WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Flood Assessment in Suleja Local Government Area, Niger State, Nigeria

Birmah M.N. , Kigun P.A., Alfred Y.B., Majidadi ST., Surajo L.A.

Nigerian Building and Road Research Institute, Abuja, 900001, Nigeria

A B S T R A C T

Flooding is a scenario where usually dry land gets submerged in water. This phenomenon can be caused naturally by excessive rainfall and increased surface water flow. It could also be manmade as a result of dam spillage, poor construction of water drainage and faulty installation of community water delivery pipes amongst others. Consequently, flooding contributes to one-third of environmental crises in Nigeria which results in record cases of destruction of life's and properties, natural habitat displacement, pollution of land and water resources, soil erosion and deaths in the animal population. This study accesses the cause and effect of flood in the Suleja local government area of Niger State in Nigeria, to identify the causes and patterns of flooding in the area as well as to examine the affected area in other to proffer mitigation measures. The study applies the use of a primary and secondary source of data collection for her investigation, the primary sources included site visitation to carry out interview and physical assessment, while the secondary source involved the application of remote sensing technology. The findings revealed that the flooding occurred as a result of highly intense rainfall that lasted about four hours which caused the inland water to rise. It was revealed that solid waste was dumped along the Kuspa river bank thereby blocking and narrowing water ways. For these reasons, the water level rose significantly to rooftop level and the river extended inland. The resulting effect was that building and other properties were destroyed; people were displaced while some people lost their lives. In conclusion, significant damages to properties and loss of lives were recorded and emphasis on effective mitigation measures was made to reduce the effects of the flood.

Keywords: Flooding, Climate change, Inland water way, Remote sensing, Mitigation measures

1. Introduction

Flooding is a natural event or occurrence where a piece of land (or area) that is usually dry land, suddenly gets submerged under water. Some floods can occur suddenly and recede quickly. When floods happen in an area that people live, the water carries along objects like houses, bridges, cars, furniture and even people (eschooltoday.com, 2017). Floods regularly account for nearly one-third of all global disasters arising from geophysical hazards (Smith and Ward, 1998). They now appear to be more prevalent and destructive than centuries ago and are projected to increase both in frequency and amount of devastation in the future (Parker, 2000). Floods and other extreme weather and climate events are often accompanied by loss of lives and property, damage to crucial infrastructure, disruption of socio-economic activities and, in some cases, displacement of persons in the affected areas (NEMA, 2013).
Flood affects an estimated 520 million people across the world yearly resulting to about 25,000 deaths annually. According to UN-Water (2011) floods, including urban flood is seen to have caused about half of disasters worldwide and 84% disaster deaths in the world was attributed to flooding. Flooding is one of the major natural disasters which disrupt the prosperity, safety and amenity of the residents of human settlements (Jha et al., 2012). In several parts of the Netherlands, intense rainfall in autumn of 1998 caused damage to 2470 houses, 1220 premises and 350 governmental agencies (Jak and Kok, 2000). For example in West and Central Africa more than 1.5 million people were affected by floods between the months of July and August 2012 following heavy rainstorm in which more than 11,400 homes were destroyed in Senegal; more than 94,000 in Chad and 24,000 homes in Niger (UN-OCHA, 2007).
In Nigeria, the pattern is similar with the rest of world. Flooding displaces more people than any other disaster, perhaps because about 20 per cent of the Nigerian population is at risk of flooding (Etuonovbe, 2011). Flooding is therefore a perennial problem in Nigeria that consistently causes deaths and displacement of communities. For instance, in 2010, about 1,555 people were killed and 258,000 more were displaced by flooding (Babatunde

* *Corresponding author*
E-mail address: *bmnyadar@gmail.com.*

2011).Similarly in 2012, floods claimed 361 lives, and displaced 2.1 million people(Tokunbo and Ezigbo,2012). In 2012 alone, Nigeria experienced an unprecedented flood that affected about twenty seven states of the Federation, causing the deaths of over four hundred (400) persons and displaced about two million people from their homes. The total amount of losses was estimated to be approximately N2.29 trillion (NEMA, 2013). The devastation caused by extreme events and especially floods have been exacerbated by low level of awareness of the consequential effects of human activities on drainage systems, such as dumping of refuse, erecting of structures on flood plains and other indiscriminate actions that interfere with the free flow of water (NEMA, 2013).

