

# PLANNING RESPONSE TO WATER-RELATED DISASTERS IN NIGERIA: THE RIVERS STATE EXPERIENCE

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**ABSTRACT:** The study evaluated the effects of the 2012 flooding in Rivers State in four (4) local government areas which includes: Abua/Odual, Ahoada East, Ahoada West and Ogba/Egbema/Ndoni and what are the Town planning response(s) to these flood menace in Rivers State. Visits were made to sites of flooding where photographs were taken and analyzed. Most devastating floods were seen to be of natural causes such as River over – flow, Dam burst, and compounded by torrential rains etc. Flooding induced by the effects of these natural causes have also been seen to cause serious damage to people, damage of buildings, destruction of properties, health challenges, reduction of the aesthetic beauty of the environment, increase in poverty level and death. However man-made causes of flood disasters are seen to occur in these towns and villages being the centre of activity in many countries. Floods have brought about the displacement of many people in many countries. In some countries all floods bring about the loss of human life as well as properties. These have degenerated to uncontrolled erosion in some of the affected communities. Many flooded homes are not habitable until they are fumigated and cleared debris properly disposed. It is considered that good remedial measures could be brought in place to reduce the devastating effect of floods. However Town Planning has some respite as it emphasizes on proper settlement planning, effective spatial planning and the like to further reduce the effect of these flood hazard. The study thus recommends that the building of multifunctional safety camps/settlement would be of far reaching affect, particularly those built on high non-flood sites. Willingness and readiness to investigate and predict future flooding as well as fund the remedial proposals are important components to the management of flooding. The masses should be properly informed about the harmful effects of flooding in their areas and their role in fighting flooding through collaboration with the government and non-governmental organizations from local, state and federal governments alike.

**Keywords:** Disaster, Disaster risk reduction, Flood, Planning response, Water related disaster

## INTRODUCTION

Nigeria is located between  $4^{\circ}\text{N}$  and  $14^{\circ}\text{N}$  of the equator. The Western frontiers run from  $3^{\circ}\text{E}$  and the Eastern reaches nearly  $15^{\circ}\text{E}$  of the meridian. It is bounded by Cameroon to the East, Chad to the North East, Niger to the North, Benin to the West and the Atlantic Ocean to the South. But the absolute geographical coordinates is  $10^{\circ}00\text{N}$ ,  $8^{\circ}00\text{E}$ . *CIA World Fact Book (2013)*.

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Nigeria has a federal form of government and is divided into 36 states and a Federal Capital Territory. Nigeria has population of over 160 million and covers an area of

923,768sq/km. At its widest, it measures about 1,200km from East to West and about 1,050km from North to South.

The topography ranges from low land along the coast and in the lower Niger Valley to high plateaux in the North and mountains along the Eastern borders. Nigeria suffers significantly from various types of disasters. Disasters such as floods, landslides, tidal waves, coastal erosion, sand-storms, and dust-storms either by natural or anthropogenic causes have serious impacts on the people of any nation are it developed, developing or under-developed. *Nations online Project (2013)*.

Flooding is the event when large amounts of water have overflowed from a source onto a previously dry area. Flooding in Rivers State has become a common feature in today's world. It is important that the uncontrolled flow of water be better managed to reduce the effect on human beings and on infrastructure. Uncontrolled and poorly managed urbanization is a good invitation to

massive flooding in coastal urban centres. Rivers State is located along the coastline in southern Nigeria and would fall "prey" to the impact of flooding in most parts. The direct coastal parts of the state experiences several episodes of flooding many times within one year and thereby give room to indecent living because of continued displacements and resettlements. All over the world the incidence of flooding carries with it losses in human and material worth. Flooding occurs in some parts of the world as a natural process, especially in low lying parts of the continents. Other forms of flooding are caused by human actions, and also from some inaction.

### STATEMENT OF THE PROBLEM

In recent times Nigeria has seen varying degrees of water related disasters especially flooding.

Flooding has wreaked havoc across many other parts of Nigeria including Rivers State.

