Existing literature on flood risk analysis is diverse in both focus and context. A growing number of studies present risk as an objective, quantifiable phenomenon and have consequently employed statistical analysis to assess the level of risk in any given area (Cutter et al., 2003; Samuel et al., 2014) while others have construed risk as purely subjective (Kellens et al., 2011). Understanding peoples' perception of natural hazards and the risk associated with them is a basis for developing effective mitigation efforts (Kellens et al., 2011), as this affects their preparedness and response in the event of a flood event. A number of studies have addressed the perception of urban flooding in the coastal cities

and regions (Ologunorisa, 2006; Ologunorisa and Adeyemo, 2005; Adelekan, 2010; Kellens et al., 2011; Aderogba, 2012) as well as those in the hinterland (Oriola, 1994; Ologunorisa, 2000, 2006; Ologunorisa and Tor, 2006), but few of these have focused on the peculiar circumstances of the riverine cities, especially in Africa. Other works on flood risk assessment have concentrated on the specific flood events (Olaniran and Babatolu, 1996; Onwuka, 2015), while some studies have adopted geospatial methods of analysing flood risk and vulnerabilities (Samuel et al., 2014; Bello and Ogedegbe, 2015). Curiously, conceptualisation of risk and vulnerability policies has often not put into consideration the input and experience of the local communities who are at risk of these hazardous events (Stewart, 2007), hence the failure of many of these policies to effectively mitigate losses arising from natural hazards.

This study analyses the perceived impact of a recent flood event on the lives and livelihoods of the residents of riverine communities. Specifically, the study sought to determine (i) the socio-demographic profiles of the people of the area and how these differ from one neighbourhood to another; (ii) the salient features of the 2012 flood in the study area; (iii) the perceived impact of the flood event and the coping mechanism adopted; and (iv) whether significant variations exist in the quantifiable losses sustained by residents of various neighbourhoods. A post-disaster analysis of the impact of this large-scale flooding is expected to provide a reliable outcome that would inform policy and action on flood mitigation and abatement in the flood prone, riverine communities in Nigeria.

Flood Hazard, Risk and Vulnerability Analysis: A Survey of Existing Literature

Hazard, risk and vulnerability in the context of flooding are inextricably interwoven concepts. Within the disaster management literature, hazards are seen as natural or man-made stressors or perturbations with potentially damaging effects on people, system, structure or economic assets if and when they are triggered (Ologunorisa, 2006; Maantay and Maroko, 2009; Samuel et al., 2014). Flood hazards may include floodable plains, proximity to river channels, or heavy and concentrated rainfall. Risk, on the other hand, relates to the "likelihood of a hazard event resulting in an adverse condition that causes injury or damage" (FEMA, 2001), which is a function of hazard characteristics, vulnerability of exposed entity, and the level of exposure. Usually defined with reference to a specific hazard, vulnerability connotes the degree to which an individual, household, community or system can anticipate, cope with, resist and recover from the impact of a natural or man-made hazard (IFRCS, 2012; Samuel et al., 2014).

The magnitude of impact of a flood event is dependent on the individual's or community's level of exposure to a hazardous situation and their ability to resist and recover from losses associated with such risk (Vedika and Ravindra, 2012). The rate of exposure is in turn a function of the frequency and intensity (magnitude) of the flood hazard, locational proximity to hazard source and other situational factors such as quality of building (Ologunorisa, 2006; Onwuka, 2015; Bello and Ogedegbe, 2015).

Existing studies on flood hazard revealed that people living close to a hazard source such as a river, dam, and on flood plain have higher exposure, while those who live in poorly built homesteads sustain greater losses in the event of a flooding than their counterparts located away from the hazard source and whose homes are built with durable materials (Pelling, 2007; Kellens et al., 2011; Jha et al., 2012). Various reasons have been adduced for the reluctance of people living close to hazard sources to relocate to safer locations. These reasons include maintaining family ties, livelihood opportunities, proximity to work or business location, being native to the community, low cost of land and housing, and accessible social amenities (Adelekan, 2010; Mmom and Aifesehi, 2013; Ologunorisa and Adeyemo, 2005).

A number of factors including social, economic, cultural, political, environmental, and geographical contexts in which people live (McEntire, 2001; Wisner et al., 2004) affect their exposure to flood risk. In the field of flood risk management, the impact of flood hazards is measured in terms of the direct and indirect losses sustained by the affected people (Jha et al., 2012). Direct effects of flood hazard on people may include but are not limited to loss of lives, personal injuries, damage to buildings, displacement of people from their homes, loss of valuable properties, and disruption of socio-economic life of individuals and groups (Adelekan, 2010; Jha et al., 2012; IFRCS, 2012; Bello and Ogedegbe, 2015). In 2010 alone, over 8,000 deaths were directly attributed to flooding worldwide (Jha et al., 2012), with children and the elderly being at higher risk of getting drowned than younger adults (Bartlett, 2008). Jonkman and Kelman (2005) have observed that two-thirds of deaths recorded during flooding were the result of drowning while other causes such as electrocution, health related problems and injuries suffered while struggling to escape account for the rest. Other direct impacts such as loss of farmland, farm produce, income, structural and household properties, and the outbreak of epidemics that threaten the health of survivors have also been reported (Bello and Ogedegbe, 2015). In the study of the causes and effects of flood in parts of Ibadan, Nigeria, Adetunji and Oyeleye (2013) found that 25.6% of the respondents reported the loss of lives as a major impact while another 27.6 reported injuries to household member(s). The authors also noted property loss, economic losses and outbreak of diseases as direct impacts of the flood.