The primary effects of flooding include loss of life, damage to buildings and other structures, including bridges, sewerage systems, roadways, and canals. The Secondary effects of flooding are Economic hardship due to destruction of farmlands, rebuilding costs, or food shortages, homelessness and poverty among others are the common after-effect of severe flooding. The impact on those affected may cause psychological damage to those affected, in particular where deaths, serious injuries and loss of property occur.

Across the globe, floods have posed tremendous danger to people's lives and properties. Floods cause about one third of all deaths, one third of all injuries and one third of all damage from natural disasters (Askew, 1999). In Nigeria, the pattern is similar with the rest of world. Flooding in various parts of Nigeria have forced millions of people from their homes, destroyed businesses, polluted water resources and increased the risk of diseases (Baiye, 1988; Akinyemi, 1990; Nwaubani, 1991; Edward-Adebiyi, 1997).

Despite the Nigerian Meteorological Agency annual Seasonal Rainfall Prediction, irregular flooding occurs regularly in many parts of Nigeria, some part of the country suffer severely from the hazards of floods. Suleja L.G.A. of Niger State located 20km to the North of the Abuja the Federal Capital Territory of Nigeria, has recorded series of flood events and the worst flood ever recorded was 35 years ago. According to Smith and Ward (1998), most floods in the humid tropics result directly or indirectly from climatological events, either extremely heavy or prolonged rainfall. Heavy rainfall accompanied by torrential flood claimed lives, destroyed properties and many residential homes and commercial buildings were completely submerged. On the 16th of July 2017, there was an overnight downpour that lasted for three hours resulting to partial collapse / complete destruction of buildings and floating cars. The focus of this study therefore, is on rainfall-induced flooding; causes effects and mitigation measures for preventing and reducing flood hazards in Suleja L.G.A.

1.1 Aims and Objectives

1.1.1 Aim

The aim is to assess the cause and the effects of flood in Suleja Local Government Area of Niger State.

1.1.2 Objectives

The specific objectives are to:

I. Identify the flood pattern and major cause of flood in Suleja
II. Examine the affected areas and obtain information from the residents
III. Suggest measures to mitigate future occurrence of flood in Suleja

2. Review of Literature

The major hazards being experienced in Nigeria includes land degradation, flooding, erosion, deforestation, desertification and climatic drought. Flooding in Nigeria has been due to natural and artificial factors. Flooding has been experienced in the Niger

Through Benue basin and Sokoto-basin affecting agricultural land use and buildings to a great extent. Virtually every Nigerian is vulnerable to disasters, natural or man-made. Every rainy season, wind gusts arising from tropical storms claim lives and property worth million of Naira across the country Angela (2011).

2.1 Flooding

Walesh (1989) defined Flooding as temporary inundation of all or part of the floodplain or temporary localized inundation occurring when surface water runoff moves via surface flow, gutters and sewers. Flooding is defined as a general temporal condition of partial or complete inundation of normally dry areas from overflow of inland or tidal waters or from unusual and rapid accumulation of runoff (Jeb and Aggarwal, 2008). Floods also occur when water levels of lakes, ponds, reservoirs, aquifers and estuaries exceed some critical values and inundate the adjacent land, or when the sea surges on coastal lands much above the average sea level (Rossi et al., 1992). Meteorological flood can be defined as a situation over a region where rainfall is mostly higher than the climatological mean value of the region (Ologunorisa and Abawua, 2005).

2.2 Causes of Flooding In Nigeria

Generally, causes of flood in Nigeria could be as a result of Natural Cause or Human Cause. **Natural Cause** are in form of Heavy or torrential rains / rainstorm, Oceans storms and tidal waves usually along the coast. **Human Causes** occur in the form of Burst water main pipes, Dam burst, lever failures and Dam spills. There are four broad flooding categories: Coastal flooding, Groundwater flooding, River (or fluvial) flooding, and Pluvial flooding (ActionAid, 2006; Sterna, 2012).

2.2.1 Coastal flood: Occur in low-lying coastal areas, including estuaries and deltas, when the land is inundated by brackish or saline water. Brackish-

water floods result when river water overspills embankments in coastal reaches. This overspill can be intensified when high-tide levels in the sea are increased above the normal level by storm-surge conditions or when large freshwater flood flows are moving down an estuary. Saline water coastal floods may occur when extremely large wind-generated waves are driven into semi-enclosed bays during severe storm (Smith and Ward, 1998).