Over the years in Rivers State, flood has remained a worrisome natural problem which successive governments in the State could not effectively solve. Flood therefore is still a problem in areas like Ahoada East, Ahoada West, Ogba/Egbema/Ndoni and Abua/Odual Local Government Areas. In these areas of the state, flooding has posed a major concern to the occupants of properties. The access roads to some of these properties during raining season are usually in their worse states and this deteriorates year after year. Flooding is inimical to human activities especially when it occurs on a large scale (Ogunyemi 2002). Flooding has been a threat in the study area of Rivers State which has been experiencing flood disasters as a result of so many factors like lack of spaces for drainage system, blockage of the drainage system, unplanned towns and cities, poor environmental awareness, inadequate management of wastes, poor construction of drainage system, and poor spatial planning all these help to aggravate flooding during rainy seasons.

It is an established fact that several buildings, including schools, churches, hospitals and residential homes, were submerged by flooding in Rivers State. Families living within were rendered homeless, as their homes were taken over by flood waters. Motorist found it difficult to pass through the area during the rainy season.

In these areas many lives, properties worth of billions of naira have been damaged, accidents congestion and loss of the aesthetics values of the environment, loss of arable

land, overcrowding, spread of communicable diseases and water-borne diseases like cholera, typhoid fever have become prevalent in the area, lives have been lost by car accidents as a result of flood induced damaged roads, rate of crime and conflict increased as people resort to all kinds of social vices in order to stay alive. Moving forward, this paper seeks to identify what are the planning responses to water related disaster of flooding in Rivers State with a view to proffering solution to the menace.

### GOAL

The goal of the study is to identify the planning response(s) put in place by the Rivers State government in times of flood related disaster with a view to proffer appropriate mitigation measures.

### OBJECTIVES

- i. To identify the type(s) of water related disaster.
- ii. To identify the causes and impacts of floods on the socio-economic livelihoods of the affected people.
- iii. To identify coping mechanisms employed by the community during and after floods.
- iv. To identify the disaster control, reduction and response mechanism put in place by the Rivers State government.
- v. To ascertain the physical planning measures put in place by the government of Rivers State.

### JUSTIFICATION OF THE STUDY

The study is important at this point in time because it will evaluate the effects of the floods on the socio-economic livelihoods of the affected communities. The study also established the underlying causes of vulnerability of people in communities. More importantly, it is envisioned that the outputs of the study will be pivotal in the designing of sustainable mitigation measures to minimize the impact of floods and the associated risks in affected communities.

### LITERATURE REVIEW

#### WHAT IS A DISASTER

The United Nations defined disaster as a serious disruption of the functioning of a community or a society causing widespread human, material, economic, and /or

environmental losses which exceeds the ability of the affected community or society to cope using its resources, UN-ISDR (2002). The combination of hazards, vulnerability and the inability to reduce the potential negative consequences of risk result in disaster. As a result, disasters influence the mental socio-economic, political as well as the cultural state of the affected area. Hence, disasters are considered as the consequences of inappropriately managed risk, Quarantelli (1998). These risks are the product of a combination of both hazards and vulnerability. Therefore, hazards that strike in areas with low vulnerability are less likely to become disasters, as in the case of inhabited regions.

### **TYPES OF DISASTER**

Disasters are generally grouped into two types, namely natural and anthropogenic or man-made. Natural disasters are caused by natural processes in proximity to, and pose a threat to people, structures and/or economic assets. Examples of Natural disasters are flood, cyclone, drought, earthquake, tsunami, cold wave, thunderstorms, volcanic eruption, heat waves, mud slides and storm.

Conversely, anthropogenic or human-made disasters are associated with human action, transaction or inaction. Examples of man-made disasters include: technological failures, industrial accidents, oil spills, transportation accidents and nuclear explosions/radiations. Nevertheless, the focus of this manuscript is water related disaster and planning response. Natural disasters have been around for a while, dating back to the early human civilization. During this period, natural disasters were perceived as acts of God, Drabek (1991) or retribution from the gods, Quarantelli (1998). Nevertheless, the evolution of science questioned the integrity of these beliefs. according to Niekerk, (2007), some to the earliest contributions to the field of disaster science were from Carr, (1932), Sorokin (1942), Eldanman (1952), Quarantelli (1954 and 1957), Moore (1956), Fritz and Williams (1957), Drabek and Quarantelli (1967), Doughty (1971), Hewitt and Burton (1971), Kreps (1973), (Westgate and O'Keefe, 1976), Jeger (1977), Torry, (1978) and Turner (1978). Notwithstanding these contributions to the understanding of the concept of disaster natural disasters have become a major threat to human life and the world economy Godstime James et al (2013).

