SOCIO - ECONOMIC IMPACT OF FLOOD IN AN URBAN ENVIRONMENT
(A CASE STUDY OF BARNAWA - KADUNA)

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CERTIFICATION

This dissertation entitled "Socio-Economic Impact of Flood in an Urban Environment: A Case Study of Barnawa Kaduna. By Yahya Saleh Ibrahim, meets the regulation governing the award of the Post Graduate Diploma of the Federal University of Technology Minna.

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DEDICATION

This thesis is dedicated to my late father Mallam Ibrahim Musa, Mother Hajiya Adama Suleiman and my late elder Brother Saleh Dan'azumi Ibrahim who took me to Primary School, and later sponsored me up to University. And to all "NEPU" struggling members against oppression in Nigeria. May Allah reward all of you with Jannah Firdausiya Amin. "Nigeria Daya take amma kowa yasan gidan ubanshi" (Aminu Kano, 1979).

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ABSTRACT

Flood causes havoc and serious damages to the environment and people, particularly in a densely populated areas like an urban city environment. Therefore the study titled, "Socio - economic impact of flood in an urban environment", is specifically geared towards studying the consequences of flood to the people of Barnawa in Kaduna. And to be specific the social and economic consequences in Nature. During most of the flood disasters lives and properties worth millions of naira were lost, and most social infrastructures were destroyed, great number of diseases were spread to the affected environment. Therefore, the study intend to diagonised these consequences, highlight the remote and immediate environmental causes of flood in an urban city centres. The research intend to provide possible solutions/recommendations to help avoid future frequent occurrence of the menaces in out urban environment or to a larger degree reduces its magnititude.

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CHAPTER ONE

1:0 INTRODUCTION

Flood is defined as an over flour from a river or other body of water. Flood is among the most dramatic form of interaction between man and his environment, and it emphasis the limitation of man in his attempt to control the sheer force of nature.

The occurrence and destructive effect of flood are a common phenomenon in the tropical climate, thus every part of the arid and semi arid regions experience some degree of flooding hazards the impacts and economic effects of which vary according to local topography of the soil and environmental differences.

When they occur, whether in developed or developing world they are always associated with heavy/loss of life and property, hardship, diseases and at times famine although man has been responding to flood, the phenomenon remains one of the least understood by hydrologist (including fluvial geomorphologist), planning engineers and politicians alike. This is even more so in humid tropical regions where flood occur most commonly and with greatest intensity and since the project site lies in this region, it experiences the something.

The reasons for the frequency and magnitude of floods in humid tropical regions are connected with the basic causes. The most important cause is rainfall. Excessive heavy and prolonged rainfall that occurs in several humid tropical regions constitute the most universal cause.

Other floods are associated with coastal storm surges, land slides and dam failure.

This work is therefore, intended to look more critically into the problems and suggest various control measures and structures to check the resulting effects on people of the area, and also the need for an immediate approach to combat the flood problems in the area before the situation gets out of control..

As an approach to the problems, investigations shall be made into the nature of the soils in the area, the socio-economic life of the people, the hydro-meteorological data and topographical features of the area. Recommendations and control measures to the problems are going to be made using the result of such investigations as parameter of considerations.

1:1 LOCATION AND EXTENT.

The Barnawa River is located at the outskirt of Kaduna town along Barnawa, Kaduna South Local Government. It got its source from the River Kaduna and flows to the eastern part of Kaduna South. It is approximately on latitude 10.3° North and longitude 7.20° east.

1:2 CLIMATE.

The climate is marked by two distinct season, the wet and dry seasons which are principally governed by the movement of the intertropical convergence zone (ITCZ) that is the convergence between the drier subtropical anticyclones and the moist equatorial low pressure cells (Yaro, 1986).

1:3 RAINFALL AND TEMPERATURE.

Rainfall:- in Kaduna in general is monsoonal, concentrated mainly in the northern hemisphere summer when the (ITCZ) moves Northwards. The distribution of rain such that the average annual rainfall decreases fairly uniformly from 1600 - 262mm to the Southern and Northern edge of the state.

Kaduna metropolis remains within the rain-belt throughout the month of June to August and does not experience entermoonsional (Little dry season) of the Southern Nigeria. (Danladi 1985)

Temperature:-

The mean minimum temperature in the area is 10°C. The hottest months of the year are March to April and coolest month are December and January, when the cold dry North - East harmattan winds blows across the land.

Air temperature varies throughout the year, averaging 21 - 26°C in most months. Some what higher temperature averaging 27 - 31°C occur between March and May as a result of rising isolation. However, these becomes moderate when (ITCZ) moves North to its summer position..

1:4 GEOLOGY AND GEOMORPHOLOGY OF THE SURROUNDINGS OF PROJECT AREA.

The geology of Kaduna State shows that it consists mainly of pre-Cambrian rocks otherwise known as basement complex rocks, which consists of miguatities, gneiss, schists, pyrites and lenses of quartrites.. These are intruded by late pre-Cambrian early Paleozoic

igneans rocks consisting mainly of granites. These are often referred to as the order granites and these together with the former units constitutes the Nigeria crystalline Basement complex..

The geomorphology of the area consists of gently undulating land ranging between 6C° and 671m above the mean sea level and extensive laterite table lands are common topographical features found in this area. These make out crop scares, the peneplain which are flat-topped erosion remnants which are often capped by layers of undulated laterites.

1:5 AIMS AND OBJECTIVES.

The aim of study is to this carry out a feasibility study on the causes of flooding by the Barnawa River. Its probable hazards and how to prevent such occurrences from the town and the surrounding agricultural land.

Some of the objective of this project are;

I. Understanding the natural and man made (anthropogenic) reasons of flooding in the project area.

II. Educating the people of the area concern on the hazard or effect, control emergency relief and possible forecast and preparation against it occurrence.

III. Finally, we shall prepare some possible solutions and recommendations for further studies.

Statement of Problems

Flood which is perenial to most of the areas located near the river banks, constitute one of the major problem to the growth and development of agricultural and socio-economic infrastructures in those areas, such as Barnawa in Kaduna main town. The recession of each

flooding is often accompanied by soil erosion and sometimes river bank collapsing, diseases and other inimical consequences of the flood to the surrounding area and its inhabitants.

Justification/scope and Limitation.

This project was focused on the provision of framework on which the socio-economic consequences of flood can be estimated. Scarcity of land and other urban environmental factors have made it necessary for the inhabitant of earth to use the flood prone areas for construction and agricultural activities by man. These type of interferences results in floods which led to the flood plains to become filled up with water resulting in the destruction of building, farmland, roads other infrastructures; and the socio-economic condition of the inhabitant. This study will therefore focus on the socio-economic consequences of the inhabited area of a river so as to serve as a basis in the planning of flood prove areas.

FIG. 1:1 Showing the area of the river Barnawa in Kaduna Main Town. Popularity known as Kaduna South River.

CHAPTER TWO.

LITERATURE REVIEW.

2:0 INTRODUCTION.