2.2.2 Flash flood: The flood is associated with rivers in the inland areas where sudden heavy rains can change them into destructive torrents within a short period. Dam burst is also associated with flash flood.

2.2.3 River flood: Also known as fluvial flood in river valleys, it occurs mostly on floodplains along the rivers. When the river exceeds its capacity the banks and the floodplain becomes flooded. Most river floods result directly or indirectly from climatologically influence such as excessively heavy and/or prolonged rainfall (Smith and Ward, 1998).

2.2.4 Urban or Pluvial flood: Pluvial flooding is typically associated with short duration high intensity rainfall, but can also occur with low er intensity prolonged rainfall. The pluvial flood extent can be worsened if the ground is saturated, frozen, paved or otherwise has low water permeability (Falconer, 2009). It is a characteristic of urban areas where large areas of impervious ground exist and inadequate drainage systems abound. As urban growth increases, the impervious surface area also increases; thereby rendering populations vulnerable to water inundation as natural streams and human-made drainage fails to cope with increased runoff subsequent to heavy rainfall (Youssef and Pradhan, 2011).
Urban pluvial flooding frequency is expected to increase not only due to urbanisation but also to expected climate changes (Ugarelli et al., 2011and Simes et al., 2014). The volumes involved and the risk related to pluvial flooding often result in consistent economic losses and consequent damage in the long term due to the high frequency of this kind of event (Freni et al.,2010). The primary cause of urban flooding is severe thunderstorm or rainstorm preceded by long lasting moderate rainfall that saturates the soil (Andjeikovic, 2001). Extensive urban flooding is a phenomenon of every rainy session in Lagos, Maiduguri, Aba, Warri, Benin and Ibadan.

Fig 1 LAGOS FLOOD Source: Ugonna 2016

2.3. EFFECTS OF FLOOD IN NIGERIA

In the last three decades, the impacts of flooding have increasingly assumed from significant to threatening proportions, resulting in loss of lives and properties. Though detailed statistics are not available regarding the losses sustained by the urban dwellers and flood victims, it is obvious from the available records (table 1) that irreparable havocs have been sustained by the citizen of Nigeria due to what has become perennial natural disaster in our cities. Apart from houses that collapse by flooding, schools buildings and bridges sometimes collapse as well. Markets places and farmlands are submerged for weeks and sometimes are washed away.

The devastating effect of floods was not limited to houses and people. Many farmlands both arable and agro-forestry were swept away when residential and business places were submerged for weeks. Some animals lost their lives to flooding when many buildings / bridges collapsed and electric poles destroyed. Other effects are water pollution, land degradation, leaching /erosion of rich top soil, water-borne diseases, hunger , poverty and forceful migration. Angela (2011).

Fig 2 SUBMERGED BUILDINGS Source: nigerianeye.com 2016

Fig 3 EFFECT OF FLOOD ON ROAD Source: Innova Magazine 2016

TABLE 1: FLOOD DISASTERS/ HAZARD IN SOME STATES IN NIGERIA

S/NO	STATE	DISASTER	ASSOCIATED HAZARD	NO OF PEOPLE AFFECTED	DATE & YEAR
1	Lagos	Flood	Buildings collapsed, Markets submerged, Properties destroyed.	Over 300,000 affected	Early 1970's Till Date
2.	Niger	Flood & Rainstorm	Houses, Schools, animals & farmland affected	200,000 displaced	1999, 2000& 2017
3	Abia	Rainstorm	Houses	500	July 2001
4	Kogi	Flood & Rainstorm	Houses, Schools & Farmland destroyed	1500 di8splaced	March, May 2001
5	Adamawa	Flood	Houses & Farmlands destroyed	500	April 2001
6	Taraba	Flood	80 Houses totally swept off. 410 houses extensively destroyed	More than 50,000 displaced	August 2005
7	Akwa - Ibom	Flood & Rainstorm	367 houses washed away	4000	March 2001
8	Jigawa	Flood & Windstorm	Houses, farmlands & animals destroyed	35,500 displaced in 1988; 450,150 displaced in 2001	1988, March, April & August 2001
9	Kano	Flood & Windstorm	Schools, Houses, Farmlands & animals destroyed	300,000 displaced in 1988, 20,445 in 2001	1988, 2001
10	Ondo	Rainstorm	Houses & schools destroyed	800 affected	April 2001
11	Osun	Rainstorm	Houses & schools destroyed	1700 affected	April 2001
12	Bauchi	Flood	750 Houses washed away, Farmlands destroyed	Not available	August 1988
13	Bayelsa	Flood	Houses, Schools, Markets& Farmlands submerged	2/3 of the population	1999 & March 2001
14	Borno	Flood	Houses & Farmlands	Not available	August 1988,