In addition to the direct impacts of flooding, there are also impacts that result from "complex interactions within the natural environment and the human use of resources in cities and towns" (Jha et al., 2012 p. 161) which are not immediately noticeable and hence cannot be easily quantified. These impacts include damage to environmental resources like the vegetation, the soil that supports human and animal lives, and a host of other psycho-social effects on the affected people arising from the trauma experienced and loss sustained during the flood event. Adelekan (2010), in her study of the vulnerability of poor urban coastal communities to flooding in Lagos, Nigeria, identified such indirect impacts of flooding to include shortage of potable water, increased incidence of water borne diseases, and disruptions of social and economic life of the people. Jha et al. (2012) have observed that survivors of flood events are severely traumatized, and many of them may experience symptoms of post-traumatic stress disorder (PTSD), depression, and anxiety (Mason et al., 2010).

Hewitt (1997) defined resilience as a measure of the rate of recovery from a stressful experience, reflecting the social capacity to absorb and recover from hazardous events. This also is related to the socio-economic profile of the affected people and the social network and institutional support systems that are in place (Nelson and Finan, 2008; Mmom and Aifesehi, 2013; Chacowry, 2014). Kates et al. (2006) have also identified a number of structural measures that can help in flood hazard mitigation. Such measures include building waterways, levees, and flood-resistant buildings. Forms of institutional support such as early warning systems, emergency relief operations, insurance cover, education, capacity building, and awareness raising (UNISDR, 2005) have also been found to aid individual, household and community resilience. In a regional study of the public perception of flood hazards in the Niger Delta region in Nigeria, Ologunorisa (2006), and Ologunorisa and Adeyemo (2005) identified physical relocation and the building of embankments and pavements as major adjustment measures that respondents adopted in the event of a flood. Other measures adopted by people to cope with the effect of flood include the raising of building heights, the construction of houses with flexible structures, the removal of moveable properties to nearest neighbours, and early planting/change in farming regime (Mmom and Aifesehi, 2013). In the case of physical relocation, there is ample evidence that affected people are usually reluctant to relocate to a new site (Adelekan, 2010; Mmom and Aifesehi, 2013).

The Study Area

The study was carried out in Lokoja, the capital of Kogi State, Nigeria. The city is located on a low-lying area between Patti and Agbaja Hills and bounded in the east by the River Niger. Over 60% of the built area of Lokoja lies on the flood plain of River Niger and its western tributaries. The climate

is characterised by moderate rainfall of about 1,500mm per year, with a single peak in the month of September. Mean annual temperature is around 28^0C with an annual range of about 2^0C (Weatherbase, 2014). Although the climate characteristics of Lokoja do not suggest a city that is unusually predisposed to the risk of flooding, its location between ridges and the banks of two great rivers tends to increase its exposure to the risk of flooding.

Lokoja had a population of 196,643 inhabitants in 2006 (National Population Commission, 2006) which was projected to increase to about 310, 000 in 2015. Sitting at the meeting point of Rivers Niger and Benue, the city has been a trade centre for a rich agricultural region noted for its arable farming. As the first seat of colonial administration in Nigeria, a trading post, a major fishing post and a river port, Lokoja has grown as a strategic commercial town, a fact that aided her elevation to the status of a state capital when Kogi State was created in 1991.

The city has several distinct neighbourhoods which exhibit a wide variation in socio-demographic characteristics. Out of the five neighbourhoods sampled, only Lokongoma was a medium density residential area while Andankolo, Ganaja, Felele and Sarkin Noma were fast growing, poorly planned, largely informal urban neighbourhoods with high density developments (see Figure 1). While Lokongoma has buildings constructed with concrete and aluminium roofing, the other three neighbourhoods still contain a substantial number of buildings built with mud and roofed with zinc sheet.

The geographical location of the city on the pass that separates Patti and Agbaja ridges in the areas has limited its expansion to the lowland areas between these ridges and the narrow stretch of the Niger valley. Apart from a few residential developments along ridge slopes, the town is largely funnelled along river valleys that cut through these ridges. The city's vulnerability is increased by the existence of numerous large dams upstream of these two major rivers and their tributaries, many of which are located outside Nigeria and hence, government lacks territorial control over the release of water from this dam.

The 2012 flooding that ravaged the city of Lokoja was a combination of river and flash flooding which was unmatched in terms of pervasiveness, severity and impact. An official of NEMA claimed that "[T]he level of water currently devastating the State has not been witnessed in the last 100 years" (Punch 2012). For six days the entire city was submerged, so that lines of communication were cut off. This pervasive inundation which affected 26 States in the country has been attributed to the release of

water from various dams upstream of Rivers Niger and Benue, and the lack of, and poor management of drainage systems in many places.

