

# Disaster Vulnerability and Resilience of Urban Residents: A Case of Rainstorm Disaster Risk Management in Bida, Nigeria

Maikudi Mohammed<sup>1,2</sup> Aliyu Kawu<sup>1,3,4</sup>

1.Department of Urban and Regional Planning, Federal University of Technology, Minna 920003, Nigeria

2.Centre for Disaster Risk Management and Development Studies, Federal University of Technology, Minna

3.Department of Urban and Regional Planning, Ahmadu Bello University, Zaria 810261, Nigeria

4.Corresponding author: Aliyu Kawu, P O Box 4232, Minna 920001, Nigeria, [aliyukawu@gmail.com](mailto:aliyukawu@gmail.com)

## Abstract

Rainstorm disaster is one of the challenges facing a growing number of settlements in Nigeria. Either in rural or urban centres, this environmental catastrophe, has become a recurring and increasingly formidable disaster negatively affecting socio-economic activities. The reduction of the risk and the negative effects of rainstorm disaster has long been a major concern to the residents of Bida in Niger State – central Nigeria. Using on-the-spot assessments and Descriptive Statistical Analysis (DSA), this work highlighted the effectiveness of disaster relief strategies available to victims of recurrent rainstorm events; the various structural damages occasioned by increasing vulnerability to negative effects of climate change related disasters. On-the-spot field finding shows that this disaster negatively affects all areas of human abode and livelihood in the city. Mitigation strategies mostly employed by low-income urban dwellers that constitute majority of the victims, are not only ineffective for addressing hydro-meteorological disasters, but also known to compound peculiar emergency situations occasioned by disasters. In order to effectively tackle these catastrophic events, urban and regional governments need to intervene meaningfully at all levels of Disaster Risk Reduction (DRR) including disaster risk prevention and management. The present practice of providing food items and household utensils as disaster relief materials to disaster stricken and traumatized urban poor can hardly prevent the reoccurrence or reduce the inevitable impacts of future disasters.

**Keywords:** environment / low-income / rainstorm disaster / risks / urban areas

## 1.1 Introduction

Natural disaster cannot be completely stopped. The devastating consequences of most hazards can be reduced through building resistance and community based response to cope with the event whenever and wherever it happens (Tall, Patt, and Fritz 2013; Pearce and Ayres 2012). Disaster is an extremely devastating event within the natural and man-made environment causing huge economic, social and environmental losses (Samuel, 2009; Tkacik, 2013). Disasters don't just occur; they are usually triggered by man's varying influences or developmental activities which can even lead to loss of life and property (Tkacik, 2013). To be precise, disasters are experienced anywhere when life support system fails in the face of pressure from external stress, resulting in loss of life, damage to property that further undermines living and livelihood activities (ALNAP, 2008; Dare, 2010; Habiba, 2011).

The occurrence of rain and windstorms disaster in many parts of the world is keeping many homes and urban environments in miserable conditions (Raes 2012; Raetzo 2006). Rainstorm disasters which tend to be a seasonal type of natural disaster in Nigeria, affects and displaces people, destroying properties and farmlands in its wake. This has made community response in the process of informing the general population of the community, increasing levels of consciousness about risk, and, reducing unnecessary exposure to hazards to gain global significance (Adger et al. 2008; Goulden et al. 2013). This is particularly important for community officials and urban authorities in saving life and properties, to improve the understanding of disaster issues amongst the vulnerable groups, women and children.

The negative effects of annual rainstorm disasters has been exacerbated by uncontrolled and indiscriminate human activities over time and space, having direct negative impact on the people and the welfare of cities (Western, 2000; Radcliffe, 2007; Odjugo, 2010). It is observed that the vulnerability of people to disasters can be influenced by the location and the pattern of the dominant socio-economic activities in a particular environment. The lives and livelihood activities of the urban poor are always hard hit by disasters even if the sad event were on a small scale compared to those that usually occur in rich countries (ALNAP, 2008; Birkmann, 2011). The observed unusually high impacts in these vulnerable environments could have emanated due to the low levels of mitigations employed or, as in most cases, the absence of any effective disaster risk reduction (DRR) strategy witnessed in most impoverished settlements in developing countries.

According to (Goulden et al., 2009; cited in Goulden et al., 2013:907), adaptation is 'an active set of strategies

and actions taken in reaction to or in anticipation of change by people in order to enhance or maintain their well-being'. 'Within the climate change literature, adaptation is generally "adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities"' (McCarthy et al. 2001:982; cited in Adger et al., 2008:337). In essence, adaptation "describes adjustments made to changed environmental circumstances that take place naturally within biological systems and with some deliberation or intent in social systems"' (Gallopín, 2006 and Nelson et al., 2007; cited in Adger et al., 2008:337).