The term "flood" does not have a Universally accepted definition. This is because it is viewed differently by different people. For example, floods have been described as a situation when a place is filled or covered with water, an overflow; a situation when a place is covered or spread into completely; the covering with water of a place that is usually dry (Yunus L., 1990). All these positions revealed the in-adequacy in the accommodation of excess water discharge. Therefore, floods can be seen as a situation when a river channel is inadequate to accommodate discharge from its catchment (Monk House and Small, 1978). However, it can also be regarded as unusually high rate of water discharge which often lead to the inundation of land adjacent to the river. As a matter of fact a river is said to be in floods when it overflows both its natural and artificial banks (emphasis mine).

In contemporary time, flooding has become a common feature and part of life in Nigeria not only in the low-lying coastal areas such as Lagos, Port-Harcourt, Calabar, Warri, among others but also in the hinter land. Places like Ondo, Ilorin, Kano, Kaduna, Bauchi often experiences flood during heavy rainfall events. The rural areas are also not spared from this environmental hazard.

2:1 GENERAL CAUSES OF FLOOD.

Flood are most frequently related to climate. They are purely an environmental hazard of meteorological phenomena but very often induced by man's improper utilization or abuse of

the physical environment (Oviola, 1994, 1998).

Excessively heavy and prolonged rainfall is the commonest universal cause of floods (see Olaniran, 1983, McEwen, 1989 and Babatolu 1997). Such rainfall when concentrated produces exceptional local floods. Examples are heavy rain on Exmore in August 1952, orders catchment in Czech Republic and Poland in July 1997, Ogunpa in Ibadan in 1980 and 1988, Aba at Ilorin in 1976, Lisaluwa and arogo in Ondo 1988 and 1995.. For instant, a high rainfall intensity of 71.4mm was recorded in Ibadan in 1978, a greater amount of 274.1 was later recorded in 1980 causing what was regarded as worst flood in Ibadan. This was repeated in the same city in 1988. A similar high record were recorded in Ondo: 301.4mm in 1976, 134.1 in 1984, 246.3mm in 1985 and 135.8mm in 1995 (Babatolu, 1997).

Even when rainfall is not prolonged or heavy the frequency of fall may lead to floods. This has been experience in Ondo in 1995 and Ilorin in 1976, 1988 and 1995.

Very often, exceptional rainfall enlarges lakes, flood adjacent law lying lands e.g lake eyre in Australia in 1950 - 1951. But, in low lying coastal areas, when high tides coincide with a storm surge, floods will result. These couses the pilling up of seawater which are carried inland by waves and high wind speed.. This situation was experienced in the coast lands of the Netherlands in January, 1953, in Lagos bar beach in April, 1984 and twice in February, 1995. Again, the seismic waves generated by earthquake also couse floods along the coasts. Also, the callapsed of dams and other water control measures may couse floods. Cases of such floods have been reported at Dolgurog, wales in 1952, frejus in France in 1959, Kano in Nigeria in 1988. Indeed, such dam failures are serious disasters, to both humanities and properties.

Apart from torrential rain, rapid thawing of ice may cause rivers to rise considerably and

flood over allurial plain which forms the greater part of a river valley.

In addition, some socio-economic and anthropogenic activities, have been found to induce or intensity flood condition in our environment (see Oriola, 1994, 1998 and Babatolu, 1997). Among these is urban land use. A larger proportion of the urban environment, particularly the basins of streams traversing cities, is how made impervious by the roof of buildings paved surroundings and tarring of roads.

The build up areas have increased in most cities and characterized by the features stated above. In Ibadan Nigeria, the built up area increased from 9.5% in 1949 to 28.4% in 1965. In Ilorin it was 20.9% in 1981 compared with 9.2% of 1961. Similarly 28.6% was recorded in 1989 against 13.3% record for Ondo in 1975 (Oriola, 1991). The study area is not an exception to this phenomenal over growth of structures to the stream/rivering areas, which serve as an impediment to smooth passage of water leading to flood erosion in the area, leading to the collapsing of bridges and some structures in the area. The result of these increases in built up areas is greater and earlier concentration of storm water in river and stream channels and a greater high stream flow than would occur under more natural conditions. Building and farming activities within the basin also increase sediment yield. This is usually from the exposed slopes bordering the stream and deposited on valley floors reducing the size of the channels.

The major effect of urbanization is the increase in the volume of stream flows which is characterised by decreased base flows and marked increase in peak flow. Another characteristics of urban environment particularly in Nigeria is poor drainage system along the roads or lack of proper maintenance of the existing one's or their narrow and insufficient construction. This also induces flood even at the instance of a little down poor of short

duration.

Finally, flood may result from high intensity rainfall, that intensity rainfall, that run-off rates supercede the infiltration rate of the soil. It may also be due to structural failure, such as dams.

2:2 CAUSES OF FLOOD IN THE STUDY AREA

The several causes of water inundation in the study area includes the following:-

(1) Spilling over of the river banks, resulting in flooding due to torrential rainfall. This type of flooding is climatological in nature, derived from excess precipitation over natural infiltration.

Intense heavy runs accounts for the majority of the floods that occur in the tropical regions and since the project site lies in this region, it can also be one of the causes of flood in the area.

(2) Geological State (nature) of the rock i.e basement complex rock of Kaduna do not readily absorbed rainfall, which make the greater proportion of the rain that falls to be lost as run-off (which or the principal cause of flooding) that raise the level of water of the river and consequently spill over to the surrounding farm lands and houses along its stretch.

Most of the early rains run-off the surface without infiltration into soil and causes erosion.

(3) The rising of the river bed is caused by the dumping of solid waste such as animal bones

from abbatour, domestic waste, industrial waste and crops residues by farmers and deposition of salt (sediments), brought about by rain water as a result of soil erosion and flow with river water.

In the dry season, when the velocity of flow is low (reduced) these materially deposited raises the water bed level and reduces the discharge capacity of the river. In the wet season, the early torrential rain causes flooding.

(4) Bank erosion; the tilling of the land near the banks, removal of vegetation by local people, overgrazing of the hilly water shed lead to run-off rate and consequently lead to the erosion of the bank.

Lastly, the causes of flooding condition observed during the raining season are due to seasonal rising of ground water table and the existence of clay pans and layers that have excessive fragments of iron concretions at various depths within the profiles of most of the soil identified. Deforestation and denudation which is the removal of forest from the catchment, increases the rate of run-off and aids in creating flood conditions.

2:3 FLOOD TYPES.

A better understanding of floods is perhaps through the types. Six different types of bloods have been identified as follows;

(1) Flash Floods - These are as a result of high intensity rain associated with conventional rainfall. They are of short duration, lasting for some minutes, and covering small area. Thus, the appearance are sudden. Their occurrences and distribution are ubiquitous, e.g most streets in Nigerian cities (Ibadan, Ilorin, Benin, Aba, Owerri, Oshogbo among

others) are flooded after an intensive rain. (Oriola, 1999)

(2) A single Event Flood - Single event floods are floods with a single high flow. Unlike flash floods, they have inter. duration. The Ibadan flood of 1980 was as a result of more than ten hours down pour. In some cases the rain may be for days. This type of flood is common in many parts of the world, for example Ibadan April, 1978 August 1980 and Ilorin October, 1976, Kano 1988.