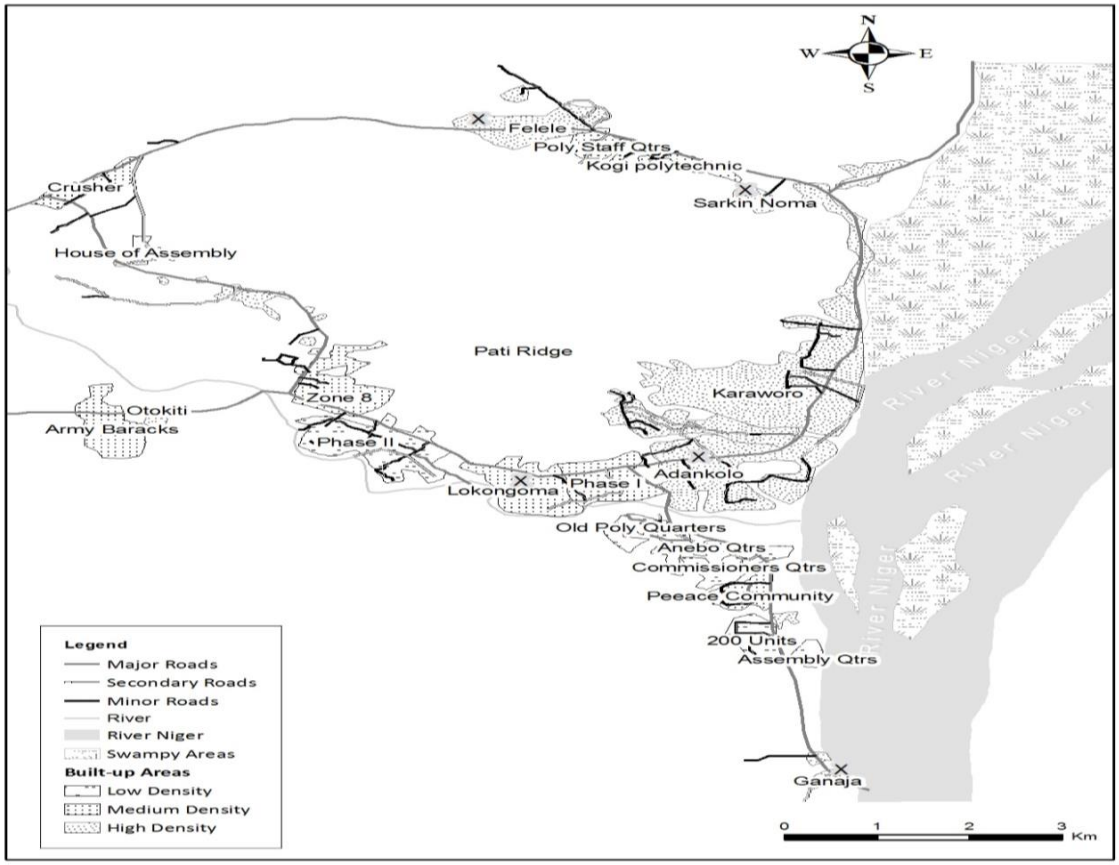

Fig. 1 Map of Built-up Areas of Lokoja

X denotes the communities from where the survey samples were drawn

Materials and Method

This study assesses the severity and the impact of the 2012 flood event on the riverine communities of Lokoja, Nigeria. This study employed a mixed methods approach, which allows an integration of quantitative and qualitative approaches that facilitate the investigation of socio-economic characteristics of flood and affected populations, while at the same time capturing the perspectives of stakeholders (community leaders) on the impact of the flood event (Stewart, 2007).

Data Collection

The data used in this study were collected through a questionnaire survey of household heads and a focus group discussion with selected representatives of various neighbourhoods. Archival data obtained for the purpose of this study include the map of Lokoja Township, a satellite image of the

city during the period of flooding as well as records of population distribution in the state. The survey of households was done to obtain information from household heads on their perception of the flood hazard that ravaged their communities. The survey was preceded by reconnaissance surveys of the town to identify the different neighbourhoods within the city and assess the level of damage caused by the 2012 flood disaster. A multi-stage sampling technique was adopted for the survey. First, a total of five neighbourhoods affected by the flooding were identified and purposively selected for the study with the help of the locals who witnessed the flood event. The neighbourhoods of Adankolo, Felele, Ganaja, Lokongoma Estate and Sarkin Noma were selected for the study based on the severity of the flood event in these communities. Each of the neighbourhoods was divided into sectors and streets were selected from each of the neighbourhoods using stratified random sampling techniques to ensure coverage. This was followed by a random selection of buildings using building numbers to generate a random list of buildings on each street. Selected buildings were chosen from several streets/roads to ensure representative coverage of the community. A total of 193 households chosen in proportion to neighbourhoods' household population participated in the survey. However, 168 sets of questionnaires were validly completed. Since the majority of buildings in the communities are multiple-occupancy, one household per building was selected for the survey (Adelekan, 2010). Respondents (household heads or their representatives) were then selected from each building based on availability and willingness to participate in the survey. Table 1 shows the distribution of selected households by neighbourhood. Survey instruments were tested for internal consistency and the result was satisfactory.