The vulnerability of an individual or society to disaster can be alleviated through short term coping strategies and longer term adaptations practices that adjust human activities to minimize risk impact and outcomes. Most often the scenarios that often necessitated the needed adjustments can be influenced by effectiveness of disaster relief institutions and agencies operative in such environment. Effective DRR can also be achieved through the participation of the affected and potential victims of environmental hazards in the planning and operations of disaster relief operations (Gilbert 2013; Al-simadi, Momani, and Olimat 2009; Conchedda, Lambin, and Mayaux 2011; van Aalst, Cannon, and Burton 2008; Birkmann 2011). It is in the light of these that the study of rainstorm disaster occurrences and community response in Bida at different time and space is carried out in order to gauge community resilience and subsequent adaptation for possible adoption in similar circumstances.

## 1.2 Aim and Objectives of the Study

This paper assesses rainstorm disaster vulnerability and community response in Bida and its environs. By examining the annual rainstorm damages, strategies employed to cope with the disasters and the victims' understanding of the catastrophe; this work highlighted possible measures that can help to further reduce the risk of hydro-meteorological disasters in similar urban areas of developing countries. This aim was achieved by: identifying types and effects of natural disasters in human settlements; an assessment of the physical damages and socio-economic effects of weather related disasters in the study area; the identification of community practices and response to rainstorm disaster; and recommending adjustments to local disaster mitigation practices in Bida and similar urban areas.

## 2.1 Rainfall related disaster events

The importance of rainfall (also referred to as precipitation), to the socio-economic development of mankind cannot be overemphasized. For one, it provides cool weather, a source of water, which is life supporting to both flora and fauna life. Despite the usefulness of precipitation, it can also become counterproductive to human progress as rainstorm or flooding that often accompanied its occurrence can result into life threatening catastrophe with devastating consequences. Rainstorm disaster which is a seasonal disaster occurring in the rainy season in this part of the world, often negatively affect and displace people. This sad event can occur as flash flooding and heavy downpour, thunderstorm and lightning, or the most common strong winds (Ayoade, 1993; McGuire, 2004).

Thunderstorm can bring heavy down pour, flash flooding, strong winds and lightning (Walter, 2005). It is usually accompanied by strong winds, heavy down pour and sometimes hail. Thunderstorms results from the rapid upward movement of warm, moist air and can generally form and develop in any geographic location, perhaps most frequently within areas located at mid-latitude. All thunderstorms, regardless of type, go through three stages: the developing stage, the mature, and the dissipation stage (Mogil, 2007). Depending on the conditions present in the atmosphere, these stages take an average of 30 minutes to go through (NSSL, 2006). Accordingly, the damage that results from thunderstorms is mainly inflicted by downburst winds, large hailstones, and flash flooding caused by heavy downpour (Mooney, 2007).

Lightning is another natural disaster that is as a result of an electrical discharge that occurs in a thunderstorm. It is estimated that between 75 and 100 people are hit and killed by lightning each year (Bruce and Kelli, 2009). Further disasters occur when, under a regime of low precipitation, where little precipitation is present, rainfall cannot prevent fires that sometimes cause wildfires when vegetation is dry. Wildfires that occur close to urban environments can inflict damages upon infrastructures, homes, farm houses, buildings, crops, and provide risk to explosions, should the flames be exposed to gas pipes, or petrochemicals (Rakov, 1999; GSFC, 2003; Giles, 2004).

Flash flooding is the process where a landscape, most notably an urban environment, is subjected to rapid floods (AMS, 2009). A flash flood is the fastest moving type of flood and it happens when heavy downpour collects in a stream or gully, turning the normally calm area into an instant rushing current. Flash flooding can also be caused by extensive rainfall released by hurricanes and other tropical storms, as well as the sudden release of

water from dams (NWSFO, 2006; AMS, 2009).

Strong winds are known to cause destruction of property: Wind is the flow of air or air mass on a large scale and is caused by differences in pressure. When a difference in pressure exists, air movement is accelerated from higher to lower pressure (Ayoade, 1993). Strong winds can be hazardous to unstable, incomplete, or weakly constructed infrastructures and buildings. Agricultural crops and other plants in nearby environments can be uprooted and damaged. With strong winds, airplanes are exposed to high risk of crashing during take-off and landing (Mogil, 2007; NWSFO, 2009).

## **2.2 Disasters, emergency response and community resilience**

Across the globe, local involvement in disaster response is emerging. For example, Community Emergency Response Team (CERT) programme in the United States of America (USA) seeks to train and empower local residents to shoulder the responsibility of being first responders to emergencies. This blends a bottom-up appreciation for the role of local volunteers in emergency response with a top-down institutional framework to facilitate training and coordination, that further providing transparency in the local decision making process and shows that effective community response to disaster and other local needs connects diverse groups within the locality ( Brennan, 2006; Adger et al., 2008; Al-simadi et al., 2009; Goulden et al., 2013; van Aalst et al., 2008). Every community has some form of capacity, no matter how small, to reduce the disaster risk to which they are exposed. This global initiative has made Ologe (2005) to assert that it is when disaster strike that the ingenuity and creativity in all of us come to the fore. For most communities in Nigeria, this capacity needs to be identified, developed for timely and effective intervention. This is where effective and efficient planning comes in. Disaster response planning embraces a clear understanding of the relationship between how we manage growth and how we plan and develop our communities. In operational terms, there is the need for an inventory of the inherent physical and material resources, organizational strength; knowledge and skills, of the vulnerable groups to be developed and applied to reduce the occurrence of disasters or minimize their impacts anywhere it occur (Olayiwola, 2005; Ologe, 2005; Brennan, 2006).

