FLOOD RISK AND VULNERABILITY ASSESSMENT OF KATCHA TOWN IN KATCHA LOCAL GOVERNEMNT AREA, NIGER STATE, NIGERIA

The occurrence of flood events has brought a lot of miseries to man and his environment. Farmers have continued to experience yearly loss of lives, properties and farm land to flood events that are caused by heavy rainfall and discharge of water from River Niger Nigeria. Flooding has been identified as one of the major factors that prevent Africa's growing population of city dwellers escaping from poverty as well as achieving the United Nations 2020 goal of improving the lives of urban slums dwellers which are being disrupted by flooding. Flood has swept some places in Nigeria in the past and will most likely strike over and over again due to the encroachment of settlements into flood vulnerable areas, which has lead to loss of lives and property there by making people more vulnerable to future flood. This research assessed the flood vulnerability level of Katcha town with a view of proffering mitigation measures that will reduce the risk of flood disaster in the town. Digital elevation Model (DEM) was used to determine the slope configuration of the area and flood vulnerability. Physical observation was also undertaken for field measurement was conducted and satellite Imagery map goggle earth 2012 was used. The Physical characteristics of different areas were examined for the purpose of identifying the high potential risk areas, The research identified the causes of flooding in the study area as lack of adequate planning and information. The findings also revealed that human activities contributed to flooding around the river bank, out of 15,000 of the total population of the study area approximately 4,600 people were living within flood impact area and they are vulnerable to flood . The research recommended that development around river bank of katcha should be discouraged, appropriate public awareness programmes should be implemented while development control unit of the Niger State Ministry of Land, Survey and Housing should delineate the buffer zone around the major rivers in the area.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

Disaster risk and vulnerability assessment is an investigation process or practical activities, is a process of collecting, interpreting and analysis of information on existing risk and their potential for harmful effect on a given organization or society. It involves the assessment of certain destructive impact on a given society; it is a determination of the probability of destruction and loss in it, human, structural, economic or political loss (Carling and Petts, 1992).

Community disaster risk assessment combines both scientific and empirical data concerning known hazards and other possible threats to the community. Although indigenous knowledge is vital, scientific data is especially important in a situation where the hazards are pending in the community. Various disasters like earthquake, landslides, volcanic eruptions, forest fires, flood and cyclones are natural hazards that kill thousands of people and destroy billions of dollars worthy of property and habitat every year.(Woodinville, 2007).

The rapid growth of the world's population and its increased concentration often in hazardous environment has escalated both the frequency and severity of natural disaster with the tropical climate and unsustainable land forms; coupled with deforestation, unplanned growth proliferation, non-engineered construction, which makes the disaster prone areas more vulnerable, poor communication, little or no budgetary allocation for disaster prevention are all characteristics typical of developing countries and these countries are most affected by disaster. (Few and Handmer, 2006).

These natural disasters are either of geo-physical origin such as earthquakes, volcanic eruptions, landslides or climatic origin such as drought, flood, cyclone, locust, and forest fire. Although it may not be visible to control nature and stop the development of natural phenomena, efforts could be made to avoid disasters and alleviate their effects on human lives, infrastructure and property. Risk assessment provides the foundation for the rest of the mitigation planning process. The risk assessment process focuses attention on areas most in need by evaluating which populations and facilities are most vulnerable to natural hazards and to what extent injuries and damage may occur. It tells you what these hazards can do to physical, social, and economic assets, which areas are most vulnerable to damage from these hazards, and the resulting cost damages or cost avoided through future mitigation project (Few and Handmer, 2006).

In addition to befitting planning, risk assessment information also allows emergency management personal to establish early response priorities by identifying potential hazards and vulnerable assets (Smith 1993). The risks faced by urban population is climate change impacts especially in developing societies as acknowledged in various regional assessments, their vulnerability cannot be reliably estimated without a detailed knowledge of local context.

A focus on risk management rather than on disaster event alone reflects a proactive attitude for dealing with potential threats to social and material assets before they are lost. The analysis and lessons learned from prior-expenses of disasters help to define profiles of risk related to people, activities and places and places that share attributes in the face of particular potential sources of loss or damage understanding. The risk related to the ability to define what could happen in the future, given a range of possible alternatives to choose from. Assessment risk based on vulnerability and hazard analysis is a required step for the adoption of adequate and successful disaster reduction policies and measure (Fielding and Burning, 2005).

Disaster risk assessment is a required step for the adoption of adequate and successful disaster reduction policies and measures, it encompasses the likelihood of certain events occurring and the magnitude of their possible consequences as a process, it is generally agreed that it include-:

- Identifying the nature, location, intensity and probability of a threat.
- Determining the extent and degree of vulnerabilities and exposure to those threats.
- Identifying the capacities and resources available to address or manage threats, and
- Determining acceptable levels of risk.

However flood has been identified as one of the major factors that prevent Africa city dwellers from escaping poverty and stands in the way of United Nation 2010 goal of achieving significant improvement in the lives of urban slum dwellers this is because many African cities lack the infrastructures to withstand extreme weather conditions. Poor urban planning together with other urban governance challenges contributes to making African urban slum dwellers most at risk (Kumer, 2006).

1.2 Statement of the Problem

Katcha is faced with frequent flooding; most people in the area are losing their properties, livelihood, farm lands, and buildings and in fact lost of their loves ones. The influx of people and un-coordinated activities of the people aggravate the conversion of the Katcha flood plain for residential, commercial and Agricultural purpose, therefore changed the drainage pattern and net work of the river as it increase the frequently and magnitude of run off for any given intensive rainfall, The means for disposing waste in the study area is the bank of river and through drainage channels. The intensive flood problem in Katcha River over the time is related to the intensity of rainfall and influence of the attribute of river Niger, encroachment of unplanned and uncoordinated

development and the growth in activities on the flood plain leading to environmental and health related problems. In view of the above, a research like this will therefore be necessary.

1.3 Aim and Objectives of the Study

1.3.1 Aim of the Study

The aim of this study is to assess the flood vulnerability level of Katcha town.

1.3.2 Objectives of the Study

The main objectives of this study are to:

1. Examine the existing ecological setting and slope analysis of the area.
2. Examine the human development activities in the area and the level of vulnerability.
3. Assess the existing drainage system in the area and the bank full regime.
4. Correlate the human activities to the topographical setting and the inducement of disaster and vulnerability level of the people.

1.4 Justification of the Study

Flood being natural or man-made are a threat to mankind Fielding and Burning (2005) Between 1963 and 1992, floods killed more people than any other natural disaster River flooding has been increasing annually resulting from loss of lives, property and agricultural produce as well as affecting activities in flooded area, Katcha and its surrounding environment such as Kipo, Tayi, Epogi, Eggan to mention but few have experienced some of it worst flooding in 2010, leading to the sub merging of farm land, loss of lives and destruction of properties. Thus it has become significant for the environmental managers to assess and evaluate the magnitude of the causes.

This project will serve as fundamental procedures for analyzing hazard and its effect on the social and physical characteristics of the community or society as to deal with cause of emergency through the susceptibility and resilience of the community.

At the end of the research work the expected benefit shall include following creative means of realization solution to one of the environmental problems in the study area, Without total relocation on the floodplain with method of, rehabilitation, upgrading and mitigation measures.

The research at the end will give intensity of development and land use on katcha flood planning with effect on the flow river and flood of occurrences as means for emergency preparedness in the risk areas and the town at large, methods on vulnerability assessment to flood and the disaster management would be realized using land use and flood intensity and damage

1.5 Scope and Limitation of the Study

The research scope in concerned with reducing the risk of disaster in flood prone areas, the research work would also involve mapping out vulnerable and prone areas to show places that would be at risk in the event of flood, and predict the occurrence of flood and proffer mitigation measures. But due to time frame for the research and the cost of covering all prone areas the research work is limited to katcha town.

1.6 Description of the Study Area

Katcha local government was created in 1996 by Sani Abaca's administration; It is located almost at the extreme South of Niger State surrounded by other local government area such as Bida to the north, Kutigi and Enagi to the west and Agaie, Lapai to the west. (Fig 1.2) Katcha town in Katcha local government area of Niger State is situated along the bank the bank of Yaba River which is a tributary to river Niger; it is just about 4km away from bank of River Niger itself, History and

tradition have it that Katcha as a village was founded around 16th country with a present population of approximately 15,000 people, National Population commission, projected population (2006) The early settlement was on a spot directly opposite to the then Baptist Missionary School now Bangifu model primary school, The settlement is connected to good atmosphere condition and conducive for human inhabitant as well as its proximity to both Yaba river and river Niger.

According to history, Katcha derive its name from the main pre occupation of the origins which was basket weaving known in Nupe speaking language as Kasa, the same raw materials was used for fishing which later become one of the major occupations of the people.

1.6.1 Socio – Economic Activities

The people of Katcha are predominantly farmers and fishermen, with the help of Yaba River, the activities usually take place throughout the year. Friday is usually the busiest day of the week as it is the day set for marketing activities on this day, many people travel from far and near Katcha such as Kogi, Kaduna, Onitsha, Bida, Minna, Agaie and Lapai among others either by road or by water for the purpose of buying and selling. Yaba River is use for both domestic and agricultural purpose such as drinking, bathing, washing and cooking.

1.6.2 Temperature

The main monthly temperature in katcha local government area ranges between 32^0 in March and 27^0 in December. This is a very close range and as such high level, the hot is a regular feature of the local government area. The discomfort is greater with the rising humidity in march-April before the cooling effect of the rains. The main annual rainfall is about 1270-1530mm mainly received over seven to eight months (April-October) of the raining season, which is area of just four months

dry season. Katcha is within the southern guinea savannah vegetation belt mosaic of rain forest sobering woodland and grassland.

1.6.3 Vegetation

Here the rainfall and other environmental factors support the Natural Vegetation Consisting of open forest and tall grasses with some undergrowth. The generous establishment of mango a, orange, cashew and forest resources support the Natural Vegetation of the study area.

1.6.4 Soil

The characteristics of soil in the study area bear a close relationship to the geology, Soil here is derived from geological parent material, with up the trophy of Niger River where Katcha is situated are feral soil and stone formations with clay sub-soil.

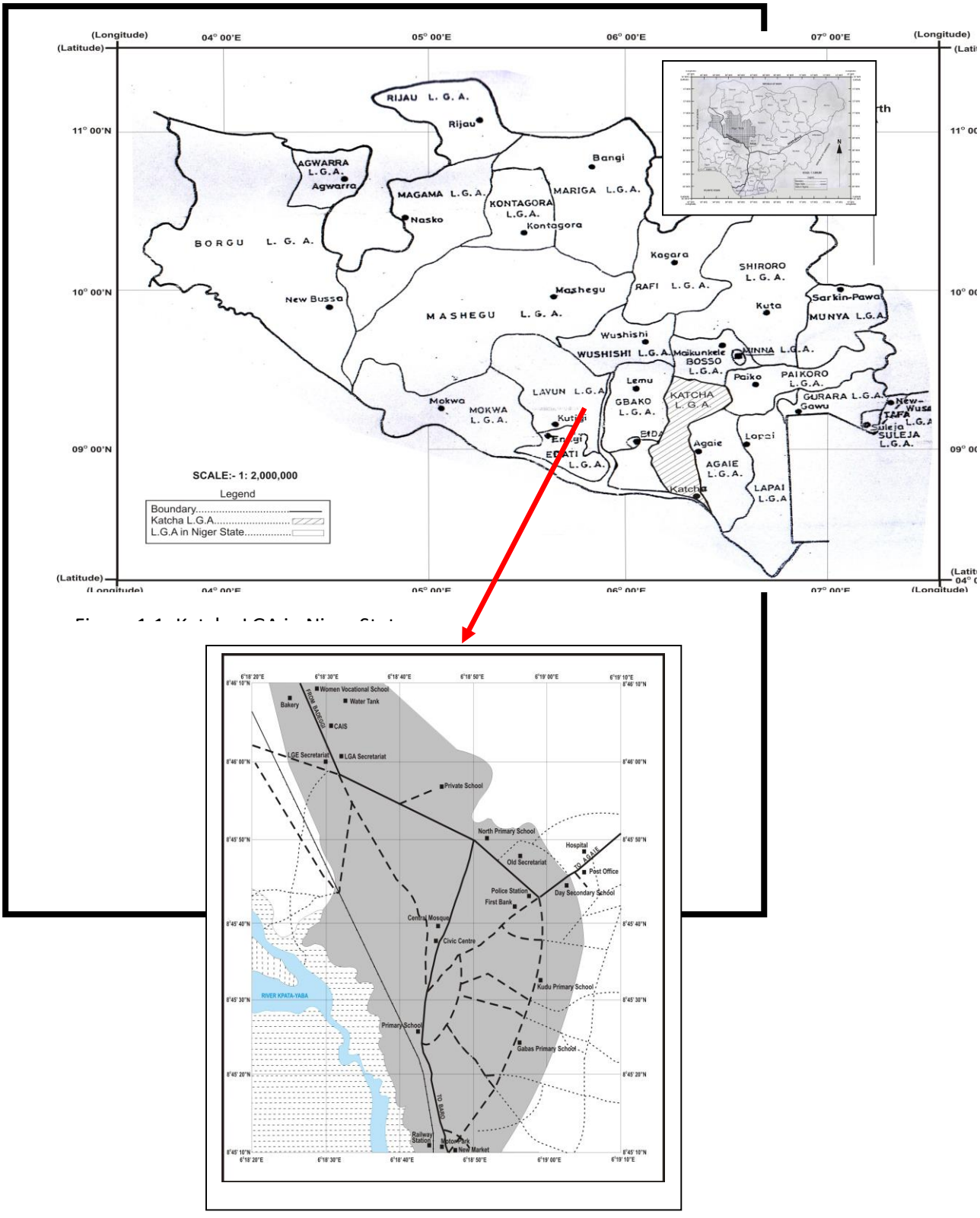


Figure 1.2 Study Area, Katcha Town.