### **WATER RELATED DISASTERS**

Disasters, either by natural or anthropogenic causes, have serious impacts on the people of any nation be it developed, developing or under-developed. The main water-related disasters that have frequent occurrence in Nigeria are floods and drought.

Floods (too much water) and on droughts (too little water) are the most obvious water related disasters. These less obvious facts about disasters relate to root causes such as human activity that could be addressed through improved public policy or is the result of poor policy. These indirect causes or aggravating factors could be varied and can include water resources management policies, agricultural policy, environmental protection policy, industrial and economic development policies and the like.

Floods are among the most devastating natural hazards in the world, claiming more lives and causing more property damage than any other natural phenomena. In Nigeria today most people living in and around the banks of the rivers, coastlines are very vulnerable to flooding since their means of livelihood depends on the river and the adjoining creeks. This is very prominent in states of the Niger Delta and other states in the flood plains of Nigeria. Across the globe, floods have posed tremendous danger to people's lives and properties. Floods cause about one third of all deaths, one third of all injuries and one third of all damage from natural disasters. Askew(1999).

In Nigeria, the pattern is similar with the rest of the world. Flooding in various parts of Nigeria have forced millions of people from their homes, destroyed businesses, polluted water resources and increased the risk of diseases. Baiye (1988); Akinyemi (1990); Nwaubani (1991); Edward-Adebisi (1997).

### **CAUSES OF WATER RELATED DISASTER (FLOODING) IN NIGERIA**

Generally, causes of flood in Nigeria could be as a result of natural cause or human cause. Natural cause is in form of heavy or torrential rains/rainstorm, oceans storms and tidal waves usually along the coast. Anthropogenic causes are in form; burst of water mains pipes, damp burst Levee failures, and Dam Spills. However, in Nigeria flooding occurs in the following forms:

- Coastal flooding
- River flooding
- Flash floods
- Urban flooding
- Dam burst/levee failures
- Dam Spills.

Coastal flooding occurs in the low lying belt of mangrove and fresh water swamps along the coast. The National Oceanic and Atmospheric Administration (NOAA) have listed several conditions that can lead to coastal flood. These include:

- ❖ Severe weather events create meteorological conditions that drive up the water level creating a storm surge. These conditions include strong winds and low atmospheric pressure that can be caused by tropical cyclones (such as hurricanes), by mid-latitude extra tropical storms or by any severe weather conditions.
- ❖ Large waves, whether driven by local winds or swell from distant storms, raise average coastal water levels and can cause large and damaging waves to reach land.
- ❖ High tide levels are caused by normal variations in the astronomical tide cycle. When a severe storm hits during high tide, the risk of flooding increases significantly.
- ❖ Depending on the storm event, flooding from storm surge may be combined with river flooding from rain in the upland water shed, thus increasing the flood severity. It is important to note that coastal flooding is different from river flooding, which is generally caused by severe precipitation.
- ❖ Other larger scale regional and ocean scale variations, caused by seasonal heating and cooling and ocean dynamics can contribute to high water levels.

**Coastal floods** are generally extremely dangerous, and the combination of storm surge, tides, river inflow and waves can cause severe damage, NOAA (2013).