Issues of identification, assessment and monitoring of disaster risks have taken a forefront in many nations. Loss of lives and property on the increasing occurrence of disasters can be substantially reduced if there is an instituted culture of disaster prevention and improving resilience. This in turn requires the collection, compilation and dissemination of information on hazards, vulnerability and capacities to forecast and cope whenever disaster strikes. Furthermore, disaster impacts and losses can be substantially minimized if, for instance, urban authorities, individuals and communities in hazard-prone areas are well prepared and ready to act and are empowered for effective disaster risk reduction and management. Strengthening disaster preparedness also involves strengthening policies, technical and institutional capacities, promoting support for dialogue and developing coordinated approaches or promoting the establishment of emergency funds where and when appropriate (Western, 2000).

Resource-dependent societies are often postulated to be particularly vulnerable to climate variability and change (Thomas and Twyman 2005; O'Brien et al. 2006; and, Intergovernmental Panel on Climate Change 2007; Goulden et al., 2013). Climate variability, in particular extreme climate events, causes impacts on resource-dependent societies that affect assets and livelihoods (Goulden et al. 2013; Adger et al. 2008). In as much as curtailing the risks associated with environmental degradation in human settlements is important to understanding issues associated with global climate change, the knowledge about the effective and efficient management of the human ecosystem becomes imperative. The reduction of the negative effects of natural disasters events in urban areas can contribute immensely to the needed economic, environmental and social growth of human settlements.

This work highlights vulnerability of urban residents to a recurrent weather event and the continuous response to reduce its effects on the fragile environment and the vulnerable urban low-income earners that dominates developing countries' burgeoning urban environments. As it has been observed (Goulden et al. 2013), there is limited understanding of the factors that determine which adaptations are available to poor urban populations and, in particular, what contributions are these available adaptation and mitigation strategies made to community resilience?

## **3.0 Methods**

### **3.1 Study Area**

The ancient city of Bida is an urban Local Government Area (LGA) located in the Southern Guinea Savanna ecological zone of Nigeria, West Africa, about 90 kilometres south west of Minna, the Niger State capital, and

bounded by Gbako, Katcha and Lavun LGAs. The study area is the third largest urban settlement in the region populated by 178,840 people as at 2006 (NPC, 1991 and 2006). Geographically, the town is located between latitudes  $9^{\circ}1'$  and  $9^{\circ}8'$ , and longitudes  $5^{\circ}57'$  and  $6^{\circ}4'$  (Longman, 2003; Googleearth, 2012). The major ethnic group is Nupe which also has the town as its headquarters with a number of districts in its domain. The traditional leadership style of the ancient city is the Emirship, and the head of the town is addressed as Etsu Nupe. The present Etsu Nupe is in the person of Etsu Yahaya Abubakar became the 13<sup>th</sup> Etsu Nupe in September 2003.

The study is an ancient settlement, and, just like other similar traditional settlements in Nigeria, they are known to have gained the status of urban areas over 200 years ago (Nadel, 1961; Mason, 1981; Usman, 1981). Bida was funded mainly on fishing and Fadama agricultural practices along the tributaries of river Gbako that passes through the centre of the town. Both commercial and subsistent agriculture which founded the settlement have now given way to the familiar developing economies' secondary and tertiary economic activities of cottage industries and commerce relentlessly fuelled by large scale urbanization and the technological adaptations of the late 20<sup>th</sup> century.

### **3.2 Data types**

Primary data were acquired through the use of structured questionnaires, on-the-spot observations and the subsequent socio-economic and physical surveys, and oral interviews of the victims of rainstorm disasters in the study area. The questionnaires items solicits information on: state of the damaged properties, types of damage to the properties, time and the extent of the disaster event, victims' income before and after disaster occurrence, occupation, gender, and marital status of the victims of the disasters. The devastating rainstorm event of 6<sup>th</sup> May, 2011, and the properties destroyed were also captured by digital camera. Generally, the primary data used for this work was combined with data from secondary sources consisting of published and unpublished works like text books, academic journals, manuals, media, internet materials, unpublished project works, theses and dissertations.

### **3.3 Samples**

Samples for this study were drawn from the 14 political wards in Bida LGA that constitutes the study area. A total of 1,788 structured questionnaires were administered amounting to 1% of the 178,840 people living in the metropolis with an average of 127.7 questionnaires for every ward (NPC, 2006). The questionnaires were administered to either a male or female adult household heads available at the time of the visit using systematic sampling technique that chooses a house to be sampled from the interval of four (4) houses on the main streets of sampled ward including those affected by the catastrophe of May, 2011.