Source: Ministry of Land and Housing Minna, (2012)

CHAPTER TWO

2.0 LITERATURE REVIEW

Disaster is an extreme devastating event within the natural or man-made environment, with huge loss to lives and properties, at the same time could end up as total displacement. Almost all the countries of the world are prone to disaster in one form or the other, there are natural hazards which can become disasters, especially when they strike an unprepared communities or environmentally degraded area; Among all kinds of natural hazards of the world, flood is probably most devastating widespread and frequent on the humid tropics and sub tropical climate. River flooding is a recurrent natural hazard as a result of excessive rainfall within a short duration of time without blockage in the river course and consequently gives rise to high river discharge that causes huge damage to crops infrastructures and lives.

Flood disaster as a natural hazard in urban and rural centre of the world has given room to different research topics for more than three decades as of solving the problem in the society. Flood is described inundation or excess water from river or other water bodies. It is natural disaster coursed by natural forces and it inflicts human and materials loses (Fielding and Burning, 2005).

2.1 Floods along Drainage Channels

Floods affect the ecology of a stream scouring away aquatic or riparian plants and increase the drift of aquatic insects Godon*;* Mahon and Finlays (1993). River flood plains are as a result of stream adjustment to its environment in order to carry it load efficiently, They are primarily from deposition of fine sediment on the flood plain at any time flood occurs. This sediment deposition leads to situation where the stream flows at higher elevation; thereby leading to possible over flowing of the river bank Also Umoh (2000) added that flood plain flooding occurs when excessive

discharge can not be contained particularly between the month of August and September in the Niger Basin area.

Kattlemann (1997) has shown that socio economic and anthropogenic activities have been found to induce or intensify flood condition in our environment. Through land use, the basins of stream traversing cities, town and communities are now made impervious by the roof of buildings paved surroundings and tarring of roads.

Urban flood is a problem encountered in the urban area of low land or plain area, Where water can not flow easily or been blocked by particles, it poses danger to the living of the people and in the socio-economic activities of the area affected. Obviously the third world nation believe to have suffered more of the plaque of flooding countries like India had experienced flooding in more frequency, especially in the north eastern part of the country (Brahmaputra-Gangu)

The fact that flood is a natural disaster is undisputable, the only problem that remains is on the level of efforts been committed into solving the problem which does not justified by the results achieved when mitigation measures are been put in place to actualize the sustainable human settlement development programs, there is need for the assessment of vulnerability of urban and rural structures to flood in developing nations so as to check excess wastage and destruction of physical and social environment resources. The problem in flood management is that proper assessment of flooding has not been carried out by implementation agencies or other bodies in charge of performing the task of taking care of the environment they do not also have maximum support of the government in solving the problem once and for all, in lieu of the operational problem therein, the need for, Risk and Vulnerability Assessment (RVAs) (Kattlemann,1997).

Vulnerability Assessment (VAs) is a relative tool for urban and rural i.e. community flood prevention or mitigation, and is quite regarded as flood hazard analysis, threat assessment and risk assessment, it is a means to identify the hazard and determine the possible effect on the social, physical and economic activities of a community. The method of flood assessment is important as information given will be use for sustainable development programmes and strategies to reduce flood hazard emergencies prevention, mitigation, response and emergency recovery also as medium of warning and evacuation of lives from the flood areas Wisner; Howord, Cannon and Davis (2004) This entails the susceptibility of resilience of the physical structures or the development in the floodable area of urban or rural environment sustainability is related to the factors that may cause an emergency response within the community these ranges from the developmental level of the community on the flood plain, with congestion of activities, resilience however is the ability of those development or congested activities to withstand the damages that may caused by disasters (Wisner, *et al*., 2004).

In real sense of it, flood as applied to a particular place is hazard of emergency and of great risk depending on, the attitude of the people and how well their level of preparedness against and management in case it occurred. The vulnerability assessment (VAs) for flood involves examination of the potential for the past flood events and possible effect of such event the main purpose is to reduce the effects of future occurrence in the area. This system is a coordination effort of relief to the victims by tackling the deteriorating environment and reduces the effects of the hazard on the people (Laughhin and Kalma, 1990).

Flood as a liveable problem of urbanization contents in environmental management could be seen from different angle. Wisner et al (2004) emphasised that flood do occur when water flows over an area which is not usually inundated, and if thus land is used in a manner of compatible with

inundated there likely be flood hazard. Similarly Yeo (2003) considered flooding as a natural disaster of over flow of innovation that comes from river at the same time threatens to life and properties.

On the contrary Smith (1993) assumed that there is inadequacy in the use of the term, and generalized a common term, but reaffirm it as unaccommodating express water from the river on its catchments as well as unusual high rate of discharge water which often lead to the inundation of laid adjacent to the river flood is the over flow o excess water on natural and artificial bank or plain area. Flood is an environmental problem of inundated water; posses risk to, lives, property, with the ability to change the morphology of any community or urban environment.

The cause of flood by Wisner *et al.* (2004) gives that flood is mostly related to climate, it is purely an environmental hazard of meteorological phenomena, which often induced by improper environment. This assertion was strongly argued by Penning and Green (2000) that problems of Africa today are not cause by climate change but uncontrolled and uncoordinated roles of man as the major factor of geo-environmental degradation are it intentional or inadvertent. Given that the act of man is a variable for flood assessment.

Penning and Green (2000) elaborated on the factors that could aggravate flood disaster or hazard over a particular time in a particular place. With an interaction fusion these includes: the global climate change due to man's activities when the regional topical is influence within the valley, exposure condition in terms of encroachment along the flood plain, drainage condition in the settlement areas, wave action from tsunami and exposure of oceans and delta islands.

In summary, flood is an interaction of human activities and the phenomena of the natural environment. The effects of flood are basically havoc and of serious damages intent to the

environment and people especially within a populated area as been aggravated by intensive human settlement and substandard infrastructure: nevertheless the management of flooding and the proper treatment of storm water that flows is an essential feature of healthy community Umoh (2000) The method of managing flood remains controversial as it is of a relative term of economic and priority of government of any nation Umoh (2000) had drown that attention towards the need, to promote the storm water drainage in the production of urban or community land for human settlement commerce, industry and the reclamation of land. In view of this disaster preparedness was designed as a means of disaster management by United Nations. Wisner e*t al* (2004) presented ways of managing flood which entails flood adjustment flood controls, emergency action, structural changes, land regulation and flood protection.

This method could not address a reliable analysis of the vulnerability of the land use and activities on the flood prone areas. Giving the question of necessity for assessment, while there has not been flooding. Suggestion of Penning and Green (2000) was basically on managing the area after the flood occurrences. It lacks preparedness for flood hazards takes a fresh look at community or city vulnerability and gives that there is need for assessment, to consider issue before any flood disaster out break, as it will strengthening the resilience of the community (Penning and Green, 2000).

2.2 Human Vulnerability and Environmental Hazard

Responding to environmental risk stimuli Burton and Kites (1994) described natural disaster as those elements of the physical environment that are harmful to man as a result of natural forces Smith (1993) Open that environmental determinism has directed the bulk of polity and research towards a preference for physical rather than social science analysis and policy recommendation in disaster management. Practical in tremendous are in danger of ignoring deference in the influence of individual and social characteristic on sub compatibility or response to environmental

risk. Responding is lack of critical analysis human causes for environment hazard; Woodenvile (2007) Championed a radical approach to disaster analysis, which drew on the Marxist tradition and dependently theory. It was argued that relationship between society and nature, not as one-off extreme events taking place out side of development.

Environmental risk or humanitarian disaster with a natural trigger are the products of physical pressures in the form of environmental hazard, and human pressures experience as vulnerability following from the work of Woodenvile (2007) environment hazard and human vulnerable are presented as the local out come of progressions from root causes (global political economy, global climate change) via intervening dynamic pressures that ling global or historical forces with the immediate conditions (a lack of institutions, rapid urbanization local topography) that superficially indicate danger.

Vulnerability is broken down into three components exposure, resistance and resilience.

- **Exposure:** The factors that make a community assessable to flood hazard which includes illiteracy, ignorance, poverty and like of awareness e.t.c.

-**Resistance:** The means by which people or organization use available resources and abilities to face adverse consequences that could lead to a disaster. It was initially used by engineers in considering construction design and related to level of resistance to physical forces exerted by ground motion, wind and water.

-**Resilience:** This is the capacity of a systems, community or society to resist or change in order that may obtain an acceptable level in functioning and structure. It is the ability of a community to organized it self and increase the capacity for learning and adaptation, including the capacity to

recover from disasters. Resilience of a community is it ability to withstand hazards and potential devastations that go with them.

2.3 Technological and Physical Bias to Vulnerability Exposure

Within the human ecology tradition, vulnerability was measured by exposure to hazard. Blakie and Wisner(1994). These investments encourage formal or informal development on hazardous sites. Whilst engineering responses provided much protection, there are examples of cases where hazards have surpasses the threshold of safety provided by physical structures with very high human costs. Smith (1993) offers the example of squatters who have settled adjacent to that flood defences of the Yamuna River to gain access to work in the centre of Delhi far more than 25 years these with residents forced evacuate at least once a year. Second, the presence of environmental infrastructure can increase the market value of protected land, the physical component of hazard analysis is undoubtedly critical; this approach underestimates the importance of socio-economic or political forces in shaping the production and distribution of risks and vulnerability (White and Etkin, 1997).

2.4 Vulnerability and Coping Strategies

Like vulnerability, opportunities for coping with or adapting to hazards are influenced by livelihood, community structures, social groups, house hold, gender, age, ethnicity historical time and physical/psychological health Burton and Kites (1994) though the relationship between vulnerability and coping is not necessary reinforcing (for example, whilst age may increase vulnerability, experience can enhance coping) assets for coping tend to be less common when vulnerability is already high, resulting in the ‘ratchet effect of vulnerability Carling and Petts (1992) where with each new hazardous event those impacted become more vulnerable to future

events. A number of accounts within hazards studies have proposed models to examine forms of coping. Wisner *et al,* (2004) extend this by incorporating co evolutionary adaptation in biological and cultural systems in a four-stage model of increasing hazard severity and scale of adaptation, hazard impacts are absorbed within any tangible impacts or observed short term adjustment with close links to the cultural ecology debate of the late 1970s the absorptive capacity of a society is conceptualized as being determined by its long-term biological and cultural adoption(such as disease resistance and dietary norms or traditional land management systems) and also by less long-term incidental adjustments such as the architectural design of housing urban morphology.(Fregene and Amadi, 2003).

Countries and urban regions as seen as being vulnerable through their inability to generate the financial resources required to offset increasing vulnerability and hazard impacts. Burton and Kites (1994) But capacity to manage risk should not be reduced to the size of the urban economy alone. The relatively rich city of Washington DC is a case in point, here in August 2001, intense rainfall led to wide spread flooding and back outs, bringing the city to a Stand still Bannet (1991) argues that national competition between the republican party (which dominates congress) and the democratic party (which runs Washington) has cost the city investment and disaster relief creating what some have long described as a federal disaster area.

2.5 Social Drivers of Vulnerability

A full an analysis of the effect of the floods requires to linking the physical hazard to the social impact resulting from it, this impact are both direct, from the flood itself and indirect, from living with in the background (Few and Handmmer, 2006)

The office of science and technology foresight significant attempt to date, the controls on flood risk in the UK by linking physical and societal drivers, the optimal responses of future risk using a source path way receptor flood risk model, the study found that for the three out of four modulated. Socio economic scenarios to 2080, social factors were the most important determinant of the impact of future flooding event, but also had the highest range of uncertainty. Prominent among the key messages for researchers was to reduce the uncertainty in knowledge of this social factor and, from this, to make a strategic assessment of the optimal responses to flood risk for particular areas (Askew, 1999).

The concepts of vulnerability, coping capacity and adaptation help define the potential for managing future flood risk, (Esa, 1998). Vulnerability is the conditions and process that determine both the likelihood of exposure and resulting susceptibility of individuals and social systems to the hazard. Brooks and Carol (2003) defines vulnerability in the context of floods as:

"A set of conditions and processes that determine the likelihood of exposure and the resulting susceptibility of humans or human systems to the adverse effects of a flood hazard."

There is a growing interest in using the social aspect of vulnerability as tools to develop policies that can minimize risk and maximize the ability to anticipate and adapt to the flood hazard characterizing the social aspects of vulnerability come from investigating the impacts of past floods at the individual and community and living with continuing and increasing vulnerability to future floods. Generalisation is difficult as the relationship between the scale of the event and the actual or potential hardship suffered is not unique; the same event may have very different effects even on adjacent households (Wisner *et al*., 2004). Although vulnerability is multi-faceted, helpful indices can be derived based on the social characteristics of particular areas, such as the social flood vulnerability Index (SFVI). Fregene and Amadi (2003) integrated social factors (presence

of long term owners, presence of long term sick, elderly and lone parents) and financial factors (non-homeowners, non-car owners, presence of unemployed, and amount of crowded housing). Flood then alleviation benefits can then be assessed more accurately with this information to hand Penning and Green (2000) Coping capacity is implicit in the above definition of vulnerability. It takes a positive approach, emphasising the ability of individuals and groups both to avoid exposure to hazard and to tolerate and recover from the adverse effects when that hazard becomes a disaster (Few and Handmer, 2006). It is important to emphasise the action potential of individual communities and not just label them 'disaster prone Social factors and institutional factors must both be studied in order to establish the best policy approach to maximise coping capacity and thereby reducing vulnerability (Fielding and Burning, 2005).

Adaptation to the flood hazard denotes a long-term increase in coping capacity which can arise from a combined change in individual behaviour, resources, infrastructure and functions of individuals and their community Brooks and Carol, (2003). Although applied extensively in developing countries. this concept has also proved useful in developed countries, particularly in the context of coping with climatic change and consequential increased flood risk by studying the social characteristics of particular areas, we can analyse the 'adaptation likelihood' of the existing social status quo and focus on what appears to work best (Brown and Cuthen, 2002).