The survey questionnaire for households was developed based on the conceptual framework and existing literature on flood risk management that conceptualizes disaster impact in terms of risk exposure, vulnerability and resilience of the affected system (Dolan and Walker, 2004; Adelekan, 2010). Specifically, the questionnaire elicited information on the risk and vulnerability factors for households and communities, which included the magnitude of the event, the socio economic characteristics of the respondents (household head's age, sex, income, level of education), their building characteristics (building material, roofing material), the impact of the event in terms of farm produce in '000 naira, lost human lives, properties destroyed, displaced persons, income) and the coping mechanisms adopted to ameliorate the effect of the flooding. Previous works on flood risk perception showed that demographic characteristics, including level of income, type of residence, and educational level; frequency and severity of hazard; and availability of institutional support are important in analysing households' vulnerability, resilience and coping mechanisms (Ologunorisa, 2006; Adelekan, 2010; Mmom and Aifesehi, 2013). Key informants selected from the neighbourhoods under study were interviewed on the perceived causes, effects and coping mechanisms of their

neighbourhoods. Key informant interviews were done via focused group discussion organised for the representatives of each of the five neighbourhoods surveyed. The focus group discussion took place once and the five representatives of the neighbourhoods were present at the meeting where they answered questions bordering on risk, socio-economic status of residents, perception of flood, impact of flooding on the neighbourhoods, coping mechanisms and government intervention during the flood event. Semi-structured questions were drawn to guide the discussions in the meeting. This format was adopted for the discussion because it encouraged involvement through a focused, but conversational, two-way communication (Cloke, 2004). The discussions focused more on the communities' perception of the flood hazard, the nature and extent of loss they sustained, types of coping mechanism adopted and mode of external support received to alleviate the impact of the flood event.

Table 1. Distribution of Sampled Households by Neighbourhoods

Community	2006 Population Census Figures	2013 (Projected) Population	Estimated Household Population	Sample Drawn (1.6%)	No of Questionnaire Completed
Felele	8,060	10,091	1,261	20	20
Adankolo	22,906	26,768	3,346	52	47
Lokongoma Estate	18,820	22,815	2,852	44	34
SarkinNoma	6,062	9,549	1,194	19	18
Ganaja	25,896	30,393	3,799	59	49
Total	81,744	99,616	12,452	193	168

Data Analysis

Data from the household survey were analysed using tabulation, charts and descriptive statistics like mean, range and mode. A one-way ANOVA was used to test whether a significant difference existed in the quantified losses sustained by households during the flood. The losses captured in the analysis included farmland (hectares), farm Produce (₦ '000), lives (number), properties (₦ '000), displaced persons (number) and lost income (₦ '000). Post hoc comparisons, using the Tukey HSD test among the mean scores of quantified losses for the different neighbourhoods on household losses in deaths; lost income, farmland, farm produce, and properties; and displaced persons were conducted. Information obtained from the key informants during the focus group discussion was analysed manually using content analysis. Content analysis refers to a variety of techniques for making inferences by objectively and systematically identifying specified characteristics of messages (Holsti, 1969:14). Topic coding was used to group the texts into various categories in accordance with the sub-themes of this research (BeLeu, 2014). The categories identified included perceived risk factors, severity, losses arising from the flood event and the coping mechanisms adopted to mitigate its impact.

Results and Discussion

Household Heads' Socio-economic Characteristics

The distribution of the household heads by age as presented in Table 2 shows that almost half (48.0%) of them were between 31 and 45 years while 20% were between 16 and 30 years, indicating a preponderance of youthful household heads. Many of these were working class people engaged in diverse activities such as trading (36%), farming (24%) and public service (10.7%). A significant segment of the sampled population (24%) had no formal education while 33.3% had primary education. Trading was the dominant occupation of household heads, accounting for 36% of the total, followed by farming (24%), artisanship (17%) and public service (10.7%). Analysis of household heads' income revealed a preponderance of low income earners among them, as more than 80% earn N30, 000 (about USD190) or less monthly while just 18.4% earn above N30,000 monthly. Combined household income followed the same trend, as the majority (75.2%) have a combined income of N40,000 or less (see Table 2).

Table 2: Selected Household Characteristics

Variables	Group	No of Respondents	Percentage
Age of Household Heads	16-30	34	20
	31-45	81	48
	46-60	27	16
	>60	27	16
	Total	168	100
Educational Qualification of Household Heads	No Formal Education	40	24
	Primary	56	33.3
	Secondary	58	34.7
	Tertiary	13	8
	Total	168	100
Occupation of Household Heads	Farming	40	24
	Artisan	29	17.3
	Student	7	4
	Public service	18	10.7
	Trading	60	36
	Transport	4	2.7
	Others(specify)	9	5.3
	Total	168	100
Monthly Income of Household Heads	0-10,000	52	30.7
	10,001-20,000	52	30.7
	20,001-30,000	34	20
	30,001-40,000	11	6.7
	40,001-50,000	11	6.7
	>50000	9	5.3
	Total	168	100
Combined Household Income	0-20000	81	47.8
	20001-40000	45	28.4
	40001-60000	16	10.4
	60001-80000	4	1.5
	80001-100000	7	3
	>100000	16	9
	Total	168	100

Building Characteristics

An analysis of quality of building, shown in Table 3, revealed that 58.7% of respondents settled on low dry land and 17.3% on upland areas, in contrast with 22.7% and 1.3% living in floodable low land and river valleys respectively. The buildings were generally made of stable materials, as 58.7% live in concrete bungalows and another 9.3% in concrete storey buildings. However, a sizeable portion (13.4%) of the population live in poor housing conditions, specifically wooden shacks. Table 3 shows that the majority (58.7%) of the sampled households owned the dwellings they lived in, while 38.7% were tenants, with others accounting for the remaining 2.6%.