## **4.0 Data Analysis**

### **4.1 Socio-economic characteristics of victims of rainstorm disaster**

A total of 616 male respondents were sampled forming 35.5% of the sample while a total of 1,118 females were sampled to make up 64.5% of the total sampled size. More response was obtained from the females in the area than males, because they are the highest accessible in terms of response obtained and at the time of the visit. The result shows that about half of the respondents are youths of 16 – 30 years of age and over 94% are in the working age group. The majorities of the respondents are married (over 64 per cent) and employed as trader (29.3%) and civil servants (21.3%). Those engaged in different categories of self-employment ventures amounted to 31.5%, while students and the unemployed total 17.9%.

Rainstorm disaster affects the low-income groups more severely and further adversely affects their socio-economic life. About 4.5% of victims of rainstorm disaster in Bida has monthly income of less than N5,000 (that is less than US\$1 per day)\* and over 18% earn between N5,000 and N15,000 per month (1–3.33 US\$ daily). Overall, more than 72% of the victims earn monthly incomes below N20,000 ( US\$134\$) and only 27.7% earn above this figure. The implication of this is that their little income meant for feeding and daily family upkeeps are suddenly diverted to coping and surviving the devastating effects of the storm.

### **4.2 Areas and the extent of damage**

All areas in Bida are usually affected by rainstorm disaster which has been a recurring annual event. Field surveys revealed that between 2000 and 2011 rainstorm disaster has become a recurring annual event affecting all areas and sectors of the study area. It was gathered that 86.4% of the respondents were affected by the rainstorm disaster in their immediate living and working environments. Rainstorm disaster usually cut across various land uses, with about 85.2% of the sample victims having their residential properties destroyed. Commercial land uses amounted to 10.8% of the destroyed properties, while, institutional and industrial land uses had about 4% (Plates I and II, and Table1).

**Table 2: Land uses affected by rainstorm disaster**

Land Uses	Frequency	Percentage
Residential	1,478	85.2
Commercial	187	10.8
Institutional	54	3.1
Industrial	15	0.9
<b>Total</b>	<b>1,734</b>	<b>100.00</b>

Source: field survey, August, 2011

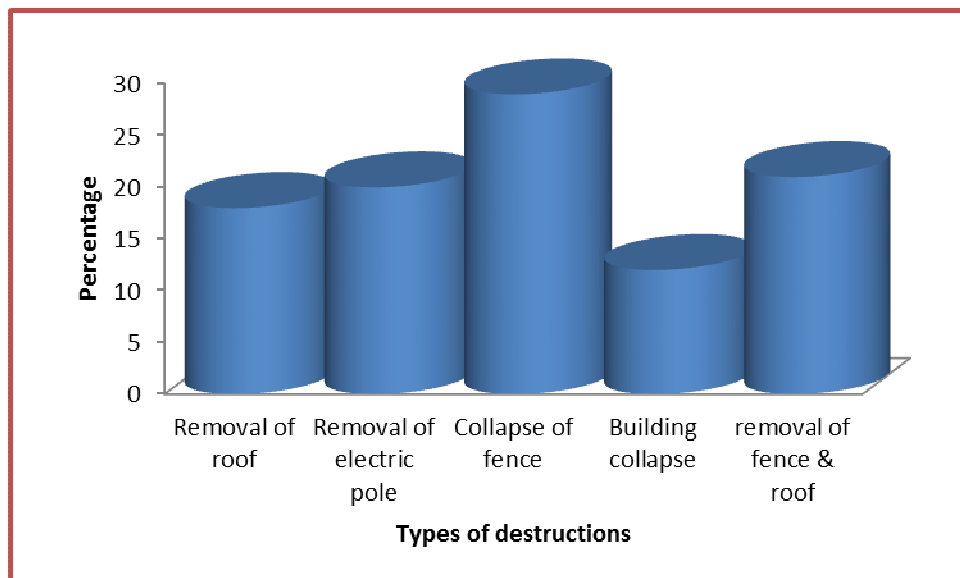


Source: Field Survey, May, 2011

**Plate I: Affected Building Structure in Wadata Ward, Bida**

#### 4.3 Physical Damage to urban infrastructure

It is believed that rainstorm has additional effects especially on urban infrastructure. Field observations gathered that victims of rainstorm were able to identify associated secondary forces besides rainstorm that caused additional devastation to homes and urban infrastructure. Over 20% of the victims of rainstorm disaster in the study area blame the secondary impacts of the storm more on weak electricity poles that put up little resistance to the sudden winds. This has led to serious power interruption to both home and business activities which is an additional setback especially to the poor communities recovering from the devastating disaster. About 18% of the victims also had the roofs of their houses blown off. More than one-fifths of experienced fallen fences, and another 12% experienced total building collapse, and another 21% experienced both collapse of fences and the blowing away of the roof of building structures (Figure 2).