River flooding in Nigeria.  
Source: NEMA (2012)

**River flooding** occurs in the flood plains of the larger rivers.



River flooding in Nigeria's Benue River,  
Source: NEMA (2012)

**Flash floods** are associated with rivers in the inland areas where sudden heavy rains can change them into destructive torrents within a short period. Flash floods are rapid flooding of geographic low-lying areas: washes rivers, dry lakes and basins. It may be caused by heavy rain associated with a severe thunderstorm, hurricane, tropical storm and melt water from ice or snow flowing over ice sheets or snowfields. Flash floods may occur after the collapse of a natural ice or debris dam, or a human structure such as man-made dam. Flash floods are distinguished from regular flood by a timescale of less than six (6) hours. [www.NWS.org](http://www.NWS.org).

**Urban Flooding** occur in towns located on flat or low-lying terrain especially where little or no provision has been made for surface drainage, where existing drainage has been blocked with municipal waste, refuse and eroded soil sediments. Extensive urban flooding is a phenomenon of every rainy session in Lagos, Maiduguri, Aba, Warri, Benin, Ibadan and recently Port Harcourt.



Typical scenarios of urban flooding in Lagos, Nigeria.  
Source: NEMA (2012)



Typical scenarios of urban flooding in Lagos, Nigeria.  
Source: NEMA (2012)



Typical scenario of urban flooding in Lagos, Nigeria.  
Source: NEMA (2012)

Other notable causes of urban flooding includes anthropogenic causes like population pressure,

- ❖ Deforestation
- ❖ Trespassing on storm water drains
- ❖ Unplanned urbanization which is the key cause of urban flooding.
- ❖ Unauthorized colonies
- ❖ Poor water and sewage management
- ❖ Lack of attention to the nature of hydrological system
- ❖ Lack of flood control measures
- ❖ Multiple authorities in a city but owning responsibility by none.

**Dam burst/levee failure:** A dam is a barrier across water that obstructs, directs or slows down the flow, often creating a reservoir, lake or impoundments. Most dams have a section called a spillway or weir over which, or through which water flows either intermittently or continuously. Dam failures are comparatively rare but can cause immense damage and loss of life when they occur.

## CAUSES OF DAM FAILURE

- ❖ Sub-standard materials/techniques used for the construction.
- ❖ Spillway design error
- ❖ Geological instability caused by changes in water levels during filling or poor surveying.
- ❖ Poor maintenance, especially of outlets pipes.
- ❖ Extreme inflow-Cameroon experience
- ❖ Human, computer or design error.
- ❖ Internal erosion, especially in earthen dams
- ❖ Earthquakes.



Aerial photograph of typical scenario of dam failure in Nigeria.  
Source: NEMA (2012)

## IMPACT OF WATER RELATED DISASTERS

The National Emergency Management Agency (NEMA) in Nigeria says flooding in (2010) brought the number of people displaced to 258,044 while about 1,555 lives were lost to cholera due to contaminated drinking water caused by the flooding. NEMA (2010)

The impact of flooding in Nigeria has assumed various dimensions which have tilted towards the negative side. The magnitude is very enormous as many lives and properties running into millions of naira have been destroyed. The devastating effect of floods is not limited to houses alone, it spans across social economic, physical and institutional spheres of the society.

## THE RIVERS STATE EXPERIENCE

Flooding in Rivers State is not new as it is a known and established fact that Rivers State is amongst the states in Nigeria that is below sea level and such it at risk of

flooding ranging from urban flooding, flash floods, river flooding etc. In 2012, in the face of numerous warnings issued by the Nigerian Meteorological Agency of severe rains in 2012, the government did not prepare enough to face the magnitude of flooding her residents would face. Although the government said it had made adequate preparations to control the effects of the flooding by cleaning the blocked drains and the like. Over “100 villages have fallen to the rampaging flood from the overflowing Orashi and Sombrero Rivers in north-west areas of Ohaji/Egbema/Ndoni and Ahoada (East and West) local council areas of River State.” Businessday (2012).

This had cost the state government colossal loss of lives and properties, farmlands washed away, livestock destroyed and infrastructures damaged. Here are some pictures from the scene.



Effects of flooding in Ahoada, Rivers State, Nigeria.  
Source: NEMA (2012)



Flooding at East-West Road, Ahoada. NEMA (2012)

The negative impacts of flooding include:

- ❖ Drowning is the leading cause of death in case of flash floods and coastal floods.
- ❖ Fatal injuries can occur during the evacuation or clean-up activities. Injuries consist of small cuts,

puncture wounds from glass debris of nails. Electric shocks can occur as well.