Table 3: Building Characteristics

Variables	Categories	Frequency	Percentage
Building location	Low land (dry)	99	58.7
	Low land floodable	38	22.7
	River Valley	2	1.3
	Upland Area	29	17.3
	Total	168	100
Building Type	Wooden house/shack	18	10.7
	Wooden house on stilts	4	2.7
	Bungalow (Concrete)	99	58.7
	One or More Storeys (concrete)	16	9.3
	Zinc	7	4
	Mud	25	14.7
	Total	168	100
Occupancy Status	Owner	99	58.7
	Tenant	65	38.7
	Squatter	2	1.3
	Others	2	1.3
	Total	168	100

Characteristics of Flood Disaster

A survey of the perception of residents regarding the characteristics of the disaster showed that most residents (69.3%) perceived it as a rare occurrence, 14.7% as seldom occurring and 12% as an event that occurred quite often. On the other hand, a small percentage (4%) of respondents rated flooding as an event that occurs very often. On the severity of the flood event, 61.3% of respondents rated it as extremely severe, another 20% rated it as severe while 8% and 5.3% rated it as fairly severe and not severe respectively. Only 5.3% rated the events as not severe.

Table 4: Characteristics of Flood Hazard

Variables	Categories	Frequency	Percentage
Frequency of flood Hazard	Rarely	116	69.3
	Seldomly	25	14.7
	Quite Often	20	12
	Very Often	7	4
	Total	168	100
Perceived Severity of the Flood Event	Extremely Severely	103	61.3
	Fairly Severe	13	8
	Severe	34	20
	Not Severe	18	10.6
	Total	168	100

Impact of Flooding and Coping Mechanisms

Common flood impacts reported by respondents included disruption of movement (14.5%), damage to roads (13.9%), loss of valuable properties (13.7%), loss of farmlands (13.1%) and environmental pollution (11.5%) (Table 5). These statistics attest to the severity of the flood event, as significant proportions of households reported impacts that cut across virtually all aspects of their livelihoods. The fact that 11.7% of the respondents reported loss of lives as one of the impacts of the flood is a confirmation of the high number of fatalities of the flood event. This has widely been reported in national dailies and electronic media.

Respondents rated the various mechanisms adopted to cope with post-disaster perturbations. A significant number (23.7%) of sampled households reported keeping children at home during the flood, while another 19.1% cited taking available unaffected routes as the mechanisms adopted to mitigate the adverse effects of the flood. Construction of wooden bridges (17.2%), clearing of blocked drainage channels (13.0%), and road reclamation using sandbags and sawn dust (11.2%) were some other measures adopted by the respondents in coping with the effect of the disaster.

Table 5: Impact of Flooding

Impact	Frequency	Percentage
Damage to Roads	51	13.9
Disruption of Movements	53	14.5
Environmental pollution	42	11.5
Inundation of Community	40	10.9
Children Prevented from going to School	39	10.7
Loss of farm produce and farmlands	48	13.1
Loss of valuable properties	50	13.7
Loss of lives	43	11.7
Total	366	100
Coping Mechanisms		
Road Reclamation Using Sandbags and Sawn Dust	24	11.2
Taking unaffected routes if available	41	19.1
Construction of wooden bridges	37	17.2
Periodic environmental sanitation measures by community	20	9.3
Clearing Blocked Drainage Channels	28	13.0
Children remain at home until floodwater subside	51	23.7
Use of Rain Boots	14	6.5
Total	215	100

Spatial Variations in the Impact of the Flood Event

The result of the Analysis of Variance (ANOVA) is shown in Table 6. It is evident from the result that significant variations exist among households across the five neighbourhoods in terms of loss of farm produce ($F_{4,31}$=3.027; p=0.32), lives ($F_{4,27}$=5.737; p=0.002), properties ($F_{4,48}$=2.581; p=0.049), income ($F_{4,55}$=3.405; p=0.019) and number of displaced people ($F_{4,35}$=3.043; p=0.025). The situation however is not the same when loss of farmland is considered. There is no significant variation in the quantity of farmland lost by residents of various communities ($F_{4,38}$=0.496; p=0.739) that made up the city. Post hoc comparisons using the Tukey HSD test indicated that the mean loss of farm produce (M = 3.60, SD = 0.89), properties (M = 3.60, SD = 0.89), and income (M = 3.60, SD = 0.89) in Sarkin Noma differs from other neighbourhoods while the mean loss of lives and mean number of displaced people (M = 3.60, SD = 0.89) (Table 7) in Ganaja and Lokongoma were significantly different from other neighbourhoods.

Table 6: Variations in the Impact of Flood Disaster

Nature of Loss Sustained		Sum of Squares	df	Mean Square	F	Sig.
Farmland (Hectares)	Between Groups	802.29	4	200.573	0.496	0.739
	Within Groups	11325.77	28	404.492		
	Total	12128.06	32			
Farm Produce (N '000)	Between Groups	4729911.41	4	1182477.853	3.027	0.032*
	Within Groups	12109097.73	31	390616.056		
	Total	16839009.14	35			
Lives (Number)	Between Groups	83704.09	4	20926.024	5.737	0.002*
	Within Groups	98486.87	27	3647.662		
	Total	182190.96	31			
Properties (N '000)	Between Groups	17883974.85	4	4470993.714	2.581	0.049*
	Within Groups	83164866.40	48	1732601.383		
	Total	101048841.28	52			
Displaced (Number)	Between Groups	67612.99	4	16903.248	3.405	0.019*
	Within Groups	173738.90	35	4963.969		
	Total	241351.90	39			
Incomes Loss (N '000)	Between Groups	18650193.51	4	4662548.378	3.043	0.025*
	Within Groups	84272800.08	55	1532232.729		
	Total	102922993.60	59			