Source; Field Survey, May, 2011

**Fig. 2: Rainstorm Disaster Damages to Structures**

#### 4.4 Local Knowledge about the Cause of the Damages and Destructions

The immediate effects of rainstorm disaster vary just as what the victims believed caused the different destruction. In assessing the nature of rainstorm disaster in the study area, results of field analysis shows that the victims identified the particular rainfall related or induced environmental disaster that wrecked damage on their homes, roads, and other structures. Over 50% of the respondents asserted that the damages that occurred during rainfall were mostly triggered by strong winds and heavy downpour which further caused serious flooding. Another 21% believed the devastating effects was dues to thunderstorm and lightening, while a quarter of the victims identified flash flooding as the cause of the social and environmental destructions usually witnessed during and after the likes of the events of May 2011.



Source: Field Survey, May, 2011

**Plate II: Gullied waterway eating up a major access road**

#### 4.5 Nature the after effects of rainstorm disasters

Meteorologically, the duration of a rainstorm can determines the nature of the rainstorm and its effects including the likely structural damage. Field interviews and physical observations revealed that the May 2011 event in Bida – just as the previous ones, lasted for about three hours given it the characteristics of flash flooding with heavy downpour and strong winds.

In addition to rainstorm serious structural damage to road and buildings were also caused by exogenous forces attributable to man. For example, field assessment results show that about a quarter of the victims of the disaster identified inadequate drainage as a factor responsible for damages caused by flooding and about 31.6% said the damage happened as a result of generally weak building structures prevalent in the area. These weak housing structures are either improperly built or inferior materials were used. While about 20% pointed at the direct effects of unusually strong winds on buildings that lack adequate protection by trees from the direct and persistent onslaught by strong winds.

## **5.0 Discussion of findings**

### **5.1 Mitigation and coping**

Field assessment shows that the acknowledgement of unfavourable natural occurrences is always anticipated by victims of rainstorm in Bida. This observation is largely due to the familiar annual commencement and cessation of rains for over a decade now. Lack of support from agencies of regional and urban governments has largely constrained physical and socio-economic circumstances of the victims thereby frustrating all efforts to fight or build formidable resilience. The results of these challenges are exhibited in the different rudimentary and unsustainable approaches adopted by the increasingly vulnerable populace. The mitigating approaches used to safeguard buildings and other structures in the study area include:

#### **5.1.1 The use of weight on roofing material**

Victims of rainstorm disaster in Bida and similar environments are also known to cope with the events by placing heavy weights chiefly made of rocks, used tyres and bricks on roofs of buildings. This is done in order to give additional weight to the roofing materials and to add strength to resist damage by winds. This practice is widely carried out and believe to prevent roofs of building from been blown off by storm.

#### **5.1.2 Repairs of Damaged Structures**

About one fifth of the victims of rainstorm disaster carried out partial repairs on roofs of building structures by engaging skilled carpenters to reconstruct and replace damaged roofing materials. This common exercise, apart from been a largely affordable and immediate recovery operation, also serve to strengthen these materials against the next round of the disaster event.

#### **5.1.3 Communal interventions**

Victims of disasters, who are financially constrained and are unable to invite paid labour do attract communal labour for assistance. The extended family system practice in the area also play a major part in this free communal service by inviting members including those residents outside the affected community to assist by given labour or material for coping. A member of the extended family might have the skills to handle reconstructions and or can engage the services of members of the guild for free or at subsidised rate.

#### **5.1.4 Relocation and Planning**

About 15% of the victims of rainstorm disaster in the study area have relocated to a new place of residence due to building collapse or due to heavy damage to residential accommodations. These sets of victims are mostly of higher income groups that besides having a network of support also possess affiliates that are ready to accommodate them in times of distress. This coping strategy normally comes from support groups who could be members of the extended family, or trade unions and other professional associations.

#### **5.1.5 Long-term mitigations**

There is hardly any long-term mitigation or coping measures practiced by the victims of rainstorm disaster in Bida. For example, the usual environmental management practices of tree planting, adherence to the local and regional building regulations and, the maintenance of functional drainage systems are hardly acknowledged by the victims as practices that can reduce the effects of rainstorm. Many of the victims do not seem to see any connection between blocked urban drains and flooding. Majority of the victims and residents alike simply see the catastrophe as 'act of God'. Only the high income residents acknowledged that such practices like regular environmental sanitation can help especially in long-term mitigation practices.

## **5.2 Policy formulation and implementation**

### **5.2.1 Appropriate funding of relief agencies**

The operations of formal agencies set up to manage disasters at local and regional levels are mired by serious handicaps such that the activities of these all important urban managers are hardly known to both victims of disasters and the general public. The unfortunately high poverty rate and low-level of education in the study area, has marred most victims from acquiring appropriate awareness about disaster relief agencies in the society, or adequately participating in disaster relief operations to their advantage. For example, most residents in these disaster prone areas of the city do not know which government agency to report to or which emergency numbers to call to seek assistance in terms of need.

### **5.2.2 Need for policy change**

The need to have all-embracing and comprehensive Disaster Risk Reduction Strategies in place at all

communities across every part of the country cannot be over-emphasized. There is the need for the establishment of well-funded and functional disaster management agencies in all towns and cities besides regional the present agencies now in operation. The present practice that empowers disaster relief organizations to only distribute material support to victims, need to be reviewed in order to accommodate urban and regional disaster mitigation and proper rehabilitation.