Integrating these social and institutional adaptative responses to a flood hazard may lead to a 'virtuous circle' where the processes by which vulnerability is reduced also reinforce community links and connection with stakeholders. As Few and Handmer (2006) noted "response to flood risk that is rooted in public inclusion and local scale capacity building is a key element in long term risk reduction" A consensus is emerging that the adaptations that are required are those that integrate policies and skills of individuals and stakeholders. Attention must still be given to

maximising the effectiveness of those methods that need high level organisation and management, such as flood warning and strategic emergency planning,

International Strategy for Disaster Reduction ISDR (1998) full preparedness should include: Risk and vulnerability mapping, Public awareness and education, Early warning and evacuation, Public information, Relief, response and recovery, Resilience/ resilient, Planning at all levels to ensure co-ordination of the disaster response (Few and Handmer, 2006).

In this regard it will be helpful to develop an accurate picture of the state of this integration from the point of view to apply such for this present study.

2.6 Community and Housing Flood Impact

Flooding impacts on communities are complex and varied. There is some evidence that in the aftermath of a flood, cohesion can increase with every one pulling together, termed social fusion by Yeo (2003) but much of this evidence is anecdotal. Instead the flood may eventually act as divisive influence on the community due to its impact on certain groups. This arises from the longer term assistance event though these groups might, in fact, have had greater need. Such effects can over ride social fusion, creating cleavage planes This was noted by Godon, Mahon and Finayson (1993) in communities in Perth and Strathclyde, flooded in 1993 and 1994 respectively, One thousand out of the 1200 flooded properties comprised local authority housing (Smith, 1993) In the after math of the flood it was widely thought that these tenants had been favoured over owner- occupiers and private tenants. Yeo (2003) provides an international review of the impacts of flooding on property value, reporting effects lasting from two to more than ten years, and a wide range of changes in values associated with flooding. They vary from reduced values of up to 60

(values associated with the benefits of repairs). Some reduced valuations were associated with the publication of flood risk maps.

Flood is a phenomenon that causes problem in every part of the world. The lives and properties lost due to the devastating effect of flood have been enormous. Various farm lands have been destroyed due to flood. Examples of such were the farm land along the river bank of Katcha, Epogi, Eggan, Tayi, Suragi and Kipo all in Niger State which were rendered useless by the flood disaster of 2010.

The great flood in Minna (1991) cannot be over-emphasized. This flood rendered many people homeless especially those living around Keteren Gwari, new market area of the town Anguwan Kaje, while various plots of lands and Cattle were destroyed.

Esa (1998) incorporate the use of reliable mathematical models to evaluate and predict the performance of hydrological system under expected or known condition of stress. The effect of physical walls such as dams, drainage system, channelization and the links must be understood before construction begins. The hydrologists have to play a fundamental role in our quest for better managed and understood environment. His competence will have a tremendous impact on the success of all water resource activities regardless of scale.

The flow of water and associated sediments and containments in low land channels is as a result of complex geometry and the seasonal effects of vegetation growth on the bed and banks interacting with changing discharges. Three dimensions in channels shape and effect on flow and transport processes by creating zones separated from the main flow by localized lines of internal shear (Carling and Petts, 1992) man also contributes significantly to changes in channels morphology; floods are caused not only by excessive rain but by human activities on the surface

of the earth, such as farming, deforestation and urbanization. These actions increase the runoff from rain. This storms that previously would have caused no flooding today inundate vast areas, two broad types of man-induced changes can be identified. Those changes brought about by direct modification to the channel it self, which often take the form of engineering works designed to alleviate the effect of flooding (Askew, 1999).

2.7 River Flooding

In the riverine flood is the primary or basic transportation or deportation of material, it also involve in water cycle that involve in transportation The river define it boundary during the cost of it self, the river erote at one point to another. **River regime** can be described as one of the characteristics of a reach of a River, the variability in its discharge through out the course of a year in response to precipitation, temperature, evapo-transpiration and drainage basin characteristics,

Streams and rivers are the basic transportation system of the part of the rock cycle involved with erosion and deposition of sediments. They are also a primary erosion agent in the sculpture of our landscape. River carries three types of load; suspended. Bed and dissolved. The sum of the three is the total load. The suspended load is carried above the stream bed by the flowing water. It is often the largest part of the total load. And makes rivers look muddy. Much of the sediment transported in rivers is periodically stored by the deposition in the channel and on the adjacent flood plain. These areas collectively called the river rime environment are the natural domain of the river. Lateral migration of bends of rivers and over bank flow combine to produce the floodplain (Ohl and Tapsell, 2000).

2.8 Factors Influencing Flood Severity

White and Etkin (1997) identified many factors together determine whether a flood will occur. The quantity of water involved and the rate at which it enters the stream system are the major factors. When the water input exceeds the capacity of the stream to carry that water away downstream within its channel, the water overflows the banks. The rate of surface runoff is influenced by the extent of infiltration, which in turn is controlled by the soil type and how much soil is exposed. Topography also influences the extent or rate of surface runoff. The steeper the terrain, the more readily water runs off over the surface and the less it tends to sink in to the soil. Water that infiltrates the soil, like surface runoff, tends to flow down gradient, and may in time also reach the stream. Therefore the relative amounts of surface and subsurface (ground water) runoff, which are strongly influenced by the near-surface geology of the drainage basin, are fundamental factors affecting the severity of river flooding. Vegetation may reduce flood hazards in several ways. The plants may simply provide a physical barrier to surface runoff, decreasing its velocity and thus slowing the rate at which water reaches a stream. Umoh (2000) emphasizes that there are two (2) basic form of flood regulation namely; to detain and delay runoff by various forms on the ground surfaces and in smaller tributaries of the water shed and to modify the lower reaches of the river where flood plain inundation is expected. The first form of regulation aims at treatment of water shed slopes, usually by reforestation or planting of other vegetative cover so as to increase the amount of infiltration and reduce the rate of overland flow.

These types of treatment, together with construction of many small flood storage dams in the valley bottoms may greatly reduce the flood crests and allow the discharge to pass in to main stream over a longer period of time. Under the second type of flood control measure, designed to protect the flood plain areas directly, two quite different theories can be practiced. First, the building of levees, dykes parallel to the river channel on both sides, this can function to contain the over bank flow

and prevent inundation of the advancement floodplain. Such levees are broad embankments built on earth and most be high enough to contain the greatest floods other wise they will breached rapidly by great gaps, termed crevasses at the points where water spill over.

Ohl and Tapsell (2000) another method of flood control is the construction of sewerage system which helps in the elimination of surface water runoff from the built up area as quickly and as efficiently as possible. Separate storm water sewers are normally constructed to discharge its content in to a local water course at its nearest point.

Nigeria and other African countries have experiences many flood event both severe and minor once, A report of the Southern African Development Committee (SADC), regional early warning unit, stated that the Mozambican killer flood left 62 people dead forced 80,000 people from their homes and affected as many as 460,000 people in 2012, (Daily Trust 23/ 10 /2012).

Kano State in July experienced torrential rain that caused River Niger to overflow and dams to Collapse sixty villages were submerged while destroyed farm lands, lives stock and agricultural produce estimated to be worth millions of naira.

According to Daily Trust 23/10/ (2012) reported that property worth thousands of naira was destroyed by flood as a result of heavy rainfall which lasted for more than nine hours. they further stated that the most affected areas included Amuwo-Odofin, Ajegunle, Victoria Island, Amukoko and Apapa. Others were Mushin, Agege, IKeja and Oshodi all in Lagos State. The flood was attributed to the non- clearance of the Orile- Badiya lagoon by the lagos mainland local Governments and so all the areas along the lagoon were flooded. Residents of these areas were rendered homeless as their houses were submerged in the flood Daily. Heavy rainfall caused a flash flood which devastated parts of Abuja and its major satellite towns. Not far from the city gate

the road was submerge forcing some motorist to abandon vehicles in the flood waters. A small stream flowing through Gwagwalada broke its banks after hours of heavy rain. The water submerged houses and left 60 families homeless. The vast affected buildings in the suburb were illegally built and closed to the stream. Kubwa was also flooded for the second time in less than a month. The Federal Capital Development Agency (FCDA) said it would demolish the buildings damaged by the flood. To some residents of nyanya Abuja, Saturday will ever remain in their memories because it was the day Streets and houses in the area were sub-marged by flood after a heavy downpour that started at 4: 30pm. Guardian, 1/8/ 2012. Nasarawa Communities, not less than six communities along njiri River in Nassarawa State have been sub-merged by water from the abandoned Farin Ruwa Independent hydro electrical power project in Farin Ruwa Development Area of the state, some people of the Area who spoke to daily trust, said the water gathered at project site, and flowed back in to the community, displacing several people and washing off crops, not less than 5 houses were washed off in Manga alone, Duniya Jatau, Hundred of people have been displaced many lost farms, motorcycles, canoes and houses to the flood.

At least 35 people confirmed dead and manning missing as flood ravage 6 Local Government areas in Plateau State south Senatorial district on Sunday night 12 August 2012, A lot of damages occurred during the incident, About 1,500 people were missing and manning were displaced, According to Senator Representing the Plateau State south Senatorial district, Senator Victor Lar who visited scene said that this is the worst flood incident over 50 years of his existence (Guardian 1 August, 2012). There are number of challenges that face the hydrologists in is bid to control flood. Umoh (2000) incorporated the use of reliable mathematical models to evaluate and predict the performance of hydrological systems under expected or known conditions of stress. The effects of physical walls such as dams, drainage systems, channelization and the likes must be understood

before construction begins. The hydrologists have to play a fundamental role in our quest for a better managed and understood environment. His competence will have a tremendous impact on the success of all water resource activities regardless of scale.

Esa (1998) another method for controlling flood is the flood frequency method; thus far the methods used to determine peak discharge rates have been based upon a rainfall frequency. The frequency of the runoff derived by this method is not necessarily the same as that of the rainfall due to assumptions regarding antecedent conditions and the estimate of abstractions from the initial precipitation. A method of dealing with the runoff directly is called the flood frequency method. Unfortunately this method does not provide a hydrograph shape but gives only a peak discharge of known frequency.

The total direct runoff in this method must be approximated for most cases by using precipitation values and a direct run- off computation such as the Curve Number approach, storm volume-frequency curves can also developed for regional areas to aid in finding the direct run- off to be expected for a selected design frequency, The shape of the hydrograph can be stretched to produce the desired peak discharge and direct run- off volume. This procedure is trial by error but is accomplished quickly, all of these solutions are good but most of them are developed base on the hydrology of a particular area and may not work for other areas, because hydrology varies from place to place. The remote sensing and GIS approach is better when compared to these other methods because it involve clear mapping that would be understood by every one who sees the map. Another advantage is that most mitigation measures are concerned with post disaster solutions and are not effective for pre- disaster planning (White and Etkin, 1997).

2.9 The Flood Patterns of River Niger in Nigeria

The River Niger flow in Nigeria exhibits a seasonal flood regime, which is responsible for the annual flood characteristics of the river in Nigeria and a time trend, which hitherto has not been described.

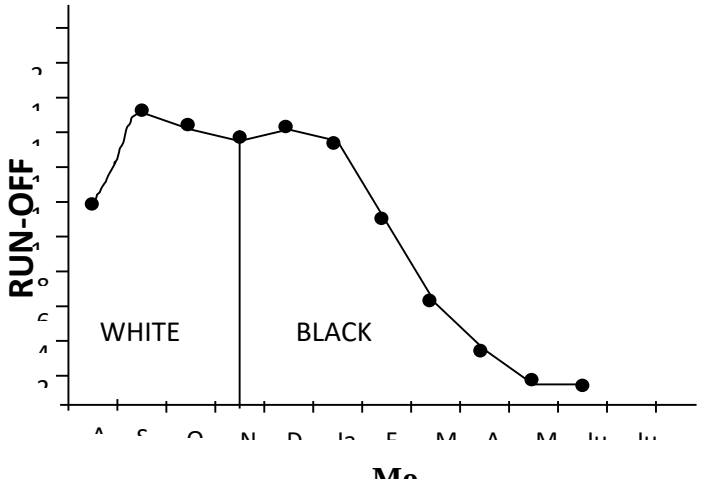


Figure 2.1: Seasonal flood regimes of River Niger in Nigeria

Source: Hydrology Department, Jebba Hydro power generating station, Niger, (2012)

2.9.1 The Seasonal Flood Regime

Umoh (2000) described the seasonal hydrology of River Niger. During the months of May to October, rainfalls in the northern parts of Nigeria south of Niamey produce floods that quickly reach kainji with a peak flow of **4,000 to 6,000 m^2** in September to October. This floodwater is laden with silt/clay sediments and is of high turbidity. Due to its colour, it is locally referred to as the "White Flood".

The second flood originates from the river's headwater region of high annual rainfall in the Fouta djallon highlands in guinea, and passes through the sub-arid region and deltaic swamps around Timbuctu. In these areas looses much of its silt load and water to evaporation and infiltration. Very little water is added to the flow before it reaches Kainji in November with a peak flow of about **2,000 m^2.** The water is relatively clear due to its low silt load and is thus locally called the "Black Flood" Two distinct floods were thus manifested at kainji annually.