(3) Multiple Event Floods - They are associated with cyclonic rainfall. They cover a large geographical area, produce a large volume of stream flow and extend over a period of several weeks or months, e.g the river catchments flood of July, 1997 in Czech., Poland, and Republic of Germany.

(4) Seasonal Flood - These are re-occurrence of multiple event flooding. The periods of high water often extend over several months. The flooded area always extends more than thousands of kilometers. Seasonal floods are often a combined effort of inflow of water from many tributaries. The heavy discharges of water during the raining season often results in floods mainly in September or October in the Niger Delta area in Nigeria and around July - August in some Northern states in Nigeria.

(5) Coastal Flood - Coastal Floods are associated with meteorological conditions which produced abnormally high sea level. They are known as storm surges, which occur at spring tides. When the wind speed is high, the sea pile up against the coastline and large - scale turbulence is generated, moving the wave up the shore above the height of the embankment wall. This type of flood has been reported at the Lagos bar beach in Nigeria, Gulf Coast of the United State and at the Bay of Bengal.

(6) Estuaries Floods - This type of flood occurs at the mouth of a river. It is a situation

when the high spring tides impede the seaward fresh water flow, which consequently exceed the channel storage capacity of the river. Similarly, there is conflict between river and seawater in delta areas which equally results in flooding. Thus is always the case in the Niger, Nile, and Mekong delta areas.

2:4 CAUSES OF RIVER BANK EROSION.

A bank of a river may fail due to a combination of the following causes:-

(1) Washing away the soil particles of the bank by current or wave of water.

(2) Sliding due to the increase of the slopes of the banks as a result of erosion

(3) Sloughing or sliding of slope when saturated with water, this is usually the case during floods of long duration.

(4) Sliding due to seepage of water flowing back into the river after the receding of flood and the internal shearing of strengths further decreased by the pressure of seepage flow.

E. Pepping in a sub-layer due to movement of ground water to the river which carried away sufficient material with it.

The way banks fail under (i) and (iv) may be said to be due to reduction of internal strength, and those under (v) is due to foundation failure.

2:5 EFFECTS OF FLOOD.

2:5 EFFECTS OF FLOOD.

Flood cause havoc and serious damages to the environment and people, particularly in populated areas. The damages range from destruction of properties, roads or infrastructures farm lands to displacement of persons and loss of human life. Bangladesh floods of 1970 claimed 300,000 lives. In 1980 when ogunpa stream in Ibadan, Nigeria flooded, 100 people died in the flood water, similarly in 1988 Kano flood claimed 56 lives. When river order flooded part of Czech Republic and Poland, more than 100 people died (Winter Jocoben, 1997).

The flood of 1980 at Ibadan rendered 50,000 people homeless and properties worth millions of naira was destroyed by flood water, similarly in 1988 Kano, over 40,000 people were rendered homeless, and another 2,000 people in Dekina, Borno State. Also at Lafia 1,000 people were left without a place of abode after the flood. In Kwara State over 10,000 were rendered homeless in the floods that ravage Patigi, Kpada and Gbogbondogi Local Government Areas in May, 1997.

Damages to buildings and properties by flood water are terrible and too numerous to estimate. For instance, the floods of Lagos Nigeria in 1984 destroyed virtually all the stalls constructed at the Lagos bar beach. This re-occured in 1988 and 1995. These last two flood events threatened the entire Victoria Island. Many commercial houses and shops were flooded and properties destroyed. Indiegore flood of 1981 submerged 40 houses in Aba Imo State. River over flood of 1997 cleared 1,200 towns villages in Czech Republic and Poland. (Fabiyi 2000)

Extension damages are often done to agricultural products and lands by floods. In Niger Delta, well over 650,000 hectres of good agricultural land are flooded annually for not less than two months. The over flood of 1997 damaged some 70,000 hectres of arable land and the entire

Ziltendorf valley in Germany was inundated with water many meters high. River Tarabe, donga, Sontan and Gongola river was often over flow thier banks inundating the lowlands and the fertile flood plains along their overseas. The inhabitants of these areas are forced to abandon their farmlands and entire village when flood comes. Similarly, in the Northwestern part of Nigeria, river Sokoto and Rima and their tributaries very often, flood more than 440,000 hectres of arable land annually. Also, in Kwara State, Tsonga and Lafiagi and some other villages bordering the Niger are always in floods and more than 20,000 hectres of fertile flood places and fadama are usually affected by flood. (Fabiyi 2000)

In some cases, flooding activities of streams may be of advantage to the people. This is a situation when the flood water brings sediments, which are subsequently deposited on the flood plain and enriched the soil. Many people, particularly in the rural areas, take advantage of such floods and cultivate the flood plain. This land is known as Fadama in the Northern part of Nigeria. It is important to note that ancient agricultural technique make use of flood water. For example, Basin Irrigation was introduced into the middle East about 6,000 years ago (Adejuwon, 1979). This involves tripping flood water by building low dykes for agricultural purposes. This land management technique has been practice in arid and semi-arid regions of Africa and Asia for more than 5000 years.

2:6 EFFECTS OF FLOOD IN THE STUDY AREA.

As already discussed flood menace has caused very serious and irreparable havocs to our environment. Such havocs includes the loss of lives, destruction of properties and the degrodation of agricultural lands.

The topographical condition of the area i.e with it's steep slops coupled with low vegetal cover, and the poor management practices on the land; it is basically subjected to flooding effect, when ever rain storm exceed the rates of infiltration.

All other factors, such as the relative humidity and hydro-meteorological information form the basic of the amount and duration of rain storm which is the main cause of flood in our environment.

With knowledge of the causes of flood as earlier discussed above with reference to Barnawa river, one may conclude that, the unusual flood occurrence that result from heavy rainfall may cause a great hazard to human settlement in Barnawa Town because of its position on the down stream.

Such hazards includes:-

- Loss of human lives.
- Loss of Livestock.
- Causes of gullies to the entire surrounding.
- Destruction of roads
- Loss of crops grown and
- Inundation of agricultural lands accompanied by erosion hazard in the affected areas.

The above factors are classified under direct effects of flood to human settlement.

Its also include:-

- Corrosion of farm equipment.

- Destruction of stored agricultural materials like seeds, fertilizer and probable feeds for animals.

On the other hand, damages cause by indirect effects are generally associated with health and general welfare.

2:7 COMBATING FLOOD MENACE.

Two feasible measures for combating flood menace in man's environment are flood adjustment and flood control. The thing one should note is that absolute control of floods is impossible because flood is a natural phenomena, rather partial control in form of protection is achievable.

Flood adjustment involves any or combination of the following, accepting the loss, public relief, emergency action, flood proving, structural changes and urban use practices.

The most common adjustment to flood is to accept the loss arising from its occurrence. This is particularly the case when and where the people are poor and helpless. Such people are either not aware of any alternative course of action or too poor to do anything.

Immediately after any flood disaster, the first thing is to establish a "Relief Fund" to assists the flood victims. This may be the action of Government, valuntary or non Governmental organisation (NGO), e.g Red Cross organisation. Friends, relations and members of religious groups, often offer relief assistance to victims. The Federal and state Governments, Government of friendly nations, private companies and various individuals often donate to the fund.