Source: Durotoye, B., (1999).Edited 2017

3. Study Area and Methodology

3.1 The Study Area

Suleja L.G.A was established by the Local Government reform of 1976 from the defunct Abuja native authority. Suleja lies between Latitude 9º12′1.17″ N and Longitude 7º10′20.25″ E of the Meridian. Suleja L.G.A was created in 1976 and it shares boundary with Gurara to the North-West, Tafa to the East in Niger State and Gwagwalada, Zuba to the south, in Federal Capital Territory. Suleja is about 20km North of Abuja FCT and about 100km North-East of Minna the State Capital of Niger State. (Aminu, et al., 2013). Suleja has about ten (10) Wards within the Local Government Area namely; Bagama 'A', .Bagama 'B', Magajiya, Iku South I, Iku South II, Hashimi 'A', Hashimi 'B', Maje, Kurmin Sarki and Wambai. According to 2006 provisional population census, Suleja Local Government has a population of 216,578 and covers a land mass area of 118,910 Sq.km. (Niger State Facts and Figures, 2011). (Figure 3.1, 3.2 and 3.3). The average annual temperature is 26.3 °C and the average rainfall is 1328 mm. The highest precipitation occurs in September; with an average of 272 mm. March is the warmest month of the year with average temperature of 29.0 °C. The lowest average temperature is in August, at 24.5 °C. (http://en.climate- data.org/location/31737/).