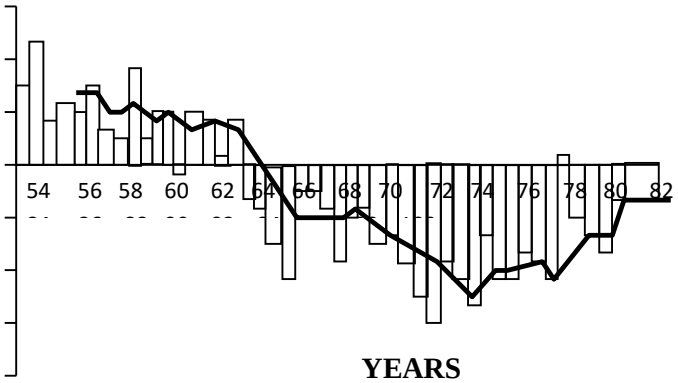


Figure 2.2: Wetness indices of River Niger
Hydrological Years (2000 – 2001)
Source: Hydrology Department,

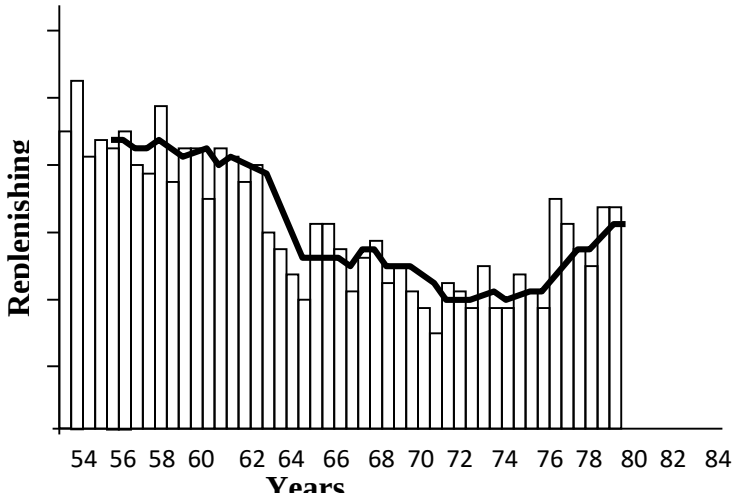


Figure 2.3: Replenishing Ratio of

Source: Hydrology Department, Jebba Hydro

The flow of River Niger at jideribode from 1954 to 1960 Umoh (2000) The flow of the Niger potentially maintained this ratio until the first 5- and further 2.0 in the following years until 1995. Since then however, the replenishing ratio has been rising. The implication of this is that in the 32 years of the existence of the lake,its hydrological residence time gradually increased from 90 days at impoundment to as much as 180 days year period (1968-72) immediately following the closure of the dam (Fig.2.3). Consequently, the replenishing ratio of lake fell to 3.0 in the first decade of the existence of the lake. In an analysis of the discharge data of river Niger, Sagua and Umoh

(2000) opined that River Niger flow has a time trend that was not taken in to account in the design of Kainji Dam. However the precise time lag of this trend was not known.

2.9.2 Manifestations of the River Niger Flood Regimes in Kainji Dam Annual Floods

The two annual floods- the white and black floods, sustain the kainji dam level. However there is only one high lake level period during the dry months of the year as a result of the regulation of the river flow by kainji dam. As water use for hydropower generation continues, the lake level is progressively drown- down and a substantial area of the shoreline is exposed as the draw-down area. The low flood cycle of River Niger resulted in Kainji dam, with an Active storage Capacity of 12.0*10 m, a replenishing ratio (Sagua and Fregene, 1997).

Sagua and Fregene (1997) reported that the maximum depth of the dam has been variously quoted as 50.4m, at high water level. The sediments / loads of kainji dam Mbagwu and Amadi (2011) the amount of sediment entering kainji dam either as bed load or saltation was small therefore the major source of sediments supply was the suspended load which were carried mainly by the black floods.

The total silt carried by the river Niger passing through jebba in the year 1989 before the impoundment of kainji dam was 4.6*10 tons, Among the major effects of flood on this dam are water released from the dam, apart from destroying farm lands of the farmers when it over floods, the dam has rendered quite a number of the inhabitant's homeless, forcing some of them to migrate to other locations faraway from their homestead, (Sagua and Fregene, 1997).

2.10 General Characteristics that Enhance Flood

Flood, inundation of land by the rise and overflow of a body of water. Floods occur most commonly when water from heavy rainfall, from melting ice and snow, or from a combination of these exceeds the carrying capacity of the river system, lake, or ocean into which it runs. Usually the combined flow of several water-swollen tributaries causes flooding along a river bank or shoreline. Accounts of floods that destroyed nearly all life are found in the mythology of many peoples. Not all floods are destructive, however. The annual floodwaters of the Nile and other larger rivers deposit fertile soil along the surrounding floodplain, which is used extensively for agriculture (Carter Nick, 1991).

The rise and fall of the water level in a river is called the flood wave. Its highest point, or crest, travels progressively downstream. In the upstream portions of a river the flood crest passes quickly. Further downstream the greater volume of water causes slower passage of the flood crest resulting, in floods of longer duration. In many regions, annual floods follow the thaws and rains of spring; flooding also may occur because of thawing ice jamming narrower and shallower parts of a river. In the Arctic regions, especially in the basins of northward flowing rivers, the floods are caused by the thawing of the southern portion of the basin before the ice blocking the lower course of the river melts. Less predictable are floods resulting from ocean waves, called storm surges, pushed onshore by an advancing hurricane, and from sudden torrential flows, called flash floods, following a brief, intense rainstorm or the bursting of a natural or man –made dam or levee. In addition to the duration and quantity of rainfall, the nature of the soil (permeability; state of saturation) of an area affects the frequency of floods (Abams, 1995).

During a flood, the water level of a river is higher than usual, and its velocity and discharge also increase as the greater mass of water is pulled downstream by gravity. The higher volume [mass]

and velocity together produce the increased force that gives flood waters their destructive power the elevation of the water at any point is termed the stage of the river. A river is at flood stage when river stage exceeds bank height. The magnitude of a flood can be described by either the maximum discharge or maximum stage reached. The river is said to crest when the maximum stage is reached. Flooding may afflict only a few kilometres along a small stream, depending on how widely distributed the excess water. Floods that affect only a small, localized areas or streams draining small basins are called upstream floods. These are most often caused by sudden locally intense rainstorms and by events like dam failure. The resultant flood is typically brief, though it can also be severe (Woodinville, 2007).

Generally, flood control measures along a river are attempted at both its headwaters and its low-lying floodplains. Runoff can be detained in the headwaters by planting ground cover on the slopes, building terraces to increase soil infiltration and prevent soil erosion, and building small check dams or retaining ponds to reduce the flow of water. Flood control on the lower floodplains involves building levees to contain the flow and straightening or dredging the channel to improve flow characteristics. Among the chief flood-control projects in United States are the flood control works along the Mississippi River, the installations of the Tennessee Valley Authority, the Glen Canyon and Hoover dams on the Colorado River, and the systems of dams in the Columbia River basin (including Grand Coulee Dam) and in the Missouri River basin.

2.10.1 Preventive and Adjustment Measures of Flood

Preventive Measures against flooding include:- Engineering Structures, examples levees and flood walls, sand bags or cement, Reservoirs to stop flooding, On site storm water detention, Channels improvement, Channels diversion.

Adjustments Measures include:- Flood plain regulation and Insurance, how do you maximise, (Few and Handmer, 2006).

2.10.2 Vulnerability Assessment and Preparedness

One method that had not been fully employed in the field of disaster management in Africa and in Nigeria is vulnerability assessment of buildings in urban and rural area, Schmudde (1998) present vulnerability assessment as a dynamic ongoing process of people and organization that assess hazard and risk. A means of establishing a data base that focus on the likely effects of potential hazard and anticipates relief need with the available resources World Health Organization (2001) portrayed vulnerability assessment as hazard analysis, threat assessment, or risk assessment. It is a procedure for identifying hazard and determines their possible effects on community activities or organization.

Vulnerability assessment method is reliable in assessing the relative effects of flood disaster. It entails acquisition of relevance information regarding sustainable development in terms of the organised programmes and strategies to reduce any form of flood hazard. It is of emergency prevention mitigation and preparedness such as; emergency response and recovery (World Health Organisation, 2001).

2.10.3 Flood Preparedness

In view of the effort of these international organization, procedure given or preparedness was based on: The objectives of vulnerability of typical structures of a disaster plan. For the public resource mechanism public education and training as an important of disaster management.

However vulnerability is tied to particular geographical location or communication in which the threat could be identified by the frequently occurrence of flood prone areas drainage and rivers

they could be squatter settlements water logged areas of low socio-economic status. The use of vulnerability assessment in disaster preparedness is a means of structuring data collection and geared towards understanding the level of potential risk (Fhifer and Kaniasty, 1999).

2.10.4 The Need for Vulnerability Assessment in Hazard Preparedness

On technical level, vulnerability assessment serves as the starting point for the disaster preparedness strategy with the information, there in very useful in term of disaster. There are 4 (four) main reasons for vulnerability assessment in disaster preparedness (Adeniyi, 1998).

1. The accuracy of the information assists the discussion makers about the utility of national and local level approaches to disaster preparedness.
2. The awareness they help the decision maker on disaster propensities.
3. It serves as the basis for more continuous habit of monitoring the trend in physical, socio-economic and infrastructural condition of the disaster for developing a database and ability to maintain and updating the information for planning and development.

2.10.5 Process of Vulnerability Assessment

There are considerable reasons for rational process of vulnerability assessment (Mbagwu and Amadi, 2011) it includes the following:-

A. To explain to others what is being done and how they can participate.

B. To ensure that significant aspects of vulnerability assessment are not missed

C. To justify the validity of the results.

These steps involves

Stage 1: Project definition, this determines the aims and objectives, scope and the task performed, the resources needed to perform them.

Stage 2: Formation of planning group, the representative of planning group or organization as to gather information,

Stage 3: Identification of hazard

Stage 4: Hazard descriptions, this is presentation of hazard in relation to the effect in the community as it manifest itself in differs ways.

Stage 5:- Community and environmental description. The outlines of relevant property or environment that may affect or be affected by the hazard, at this stage more hazards may be identify.

Stage 6: Description of effect: - This elaborates the account of community Vulnerability in situations the incident, accident, emergency or disaster.

Stage 7: Hazard priorization: - At this stage the determination of hazards that is of direct impact is noted first and all others to follow base on likely effect.

Stage 8: Recommendation for action: This is the link between vulnerability assessment and other emergency activities.

Stage 9: Documentation: This is compilation of all results and the decision is necessary to justify the recommendation.

For successful urban and rural planning management the need for vulnerability assessment is of great flood hazard in urban and rural communities which could be of great advantages to Nigerian hydrological problems (Yeo, 2003).

2.11 Impact of Hazard on the Community

Hazards create direct damages, indirect effects, and secondary hazards to the community. Direct damages are caused immediately by the event itself, such as a bridge washing out during a flood. Indirect effects usually involve interruptions in asset operations and community functions, also called functional use. For example, when a bridge is closed due to a flood, traffic is delayed or rerouted, which then impacts individuals, businesses, and public services, like fire and police departments that depend on the bridge for transportation. Secondary hazards are caused by the initial hazard event, such as when an earthquake causes a tsunami, landslide, or dam break. While these are disasters in their own right, their consequent damages should be included in the damage calculations of the initial hazard event. Your loss estimations will include a determination of the extent of direct damages to property, indirect effects on functional use, and the damages from secondary hazards that are threaten your community or state (McEwen, 1989).

2.11.1 Emergency Planning and Disaster Management

An estimated 2billion people globally were affected by disaster in the 1990s, tripling the number of impacted people in the 1970s, with economic losses increased by a factor of 5 during the same period from $138 to US$629 billion Furthermore if this trend persists it is estimated that by 2050, natural disasters would have a global estimated cost of $300billion a year, In lieu of this growing trend of increase spate of disaster the Hyogo Framework of Action (HFA) 2005-2015, instituted a ten year action plan aimed at reducing the loss of life, social, economic and environmental losses

caused to communities as well as nation states as a result of disasters. (World Health Organisation, 2001).

HFA highlighted three strategies points and these are:

i. The integration of disaster risk reduction in to sustainable development policies and planning at every level with a focus on disaster planning, mitigation, preparedness and vulnerability reduction.

ii. Developing and strengthening of institutions, mechanisms and capacities at all levels, with emphases on the community, to build resilience to hazards.

iii. The systematic incorporation of risk reduction approaches into the implementation of emergency preparedness and recovery programmes.

The five priorities for action of the HFA:

- Ensure as priority, a strong institutional base for disaster risk reduction at the local and national level.
- Enhancing early warning through the identification, assess monitoring of disaster risks at all levels.
- To build a culture of safety and resilience through knowledge, education and innovation.
- Reduction of underlying risk factors.
- To enhance effective response at all levels, through strengthened disaster preparedness.

Agencies responsible for disaster management

- National emergency Management agency (NEMA)
- State Emergency Management Agency (SEMA)
- Local Government Emergency Management Agency (LEMA)

Responding Agencies

- NEMA.
- POLICE.
- FRSC.
- CIVIL DEFENCE.
- HEALTH SERVICE.
- FIRE SERVICE.
- EPA AND OTHER RELATED AGENCIES.

People in Emergency Management

-Gold - policy. (Category 1)

-Silver – tactical. (Category 2)

-Bronze – operational. (Category 3)

2.11.2 Nigeria's Existing Emergency Policies

- Search and Rescue Epidemic Emergency Evaluation plan (SREEP).
- National Disaster Response plan (NDRP).
- National Aviation/Influenza Response plan
- National Nuclear and Radiological Emergency plan
- Lake Nyol Disaster Response Manual.