* Values significant at 95% confidence level

Table 7: Summary of Tukey's Post Hoc Analysis Multiple Comparisons*

Dependent Variable	(I) Group	(J) Group	N	Mean	Standard deviation	Standard Error	Sig.
Farm Produce ('000 Naira)	Sarkin Noma	Adankolo	4	17.00	0.00	0.00	0.0
		Ganaja	14	55.36	45.80	12.24	0.0
		Lokogoma	4	65.00	51.96	25.98	0.0
		Felele	19	493.42	553.73	127.03	0.0
Lives lost (Number)	Ganaja	Adankolo	11	2.82	1.78	0.54	0.0
		Lokongoma	12	5.00	1.81	0.52	0.0
		Felele	7	4.86	2.91	1.10	0.1
		Sarkin Noma	13	1.54	2.90	0.81	0.0
Properties ('000 Naira)	Sarkin Noma	Adankolo	30	94.67	65.38	11.94	0.0
		Ganaja	39	265.39	307.42	49.23	0.0
		Lokongoma	11	149.13	128.12	38.63	0.0
Displaced Persons (Number)	Lokongoma	Adankolo	15	12.80	8.44	2.18	0.0
		Ganaja	34	11.74	7.88	1.35	0.0
		Felele	9	17.78	31.35	10.45	0.0
		Sarkin Noma	18	11.56	8.48	2.00	0.0
Income loss ('000 Naira)	Sarkin Noma	Adankolo	37	11.00	6.67	1.10	0.0
		Ganaja	33	15.06	20.39	3.55	0.0
		Lokongoma	23	9.13	7.61	1.59	0.0
		Felele	19	13.32	7.31	1.68	0.0

* Only the significant pairwise comparisons are shown in this table.

Key Informants' Perception of the Flood Event

The focus group discussion was centred on gauging the neighbourhood-level impact of the 2012 flood event in the study area. The themes for discussion included the socio-economic conditions of the neighbourhoods, perceived causes and impact of the flooding, the coping mechanism employed and the extent of government intervention.

Socio-Economic Conditions of the Neighbourhoods

When the discussants were asked to rate their neighbourhoods in terms of socio-economic status, all of them said they believed that their neighbourhoods were not rich. However, the representative from Lokongoma believed that his neighbourhood was planned, most of the roads were paved and inhabitants earned a "fairly good" income. Others however stated that their neighbourhood could not be compared with Lokongoma in terms of infrastructure and the presence of "big men". When asked

to rate the five neighbourhoods in terms of their socio-economic well-being, a representative said "Lokongoma first, Adankolo second, Felele third, Ganaja fourth and Sarkin Noma [a] distant fifth".

Causes and Impact of Flooding

Representatives of the neighbourhoods indicated that even though the proximity of these neighbourhoods to River Niger and its tributaries was a major risk factor, the immediate cause of the flooding was the release of water from dams upstream. In fact, the representative from Ganaja remarked that "it is a taboo for River Niger to go beyond its boundary". Other representatives agreed that though flash floods were recurrent risks in the town, flooding of River Niger remained a rare occurrence. The neighbourhood representative from Adankolo explained that this magnitude of flooding had not occurred since he was born: "This River has been there since the time of our forefathers, but this type of flood has not been witnessed". Three other representatives agreed with this view. However, the representative from Lokongoma reasoned that if the government and the people had played their parts well, the destruction witnessed could have been reduced. He noted that "people are building along river channels, and pouring refuse into drainages and canals, thereby blocking the natural path of water and the government is watching. I think we should blame ourselves, not other people". It appears that the residents did not see proximity to the hazard source as a serious risk factor. Rather, they blamed the occurrence of the flood on human interventions within and outside the neighbourhood. When asked whether they anticipated the flood event, the neighbourhood representatives unanimously answered in the negative. They reasoned that since the River had not flooded in decades, they did not have any reason to believe it would flood in their generation. But further questioning showed that they were aware of the radio and television announcements that a flood was imminent, but they did not heed the call to take precautionary measures.

When they were asked to rate the severity of the flood event, the discussants were emotional as they recalled the losses they and other residents incurred. "The flood killed more than ten people in Adankolo alone", lamented the neighbourhood representative. Another representative from Sarkin Noma said "[the] majority of those that died in the flood in my area are children". According to them, most deaths occurred on the first day of the flood as people were caught unawares. On the prevalent impact of the flood in the neighbourhoods, the discussants identified "complete" inundation of their localities and the attendant restriction of movement; the collapsing of buildings; the loss of income, household properties and crops; damage to buildings, roads, community halls and other infrastructure; and the inability of children to attend school. Neighbourhood representatives reported acute shortage of cash and other materials required for everyday living. They also noted that several days of

unrelenting flooding caused the outbreak of epidemics with dire consequences on the health of survivors.

Coping Mechanism

The most common coping mechanism that all the representatives mentioned was relocation from affected structures to unaffected ones. These new abodes were usually those of family, friends, acquaintances, church members or public places like worship centres, schools, and military barracks. The representative of Sarkin Noma neighbourhood stated that "my family and many others left our belongings and ran to the military barracks for safety". Asked whether the accommodation was conducive, he said "about eleven of us in a small room! No, it is far from being convenient". Those whose houses were not flooded had to stay at home while the flood lasted. The representative from Adankolo said "we stayed at home for six days and it was like eternity". He however said that some daring residents devised means of navigating the flood water to enable them interact with the outside world. One discussant noted that the mobile phone helped them to cope, as they were able to monitor the situation from their "confinement".