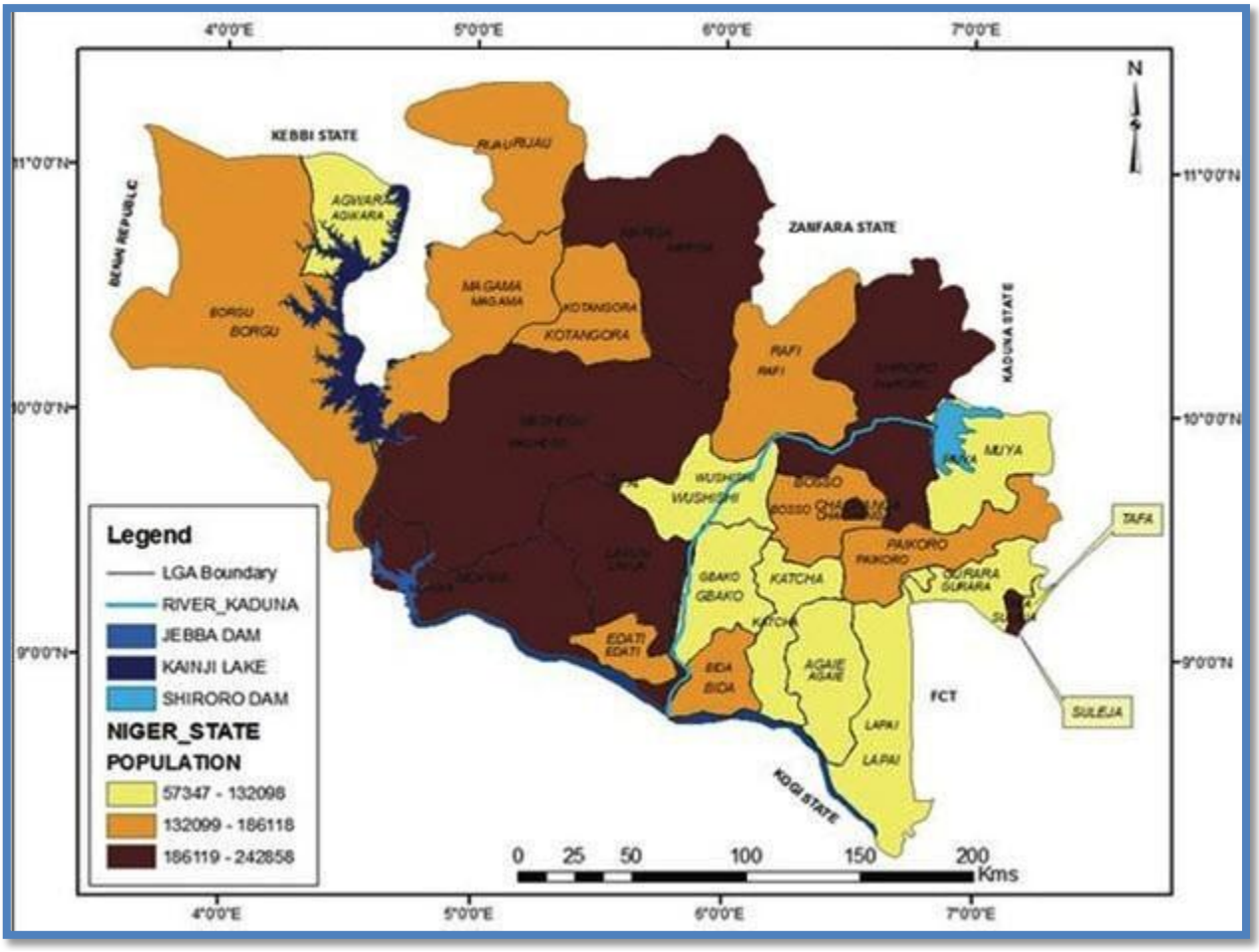

Figure 3.1 Niger State showing the Local Governments Areas

Source: Ikusemoran (2013)