The relief activities involve, receipt of food items, clothing materials, and money from various donors and distribute them to the victims and rehabilitate them. For example,

Germany's bank for reconstruction made available to the flood victims of July 1997 a credit package worth 200 million Dutch marks. Again the German government assisted the victims of the flood by providing a comprehensive programme worth some 500 million Dutch marks. Some individuals claimed up to 2000 Dutch marks per household immediately. (Kaduna State Relief Agency 1997)

The justification for the various forms of relief is that they help to ease the immediate distress and aid initial rehabilitation of the victims. Though it is a useful adjustment to floods, but sometimes it becomes a right rather than a charitable gift. This is because incentive to avoid future losses is removed and persistent occupation of the flood plain is encouraged (Sewel 1969).

Emergency Action.

This is the best option for floods that last for many hours or days, especially for the cases of single and multiple events floods. This action involves removal of people and properties from the area subject to flooding. People remove their properties and evacucite the area anytime they observe that flood water is rising. In some cases the local authority or government undertakes the evacuation since efforts are to the impact of floods, flood fighting steps include building of temporary dykes along the rivers (Fuvon, 1963) or outside a building, moving goods and equipment to height unreachable to flood water e.g upper floors of build and protecting equipment with plastic or waterproof sheets or grease. In some cases people or business organizations reschedule their operations. They give their workers holidays and suspend their opration till after the floods.

Emergency action can substantially reduce flood losses, but such actions may encourage

persistant human occupation of such disaster prone areas.

Structural Changes.

This is another measure at reducing potential flood losses. Walls are constructed with impervious materials. The building may be underpinned, while windows and other opeinings at low levels are closed in some cases buildings are erected on hills. There are many instances when people have to sand fills the flood prone areas before building is erected. It is a common measure in Lagos, Nigeria where factories and stalls have been built on fills. Again, federal government of Nigeria at any threat of floods embarks on sand filling the land bordering the coast.

These measures are workable when the duration of floods is short and where the velocity is low and the depth of flooding is less than 1 meter. Modifications to existing building are possible but in most cases they are incorporated into the structures. Land fills often help in reducing the impact of flooding. This is most effective when undertaking before any construction particularly in industrial or urban environment. At any rate structural changes and landfill are probably the most widespread measure embarked upon by individuals in the third world countries. However, governments impact in this direction is seen in some areas. These measures like the previous once easily encourage persisitant human occupation of flood plains.

Another flood combating measure are;

Flood Proofing:-

Flood Proofing:-

This involves both emergency action and structural change. It is a measure act that help at repealing flood water. For example, closure of low level windows or sunp pumps and elevated outlets pipes to remove water which sepps into basements and interiors of buildings. Houses are built on stilts (Sceaffer cited in Sewel, 1969). This method like other adjustive action, to flood tends to forster persistent human occupation of flood plains.

Land Use Regulations:-

This is a measure involving allocating the flood prone areas to uses that will gain what is lost in floods, for example, agriculture and recreation activities. This is because potential losses tend to vary with the type of use. High losses are expected on land used for industrial purposes and very low on land used for recreation or agriculture (Sewel, 1969). Again, it should be realized that flood losses constitute a cost and it must be considered when calculating the net returns from such land.

A variety of means of regulating flood plain occupation according to Murphy (1958) are statutes, ordinances, divisional regulations and decreas (in military governance) government purchases of property and subsidized relocation. It is the government's responsibility to formulate and enforce the regulations. One good thing about land use regulation is that it encourges careful weighing of the costs against the benefits of using the flood plain and offers a valuable complement to other type of adjustment to flood.

2:8 PROTECTION AGAINST FLOOD IN FRANCE.

Damaged caused by floods is always very severe and can have important economic and financial consequences. This has led the public Authorities to organize an automatic system for

flood forecasting, assistance and rescue in case of catastrophes and as a precaution to set up systems for flood control and permanent protection.

(1) **Forecast:-** is based on a modern data collection system with real time tele-transmission to flood warning centres, using various mathematical models for competent forecasting.

(2) The Flood Warning Centre:- intervenes in the case of real risk of flooding. It is responsible for informing the populations and public services involved.

(3) Prevention:- of high flows and flooding depends on the establishing of risk exposure plans, urban planing limiting the development of threatened zones, coordination of protective devices and it necessary, the construction of specific installations or adapting existing ones, dams, dykes, spillways, periodical dredging for flood mitigation and protection against high flows.

Several rivers in France have been equipped with complete systems. The Loire, the Rhone, the seine and also tributaries such as the Ardeche, the Aude, etc.

(4) Replenishing Low Water Flows:- Drought or important water withdrawal at certain times of the year cause a decrease in flow rates, sometimes dangerous for natural media and aquatic fauna as well as for health, and can impede all down stream water uses.

Thus, the state endowed itself with sufficient legal clauses in order to regulate water withdrawals and to forsee the minimal water release necessary to replenish low water flows. They are associated with authorizations or operating concessions.

If inter-seasonal flow rates can be regulated by building dam - reservoirs, the utilization of gentle techniques, based on the natural functioning of the environment, and its capacity for strong, surplus rainfall and releasing it during the dry season, has led to the

implementation of other solutions; such as drawing ecological profiles of brooks or small streams, restoring ponds, reed-beds, peat bogs and marshland, protecting wellands, plantation and reforestation of banks, use of appropriate agricultural techniques.

(5) Agricultural and Rural Water:- In some regions of sourthern France, Regional Development companies (S.A.R) were entrusted with the overall mission of controlling water, aiming at improving and ensuring water supply. They are, the Gascogne Development Company in south pyrenees, the hower Rhone languedoc company in lanue doc - Ronssillon and the canal of provence company for the Riviera Coastline.

The developments thus implemented Creservoirs, canals, galleries) by Regional Development Companies made it possible to irrigate wide areas of a collective nature, 110,000ha in the south pyrenees, 130,000ha in languedoc - Raussillon, 68,000ha in provence, which should be added to numerous individual irrigation systems. The management of collective networks is mainly carried out by SARS by way of concessions. Permanent teams, using special means of communication and tele-monitoring carry out a reliabel non stop monitoring and intervene when necessary.

Some SARS complete their actions by giving advice to farmers regarding a rational use of water, by conducting agronomic tests in an experimental way, and by developing technico-economic data banks related to irrigation or manging laboratories for analysis of soil or water.

These irrigation systems are always integrated into sanitation or drainage operations as well as land reclamation.

Further to their mere water activities some SAR'S are involved in diverse economic developments in rural areas rural tourism creation of enterprises, support.

2:9 EROSION CONTROL AND TORRENT REGULATION IN FRANCE.

Introduction - From time immemorial German Societies have been trying to protect themselves against damaging natural phenomena such as erosion, torrential water flows, floods, drought etc. Control of water causes, from their mouth, has led to the implementation of large development programmes.

Erosion Control and Torrent Regulation:-

Owing to their relief and climatic conditions, mountains lands are particularly exposed to risks of erosion caused by frost, melting snow and mostly by rainfalls that are sometimes torrential.