Government Intervention

All the representatives of the neighbourhoods acknowledged that the government did one thing or the other in responding to the need of the affected people. One of such interventions was the relief materials provided by the central government. They however complained about the inadequacy and poor quality of the items supplied. A neighbourhood representative quipped, "Yes, the Federal government brought relief materials, but it is like a drop in a mighty ocean when you match it with the need of the people". "The State (provincial) government [is] supposed to complement [this gesture], but up till now we have not seen anything from them", he said. Other representatives attested to the efforts of the State government to clear drainage channels so that the flood might recede and also to evacuate those trapped in the flood. According to them, some got foodstuffs, building materials, mattresses, drugs and other relief materials. Asked about assistance from non-governmental organisations, the discussants noted that the support from family members and faith based organisations had been overwhelming. One of the interviewees stated, "my family and I were given a 3 ½ ft. mattress. Is it for me or my six children or all of us to sleep on"? The situation seemed the same across communities, as representatives pointed to the inadequacy of the relief materials in the face of the monumental tragedy that befell them. However, the neighbourhood representatives identified assistance from family members, friends and faith-based organisations, especially outside the city, as the major sources of help that assisted them cope with the impact of the flood event.

Discussion of Results

The socio-economic profiles of the respondents showed that the sampled communities were made up of young household heads who were averagely educated and mostly low income earners. These characteristics play an important role in determining their vulnerability, resilience and coping mechanism in the event of a disaster (Adelekan, 2010). It has been argued that risk perception which affects disaster preparedness and consequently the severity of the impact of a flood event is directly related to the socio-economic characteristics of households and individuals (Heryanti, 2012). The ability of households and individuals to resist and recover from a hydro-climatic perturbation depends on their income. Although variations existed in income distribution among the households sampled, the income level was generally low. Many of the households could barely meet their subsistence needs, let alone have savings which they could fall back on in the aftermath of a flood event. Responses from neighbourhood representatives attested that poverty was dominant among the residents. Neighbourhood representatives from Adankolo, Ganaja and Sarkin Noma confirmed that the majority of their neighbourhood members could hardly meet the subsistence needs of their families. The impact of age and sex on the vulnerability of the exposed population has been established in the literature. For instance, Kellens et al. (2011) have noted that women were more risk averse than men, hence the larger percentage of disaster victims were men (Jonkman and Vrijling, 2008). Chacowry (2014) has also noted that most the household heads were young, there were likely to be many children in the households, a factor that could increase the vulnerability of the households to flooding.

The risk characteristics in terms of frequency of occurrence and the severity of impact are also important determinants of the magnitude of loss sustained (Ologunorisa, 2006). In the current study, most residents perceived river flooding as a rare occurrence. Residents' perceptions that river flooding is a rare occurrence would likely affect their preparedness, vigilance and mitigative behaviours in the event of a flooding. Similarly, when flooding occurs at a regular interval, it makes cumulative mitigative efforts have little effect. The severity of a flood can be reckoned in terms of the scale of impact. For instance, a flood that caused loss of human lives or significantly destroyed household livelihoods and infrastructure can be categorised as extremely severe while one with minor disruption of household schedules might be regarded as not severe. It is expected that flood severity will increase with proximity to hazard source (river) (Miceli et al., 2008; Chacowry, 2014). Hence, households living close to a river channel are likely to experience greater impact of flooding than those located at a distance from it. Ganaja, Adankolo and Lokongoma communities were located on river banks while Felele and Sarkin Noma were located at an appreciable distance from the river channel (Figure 1). As

noted earlier, the rugged topography of the city was a major factor that restricted settlements to river valleys. This situation was also responsible for the high cost of acquiring land in the city, which in turn forced many poor households to settle in the floodplains of these rivers where cost of land was relatively cheap (Pelling, 2007).

An appreciable percentage of the households surveyed still resided in floodable lowlands and river valleys with the attendant high risk of flooding. However, the majority of households lived in buildings made of stable materials, a factor that could aid resistance to flooding. Evidence from the household survey showed that over two-thirds of the households were living in concrete houses. Nonetheless, many of these houses were at various stages of completion, even though the houses were already inhabited. Hence, living in partially completed buildings may increase the vulnerability of affected households. The fact that more than half of the households interviewed owned the dwelling they lived in speaks much about the level of risk perception, as home owners have been found to be more risk aware than tenants (Grothmann and Reusswig, 2006). This factor also determines the readiness of home owners to invest in capital intensive long term individual or community (structural and non-structural) mitigative measures which a tenant might not be favourably disposed to..

Perceived factors that increase risk exposure include proximity to river channels (hazard source), low altitude location, poor drainage and the government's failure to put in place measures that reduce risk exposure (risk management) or mitigate the impact of a hazard in the event of a disaster (Oriola, 1994; Miceli et al., 2008; Ologunorisa, 2006; Kellens et al., 2011). Suffice it to mention here that individual or group perception of a hazard and its associated losses are subjective measures which depend on individuals' past experience, present realities and other psycho-social factors that affect how risks are perceived (Kellens et al., 2011). Hence, people living on a dry lowland may not feel as threatened as those living on flood plains. The risk perception of dwellers of communities where flooding is a rare occurrence would differ markedly from that of others.