- ❖ In the short-term the impact of flooding on the transmission of communicable diseases is limited, although there is definitely an increased risk for waterborne and vector-borne diseases.
- ❖ Floods can damage lifetime systems such as the water and sanitation infrastructure, and can interrupt water supply and sanitation services.
- ❖ Water sources might become contaminated during flooding. Latrines and shallow wells could be flooded, representing a major health hazard.
- ❖ Toxic chemicals could contaminate water sources during flooding, but this has not been adequately documented to date.



Effects of flooding in Ahoada West in Rivers State, Nigeria.  
Source: NEMA (2012)



Effects of flooding in Ahoada West in Rivers State, Nigeria.  
Source: NEMA (2012)



Effects of flooding (early harvesting of crops) in Ahoada West of Rivers State, Nigeria.  
Source: NEMA (2012)



Flood displaced children in Camps provided by the Rivers State.  
Source: NEMA (2012)

However, in the midst of these negative impacts of flooding, there are some glad tidings it comes with. These are:

- ❖ Nutrients: some floodplains are made more fertile after flooding as the floodplains have deposits of nutrients that were carried from other places.
- ❖ Also floods replenish groundwater systems by recharging the underground aquifers.
- ❖ Reservoirs are filled which enhances national water security
- ❖ It also washes away accumulated waste from water channels and improves the channel of water flow.

The sectoral impacts of flood are highlighted as follows;

In the agricultural sector, there is always damage to farmlands, fishing infrastructure i.e fish ponds and in some cases shrimp factories, ready to be harvested produce damaged, livestock is lost. Stocked agricultural produce and grains are damaged. The resultant consequence of these are the reduction of future crops yields, no planting of future crops, reduction in the fishing stock, in some cases there is massive loss of employment.

In the water and sanitation sector, damages are made to the water collection works, water processing plants, water distribution pipes, distortion of water distribution network, and damage to the sanitary sewage network. The consequences of these are increase in the cost of water supply with the use of trucks. As there is massive digging and equipment of emergency wells and boreholes in affected areas.

In the housing and human settlements; there is total damage and destruction of houses, household appliances and furnishings are damaged. Public buildings and facilities are destroyed. The implications of these are; supply of temporary housing, relocation of housing in safe areas and there is a huge cost of migration to families.

The transportation and communications sector is also involved as there is damage to roads and bridges, automotive stock is depleted, railway tracks are damaged airports and seaports are not left out. This will result in increased cost of goods and services as motorists use alternative of longer routes to their destination and/or in poor condition. This is evident in Lokoja-Abuja road situation. Cost of telecommunications towers reconstruction, loss of income in air and sea transportation.

Commerce industry and services are not left out as most infrastructures are damaged with respect to equipment and machinery, finished production (stocks and inventories are damaged or lost). This means production will be reduced; there will be temporary job losses. This is evident in the recent flooding of 2012 in Nigeria.

The tourism sector is also affected as tourism infrastructure, furniture and tourism equipment are damaged. Beaches and other tourist attractions are damaged. There is reduction in hotel occupancy and income of enterprises, negative effect in linked activities, and unemployment.

Also the education and cultural sectors are always affected as schooling facilities, furnishings and educational materials are damaged. Historical and cultural heritage are damaged. In this situation, there is delay school year. Schooling centres are sometimes used

as shelters for displaced population during disaster. There will be reduction in income to the damaged culture and historical centres (Museums etc).

The health sector is also affected as most health infrastructure are either damaged and/or destroyed like hospitals, health centres, clinics, dispensaries etc. loss of equipment, furnishings, medicines and stock. This implies that there would be increased funding for provision of medical services, increased funds to relocate health centres to safer grounds. Increase in epidemics or infective diseases.

On a final note, the environment is also damaged as natural resources are damaged from their natural state, land is destabilized, deforestation occurs, sources of water is polluted, beaches are damaged. The implication is that environmental services will be lost.