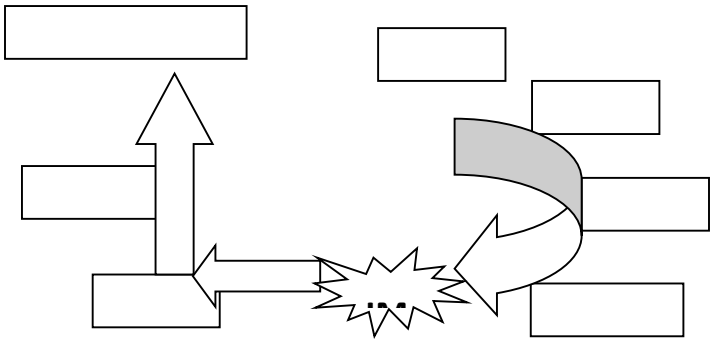


Figure 2.4: Risks, Vulnerability and Community Resilience Development (Resilience Planning Cycle) Source: NEMA, (2012)

2.11.3 Aspect of Risk Assessment

Risk assessment: is the overall process of risk identification, risk analysis, and risk evaluation. Risk Assessment is one of the key components of disaster recovery planning. In order to create the most effective plan for recovering after a calamity, an organization must first consider what the

potential disasters are that they could feasibly encounter, and how each of these might impact their lives, environment and business continuity (Kumer, 2006).

i. Identify the risks, be proactive and examine the risks and the potential damage it could cause. Go through case studies to understand the extent of damage such incidents have caused in the past.

ii. Establish facts as to what might be harmed and how. Infrastructure, Intellectual property, peoples exactly determine what kind of harm might be caused to each of a worst-case scenario.

iii. Evaluate the risks and get a fix on precautionary measures.

Risk Assessment is probably the most important part of planning emergency planning in the event of a disaster, The greater it covers risks, types and solutions in detail, the better prepared we are when disaster strikes.

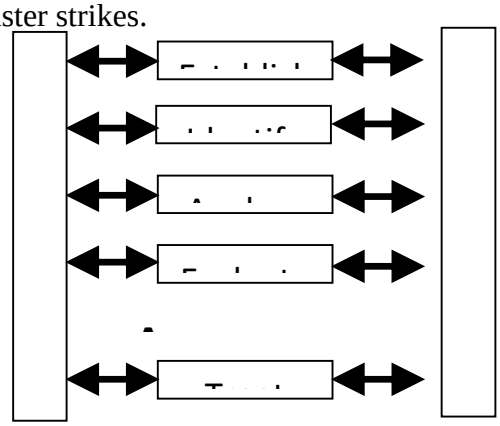


Figure 2.5 Stages of Risk Assessment in the Overall Risk Management

Source: NEMA (2012)

Role of NGOS, CBOS, FBOS, and other Organizations in Disaster Management

Basically they:

a- Engage in public awareness campaign about disaster.

b- Educating people on how to mitigate the consequences of disaster

c- Psychological support

d- Relief Interventions

e- Assessment, and

f- Response.

Table 2.1 Red Cross Assessments during the 2012 Flooding

State	No of LGAs Affected	IDPs	No of death
Adamawa	6	15879	24
Taraba	6	12440	3
Plateau	2	1645	3
Benue	4	7801	5
Kogi	9	30709	19
Niger	9	2039	47
Edo	3	3960	10
Delta	8	45887	19
Bayelsa	8	73915	1
Total	**55**	**229919**	**131**

Source: NEMA, (2012)

From Table 2.1 above, a read cross assessment during 2012 flooding Reveals that, 55 local Government Areas across the country were affected while 121 people were recorded dead. 6 local Government were affected from Adamawa State while 24 people died during the event. 6 local Government were affected in Taraba State while 3 people died during the incident. 2 local Government were affected in Plateau State while 3 people died. 4 local Government were affected in Benue State and 5 people were recorded dead. 9 local Governments from Kogi State were affected while 47 people were recorded dead. 9 local Government within Niger State were also affected during the 2012 flood event while 47 people recorded dead. 3 local Government areas from Edo State were affected by the flood and 10 people were recorded dead. 8 local Government in Delta State experienced flood in 2012, while 19 people are recorded dead during the incident. In the same year, 8 local Government from Bayelsa State are also affected by the flood and 1 person was recorded dead during the incident.

Table 2.2 Examples of Relief Interventions by CBOs and FBOs during 2012 flooding

S/N	Organization	Items	Quantity
1	Dominion chapel church	-Parboiled Rice	20 bags
		-Assorted second Clothes	51 bags
2	Rice Millers Association	-Rice	1,230 bags

Source: NEMA, (2012)

Table 2.2 shows the Relief Interventions donated to the victims of 2012 flood across the country by CBOs and FBOs

Dominion chapel church donated parboiled Rice 20 bags and assorted second cloths 51 bag all to national emergency management agency Abuja while Rice Millers Association donate 1,230 bag of Rice for the victims of 2012 flood across the country to NEMA Abuja. While NEMA Abuja

distributed those Items listed above to various State and local Governments that were affected during the 2012 flood that Include:-Adamawa State, Taraba State, Plateau State, Benue State, Kogi State, Niger State, Edo State, Delta State and Bayelsa State accordingly.

Table 2.3 Role of Private Sectors in Disaster Management.- Basically Relief Intervention, e.g. During 2012 Flooding.

S/N	ORGANIZATION	ITEMS	QUANTITY
1	Mouka foam	- Mattresse	200 Pieces
		- Pillow	200 Pieces
2	Mobil Producing Nig. Ltd	- $500,000	$500,000
3	MTN Nigeria	-Mattresses	500 Pieces
		-Bed sheets	500 Pieces
		-Pillows	500 Pieces
		-Tower cooking pots	200 Pieces
		-Kerosine stoves	200 Pieces
4	Dana Drugs Ltd	-Amebanil syrup	3 Cartons
		-Paradana syrup	6 Cartons
		-Lam 200	3 Cartons
		-Metronidazole inj. 100ml	2 Cartons
		-Dextrose saline 1000ml	
		-Dextrose water 1000ml	15 Cartons
		-Normal saline 1000ml	
		-Paradana 96	10 Cartons
		-Ferrodan capsules strip	
		-Ferrodan syrup	10 Cartons
		-Danacid suspension	4 Cartons
		Womidan suspention	6 Cartons
		-XPELCough syrup	4 Cartons
		ULdan	2 Cartons
		-IVJ	1 Carton
		-Amebanil tablet 96	3 Cartons
			2 Cartons
			1 Carton
			4 Cartons

Source: NEMA (2012)

Table 2.3 shows the Items and their quantity donated by the private sectors to the victims of 2012 flood in Nigeria.

Mouka foam Company donated 200 pieces of mattress and 200 pieces of pillow to National Emergency Management Agency Abuja and were distributed to the victims State and local Government in Nigeria.

Mobil Producing Nigeria limited donated $850, 000 to NEMA for the victims of 2012 flood in Nigeria. While MTN Nigeria donated 500 pieces of mattress to the victims also Dana Drugs Ltd donated drugs, all Items listed above were distributed accordingly to the State and local Governments victims of 2012 flood in Nigeria.

2.11.4 Application of Remote Sensing and GIS in Flood Mapping

In 1960 when the term remote sensing was first coined to simply referred to the observation and measurement of an object without touching it. Since that date, remote sensing has taken discipline dependent meaning in the environmental sciences of geography, geology, engineering, forestry, and agriculture. It is usually referred to as "the use of electromagnetic radiation sensors to record images of the environmental which can be interpreted to yield useful information.

Ohl and Tapsel (2000) also defines it as "the acquisition of data and retrieving information about objects or materials located at the earths surface or its atmosphere by a device separated from it". Floods not only damage property and endanger the lives of humans and animals, but have other effects as well. Rapid run-off causes soil erosion as well as sediment deposition problems downstream. Spawning grounds for fish and other wildlife habitats are often destroyed. High-velocity currents increase flood damage; pronged high floods delay traffic and interfere with drainage and economic use of lands. Bridge abutments, bank lines, sewer outfalls, and other

structures within floodway's are damaged, and navigation and hydroelectric power are often impaired. Financial losses due to floods commonly amount to millions of pounds each year Smith (1993) For a long time, people have studies the world using models such as maps and globes. In the last thirty years, it has become possible to put these models inside computers, more sophisticated models into smaller computer every year. These computer models, along with tools for analyzing them, make up a geographic information system, In a GIS, you can study maps with the right data and see whatever information you require, features like land, elevation, climate zones, forest, political boundaries, population density, terrain, per capita income, land use energy consumption, mineral resources among other things (Tapsell and Tunstall, 2001).

Terrain is synonymous with land Abams (1995) The terrain which includes land surface geology, hydrology, vegetation and soil was defines by Abams (1995) as "an area of the earth's surface the characteristics of which embrace all reasonable cyclic attributes of the biosphere, the soil and underlying ecology, hydrology, the plant and animal population, the extent that these attributes exert a significant influence on present and future uses of the land by man".

As noted by Tapsell and Tunstall (2001) topography of floodable areas is poorly analyzed and could be investigated profitably by using remote sensing techniques. The power of remote sensing for detailed analysis of low relief topography is enormous but little studied, it allows for classification of lake form, distinct topographic features and possibly mapping of spatial concentration of suspended solids and flow lines over inundated areas.

Kumer (2006) demonstrates this potential using Radial imagery of the Amazon and Orinoco flood plain. Their measurements indicated that flooded topographic area have statistical self-similarity with respect to area, implying that relief on the flood plain display fractal characteristics. Such a

result if of general application would have implications for modelling spatial variation in floodable area deposition.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

This chapter describes the various data, materials; Instruments and soft ware and methods that were used in carrying out this research, among the issues treated are materials used and their sources, techniques of data collection, planning and design of field surveys, Analysis of data and images and the generalisation of digital elevation model.

3.1 Sample Size and Sampling Procedures

The population of the study area was 11,281 according to National Population Commission (2006) and was projected for 5 years to 15,100, at 10% yearly. Therefore, The total population of the study area was used as sample frame for this research. Sample size was calculated from the projected population using the national average household size which was put at 6.2 percent (NPC; 2006). Therefore; 15,100 divided by 6.2 give approximately; 2,436 households. This is used to estimate the percentage sample size; 250/2,436 100=6.2, 6.2 percent are the sample size for this research; base on which 250 questionnaires were prepared and administered. A survey was undertaken on households that had experienced flood and households located within flood risk areas but not flooded. Systematic sampling technique at every 5 items intervals was adopted in administration of the questionnaire.

3.2 Materials/ Instruments

The data utilised in carrying out this research work were collected from primary and secondary sources and manipulated to produce required data, verification of manipulated data was carried out through conducting ground truth exercise, using handheld GPS (etrex GARMIN).

The topographic map covering the study area Baro N. E sheet 205 N. E at scale 1: 50,000 was obtained from Ministry of Lands and Housing Minna, including map of the study area all obtain scanned and digitized and analyzed for developing the vulnerability mapping of the area for disaster response planning purpose, Research result, reports and journals on area of the study also formed part of the data used for the analysis, while the satellite image of katcha (2012) was down loaded from goggle earth (2012) from Niger State Geographical information system, the coordinates were recorded. (See figure 3.1 and 3.2)

3.3 Planning and Design of Field Survey

Field survey entails going to the field to pick GPS ground control points and do ground verification, 33 GPS ground control points were assessed as shown in Table 3.1 the values of X and Y were read for each Identified feature as well as the attribute remark of each points were recorded for ground verification.

3.4 Digital Elevation Model (DEM)

A Digital elevation Model (DEM) of the area was developed to get the terrain of the area. A topographic map of katcha was used to generate the x, y and z coordinates and imputed in to an excel worksheet and later to IDRISI software for final image processing. The DEM was super-imposed on the image to get the terrain of the study area.

3.4.1 Secondary Data

Several secondary data were sourced and used for the study, this include map of the study area, topographical sheet of the study area which were obtained from the ministry of lands and housing Minna, information on the issues of recent and past flood were also obtained from SEMA, these were in addition to different information about the study area which was obtain from various text

books, government publications, journals and internet based source, relevant literature materials on flooding

3.4.2 Method of Data Analysis

The method for the analysis of data in this research work involves

1- Data coding-this is the preparation of raw data collected in to computer software know as statistical packages.

2- Map digitization- Maps are adopted from the topo sheet for understanding and explanation of the study area, this process involves scanning the maps for digitizing online using Arch view software processing of the features and presentation of the generated maps for proper application of the study.

The map with the traced contours was imported into/retrieved in MapInfo and the software generated X and Y which represent longitude and latitude values for the points on the contour which represents the Z value.