Figure 3.2: Suleja L.G.A Satellite Imagery

Source: Google Map Data 2017

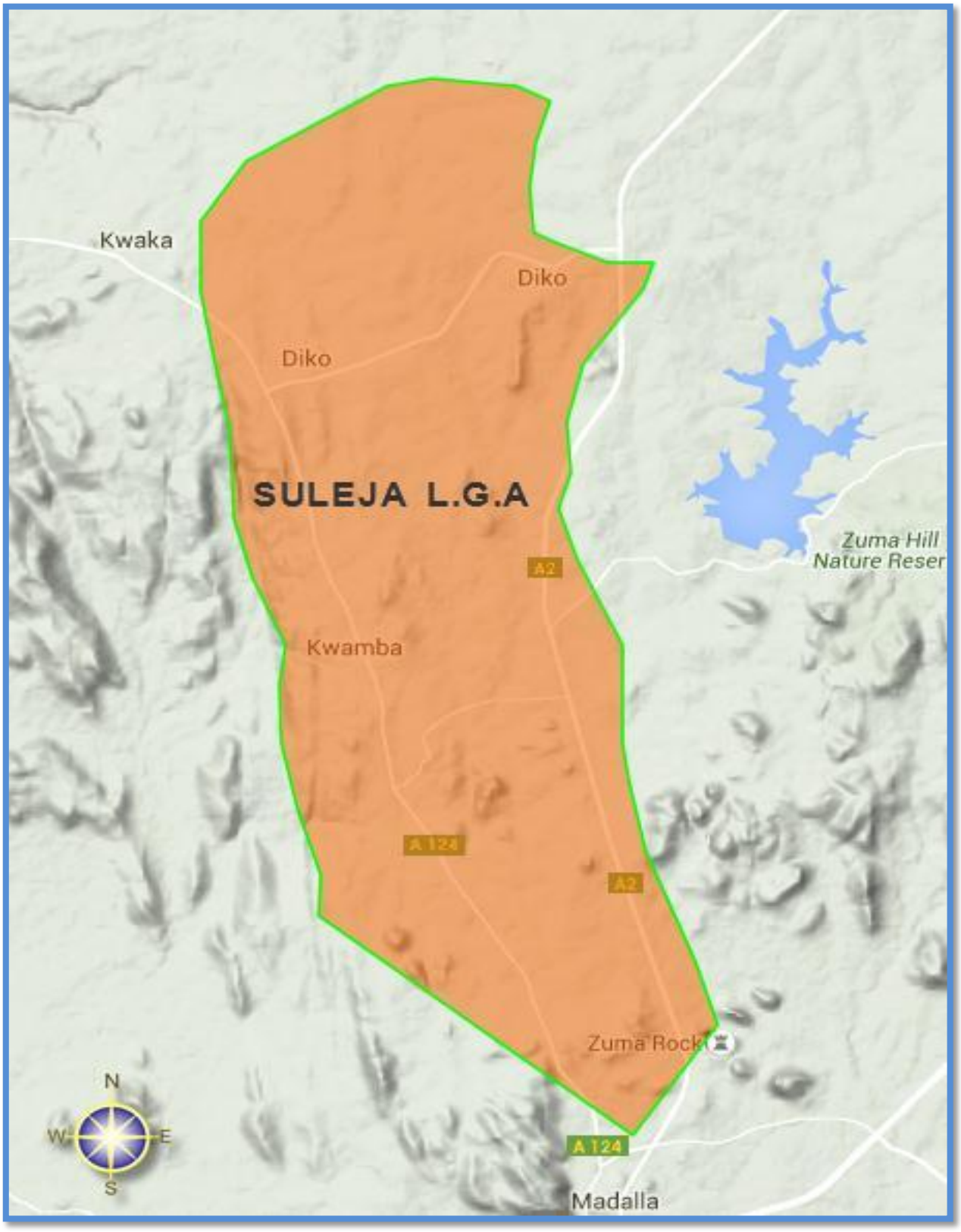

Figure 3.3 Suleja L.G.A Topo Map/ Satellite Imagery

Source: SALB, 2009/UNOCHA/ROWCA, 2012. (Google Map Data 2015)

3.2. RESEARCH METHODOLOGY

There was a courtesy visit to the Suleja Local Government Area Headquarter, to notify the Officials about the purpose of the visit. The Secretary of Suleja L.G.A., with his Officials took the NBRRI Staff to the various spots where the flood incidence occurred.

3.2.1 Primary Source: The Primary Source encompasses obtaining first hand information which has to do with site visit, personal observation and conducting interview with the people of living around the affected areas in Suleja.

3.2.2 Secondary Source: Involving the use of literature, satellite imageries, maps, Global Positioning System (GPS), Camera, internet and desktop studies.

4. Result of Suleja Flood Investigation

The Research Officers from NBRRI visited the Suleja Local Government Secretariat to see the Secretary of the Local Government pertaining the recent flood occurrence in Suleja. The Secretary with some Directors of the Local Government took the entire team to the various points with the worst effects of flood, where lives and properties were lost in Suleja.(Plate 1).

PLATE 1: SULEJA L.G.A SECRETARIAT

FIRST LOCATION

The Secretary of Suleja Local Government Area took the Team from Nigerian Building and Road Research Institute to the various areas affected by the recent flood.

The first site was Kuspa bridge that is geographically located at 09°10′10.9″ N, 007°10′48.0″ E of the meridian. The Kuspa Bridge has a length of 18.6m, width of 6.2m and a wing wall length of 1.43m. The flood removed the hand rail of the bridge at both sides. (Plate 2,3,4,5 and 6).

The flood was caused by heavy rainfall which started from 12 midnight to 4:00 am in the morning.

During the investigation it was observed that buildings along the river were destroyed. -The water level rose to roof level and river extended inland of about 20m-25m.

There was huge solid waste dumped along the Kuspa River Bank and narrowing its path.

FIGURE 4.1 : SATELITE IMAGERY SHOWING THE RIVER AND PART OF SULEJA SETTLEMENT (KUSPA).

PLATE 2: KUSPA BRIDGE

PLATE 3: KUSPA RIVER

PLATE 4: BUILDING LOCATION CLOSE TO THE RIVER

PLATE 5: PARTIAL COLLAPSED OF BUILDINGS IN KUSPA

PLATE 6: AN INTERVIEW WITH RESIDENT OF KUSPA AFFECTED BY THE FLOOD

SECOND LOCATION

The Yaro bridge has a length of 8.7m, width of 13.6m and is geographically located at 09°10′14.6″ N, 007°10′54.5″ E in uncle Yaro second gate, Suleja. The flood affected the embankment of Yaro bridge and landslide was also observed revealing the Water Board main distribution Pipes seriously damaged by the flood.