### DISASTER RISK MANAGEMENT IN NIGERIA

The institutionalization of disaster management in Nigeria began in 1906 with the establishment of the Fire Brigade which combated fire and provided humanitarian aid and relief to minimize disasters impacts, NDMF (2012). Formal Large-scale state organized disaster management began in 1976 with the establishment of the National Emergency Relief Agency (NERA) which focused on the aftermath of disasters and tended to the needs of disaster victims (NDMF). Based on the strategies outlined by the UN International Decade for Natural Disaster Reduction (IDNDR), the Federal Government of Nigeria (FGN) in 1993 expanded the authority of the National Emergency Relief Agency (NERA) to include all stages of disasters and established the agency as an independent body under the Presidency. The National Emergency Relief Agency (NERA) was restructured in March 1999 with the renaming of the agency as the National Emergency Management Agency (NEMA). This enabled the agency to oversee a more holistic approach to the management of disasters in all phases and all associated consequences. In the light of this, NEMA has the mandate to put in place the following;

National Disaster Response Plan (NDRP); this establishes a process and structure for systematic, coordinated, and effective delivery of Federal assistance to address the consequences of any major disasters.

### GENERAL RESPONSE TO WATER RELATED DISASTER

Although natural disasters cannot be avoided, studies have shown that adequate disaster management plan can reduce its impacts on lives and properties. Moreover, disasters often do not respect national and international

boundaries. As a result governments and international organizations are cooperating to promote global and regional initiatives to address the full/partial disaster management cycle consisting of mitigation, preparedness, response and recovery. Twigg (2004)



Fig. 1 Full Disaster Management Cycle  
Adapted from Twigg, J.(2004)

### DISASTER RISK REDUCTION STRATEGY

The general response to water-related disasters like flood has to be properly organized in the following ways DDR,

- ❖ Creating awareness on the dangers and vulnerable nature of people living around low-lying area that are prone to flooding.
- ❖ Evolving a mechanism for forecasting, monitoring and control of floods.
- ❖ Promote and strengthen training at all levels in erosion and flood prevention management and control.
- ❖ Protection of marginal lands by limiting utilization to their carrying capacities.
- ❖ Subjecting resources users and developers to guidelines in order to reduce the vulnerability of the environment to disaster.
- ❖ Provide early warning systems to avert the escalation of flood hazards.

A proactive perspective to reduce the impact of water related disasters requires a more comprehensive approach that encompasses both pre-disaster risk reduction and post-disaster recovery. This should be incorporated in policies and institutional arrangements that support effective action. According to Abrahams (2003), Atu (2003), Basaen (2003), Benouiar (2003), and



Cordona (2003) such an approach could include the following strategies.

- ❖ Risk analysis to identify the kinds of risks faced by people and development investments as well as their magnitude.
- ❖ Prevention and mitigation to address the structural sources of vulnerability
- ❖ Risk transfer to spread financial risks over time and among different actors.
- ❖ Emergency preparedness and response to enhance a country's readiness to cope quickly and effectively with an emergency.
- ❖ Post-disaster rehabilitation and reconstruction to support effective recovery and safeguard against future disasters.

#### **CONSTRAINTS TO REDUCE DISASTER IN NIGERIA**

- ❖ Poverty and poor level of basic education and the generality of the populace.
- ❖ High level of corruption in the country
- ❖ Perception of politicians and policy makers that disaster risk reduction is much less visible than emergency response
- ❖ Donors and support for agencies less willing to fund risk reduction compared to their support for emergency assistance.
- ❖ The media pays little interest to disaster risk reduction programmes.
- ❖ Low awareness and education in disaster risk reduction and management system among NGOs, CBOs, and FBOs.