Table 3.1: GPS Readings for the Flood Impact Area

LOCATION NAME	G P S READINGS		ATTRIBUTE REMARK
	Easting/long.	**Northing/lat.**	
1. By the edge of the river, pkata yaba katcha	6^0 18^{11} ^{28} .27	8^0 45^{11} 44.75	Relatively marshy
2. By the edge of a shop at canoe market kpata katcha	6^0 18^{11} 29.93	8^0 45^{11} 42.96	Water lock
3. By rail ways quarters, Ndadogi area katcha	6^0 18^{11} 30.95	8^0 45^{11} 41.41	Marshy within the gulley
4. Within Farm land by the ridge Along Kipo road katcha	6^0 18^{11} 32.71	8^0 45^{11} 39.82	Marshy within the gulley and liable to flood
5. By a small stone within Rail ways Station Along kipo road katcha	6^0 18^{11} 34.66	8^0 45^{11} 39. 14	Within giant slope
6. By a Railways, cuttings, embankments, Along baro road katcha	6^0 18^{11} 32.99	8^0 45^{11} 37.16	Relatively sloppy
7. By the entrance of Sawmale, kpantoroko area	6^0 18^{11} 33.02	8^0 45^{11} 34.93	Water lock and area liable to flood
8. By the edge of a Borehole, within edogi area katcha	6^0 18^{11} 35.76	8^0 45^{11} 33.36	Water lock and liable to flood
9. By a small tree inside Mechanic workshop kpantoroko area	6^0 18^{11} 36.89	8^0 45^{11} 31.91	Relatively sandy
10. By the edge of Stream, kpantoroko area katcha	6^0 18^{11} 38.27	8^0 45^{11} 30.62	Marshy within the gulley
11. At thentrance gate of patanpa Primary school, ndadogi area katcha	6^0 18^{11} 39.28	8^0 45^{11} 27.76	Water lock and area liable to flood

12. By the edge of saganuwa Residential house, ndadogi area katcha	6^0 18^{11} 40.23	8^0 45^{11} 24.06	Relatively sloppy and area liable to flood
13. By the gate of residential house of wunangi village head katcha	6^0 18^{11} 41.25	8^0 45^{11} 20.86	Relatively sloppy and area liable to flood
14. By the edge of a gurter opposite umar gbagana res, house,wunangi katcha	6^0 18^{11} 41.97	8^0 45^{11} 17.95	Steep slopes and area liable to flood
15. By the edge of rail ways culvet, wunangi	6^0 18^{11} 42.73	8^0 45^{11} 16.00	Relatively sloppy with an embankment
16. By the edge F S P clinic building, wunangi area	6^0 18^{11} 42.85	8^0 45^{11} 11.67	Marshy area and liable to flood
17. By the edge of Baptist church building, wunangi area katcha	6^0 18^{11} 42.98	8^0 45^{11} 08.61	Relatively marshy and area liable to flood
18. By the Pond kurmangas, Zangbodo area katcha	6^0 18^{11} 42.50	8^0 45^{11} 04.89	Steep Slopes and area liable to flood
19. By the edge of farm land, Zangbodo area katcha	6^0 18^{11} 44.10	8^0 45^{11} 01.41	Marshy within the gulley and area liable to flood
20. By the bore hole opposite Alh, taufeeq residence, Baptist area katcha	6^0 18^{11} 45.10	8^0 44^{11} 55.21	Relatively slope and area liable to flood
21. By the pit, along north pri,sch, Baptist area katcha	6^0 18^{11} 45.00	8^0 44^{11} 49.57	Steep Slopes and area liable to flood
22. By the edge of rail ways cutting embankments, Baptist area katcha	6^0 18^{11} 47.20	8^0 44^{11} 44.89	Slope area and liable to flood
23. By the small stone within farm land of Alh, Ndagi, Wunangi area Katcha	6^0 18^{11} 43.37	8^0 45^{11} 13.5	Marshy area and liable to flood

24. By the edge of latrine of north pri, sch, wunangi	6^0 18^{11} 48.15	8^0 45^{11} 12.3	Marshy area and liable to flood
25. By the edge of Borehole at the front of north pri, sch, wunangi katcha	6^0 18^{11} 49.70	8^0 45^{11} 11.3	Marshy area and liable to flood
26. By the Well opposite Yaliman bit resident, wunangi area	6^0 18^{11} 49.70	8^0 45^{11} , 10	Relatively sandy and liable to flooding
27. By the mosque opposite north pri, sch, wunangi area	6^0 18^{11} 49.44	8^0 45^{11} 10	Steep slope and liable to flooding
28. By the edge of Fish pound along north pri, school katcha	6^0 18^{11} 39.35	8^0 45^{11} 10	Marshy within the gulley and liable to flood
29. By the edge of Rice farm, along pomp house katcha	6^0 18^{11} 37.62	8^0 45^{11} 10.0	Marshy area and liable to flood
30. By a Minor erosion, along pomp house katcha	6^0 18^{11} 34.73	8^0 45^{11} 27.7	Steep slope and area liable to flood
31. By the Pomphouse gate, ecegi road katcha	6^0 18^{11} 32.28	8^0 45^{11} 33.5	Relatively flat and area liable to flooding
32. By a ridge within the Rice farm of late Alh, shehu katcha, ecegi road	6^0 18^{11} 29.05	8^0 45^{11} 38.0	Marshy area and liable to flooding
33. By a small stone across the road leading to the edge of the river, kpata yaba	6^0 18^{11} 26.99	8^0 45^{11} 4.6	Relatively slope and area liable to flooding

Source: Authors Field survey,(2012).

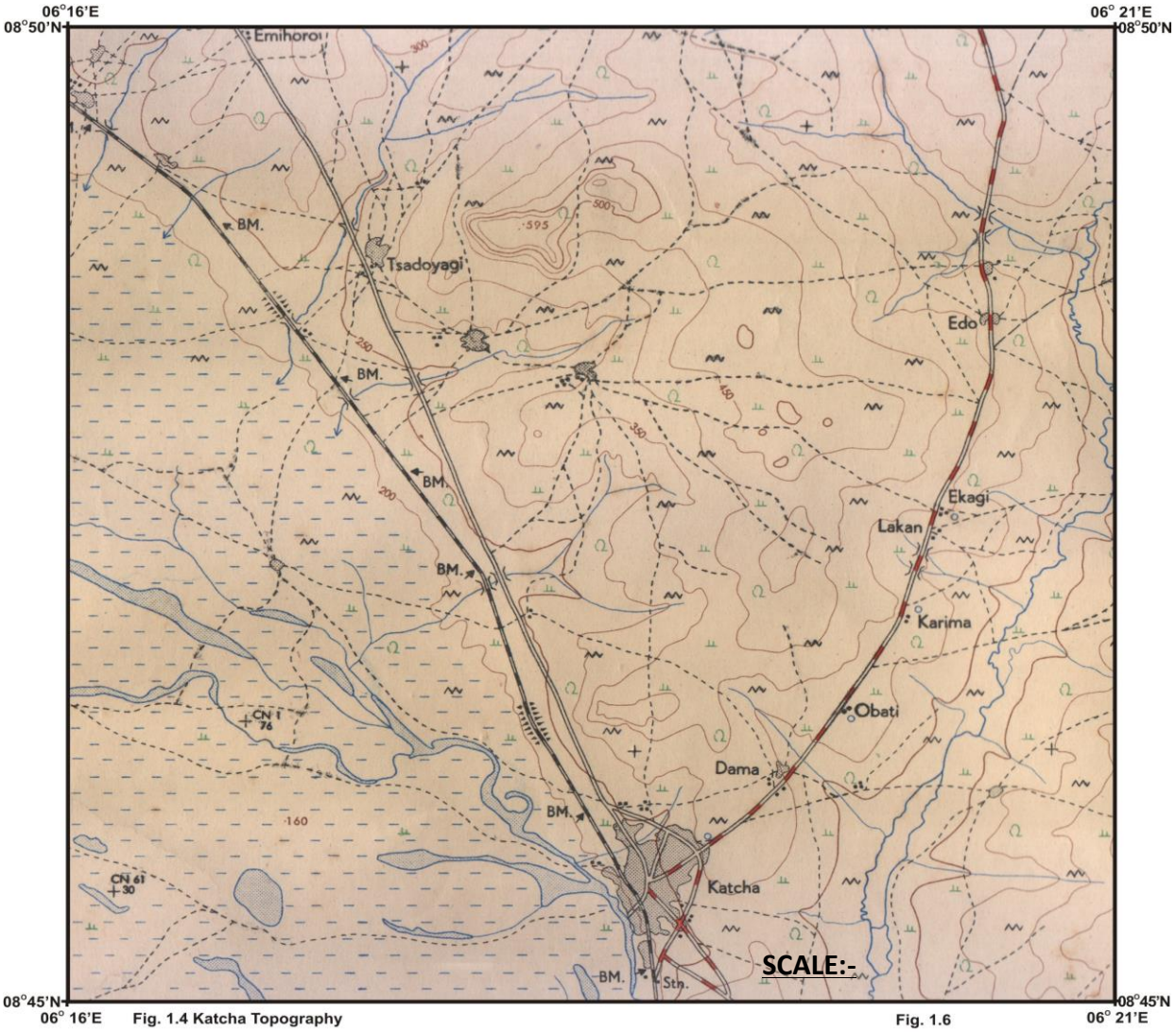


Fig. 3.1: Katcha Topography

Source: Ministry of Land and Housing Minna (2012)

Fig. 3.2: Image of Katcha Town

Source: Google Earth, (2012)

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter addresses the analysis of relevant data collected on this project with consideration on the behavioural and physical approach to data analysis within the coverage area using the maps generated from aerial photography and other maps which were digitized presenting the areas of vulnerability on the floodplain.

4.1 Socio Economic Status Assessment

In the process of this research, 250 questionnaires were distributed and 235 (94%) of all the questionnaires were returned and among those returned 8.51% of the respondents are of the age group of 20-30 years old while those of the range of 21-40 years are 42.55%, 41-50years are 34.04% and 14.89% are either 51 years old or older. It also came to light that 97.82% of the respondents happen to be indigenes while 2.13% are non-indigenes.

4.2 Flood Disaster Assessment

Table 4.1 Source of the Water which Causes Flood

Source of Flooding Water	**No of Respondents**	**Percentage (%)**
River Niger	250	100
River Suka	-	-
Kpata Yaba	-	-
Others	-	-
TOTAL	**250**	**100**

Source: **Authors Analysis (2012)**

Table 4.1, shows that all the respondents have unanimously agreed that the source of water which causes flooding in the study area is from River Niger, because every year during the raining season when the rain become two excessive it normally overflow down to kpata yaba katcha from there it causes flooding to the area, and from above analysis reveals that occupant and Inhabitants of katcha all agree that River Niger is the major source of water that causes flood to the area.

Table 4.2 Major Cause of Flooding

Cause of Flooding	No of Respondents	Percentage (%)
Excessive rainfall	195	79.60
Due to intensive release of water from dam	50	21.28
Poor drainage system	5	2.13
Refuse dump	-	-
TOTAL	**250**	**100**

Source: **Authors Analysis (2012).**

Table 4.2 shows that 79.60% of the respondents believed that excessive rainfall is the major cause of flooding in the study area while 21.28% are of the opinion that flooding occur due to Intensive release of water from Kainji dam, 2.13% are of the view that poor drainage system is the major cause of flooding from the above analysis it reveals that excessive rainfall which is propounded to be caused by climatic change is the major cause of flooding within the study area and the country as a whole.

Table 4.3 Flood Experience in Katcha

Flood Experience	No. Respondents	Percentage (%)
Yes	250	100
No	-	-
TOTAL	**250**	**100**

Source**: Authors Analysis (2012).**

Table 4.3 shows that all the respondents within the coverage area unanimously agreed that the River has flooded the area before due to the proximity of the town to the River.

Table 4.4 Frequency of Flooding in the Area

How often	No of Respondents	Percentage (%)
Every year during the raining season	250	100
When the water ways is blocked	-	-
TOTAL	**250**	**100**

Source: **Authors Analysis (2012)**

Table 4.4 from the analysis it reveals that all the occupants and the Inhabitant of katcha unanimously agree that every year during the raining seasons flooding use to occur in katcha

Table 4.5 Human Activity Causing Flooding in the Area

Cause of Flooding	No. of Respondents	Percentage (%)
Farming	60	25.40
Uncontrolled construction activities	105	44.43
Refuse dump	85	36.17
Mining	-	-
TOTAL	**250**	**100**

Source**: Authors Analysis (2012).**

Table 4.5 shows that 25.40% of the respondents within the coverage area agreed that farming is the predominant human activity causing flooding even were as 44.43% of the respondents are of the view that uncontrolled construction activities is the major cause of flooding in the study area while 36.17% of the respondents within the study area accepted that dumping of refuse is the predominant human activity causing flooding, from the above analysis table 4.5 reveals that uncontrolled construction activities is the major cause of flooding in the study area.

4.3 Flood Management Assessment

Table 4.6 Existence of Community Flood Management Institution and Committees

Flood Management Institution	No. of Respondents	Percentage (%)
Yes		-
No	250	100
TOTAL	**250**	**100**

Source: **Authors Analysis (2012).**

Table 4.6 shows that the responses of the respondents is unanimous as they all agreed that they do not have any form or rather type of flood management institution in the study area as they lack awareness and information as regards to flood disaster in the area.

Table 4.7 Existence of Disaster Community Awareness Programmes

Community Awareness Program	No of Respondents	Percentage (%)
Yes	-	-
No	250	100
TOTAL	**250**	**100**

Source: **Authors Analysis,(2012)**

Just as stated above, Table 4.7 also shows that the response of the respondents in the study area is unanimous (100) percent that they don't have any community awareness program been carried out in their community and area for them to be aware and prepare even know the precautionary measures to a adapt to reduce the impact of flood when it comes.

Table 4.8 Impact of the Flood Event on the Health of the People of Katcha

Impact on Health of the People	No of Respondents	Percentage (%)
Diarrhoea	-	-
Cholera	-	-
Malaria	-	-
All of the above	250	100
Others		
TOTAL	**250**	**100**

Source: **Author Analysis, (2012)**

Table 4.8 from the analysis reveals that response of the respondents in the coverage area as seen their response is unanimous (100%) as all the other diseases listed above are suffered by the victims at one time or the other after every flooding events in the area

Table 4.9 Environmental Impact of the Flood Event

Environmental Impact of Flood	No of Respondents	Percentage (%)
Lost of lives	-	-
Destruction of farm lands	-	-
Destruction of socio economic activities	-	-
Destruction of properties	-	-
All of the above	250	100
TOTAL	**250**	**100**

Source: **Authors Analysis (2012)**

As in the previous table, Table 4.9 from the analysis above it reveals that the response of the respondents to be unanimous (100%) on the issue of the environmental impact of flooding events, the respondents all agreed that the flood lives in its wake the lost of lives and properties, destruction of farm lands and socio-economic activities in the area when flood events occur in the area.

Table 4.10 Local Control Measures Applied by the People of the Area to Reduce the Impact of Flood

Local Control Measures	No of Respondents	Percentage (%)
Sand bags	230	97.87
Construction of drainages	5	2.13
Embankments	15	6.39
Others	-	-
TOTAL	**250**	**100**

Source: **Authors Analysis (2012).**

Table 4.10 shows that 97.87% of the respondents agreed that the uses of sand bag is the only local control measures embarked on by the people to reduce the impact of flooding events in the area while 2.13% are of the opinion that the construction of drainage is the local control measures even though it not done by many due to the cost implication from the above analysis it reveals that uses of sand bag is the local control measure normally apply by the majority occupants and inhabitants of the study area.