### **5.2.3 Inclusive disaster risk management**

The present response to disasters by the urban poor is not sustainable and can hardly reduce any short or long term negative impacts or increase the resilience of persons who are daily facing disasters. For instance, the use of heavy materials on roofs to counter the effects of winds can also cause severe injury to victims whenever the materials roll off. However, lack of understanding and the unsuitable attitude of the victims can change with appropriate and adequate representation of all vulnerable groups in policy formation forums for disaster risk reduction. Sustainable disaster mitigation require full empowerment of agencies mandated to the planning, response and the reduction of disaster risk with all the activities of the agencies so set up to have the input and participation of the vulnerable groups as major stakeholders.

### **5.3 Recommendations**

Recurrent annual devastation of residential structures and other land uses in Bida due to rainstorm disasters is an emerging challenge as it has further worsens the inability of the city and her residents to effectively tackle problems of urban hydro-meteorological disasters. In order to guide against the occurrence of this and similar disasters, there is the need to embrace the following:

- a.** Traditional settlements established before the introduction of modern development control lack formalized building regulations and standards to be used in enforcing development control (Kawu, 2005; Kawu and Shaibu, 2007; Kawu, Ahmed and Usman, 2012). The appropriate institution of functional development control department in all cities including traditional settlements is necessary to guide the cities' physical and structural developments in order to avert natural and man-made catastrophes particularly those resulting from haphazard building developments.
- b.** Rainstorm in the study area has been shown to be a recurrent seasonal event; hence, there is the need to establish a formal agency to address the disaster at the local levels where the resulting devastations usually affect the vulnerable members of the society. The Local Disaster Risk Management Agency should be empowered by law to function appropriately without any bureaucratic and financial hindrance.
- c.** The agency should be mandated to work along with the city's fire services department; and like the former agency, the Local Disaster Risk Management Agency should be accessible and to serve as the first disaster relief and rescue agency in case of any distress. With adequate and effective funding, the agency, in addition to providing rescue operations, should also provide immediate emergency relief materials before the State and Federal emergency relief agencies sets in if there is the need to do so.
- d.** There is the need to carry out city-wide public enlightenment particularly targeted at the vulnerable groups at the beginning and ending of each rainy season. This would alert the people on the dangers of rainstorm disasters and the need to safeguard life and properties.
- e.** Laws enforcing the regular maintenance of urban environments should be enforced through relevant state and federal institutions to guide against disasters and environmental pollution, encourage the conservation of nature and environmental sustainability.
- f.** There is also the urgent need to enforce development control in the study area in order to guide building and the rebuilding of structures. The observed disregards to building and planning regulations have in many instances exposed housing structures to disasters like flooding and have been known to constitute insurmountable difficulty during rescue operations. This calls for overall enforcement of appropriate building regulations in regard to building materials used for the construction of residential buildings and related structures like electric poles, drainage materials and other components of the built environment. The enforcement is to encourage the use of high quality building materials that can withstand the combine forces of wind and rainstorms.
- g.** There should be adequate funding urban development boards for effective monitoring of urban developments. There is the need for regular training and re-training of town planners and urban managers to be fully abreast with modern trends in managing urban disasters through effective urban management.
- h.** Tree planting should be intensified in all urban and rural areas challenged by or are likely to be challenged by hydro-meteorological disaster. In addition to having plans for access roads and drainages, there should be adequate provision of building setbacks and the planting of trees to serve as buffers during storms. These should be provided before building plans are approved for any urban development. The enforcement of tree planting would give the needed avenue to use town planning tools like development plans and other development control mechanisms to halt haphazard developments characteristic of traditional settlements.
- i.** There should be drastic policy change to favour durable material as building materials for any form of



construct activities. It would be good for public agencies and development control agencies to insist that in both new and old development, emphasis should be placed on the use of concrete electric poles to replace the wooden types which are more susceptible to storms and fire hazards. The General public too, especially the designers and builders of residential structures, should be made to embark on protective roof designs against rainstorms in the communities prone to rainstorm and similar disasters.

## 6.0 Conclusion

In many human settlements, current and potential dangers posed by rainstorm and related hydro-meteorological disasters can hardly be overlooked, however, the manifest devastating effects on life and property can be reduced or completely eliminated by instituting principles of sustainable urban management. Building community resilience is one of the ways to reduce effects of disasters (Tall, Patt, and Fritz 2013). In administrative settlements like Bida with little industrial establishments, residential structures are most hit whenever disaster occurs. Structural damages resulting from rainstorm disasters are exhibited in the destruction of urban facilities and infrastructure which served the low-income urban residents, and are the major catalysts of socio-economic endowments of cities and again a building block for community resilience. Low-income and the prevalence of impoverished population have further pushed victims of urban disasters to adopt inappropriate mitigation practices with negative consequences.