Special prevention and rehabilitation techniques are used in the high mountain of river basins. They are numerous and are aimed at stabilizing the ground and avoiding devastating high flows of torrents amongst the most operational are the following;

(1) Reforestation of Eroded Areas by Means of Settling Population planted after in vitro multiplication perfected by the national rural engineering Centre for Agriculture water and Foresting (CEMAGREF).

2 Plantation of trees and maintenance of wooded areas by means of a dynamic planting programme (work of National Office for forestry).

3 Prevention Systems; Self-stabilization dams, sediment shores, rock protection shields, avalanche barriers, wind breaks, protection against landslides, are subcontracted to the service for mountainous land reclamation (RTM) of the national office for Forestry.

4 Constructions and actions for the protection and management of watersheds dykes, canals, dams, weirs, drainage of slopes, reforestation.

However, the use of these techniques could not be efficient or even possible without an adapted legislation, the main texts of which are the mountain, low, forestry laws, and those covering civil defence and the establishing of maps of plans for hazard prone areas.

2:10 FLOOD CONTROL.

Two major approaches to flood control have been identified by Hoyt and langlein (1955). These are flood abatement and flood protection.

(1) Flood Abatement:-

These are efforts geared to the management of the watershed or river catchment. They are efforts that prevent flood hazards rather than curing it. Such efforts include, modification of cropping practices, revegitation (afforestation), riverbank stabilization and urban land use practices. All these measures are important because actions have to be taken at the upstream, the severity of stream flow in flood condition is greatly reduced.

Afforestation performs three main roles;

(1) The forest stabilized soils, consequently minimizing erosion and down stream sedimentation, which could intensify the flood condition

(2) The forest provides additional water storage by intercepting part of the rainwater. It also dries out the underlying soil through evapotranspiration.

(3) The forest maintains high infiltration rates, i.e it allows a good proportion of the falling rain to sink into the ground instead of assisting in rapid high stream flow.

Terracing, contour ploughing, zero tillage no bush burning are agricultural practices which could be used for flood erosion abactment. Such practices reduce over land flow and improve infiltration. However, these practices are only effective on small floods from streams.

Laws are expected to effectively guide the urban land use practices for example; Town Planning laws made it mandatory to devote less space to low infiltration surfaces and more to high infiltration surfaces. Also, urban developments are to be kept out of slopes greater than in degrees. A set back to streams for any structure is about 20m in low density residential areas and not less than 30m in high density areas. But these laws have not been strictly adhered to be enforced because of the social, cultural, economic and political pressures on the officers of the enforcement agency.

2:11 FLOOD PROTECTION.

This is mainly concerned about the river or stream channel. The purpose is to control the flood and minimize the damage it causes by regulating its flow or diverting it away from damageable property. The measures involve construction of flood walls, dykes, dams, and reservoirs as we rightly say in the other section of this chapter and channel improvement and dredging.

One of the major purpose of river basin projects is flood control. Examples are the Tennessee Valley Authority Scheme, in the United States of America. The eleven river basin authorities in Nigeria were also charged with this responsibility particularly in the amendment Act of 1979 where afforestation was specifically listed as part of their functions.

2:12 PAST AND PRESENT FLOOD CONTROL MEASURES.

To combat a flood problem, the following information will help in selecting an economically viable programme of combating floods.

(1) The extend and location of areas liable to floods.

(2) The physical and socio-economic characteristics of these areas.

(3) Previous flood events especially flood levels and discharges.

(4) Previous actual flood damage.

The measures of controlling and protecting flood includes:-

1 Construction of dikes which confine the flood flows, this method of flood protection was developed by the Chinese along the yellow river and other inhabited areas

2 Provision of river training works and cut offs which increases the capacity of the channel to carry water

3 Provision of secondary channels (either natural or artificial) to divert excess water

4 Construction of storage reservoirs and detention basins to store large volumes of water during floods and release it when floods recedes

5 Use of soil conservation method which reduce soil erosion and there by control silt deposition in reservoirs and flood plains

6 Introduction of improved land use practices

7 By providing suitable drainage arrangement by installing pumping facilities which comes under drainage engineering.

2:13 SOIL CLASSIFICATION.

Generally soils are classified into fours (4) textural fractions. These include gravel, sand, silt and clay reactions. Infiltration rate is high on gravel soils.

2:13:1 Sand:-

These are non-corrosive well derated soil fractions. They have poor water retaining ability. It is divided into coarse, medium and fine according to the particle size.

2:13:2 Silt:-

These are fine particles degraded from massive rock from abrasive areas. The character of silt are intermediate between sand and clay. They contain less silica compare to sand.

CHAPTER THREE.

3:0 METHODOLOGY.

The methodology is first explained in a schematic style thus;

(1) Research Topic

(2) Statement of Problems

(3) Aims and Objectives

(4) Data Collection

(5) Data Analysis FEED BACK

(6) Decision Making

(7) Data Evaluation

(8) Implementation

(9) Monitoring

3:1 DATA SOURCE .

All data contained in this project are acquired through verbal interviews and witnessed experiences and the work of past researchers on related topic and Questionnaires.

3:2 METHOD OF DATA COLLECTION AND PRESENTATION.

The collection of data in this project was through verbal interviews questionnaires and reconnaissance survey carried out by me, and some experience, being gathered by me as a citizen of the state.

3:3 DATA COLLECTION TECHNIQUES.

To carry out this work, data required was grouped into primary, and secondary data and they are as follows;

(1) Primary Data.

Which is the first hand information collected from the inhabitants of the area and observations being carried out by me.

(2) Secondary Data

This constituted information from the past works of other researchers on related topics, textbooks, journals, write - ups from libraries.

This secondary data supplied us with the materials for literature reviews.

CHAPTER FOUR.

4:0 ANALYSIS AND DISCUSSION OF DATA.

4:1 FLOOD EXPLAINED.

Some floods are of natural process that results from rainfall, and man is unable to control the basic atmospheric processes which produced most floods.

The implementation of any flood protection project is the result of various pressures. The flood plains adopted by engineers to adjust to the hazards and to achieve one or more goals, t is this goals that helps to determine the method of control measure to be selected.

The goals include:-

. To reduce flooding

. To reduce damages

. To save lives

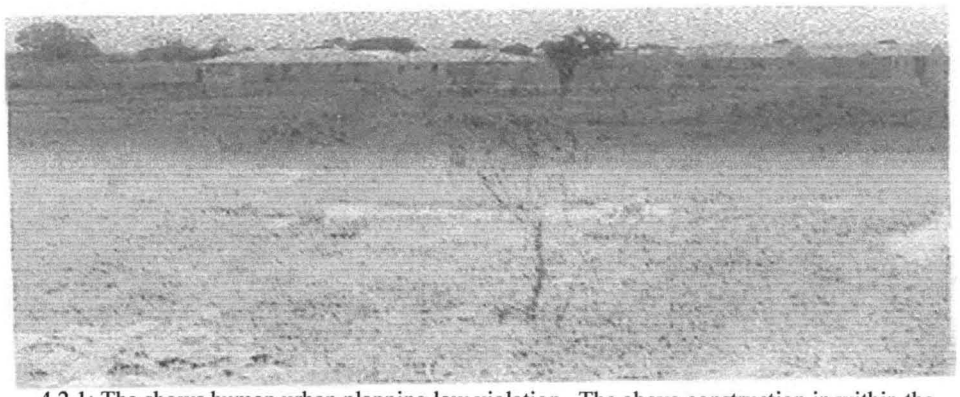
To save properties.