Above all showed from the previous tables analysis that katcha does not have any form of community flood management Institution or committees and the table 4.7 above showed that there has not been any form of community awareness programme been carried out In the community and since these programmes are not In existence they can not be rated whether they are effective or not. Flooding has a devastating effect on the Inhabitants of katcha as shown in table 4.9 where they Suffer health Complications like Diarrhoea, cholera, malaria and all other forms of water

borne diseases and flooding also brings about the lost of lives, destruction of both farm lands, socio-economic activities, and properties even though the people of katcha use sandbags (97.87%) and drainage (2.13%) as a preventive measures In reducing the impact of flood.

4.4 Rainfall Variability

In other to further understand flooding in katcha, the mean monthly discharge of a year was computed to obtain the annual Variability of the rainfall pattern of the study area and the Figure 4.1 below showed that highest average rainfall occurs in September and the minimum occurs in May.

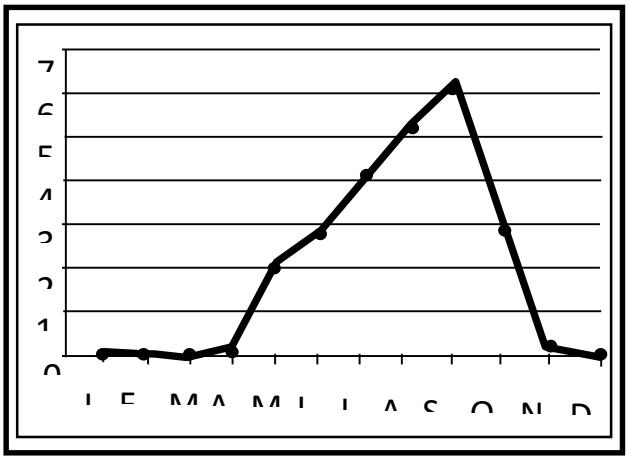


Figure 4. 1 Mean monthly rainfall in study area (Jan-Dec.2012)

4.5 Potential Risk Area Assessment

The physical characteristics of different areas were examined for the purpose of Identifying the high potential risk areas, places liable to be affected In case of flood disaster all the areas In which Kpata yaba katcha run through that make them vulnerable to flood In one way or the other have the tendency of causing flood due to Unprecedented discharge of water from dams and tributaries and also the Uncontrolled activity of man coupled with the carefree behaviour of the Inhabitants. The areas Under studies Include the areas whose GPS readings were taken, Table 3.1, but due to cumbersome nature of the names of the areas whose GPS reading were taken, I decided to Use the location point number Instead of the name just to make the analysis easier and straight forward.

From the Figure 4.1 it can be seen using GPS readings taking 10 points are within the areas that are seriously noted to be liable to flooding were as 9-15 points are within the areas that are less liable to flooding.

Vulnerable Assets Include:

Residential area, Farm lands, Access roads and Railroad.

4.6 Digital Elevation Model

In order to develop the DEM of the study area, Spot height of the area were generated, Low elevation areas were identified and were later develop to generate the Digital Elevation Model of the site.

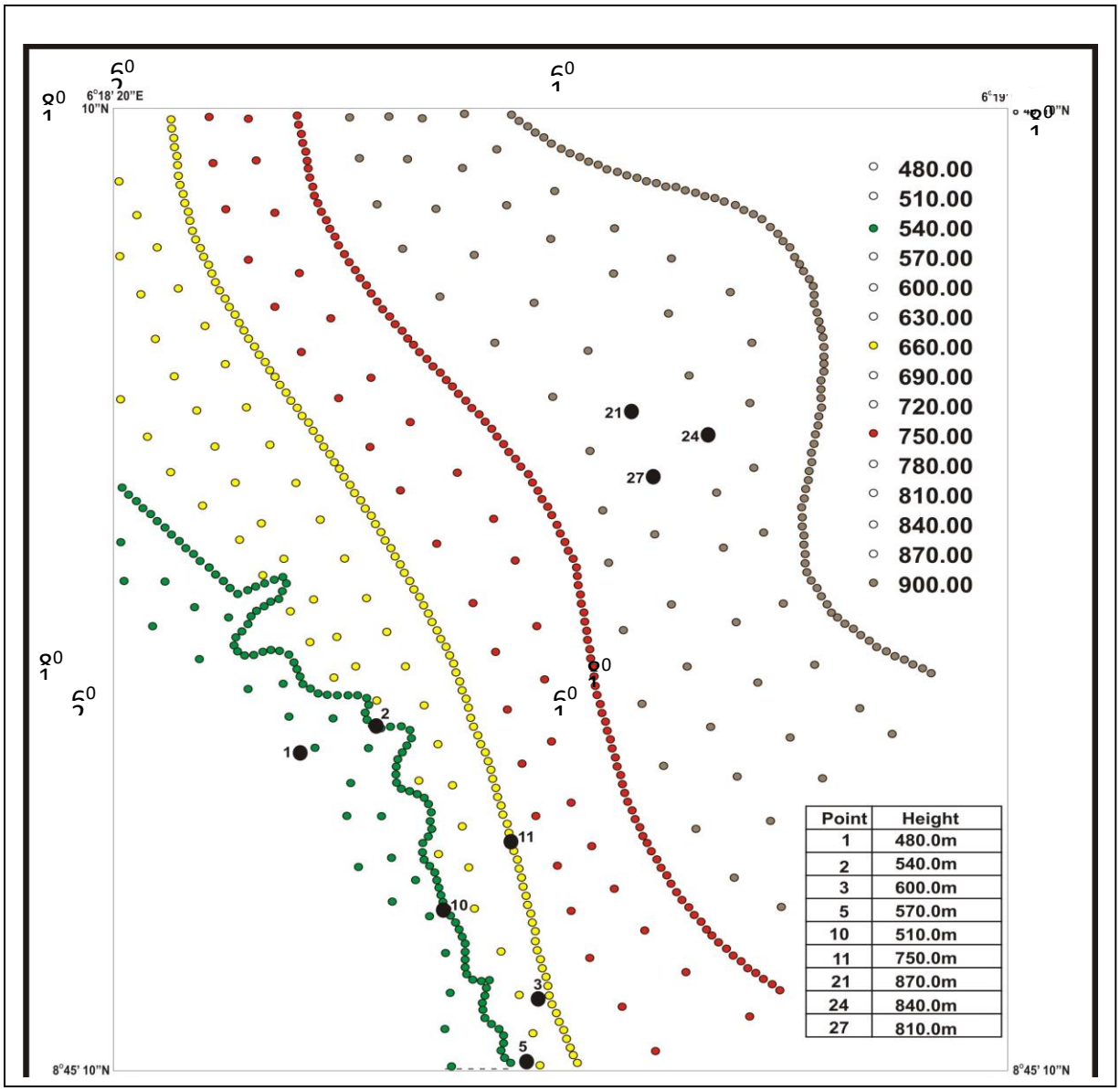


Figure 4.2 Spot Height of the Study Site

SOURCE: **Author Field Survey (2013).**

The spot height showed in green colour in figure 4.2 are height 540.00 below this are the area liable to flood because they are very close to the river kpata yaba katcha, example of this areas are point 1. 480.00 height, point 2. 540.00 and point 3. 510.00 Which are all area liable to flood below 540.00 height respectively.

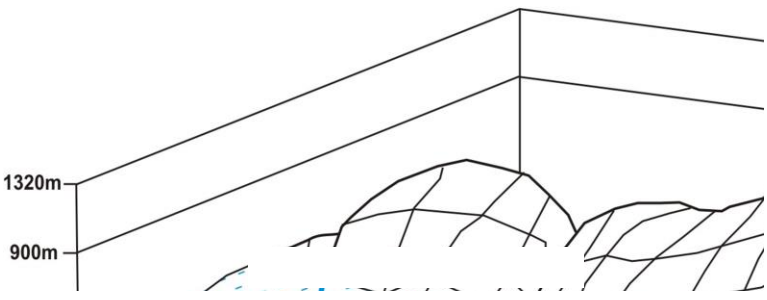
The spot height showed in yellow colour are height between 550.00 to 660.00 height there less area liable to flood because they are little bit higher than area liable to flood as shown on Figure 4.2 attached above. Spot height showed in red colour are height between 660.00 and 750.00, they are the average height of katcha area because they are either the highest or the lowest.

The highest area that are not liable to flood are start from spot height 750.00m up to 900.00m this areas are shown in brown colour spot height and is clearly drown in figure 4.2

The DEM was generated to get the terrain of the area, for studies that involve flood; the terrain of the area must be known to ascertain among other things the flow direction of water and the major cause of flood in the area.

The DEM was generated from surfer 7 after the X, Y and Z values had been imputed in the software as shown in Figure 4.3

Fig 4.3: Digital Elevation Model.



The DEM Shows the 3 Dimensional View of the Study Area i.e the Longitude, Latitude and the elevation. Thus the absolute position of the points on the earth surface is known. This makes it

Figure 4.3 Digital Elevation Model of the Study Area

SOURCE: **Authors Field Survey (2013)**

As shown in Figure 4.3 and 4.4, three (3) areas need to be relocate to the higher and saver grand because they are seriously situated within the flood impact area among others which Include Wunangi Tifi, Zangbodo and Wunangi Tako. And it is possible to view the highland and differentiate them from the low land.

The digital elevation model of Katcha town which shows three (3) dimensional position of katcha Including the River Kpata Yaba katcha running from north to south and the three (3) hills that naturally divide the area in to three (3) parts and from Figure 4.3 it shows that Wunangi Tifin Zangbodo and Wunangi Tako fall within the low land and flood impact area which probably need relocation to most saver area as clearly shown on figure 4.3

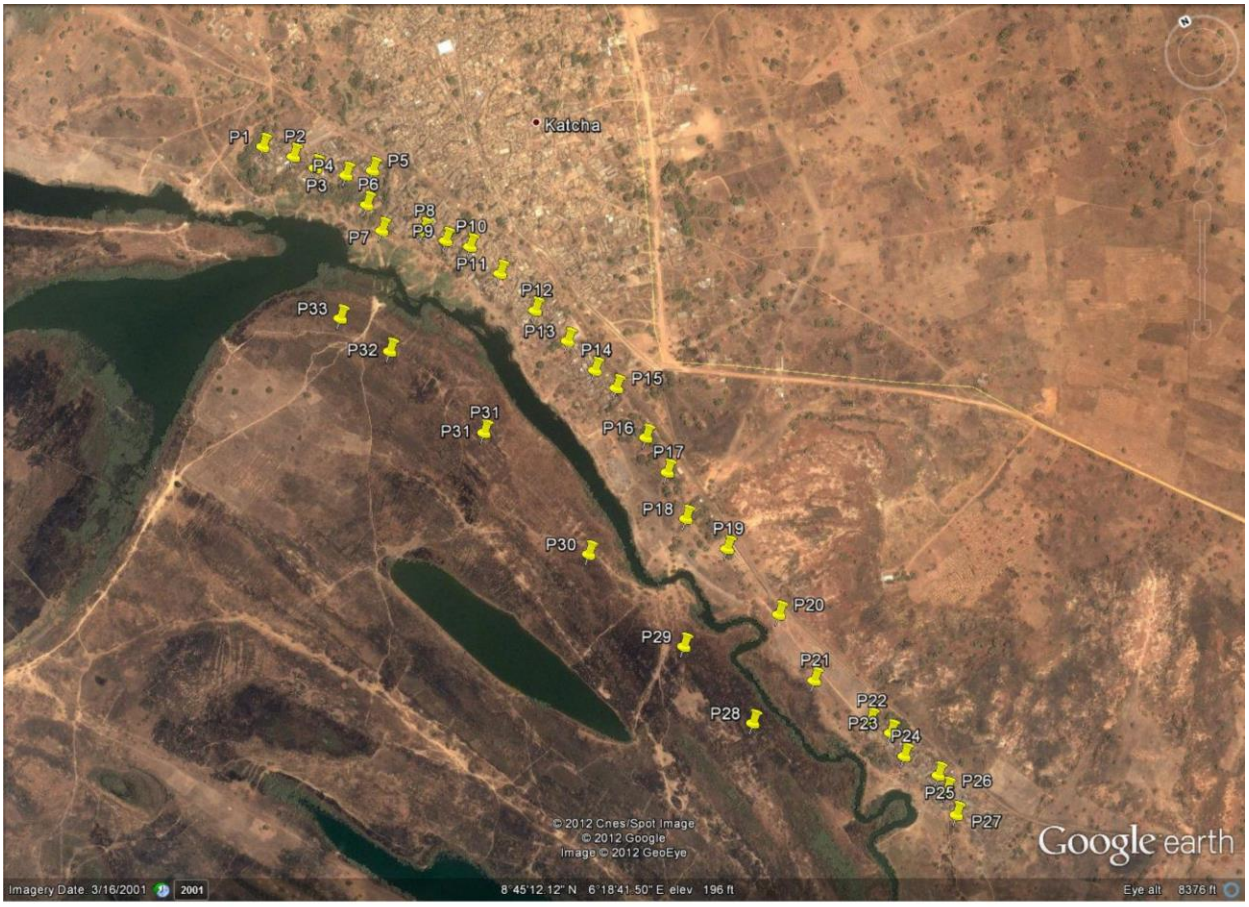


Figure 4.4 Flood Impact Area Map

SOURCE: Authors Field Survey 2013.