The impact of the 2012 flood in Lokoja took different forms that ranged from mere inundation of the affected communities to loss of lives and valuable property. The severity of the flood event was accentuated by the proportion of households that reported loss of lives. Deaths from flooding are primarily caused by drowning and injuries sustained while trying to escape from the menace. Jonkman and Kelman (2005) have observed that two-thirds of direct deaths from flood events are caused by drowning and one-third by physical trauma, heart attack, electrocution, carbon monoxide poisoning or fire. At least one out of ten households sampled in this study reported loss of lives. This explained why

almost 7 out of 10 households sampled rated the flood as extremely severe. Generally, people perceive events that cause loss of lives as "severe" even when this may not necessarily be true (Slovic, 1987).

Not only this, but also the severity of the flood event was evident in the wanton destruction of private properties and shared community infrastructure such as roads and power supply facilities, the loss of farmlands and the general disruption of social and economic lives usually associated with flooding of that magnitude. In communities dominated by farmers, traders and artisans, most of whom relied on daily earnings to meet their subsistence needs, prolonged disruptions of economic activities caused by the flood spelled economic doom for many families. This corroborated the findings of Adelekan (2010) in which 91 per cent of the sampled population reported recurrent visits to health centres due to ill-health suffered in the aftermath of the flooding.

It should be noted, however, that the nature and degree of losses sustained by households varied from one neighbourhood to another. This is confirmed by the result of the ANOVA of the losses sustained, in which significant differences existed in quantitative losses sustained in terms of lives, income, properties, farm produce and displaced persons. Only losses of farmland did not exhibit significant differences. This may be connected with the existence of limited farmlands within the city space, as many of the farmers were smallholders that utilized undeveloped plots of land. The variations recorded in the loss sustained may be explained in terms of the degree of exposure of each community to flood risk, coupled with the differing abilities of each household to prepare against, cope with and recover from the destructive consequences of flooding (Miceli et al., 2008; Chacowry, 2014). A post hoc analysis conducted to ascertain the basis of this variation showed that the poor neighbourhood of Sarkin Noma exhibited a significant difference from other communities in terms of properties and income; while Ganaja and Lokongoma differed significantly from other neighbourhoods in terms of lives lost and displaced persons respectively. It is understandable that loss of lives may be greater in Ganaja which is a predominantly poor community with sub-standard housing and blocked drainage channels. This situation may have been aggravated by its proximity to the Niger. A large swathe of the area occupied by this neighbourhood lies within the floodable valley of the river.

Since flooding was perceived as a rare occurrence in the study area, the potential of residents to anticipate and react to the hazardous event would be greatly reduced. The ability of people to cope and recover from disaster depends on their socio-economic profile, extent of their social network and the institutional framework for disaster mitigation (Adelekan, 2010, Ologunorisa and Durowoju, 2014; Samuel et al., 2014). In the same vein, coping strategies adopted by households will depend largely on the level of risk perception, resources at their disposal and the institutional support they get. Evidence

from this study showed that the level of risk awareness among the residents was low. Because many of the households were poor, they only resorted to the commonly available measures such as road reclamation, limiting activities to unaffected areas, and clearing blocked drainages to facilitate free flow of water. It is noteworthy that the affected people claimed they had not received significant assistance from the government that could aid speedy recovery. The neighbourhood representatives indicated that not only were relief materials grossly inadequate and of poor quality, but also they arrived late – making them of little or no impact. This has always been the case with flood victims in many parts of the country where relief materials are usually inadequate and often exposed to abuse by those entrusted with the administration of such supplies (Olorunfemi, 2011).

Conclusion

This study analysed the perception of riverine communities about the 2012 flood disaster. Despite the precarious location, residents of riverine communities of Lokoja seemed to be oblivious of their high exposure and vulnerability to river flooding. Regardless of the existence of hazard source and the high probability of occurrence, a significant number of the residents still perceived river flooding as a rare occurrence. This probably explained why many of them did not have adequate mitigation measures in place in the event of a flood disaster. Perception of flooding therefore appeared to be an important factor that reduced the level of disaster preparedness. Judging by the nature and magnitude of loss reported by respondents, it was obvious that the flood event under study was severe and the affected people lacked a coordinated approach to mitigate episodic disasters like flooding. Stark variations in perceived losses across neighbourhoods within the town were clear indications of the role socio-economic status plays in disaster preparedness and mitigation. Curiously, the victims lacked institutional support and social safety nets that could aid recovery from the shock. Disaster preparedness and mitigation efforts were largely personal and sometimes community based. Such efforts, no doubt, are a function of the socio-economic well-being of individuals and communities.

It is therefore strongly recommended that all-encompassing flood disaster awareness and mitigation programmes be put in place to sensitise riverine communities on the imminence of flood hazard and possible mitigation measures in the event of flooding. The government at State and Federal levels should also provide the legal and institutional framework for responding to disaster in addition to existing structural measures. Strict regulation of development in and around the river valleys should be enforced to prevent people from settling in high risk areas. Also, there must be a coordinated effort to provide relief materials to those affected, as residents reported the late arrival and poor handling of relief materials. More importantly, residents of the neighbourhoods should avoid activities and

practices that can increase their exposure and worsen their vulnerability to flooding. Such practices include blocking of drainage, channels building on floodable lands and failure to heed early warning instruction.

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