It is believed that total eradication of floods is impossible, so, man commonly minimise consequences of such events as they occur to serve one purpose or the other.

The subceptivity of soils to flooding is influenced by the factors that affects infiltration s that is permeability and the water retention capacity.

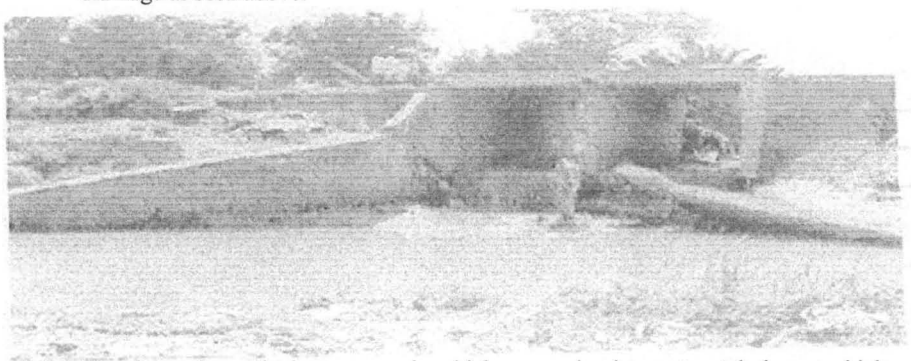
CAUSES AND EFFECTS OF FLOOD

Flood menace has caused very serious and unreparable havoc to our environment. Most e causes of flood in urban cities are due to the activity of man and to some degree from the ral point of view. Below are pictures that shows the negative activity of man that help in avating flood in urban cities as follows:-



4.2.1: The shows human urban planning law violation. The above construction in within the prohibited area of building construction within the banks of the river.

4.2.2: The above shows government too violating the urban planning laws, and this gave farmers the chance to till their ridges for farming. This led to total blockage of the drainage as seen above.



4.2.3: The above shows the hungry way in which we carelessly construct drainage, which lead to its subsequent collapsing and blocking the natural water ways, or inhibiting the smooth flow of water leading to flood and erosion in the urban city centres or towns

4.2.4: This is as a result of the above poor construction of drainage which led to making this area susceptible to erosion and the menace of land degradation. This is the consequences of lack of E.I.A. (I.s. environment impact assessment.

4.2.5: This is second side of 4.2.2 which shows the presence of water in the tilled ridges and buildings around the area

4.2.6: This shows, construction, farming, overgrazing and deforestation of the river bank area of Kaduna River in Kaduna. This areas will be first hit whenever a flood disaster occur around this are. And increase water run off.

4.2.7: This is a natural water channel leading to the Barnawa river, but around the area of the channel of refuse dump directly blocking the water way, which make the area susceptible to flooding during raining season

4.2.8: The same thing applied to this figure that is from another angle of the same spot above.

It has been replaced

4:2:7 This is a natural water channel leading to the Barnawa river, but around the area of the channel or refuse dump directly blocking the water way, which make the area susceptible to flooding during raining season.

4:2:8 The same thing applied to this figure this is from another angle of the same spot above.

4:3 ANALYSIS.

This section is based on the information recorded from the sets of questionnaire distributed to both inhabitant of the study area and those residing in the urban city of Kaduna or Kaduna metropolitan town in general. Other method as said earlier includes visits, documentary evidence and interview were employed to cross check the responses or acquire additional information pertinent to the study. The data collected which includes photographs, from the samples have been analysed and interpreted to support the aim of this research. This chapter is aptly titled analysis and presentation of data.

4:4 PRESENTATION OF DATA.

The questionnaire were categorised according to personal, general, and specific. While personal and general are meant for all resident of Kaduna town, specific meant for those in the study area. About 200 questionnaires were distributed in all. And the breakdown is as follows:-

4:5 QUESTIONNAIRE RESPONSE (PERSONAL DATA).

The questionnaires were categorised into four level of respondent i.e public servant, business man/woman, student and others as follows Kaduna Polytechnic staff and students, general public and the members of research area i.e Barnawa.

UNITS	NUMBER OF QUESTIONNAIRES SEND	NUMBER OF QUESTIONNAIRES RETURN
Public Servant Polytechnic Staff Student (KPT)	50	50
Business	30	30
Man/Woman	20	20
Other General Public	100	70
TOTAL	**200**	**170**

From the above table on hundred and seventy questionnaires were returned for analysis representing eighty five percent (85%) of the whole questions.

In the questionnaire, question 1 - 9 are based on the personal date of the respondent. And they respond according to their age categorisation as follows:-

AGE CATEGORY	NO. OF RESPONDENT	PERCENTAGE
25 Years & Below	30	17.6%
26 - 40 Years	35	20.6%
41 - 45 Years	65	38.2%
56 Years & Above	40	23.5%
TOTAL	**170**	**99.9%**

Out of the initial total of 200 questionnaires circulated for people to respond, only 170 were returned for analysis. These number form 85% over 100. Even those 170 were retrieved with difficulty. Quite a number of the respondents either claimed that they had no time to fill them or that they had misplaced them. It was after exhausting all avenue to retrieve the remaining 30 that the researcher decided to analysed those that have been received as follows:-

4:6 ANALYSIS OF DATA (GENERAL).

4:6:1 What are causes of flood in an urban areas? And they responded as follows:-

CAUSES	RESPONDENTS	PERCENTAGE
Poor Drainage System	170 All Accepted	100%
Poor Refuse Dumping Habit	170 All Accepted	100%
Absence of Drainage/Poor Construction	40	24%
Heaving Rainfall	60	35%
Poor Town Planing	30	18%

A close look at the above table, shows that 100% of the respondents accepted the fact that in the urban towns poor drainage system and refuse dumping practices in most urban towns causes flood due to blockages of the water channels. And 24% of the respondents believed that absence of drainage or poor construction of the drainage causes flood in urban towns, while 35% believe that heavy rain storm is the major cause of urban flood. While 18% believed that most of floods in urban towns, were due to poor urban planing a violation of town planing laws as depicted in picture 4:2:1 and 4:2:2.

4:6:2 Are our drainage being effectively utilized!

RESPONSE	NO OF RESPONSE	PERCENTAGE
Yes	0	0%
No	170	100%
TOTAL	**170**	**100%**

In table 4:6:2 the respondent attested to the fact that our urban drainage were not utilized the way they are suppose to be used which make urban raveling areas susceptible to flood disaster due to dumping of refuse in culvert and water ways or channels, which will in the future lead to the blockage of the channels and water will out flow from the channel to an unwanted area.

4:6:3 Do you foresee our refuse administration as a factor to increasing flood in urban areas?