#### **PLANNING RESPONSE TO WATER-RELATED DISASTERS IN NIGERIA**

Town Planning as a profession has its primary focus on ordering the use of land with respect to the organisation of the environment to achieve a safe, convenient, beautiful and functional society. However in the midst these daunting challenges posed by flooding in Nigeria, there are some approaches which if followed properly and implemented could give hope to the greater majority of Nigerians who are susceptible to flood and those who live in flood plains. These approaches are:

- ❖ Proper Settlement Planning
- ❖ Land use (spatial) management/planning
- ❖ Large-Scale structural or engineering measures
- ❖ Land-use control measures

- ❖ Integrated Water Resources Management
- ❖ Legal framework

#### **PROPER SETTLEMENT PLANNING**

As the name implies lack of proper planning of settlements have been the bane of most Nigerian towns and cities. Most of these unplanned cities have record the highest number of casualties in recent times. This is evident as most neighbourhoods are not accessible in times of disasters for easy evacuation of victims. Towns and cities should be properly planned to reduce the risk and vulnerability of these cities and towns.

Furthermore, buildings and layouts should be done and approved properly to reduce the development of slums and non-functional settlements.

#### **LAND-USE (SPATIAL) MANAGEMENT**

Efficient land management should be adopted as a complementary measure to the major engineering measures for flood mitigation and control. This may include a variety of structural and non-structural approaches. The structural approaches comprise of small and relatively low-cost mechanical devices to retard run-off rates or volume, to control or retard overland flow give protection against erosive or scouring forces. The non-structural measures comprise a variety of farming, cropping and cultivation techniques, the purpose of which are to maintain a protective vegetative cover increase infiltration and impede overflow.

Land use control management should be adopted widely in response to the increasing population pressures. Uncontrolled land use has led to significant changes to watershed ecosystems and land degradation. These changes usually have adverse effects on the natural hydrological cycle and lead to an increase in the intensity of floods. The application of the land management measure can result in improvement or conservation of the hydraulic conditions of the water sheds for flood mitigation.

#### **INTEGRATED WATER RESOURCES MANAGEMENT (IWRM) AS A STRATEGY IN REDUCING THE RISK OF WATER-RELATED DISASTER IN NIGERIA**

IWRM can be defined as a process that promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable way

without compromising the sustainability of vital ecosystems.

Kevin (2004) said that IWRM is a philosophy, a process and a management strategy to achieve sustainable use of resources by all stakeholders at catchment, regional, national and international levels, while maintaining the characteristics and integrity of the environment within agreed limits.

IWRM is characterized by the following approaches that will ensure a reasonable reduction in minimizing disaster or its impacts if it occurs.

- ❖ Integrated
- ❖ Management
- ❖ Stakeholder
- ❖ Partnership
- ❖ Balanced sustainable approach

IWRM is historic in its approach through integrating various sectors and components of the environment that include:

- ❖ Biophysical system of climate land and water
- ❖ Anthropogenic system of land use and misuse.
- ❖ Socio-political system of equitable allocation needs
- ❖ Components of management tools and techniques
- ❖ Engineered infrastructural systems such as dams, water management structure and water schemes etc DWAF (1998).

#### **Management Approach**

This simply means maximizing the use of resources, minimizing the consequences of resources use over long term, reversing the consequences of previously damaged systems by environmental rehabilitation and re-naturalization, ensuring the well-being and enhancing the quality of life of the inhabitants, seeking equitable fair and just solutions to all concerned Calder (1999).

#### **Stakeholder Approach**

This approach recognizes the importance of the involvement of individuals, landowners and government agencies, in a participatory process where all decisions around the management and sustainable use of land and water resources are made.

#### **Partnership Approach**

This emphasizes common objectives as well as defining the collective rules, responsibilities and accountabilities of every individual who, and every water use and administrative agency which participates in the process of decision making on use and management of land and water resources at all levels, down to the village and even the individual household (DWAF(1996), Calder (1999).

#### **Balanced Sustainable Approach**

This simply implies that all activities in the process of executing any water resources programme will require balanced approach decisions designed to achieve a sustainable environment as well as seek to optimize the utilization of available resources to provide sustainable services DWAF (1996), Calder (1999).