4.7 Summary of Findings

In view of the forgoing analysis of data in chapter four the resultant Inferences which serves as findings of results and interpretations carried out on this research boils down to following.

a- The study reveals that River Niger is the major source of water that normally causes flood for the area.

b- According to the field survey, uncontrolled construction activities are the major human activities causing flooding in the study area, which emanate from the alteration of the morphology of the natural surface.

c- The Study also discovered that there are no existing institutions, agencies responsible for disaster risk management in the entire locality. The level of preparedness is still very low.

d- The research also reveals that three (3) areas (Wunangi Tifin, Wunangi Tako and Zangbodo) within the locality all are seriously vulnerable to flood and they need to be relocated to a higher and saver grand.

e- The studies also found out that disease like, diarrhoea, cholera, malaria are highly endemic during every flooding event.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

Natural events such as flood and earthquakes can be hazardous to man. The disaster that natural hazards can cause are largely the result of actions by man that Increase vulnerability, or lack of action to anticipate and mitigate the potential damage of there events as an estimated two (2) billion people globally were by various form of disasters in the 1990's, tripling the number of impacted people in the 1970's, with economic loses increased by a factor of five (5) during the same period from $138 to $629 billion. If this trend persists it is estimated that by 2015 natural disasters would have a global estimated cost of $300 billion a year.

Hazards, either natural or man- made depending on the causative agent has a relationship with the natural environment as modern technology has provided ways of mitigating them. There are some factors that Influence susceptibility to vulnerability which include the nature of the hazard, the nature of the area and Institutional factors as discussed earlier on.

The physical characteristics of different areas were examined for the purpose of identifying the high potential risk areas, places liable to be affected in case of flood disaster all the areas in which Kpata Yaba Katcha run through in one way or the other have the tendency of causing flood due to unprecedented discharge of water from dams and tributaries and also the uncontrolled activities of Man coupled with the carefree behaviour of the inhabitants and lake of information.

It demonstrates that the means of reducing the causes of natural hazards is now available, the with also discusses the acquisition of a GIS, the elements involved in making that decision and the basics of how to select, establish and use such a system.

5.1 Conclusion

Reducing flood risks has been a challenge due to the rapid Increase in population of Nigeria as well as facing great environmental changes and low per capital income which in turn has attracted enormous attention from both the national and International Community in recent times With the most attention going to the climate regime as a result of the repeated flooding events.

There are numerous operational mechanisms for flood disaster waning, monitoring and mitigation which are now in used. Remote Sensing and GIS applications though not fully operational in flood risk reduction in this part of the world. Incorporating it in to environmental planning would reduce post disaster expenses.

5.2 Recommendations

There are dangers associated with flooding; these dangers have a number of different impacts which are not necessarily independent of each other, but creating different types of clearly recognizable hazards. The following recommendations are based on these understanding:

1. There is the need for the development of data base management system for easy access to environmental profile of katcha flood plain areas and other aspect of urban and rural management system

2. Local planning committee is to be established to make local plan and deal with the problem identified within a giving geographical area

3. Adequate awareness of the people at local level on issues related to floodplain protection, flood control preparedness, emergency response along kpata yaba River katcha should be enhanced.

4. Reduction of activities that alters the morphology of the natural surface, because this increases rate of run-off which in turn leads to flood.

5. The use of remote sensing data in analysis of flood extent or mapping of flood areas vulnerable to flood is necessary along side with geographical Information system (GIS) for flood management and other environmental issue in the following areas:

i. Zoning of flood way, where obstruction development is prohibited.

ii. Zoning of flood fringe areas for preserving adequate storage space for flood water.

iii. Precautionary zone at the edge of the flood prone areas.

6. Enforcement of urban and regional planning laws on issues relating to rural and urban planning or spatial use, as well as environmental act in the use of environmental resources within the urban and rural areas that may directly or indirectly have an impact on the people or the water body within the environment.

REFERENCES

Abams, T. K. S. (1995). *The* Flooding in Niger Delta, the case of Kiama. Proceedings of the International Workshop in Natural and Manmade hazards in Africa NMGS Publication Pp 34-76.

Adeniyi, P. (1998). Land use and Land cover Inventory in Nigeria. *Journal* of *Environmental Studies,* 1 (2), 101-123.

Askew, A. J. (1999*).* Water in the International Decade for Natural Disaster Reduction. In Leavesley (Eds.) Destructive Water: Water-natural Disaster, their Abatement and control. IAHS, Publication No. 239.

Bennet, G. (1991). Flood disaster effects on health. *British Medical Journal,* 3,434 - 458.

Blakie, F. & Wisner B. (1994). At Risk Natural hazards, people vulnerability and Disasters. London: Rutledge. Pp1-18

Brooks, N. & Carol A. (2003). Flooding disaster management. *Journal of Water Resources Planning* and *Management,* 7 (4), 35 – 115.

Brown, U & Cutchen, J. (2002). Flood emergency Management in developed countries. The experience of 1993, 1995 and 1997 floods, in parker D. J. (ed), London: Routledge. Pp 32 - 41.

Burton, C. & Kites H. (1994). The Psychology of disasters. A paper presented at the Virginia psychological Association Spring Meeting, Charlottesville, Virginia, USA.

Carling, P. A. & Petts. G. E. (1992). *Low Land Flood Plain Rivers: Boston, Geomorphologic perspectives*. New York: John Wiley and Son Inc. Pp 125-418.

Carter, Nick W. (1991). *Disaster Management.* Handbook on Agric Development Bank. Philippines: ADB manila. Pp 12-41.

Daily Trust (2012). Flood kills people in Plateau State on the 14/8/2012. Pp 11-13.

Daily Trust Newspaper (2012). Impact of flooding on environment. Pp 33-36.

ESA, E. (1998). Flood mapping. ESA publication division. Retrieved from, http://www.un-documents. net/ hfa.htm on the 7/11/2012 at 12:00 pm

Few, O. & Handmer I. (2006). Impact of flooding on health. A working paper reviewed at Tyndall Centre for climate change Research. Pp 63, 66 -71.

Fielding, J & Burning k. (2005). Environmental inequality and flood hazard. US: John wiley & Sons. Pp 9, 380-396.

Fregen, S. P. & Amadi, A.O. (2003). Upper Niger flood forecast. A report to the National Electric power Authority (NEPA) Lagos. Pp 23, 41- 61.

Godon, R., Mahon J. & Finayson (1993). Disaster impact and recovery. *Australian Journal of Emergency Management*, 1, 16-22.

IFRC, (2002). Worldwide Disaster Report: No 22. International federation of the Red Cross and Red Crescent societies. Geneva. Pp 32, 56 - 72.

ISDR (2005). Hyogo Framework for action: Building the Resilience of Nations and communities to Disasters: Wold Conference on Disaster Risk Reduction. Retrieved from http:/www.un-documents.net/ufa.htm on the 7/23/2012 11:40am.

ISDR (2005). Hyogo Framework of action. Geneva: Pergamum Press.

Jebba Dam (2012). Hydrology Department, Niger State.

Kattlemann, .R. (1997). Flooding from rain –on Snow events in the Sierra Nevada. IAHS Publication No. 239, 58-93.

Kumer, I. (2006). Decentralized Governance and Environmental Change: Local Institutional Moderation of Deforestation in Bolivia. *Journal of policy Analysis Management,* 14 (4), 34 - 45.

Laku, L. (2012). Introduction to Emergency Planning and Disaster Management. A paper presented at National Orientation Agency Minna In 2012 flood disaster at Ibrahim Badamasi Babangida Guest House Conference Room, Minna

Laughhin, G. P. & Kalma. J. D (1990). Frost Risk Mapping for Landscape Planning: a Methodology. *International Journal of Theoretical and Applied Climatology*, 42 (5), 41-52.

Mbagu, & A. D. Amadi I. (2011). Risk and vulnerability assessment tool and hazards analysis: vulnerability assessment steps. Retrieved from http: //epd web.engr.wise.sedu/dmc on the 6/07/12 at 12: 20 pm. Pp 1-34.

McEwen, L.T. (1989). *Extreme Rainfall and its Implication for Flooding Frequency:* A case study of the Middle River basin. *Transaction of the Institute of British Geographers*,14, (3), 285-299.

Ministry of Land and Housing Minna (2012) Map of Nigeria, Niger State, Map of Study area and Topographic sheet of katcha Town

National Emergency Management Agency (2012). A Programme Report 63 on Early Warning system

National Population Commission (2006). Population of the Katcha LGA, Niger State.

Ohl, C. & Tapsel S. (2000). Flooding and human health. *British Medical Journal*, 6 (2), 116-124.

Penning, R. & Green T. (2000). Health impact of flooding in Lewes. A comparison of reported gastrointestinal and other illness and mental health in flooded and non-flooded households. Pp 56 – 63.

Phifer, J. & Kaniasty A. (1999). The impact of natural disaster on the health of older adults: a multi-wave prospective. *Journal of Health and Social Behaviour*, 2(9), 65-78.

Sagua, V.O. & Fregene, S. P. (1997). Kanji Dam and the hydrology of the River Niger. In Proceedings of the International Conference on Kanji Dam and River Basins Development in Africa. Pp 223 - 233.

Schmudde, T. H. (1998). Understanding Flood plain development. *Journal of disaster management*, 4 (4), 56-61.

Smith, R. (1993). The great flood: a chronicle of the events and people of Perth: and Kinross during the flood of January 1993; Earth and Kinross council, Retrieved from Http://www.public safety degrees.com/articles/emergence on the 22/07/2012. Pp 123-131.

Sunday, B. (2012). Role of NGOs, CBOs, FBOs and Private Sectors in Disaster Management. A paper presented at National Orientation Agency Minna on Disaster Management and mitigation measures, Minna. Pp 10, 13-15.

Tapsell, S. & Tunstall S. (2001). The effects of flooding on health and social in the North-Eastern Region. A Report of Environmental Agency Enfield, Middlesex. Pp 46-51

The Guardian Newspaper (2012). Impact of 2012 flood disaster. Pp 12

Umoh, UT. (2000). Problems of Niger River Basin and sustainable development under increased effect of climate change. A paper presented at national training workshop in Nigeria. Pp 43-64.

W H O. (2001). World Health. A Report on Mental Health. Geneva: World Health Organisation Press.

White, G. & Etkin U. (1997). Monitoring temporal water Changes in Mediterranean and Arid Ecosystems Using a Remote Sensing Technique: case study of the Judean Mountain and the Judean Desert. *Journal of Arid Environments*, 3(3), 43-61.

Wisner, B., Howord P, Cannon T. And Divis 1 (2004). At Risk: National hazards, people Vulnerability and Disaster: 2nd edition. Indian: Routledge, Pp 44, 72-190.

Woodinville (2007). Hazard Identification and vulnerability Assessment. Woodinville Comprehensive Emergency Management Plan. Retrieved from Http://en.wikipedia.org/wiki/emergency\management" on the 2/5/2012 at 1:00:00 pm

Yeo, S. (2003). Effects of flood disaster on infrastructure. Retrieved.www.nationalsecurity.gov.au/agd/ema/ema/ema/emainternet.nsf/page/AZEM. on the 11/07/2012 at 10:30 am

Appendix A

Federal University of Technology, Minna.

Postgraduate School

Centre for disaster risk management and

Development studies

Questionnaire: To the residents of Katcha town on flood risk and vulnerability assessment of Katcha town in Katcha Local Government Area of Niger State Nigeria.

Dear

Mr./Miss……

……

I am a student of the above named institution presently writing my final project in pursuit of degree of masters of Science (m.sc).

This questionnaire aims at gathering information that are relevance to the study of the research topic.

Your co-operation would be most appreciated as you answer the questions, all information shall be treated with utmost confidentiality as they are purely for academic exercise.

Please tick ( ) in the appropriate box and fill in the gaps where necessary by the head of the family or entrusted representative only.

1. Age of the respondent

   (a) 20-30 ( ) (b) 21-40 ( ) 9 (c) 41-50 ( ) (d) 51 and above ( )

2. Origin

   (a) indigene ( ) (b) elsewhere ( )

3. Level of education

   (a) illiterate ( ) (b) primary ( ) (c) secondary ( ) (d) tertiary ( )

4. Occupation

   (a) self-employed ( ) (b) farming ( ) (c) trading ( ) (d) civil servant ( )

5. income per month

   (a) 5,000-10,000 ( ) (b) 10,000-15,000 ( ) (c) 15,000-20,000 ( ) (d) 20,000-30,000 ( )

6. Years of stays in the areas

   (a) 1- 10 yrs ( ) (b) 11- 20yrs ( ) (c) 21-30 yrs ( ) (d) since birth ( )

7. Types of buildings

   (a) tenement ( ) (b) bungalow ( ) (c) story ( )

8. drainage system

   (a) open drains ( ) (b) cover drains (c) water ways ( ) (d) others ( )

9. What is the major cause of flooding

   (a) excessive rainfall ( ) (b) due to intensive release of water from dam ( ) (c) poor drainage system ( ) (d) refuse dump ( )

10. What is the sources of water which caused the flooding in your area

    (a) River Niger ( ) (b) River Suka ( ) (c) Kpata yaba ( ) (d) others

11. Sources of drinking water

    (a) River ( ) (b) tap ( ) (c) bore hole ( ) (d) stream ( )

12. Has the river flooded this area before

    Yes or No

    If yes, how often

    (a) every year during the raining season ( ) (b) when water ways is block ( )

13. What has been predominant human activities causing flooding event.

(a) Farming ( ) (b) uncontrolled construction activities ( ) (c) refuse dump ( ) (d) mining ( )

14. Do you have community flood management institution (s)/committees

Yes or No

If yes give the name……..

15. Has any community awareness programme been carried out in the community?

Yes or No

If yes how many programmes have been done in the last five years?.....

16. How will you rate the result of such programme

(a) Highly effective ( ) (b) effective ( ) (c) not effective ( )

17. What has been the environmental impact of the flood event?

(a) Loss of life ( ) (b) destruction of farm land ( ) (c) destruction of socio economic activities ( )

(d) destruction of properties ( )

18. What has been local control measures to this impact of flood event in your area.

(a) sand bag ( ) (b) construction of drainage ( ) (c) embackment ( ) (d) others. ( )

MUSA LIMAN ALHAJI

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