RESPONSE	NO OF RESPONDENTS	PERCENTAGE
Yes	113	66%
No	57	34%
TOTAL	**170**	**100%**

The above table represent the responses of those who believe that the way and manner both the government and the public take care of refuse in the urban towns help in increasing cases of flood.

This is true, looking at the percentage, while 66% believe that the above, contribute,

34% says No. that other factors apart from refuse dump administration increase the degree of flood in our urban towns.

4:6:4 What are the social, economic, medical and psychological consequences of flood in our environment?

The above has been discussed at the beginning of the chapter, all the same, most of the general consequences as obtained from the respondent, is that, there use to be widespread of diseases and increase in government spending on the affected citizens and properties are lost buildings and social infrastructures are destroyed. And this will lead to break down communication which will lead to confusion, leading to depression and other psychologically related traumatic conditions within the invaded environment.

4:6:5 How Frequent does flood occur in your area?

RESPONSES	NO OF RESPONDENT	PERCENTAGE
Occasionally	150	88%
Frequently	15	9%
Very Frequently	5	3%
TOTAL	**170**	**100**

The above table give the total summary of the responds on the degree of occurrence of flood in the various settlement in Kaduna metropolitan town, 88% of the respondent believe that flood use to occur occasionally, while 9% says is frequently happening during rainy season and

3% believe that it is very frequent, especially during heavy rainfall due to the nature of our urban drainage.

4:6:6 Can you offer suggestion on how to solve urban flood disasters, and on how to convert the poor urban use of drainages and public enlightenment policy?

The respondent believed that with the construction of good drainage, maintenance and enactment of laws on refuse dumping in the public places and the involvement of non governmental organisations (NGO's) in public enlightenment and teaching school children the need for a healthy environment, will help check, change and reduce the level of flood in our urban towns.

4:6:7 Is the relief given to the victims enough?

If Yes how and if No give suggestion.

RESPONSE	NO OF RESPONSE	PERCENTAGE
Yes No	0 170	0% 100%
TOTAL	**170**	**100%**

The above table shows the various responses of the members on the relief amount and the process of disbursement 100% believe that, the relief is not enough and the policy of disbursement is mischievous. Therefore door to door disbursement may solve the problem raised by the victims.

4:7 (SPECIFIC RESPONSES).

4:7:1 Can you account for the property lost lass during any of the flood event around Barnawa.

PROPERTIES	RESPONSES	RESPONDENTS	PERCENTAGE
Houses	15 million	40	24%
Farm lands/Products	10 million	50	29%
Valuables	3 million	70	41%
Other Unspecified	1 million	10	6%
TOTAL	**29 million**	**170**	**100%**

The above table shows the amount and percentage of property lost during a flood event in the area of study that is Barnawa in Kaduna metropolitan town. Houses worth 15 million were lost, farm lands/ farm product, valuables and other unspecified ones worth 14 million were lost. In all ₦29 million or more was lost to flood in that area.

4:7:2 How many lives were lost?

Majority of them believe and attest to the fact that there was no loss of life but properties were lost and some sustained injuries and suffered from different type of flood related disease or ailments.

Fig. 4.7.1: Show piechart rpresnting the percentages of the houses, farmlands/farm products, valuables and unspecified belongings lost during flood menace in Kaduna, Barnawa and Malali.