#### **LAND USE PLANNING**

This deals with the physical and socio-economic planning that determines the means and assesses the values or limitations of various options in which land is to be utilized, with the corresponding effects on different segments of the population or interest of a community taken into accounts in resulting decisions. Land-use planning also involves studies and mapping, analysis of environmental and hazard data, formulation of alternative land-use decisions and design of a long-range plan for different geographical and administrative scales. Land-Use Planning can help to mitigate disasters and reduce risks by discouraging high density settlements and construction of key installation in hazard prone areas in the sitting of service routes for transport, power, water, sewage and other critical facilities.

#### **LARGE-SCALE STRUCTURAL OR ENGINEERING MEASURES**

- Major water storage reservoirs were the most commonly adopted measures for flood control and drought management in Nigeria. The construction of major reservoirs for multi-purpose use can lead to better regulation of the flow regime and therefore minimize flooding potential.
- Dykes and floodwalls: The principal purpose of dykes and floodwalls is to confine flood waters to the stream channel and selected portion of the floodplain. These barriers protect only the land area immediately behind them, and are

effective only against flood depths up to the chosen level for which they were designed.

- Retarding basins and flood storage areas: Flood storage and retardation are used to reduce the flood peak at downstream locations and confine flooding to areas within the flood control system. This flood mitigation measure is being increasingly adopted in the region to mitigate urban flooding as well as flash flooding and riverine flooding.
- Bypass flood-ways: Bypass flood-ways or flood diversion structures serve two functions in flood mitigation: to provide an additional outlet for water from upstream and to create large, shallow reservoir to store a portion of the flood water and decrease the flow in the main channel. Flood diversions are used to protect major cities and/or urban areas.
- River training works: River training works are aimed at modifying the hydraulic conditions of water course or the floodplain, and/or flood channels constructed within the floodplains. These works enable flood waters to be passed at a lower level than would occur naturally.
- Drainage evacuation system: drainage evacuation systems are mostly used in urban areas to dispose of water produced by storm run-off from within the protected area behind dykes or floodwalls. These systems include gravity drainage through pipes fitted with gates during period of low river flow.

#### **LEGAL FRAMEWORK**

This has to do with policies and the makers of the policies. Over the years there have been attempt to put in place a proper legislature that would give adequate backing to disaster management in Nigeria. But only the National Emergency Management Agency (NEMA) has been working since 1999. Most states in Nigeria don't have State Emergency Management Agency (SEMA) and Local Emergency Management Agency (LEMA). Furthermore attempts to effectively implement the Nigerian Urban and Regional Planning Law-Decree 88 of 1992 have met stiff opposition in some states of Nigeria.

No attention is being given to the Law as this has led to disorderly developments in some major cities like Port Harcourt and its environs. However if this Law and other Laws related to the environment are given its proper priority, this would encourage harmony between man and his environment.

#### **CONCLUSION**

From the above, the study concluded that the effects of the flooding in the entire study area are the same, and some of the major effects of flooding in the communities in the study area include: washing away of roads by flood waters, road and domestic accidents, damage to buildings both public and private, distortion of the ecosystem, health problems, reduction of aesthetic value of the environment, increase in poverty level and death, loss of arable lands and the like.

#### **RECOMMENDATIONS**

The study recommends the following to better check the flood menace in the study area:

1. The communities prone to flooding should be concerned with these harmful effects of flooding in the area and their role in fighting flooding through synchronization with the government at all levels, non-governmental organizations, faith based organizations, and community based organizations.
2. The responsiveness of the communities around flood plains towards the dangers inherent in flooding should stimulate their interest in taking up actions that would reduce flood related activities to the barest minimum.
3. There is need for proper enlightenment of the members of the affected communities against inappropriate dumping of refuse into drainage line to reduce flooding.
4. The government on her part should establish and encourage Local Planning Authorities to engage communities and other stake holders of the need for planning land-use planning.
5. The State Emergency Management Agency and Local Emergency Management Agency should be set up for quick response to water related disasters.
6. There should be proper orientation of communities and government alike on the type and strength of

materials of the structures to erect on their soil to reduce the impact of flooding on the buildings.

7. The government at the Local and State levels should be encourage to build emergency shelters on higher grounds to accommodate affected people in times of flood related disaster.

8. Disaster risk reduction mechanism should be established like: early warning signals, direction and movement pattern during disaster.

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