Bida is mainly an administrative and educational settlement. Unlike in the industrialized cities, this ancient city is populated by low-income earners and the unemployed. This lack lustre economic situation has further made the impacts of natural disasters like annual rainstorms - prevalent in the study area, more catastrophic consuming building structures and livelihood amenities. Without adequately funded disaster response agency of any kind at the local levels, poor victims of disasters are pushed to adopt any available mechanism in order to limit the extent of disaster damage. The non-institution of suitable rules and regulations regarding building and rebuilding of structures in this and similar cities has further curtailed the powers of urban authorities to manage the challenge with the urgency it deserve.

## References

- Adger, W. N., Dessai, S., Goulden, M., Hulme, M., Lorenzoni, I., Nelson, D. R., ... Wreford, A. (2008). Are there social limits to adaptation to climate change? *Climatic Change*, 93(3-4), 335–354. doi:10.1007/s10584-008-9520-z
- ALNAP, (2008). Flood disasters: learning from previous relief and recovery operations. Accessed June 2010 from [www.alnap.org/pool/files/ALNAP-Provention\\_flood\\_lessons.pdf](http://www.alnap.org/pool/files/ALNAP-Provention_flood_lessons.pdf)
- Al-simadi, F., Momani, F. A., & Olimat, H. (2009). Health Perception and Feeling of Health Efficacy among Deprived Adolescents in Jordan. *JKAU: Arts and Humanities*, 17(2), 263–272.
- AMS, (2009). Bow echo. *Glossary of Meteorology - American Meteorological Society*. Retrieved June 14 2009 from <http://www/amsglossary.allenpress.com>
- Ayoade, J. O. (1993). *Introduction to climatology for the Tropics*. Spectrum Books, Ibadan, Nigeria.
- Birkmann, J. (2011). First- and second-order adaptation to natural hazards and extreme events in the context of climate change. *Natural Hazards*, 58(2), 811–840. doi:10.1007/s11069-011-9806-8
- Brennan, P. (2006). *Introduction to International Disaster Management*. Heinemann, Butter Worth.
- Bruce, G. and Kelli, B. (2009). Lightning and its hazards. *Houghton sports medicine foundation*. Accessed 9th April, 2011 from <http://www.heghston.com/hha/a.htm>
- Conchedda, G., Lambin, E. F., & Mayaux, P. (2011). Between Land and Sea : Livelihoods and Environmental Changes in Mangrove Ecosystems of Senegal Between Land and Sea : Livelihoods and Environmental Changes in Mangrove Ecosystems of Senegal. *Annals of the Association of American Geographers*, 101(6), 1259–1284. doi:10.1080/00045608.2011.579534
- Dare, O. E. (2010). *Disaster Coping Strategy, A Case of Rainstorm Disaster in Minna Town*. Niger State.
- Filani, M. O., and Okafor, S. I. (2006). *Foundation for Urban Development in Africa: The Legacy of Akin Mabogunje*. The Cities Alliance, United Nations Human Settlements Programme (UN-HABITAT), Washington D. C., USA.
- Gilbert, A. (2013). How to help, and how not to help, the poor in the megacities of the South. *City*, 17(5), 628–635. doi:10.1080/13604813.2013.827838
- Giles, O. B. E. (2004). *Lightning: BBC News*. Accessed on 9th April 2011 from <http://www.bbc.co.uk/weather/features/understanding/lightning.shtml>.
- Googleearth, (2012). *Bida, Nigeria*. A Satellite Image, accessed 27 October 2011 from [www.googleearth.com](http://www.googleearth.com)
- Goulden, M. C., Adger, W. N., Allison, E. H., & Conway, D. (2013). Limits to Resilience from Livelihood Diversification and Social Capital in Lake Social–Ecological Systems. *Annals of the Association of American Geographers*, 103(4), 906–924. doi:10.1080/00045608.2013.765771