PLATE 7: WATER DISTRIBUTION PIPES AT YARO BRIDGE

PLATE 8: DRAINAGE BLOCKAGE AT YARO BRIDGE

FIGURE 2: DRAINAGE SATELLITE IMAGERY SHOWING YARO BRIDGE

THIRD LOCATION

The Region around the Nigerian - Ghana International School located at 09°11′38.1″ N, 007°11′54.7″ E, was affected by the flood. Both the full and partial collapse of buildings occurred within the area. From the information gathered, the water level during the flood rose almost to the roof level of some buildings. The flood moved cars to other place and existing buildings within the river path, were total destroyed and properties lost. During the flood incidence within this area there was no record of death due to flood. Plate 9, 10, 11 and 12).

PLATE 9: A BUILDING AFFECTED BY FLOOD CLOSE TO 2ND GATE SULEJA

PLATE 10: A CAR RESCUED FROM THE FLOOD CLOSE TO 2ND GATE SULEJA

PLATE 11: LOCATION OF BUILDINGS CLOSE TO THE RIVER @ 2ND GATE SULEJA

PLATE 12: BUILDING ALONG THE RIVER CHANNEL COMPLETELY DESTROYED CLOSE TO 2ND GATE SULEJA

FIGURE 3: SATELLITE IMAGERY SHOWING THE FORMER BUILDING

PLATE 12: AFFECTED BUILDINGS WITHIN 2ND GATE RESIDENCE IN SULEJA

PLATE 13: AFFECTED BUILDINGS WITHIN 2ND GATE RESIDENCE IN SULEJA

PLATE 13: INTERLOCKING TILES REMOVED BY FLOOD

PLATE 14: SURROUNDING BUILDINGS DESTROYED BY FLOOD

FOURTH LOCATION

The area around Chachanya located at 09°12′04.5″ N, 007°12′ 04.6″ E, was affected by the same flood and majority of the buildings along the river bank were also destroyed. From the information gathered, Chachanya had the worst flood destruction where a resident of the area Mallam Sa'adu Abubakar Asha lost 2 wives and 6 children. Their building was completely swept away by the flood at approximately 3:00am. The NBRRI Research Officers and the Secretary of Suleja L.G.A with his Directors paid a condolence visit to Mallam Sa'adu Abubakar Asha in Chacahnya, Suleja.(Plate 15 and 16).

PLATE 15: NBRRI RESEARCH TEAM WITH MALLAM SA'ADU ABUBAKAR ASHA WHO LOST HIS FAMILY

PLATE 16: LOCATION OF MALLAM SA'ADU ABUBAKAR ASHA HOUSE

FIGURE 17: SATELLITE IMAGERY SHOWING LOCATION OF MALLAM SA'ADU ABUBAKAR ASHA HOUSE

5. Conclusion and Recommendation

5.1 Conclusion

Flooding in general cannot be eliminated but can be reduced. The study in Suleja L.G.A., revealed the location of buildings very close to the river not more than five meters while some buildings are located less than a meter to the river. Some buildings built on the flood plain were completely destroyed along with lives and properties. However, it was observed that the buildings along the river were constructed with sandcrete and mud blocks. For sustainable development in Suleja L.G.A., flood risk and hazard needs an effective mitigation measure to reduce the flood effects.

5.2 Recommendation

- The Government and the Private Sector should sensitize the public on flood preparedness and prevention, through the use of awareness campaign, mass media and stake holders forum.
- The people living close to the river should be informed on the need for life saving equipments in their homes in case of emergency or sudden flood occurrence.
- The Drainages in Suleja L.G.A., should cleared for free flow of water during rainfall. Retention wall should be constructed in highly vulnerable areas where the residential buildings are located very close to the river.
- There should be routine monitoring of the drainage channels, rivers and the flood plain to remove any drainage blockages such uprooted trees, debris and solid waste materials for free flow of water.
- The Development Control Authority in the State should checkmate building locations and haphazard development within the state, most especially along the river banks.
- The Urban Observatory in Niger State should be expanded to cover Land Information System (LIS) and Flood Information System (FIS), for flood monitoring through the use of GIS and Remote Sensing.
- Flood risk map indicating low, medium and high risk hazard should be prepared periodically for sensitization and to warn the general public to avoid or stay-off the delineated flood prone areas. The map can be used for flood prevention, land use planning and emergency planning.

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