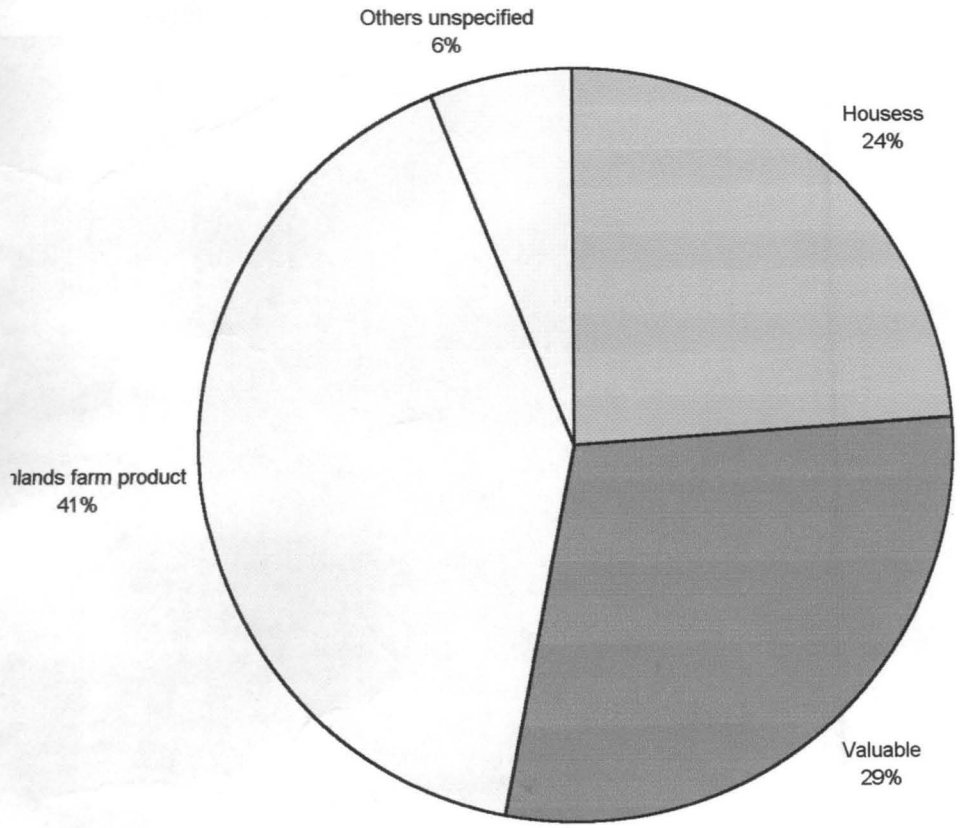


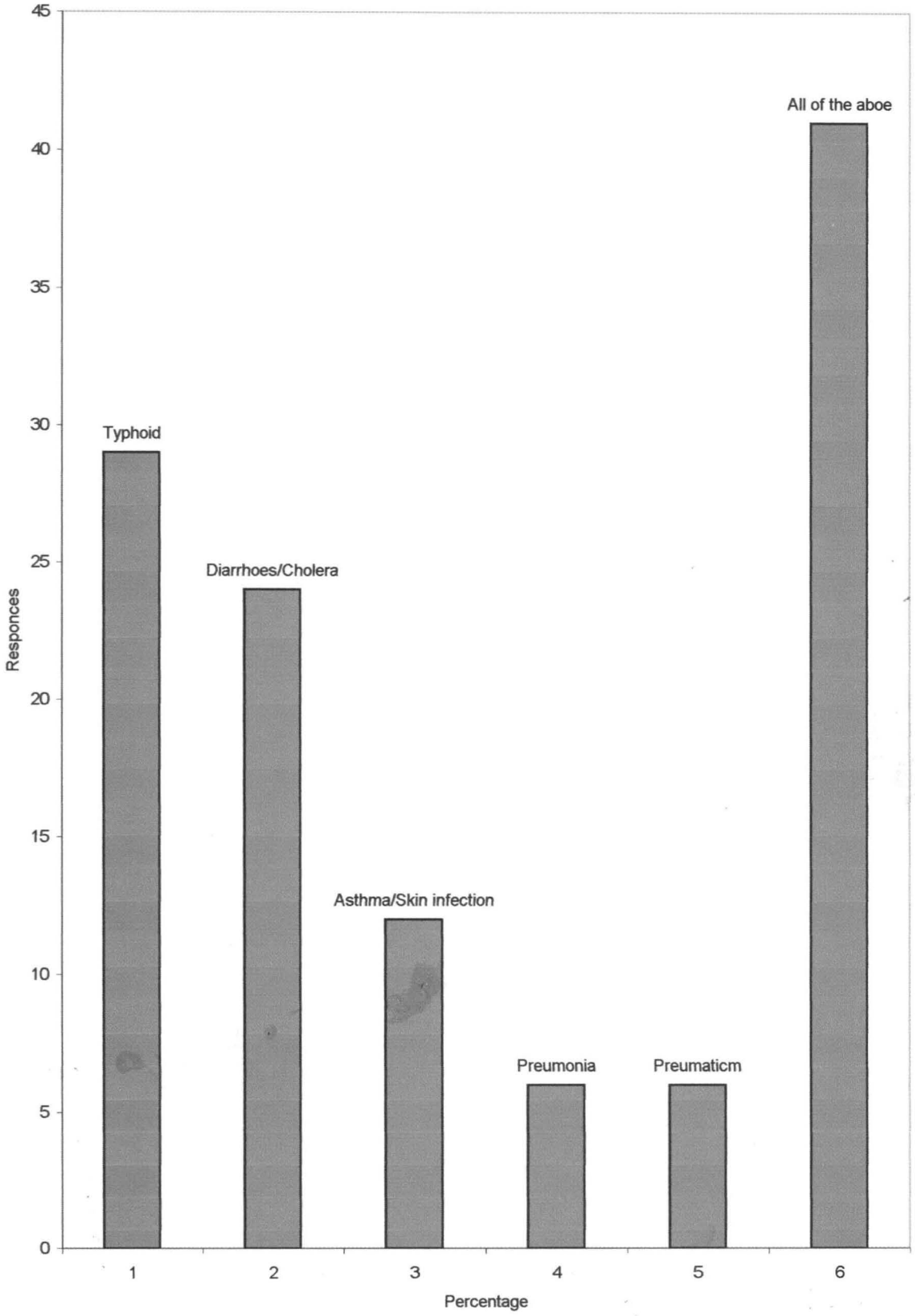
Fig. 4.7.1: Show a piechart representing the percentages of the houses, farmlands/farm products, valuables and unspecified belongings lost during flood menace in Kaduna, Barnawa and Malali.

4:7:3 Which of the following disease were prevalent during the flood event?

DISEASES	RESPONDENT	RESPONSES	PERCENTAGE
Typhoid	170	50	29%
Diarrhoea/Cholera	170	40	24%
Asthma/Skill Infection	170	20	12%
Pneumonia	170	10	6%
Rheumatism	170	10	6%
All of the Above	170	70	41%
TOTAL		**170**	**100%**

The above table shows the degree of responses by those affected during the flood event in the area of research. The various percentage show different diseases or inflictions during the event. This especially shows how typhoid fever was and is on the increase since from that period till today in Kaduna main town. This problem was aggravated by the flood event of malali in 1991 (Ministry of Health Kaduna Source).

Fig. 4.7.3: is a histogram representing the type of diesease prvalent during flood disaster in Kaduna



CHAPTER FIVE.

SUMMARY/CONCLUSION, RECOMMENDATION.

5.1 CONCLUSION/SUMMARY

It is not always the best to classify the disaster control measures into before during and after, or others like the preparedness, prevention and mitigation measures.

But these stages of action can often emerge at one point or the other. The basic idea here is to establish clear and systematic guidelines for action and make actual consideration in coping with flood disasters. The implementation of these proposals are expected to be carried out jointly by the Federal government in connection with States, Local Government and International bodies, where appropriate.

For its effective constitution a committee shall be formed encompassing all the specialist, that deal with environmental management. These should include all allied professionals. This committee aside environmental management, are expected to work out modalities to achieve its successful goals of;

(1) Forecasting flood disaster

(2) Educating the society (i.e public enlightenment)

(3) Reducing the intensity of the flood

(4) Evacuating the victims to save lives and property

(5) Disbursement of relief materials

(6) Advising the government.

If this is done the negative socio economic impact of flood will be reduced to the barest minimum.

5.2 RECOMMENDATION.

In most areas that are engulfed or embedded by flood, huge sum of money have been expended on different type of engineering measures to reduce flood destruction and to retain flood waters within specified bounds.

The first form of flood reduction is aimed at treatment of water shed sloppers, usually planting of negative cover so as to increase amount of water infiltration and to reduce the amount of overland flow of water or simply run-off.

This type of treatment together with construction of many small flood storage dams in the valley bottom may greatly reduce the flood crests and allow the discharge to pass into the main stream.

Under the second type of flood approach designed to protect the flood plain areas directly, two quite different theories can be practice or applied.

First, is the building of levees and dykes parallel to the river channel on both sides which can function to contain the over bank flow and prevent the inundation of the adjacent flood plains.

Programmes should be involved involving flood problems rather than making it solely a government responsibility as it is the case today in our society.

This can be achieved through public enlightenment over the consequences of floods and their prevention techniques. Other efforts like the provision of refuse dumps to prevent the

indiscriminate refuse disposal into water channels or ways, over grazing of land indiscriminate failing of trees, poor drainage construction, all are issues that need government and community attention.

Flood plains land use regulation should be formulated and enforce to ensure, that land should not be used for development capable of accelerating flooding.

Government should acquire flood plain land of atleast about 45 meters from the river or stream bank to avoid encroachment by developers, thus minimise flood loses.

Land users should be discouraged from engaging in activities that has potentials of increasing run-off through the enforcement of land use laws etc.

REFERENCES.

Carter J. R. and Green A. R., Flood in urban area US Geological Survey Professional Circular. Mcgraw Hills Inc. New York (1966) .

Environmental Net Work, Visioning Environment in 2010 A.D Vol. 3 NO. 1 January/August (1997).

H. I. Jumoh and I. P. Fabiyi, Contemporary Issues in Environmental Studies. Haytee Press Ilorin Nigeria (2000).

International Officer for Water, Running Dry; Why some of the World's Great Rivers no longer Reach the Sea. Vol. 8 No.3 May/June (1997).

Lee M. Thomas, Chemicals in your Community A guide to Emergency Planning and Community Right to know act. US Environmental Protection Agency (1988).

Moukhouse F. J. and Small J., Dictionary of the Natural Environment. Edward Arnold Ltd (1978).

Murphy F. C., Regulating Flood Plain Development. University of Chicago (1958).

Oriola E. O., Maris Socio Cultural Activities and Behaviour: The Implication on Nigerian Urban Environment. Journal of Issues in Social Science. Vol. No. 1 (1991).