- GSFC, (2003). *Lightning really does hit more than twice*. Goddard Space Flight Center. National Aeronautics and Space Administration. Accessed 9th April 2011 from <http://www.nasa.gov/centers/goddard/news/topstory/lightning.html>
- Habiba, M. M. (2010). *Biological Control of Yam Diseases in Bida Local Government Area*. Unpublished MSc Biological Science Thesis, Usmanu Dan-Fodiyo University, Sokoto, Nigeria.
- Kawu, A. M. (2005). *Development Control in Traditional Settlements: A Case Study of Zaria City*. Unpublished MSc (URP) Thesis, Ahmadu Bello University, Zaria, Nigeria.
- Kawu, A. M. and Shaibu, S. I. (2007). Physical Planning and Sustainable Urbanization in Nigeria. National Association of Sciences, Humanities and Education Research Journal - *NASHER JOURNAL*, 5(1): 78–86.
- Kawu, A. M., Ahmed, A., and Usman, A. S. (2012). Learning From Tradition: Elements and Practice of Urban Development Control In Zaria City, Nigeria. *American International Journal of Contemporary Research* 2(7): 205–213, July. Accessible from [www.aijcr.com](http://www.aijcr.com)
- Knox, P. L., and Pich, S. (2006). *Urban Social Geography: An introduction*. Fifth edition, Pearson Prentice Hall, New Jersey, USA.
- Knox, P. L., and Marston, S. A. (2007). *Human Geography: places and regions in global context*. Fourth edition. Pearson Prentice Hall, New Jersey, USA.
- Longman, (2003). *Senior Secondary Atlas*, 2<sup>nd</sup> Edition. Ikeja: Longman Plc.
- Mason, M. (1982). *The Foundations of the Bida Kingdom*. Ahmadu Bello University Press, Zaria, Nigeria.
- McGuire, T. (2004). *Weather hazards and the changing atmosphere earth science the physical setting*. AMSCO School Publishers.
- Mogil, M. H. (2007). *Extreme weather*. New York: Black Dog and Leventhal Publishers.
- Mooney, C. C. (2007). *Storm world hurricanes, politics, and the battle over global warming*. Houghton: Mifflin Harcourt. Accessed 9th April, 2011 from <http://books.google.com>
- Nadel, S.F. (1961). *A Black Byzantium (The Kingdom of Nupe in Nigeria)*. Oxford University Press, London, UK.
- NPC, (1991). *National Population Figures*. Lagos: National Population Commission,
- NPC, (2006). *2006 National Population Census Figures*. Minna: Office of the National Population Commission.
- NSSL (2006) National Severe Storms Laboratory. A severe weather primer questions and answers about thunderstorms. National Oceanic and Atmospheric Administration.
- NWSFO, (2009). National Weather Service Forecast Office Morristown Tennessee Definitions of flood and flash flood. National Weather Service southern region headquarters. Accessed 10<sup>th</sup> April 2011 from <http://www.srh.noaa.gov/ae/surwx/downburst.htm>
- Odjugo, P. A. O. (2010). Regional evidence of climate change in Nigeria. *Journal of Geography and Regional Planning*, 3(6): 142-150. Accessed 30<sup>th</sup> August 2012 from <http://www.academicjournals.org/JGRP>
- Olayiwola, L. M. (2005). *Town planning Instrument as a Strategy for Disaster Risk Reduction in Nigeria*. Paper presentation at NEMA Secretariat, Abuja. June
- Ologe, K. O. (2005). *Developing the Capacities of Communities for Disaster Risk Reduction in Nigeria*. Proceedings of the Consultative Launch of the National Platform of Stakeholders in Disaster Risk Reduction in Nigeria, NEMA Secretariat, Abuja.
- Pearce, G., & Ayres, S. (2012). Regional & Federal Studies Back to the Local ? Recalibrating the Regional Tier of Governance in England. *Regional & Federal Studies*, 22(1), 1–24. doi:10.1080/13597566.2012.652418
- Radcliffe, S. R. (2007). Latin American indigenous geographies of fear: living in the shadow of racism, lack of development, and antiterrorist measures. *Annals of the Association of American Geographers*, 97(2): 385 – 397. Accessed 21 June 2012 from [www.tanfonline.com/loi/raag20](http://www.tanfonline.com/loi/raag20)
- Raes, F. (2012). *Air & Climate: Conversations about Molecules and Planets, With Humans in Between*. (F. Raes, Ed.) (p. 152). Luxembourg: Joint Research Centre (JRC), European Commission. doi:10.2788/31132
- Raetz, H. (2006). Adaptation to climate change in Switzerland ‘ s natural hazards management policies.
- Rakov, V. A. (1999). “lightning makes glass”. University of Florida, Gaines Ville. <http://plaza.ufl.edu/rakov/Gas.html>. Accessed on 10th April 2011.
- Samuel, M. B. (2009). Assessment of Flood Disaster in Festac Town. Accessed on 9th April 2011 from <http://books.google.com>
- Tall, A., Patt, A. G., & Fritz, S. (2013). Reducing vulnerability to hydro-meteorological extremes in Africa . A qualitative assessment of national climate disaster management policies : Accounting for heterogeneity. *Weather and Climate Extremes*, 1, 4–16. doi:10.1016/j.wace.2013.07.007
- Usman, Y. B. (1981). *The Transformation of Katsina (1400-1883): The Emergence and Overthrow of the Sarauta System and the Establishment of the Emirate*. Ahmadu Bello University Press Limited, Zaria, Nigeria.
- Van Aalst, M. K., Cannon, T., & Burton, I. (2008). Community level adaptation to climate change: The potential role of participatory community risk assessment. *Global Environmental Change*, 18(1), 165–179.

doi:10.1016/j.gloenvcha.2007.06.002

Western, C. V. (2000). *Remote Sensing for Natural Disaster Management*. The Netherlands: International Institute for Aerospace Survey and Earth Sciences. Accessed 5 September 2012 from [http://www.itc.nl/Pub/organisation/United Nations University.html](http://www.itc.nl/Pub/organisation/United_Nations_University.html)

### **Appendix**

At the time of the survey, N150 officially exchange for USD1.0. This official rate do increase by up to 10% in the open market; the only avenue for foreign exchange. The official rate was used for this analysis.

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:  
<http://www.iiste.org>

## CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

**Prospective authors of journals can find the submission instruction on the following page:** <http://www.iiste.org/journals/> All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

## MORE RESOURCES

Book publication information: <http://www.iiste.org/book/>

## IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

