THE IMPACT OF CLIMATE CHANGE ON THE PEOPLE OF NIGERIA: A CASE STUDY OF EDO STATE

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A PROJECT SUBMITTED TO THE DEPARTMENT OF HISTORY AND INTERNATIONAL STUDIES IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BARCHELOR OF ART (B.A) HONOURS DEGREE IN INTERNATIONAL STUDIES AND DIPLOMACY, UNIVERSITY OF BENIN, BENIN CITY.

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CERTIFICATION

I hereby certify that this research work was carried out by **EMMANUELLA ONOMEASIKE IKEKHUA** in the Department of History and International Studies, Faculty of Arts, University of Benin, Benin City under my supervision.

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DEDICATION

I specially dedicate this project to Almighty God, who made the success of this work a reality and for all the knowledge and understanding he gave me throughout my schooling in the University of Benin.

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My acknowledgement goes to Almighty God, the creator of heaven and earth, for he is the reason I made it this far, may his name be exalted.
To my project supervisor, Dr. Oghogho Oriakhi, I say thank you and I appreciate your patience and understanding throughout the period of my work. May God richly reward you.

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CHAPTER ONE

BACKGROUND TO THE STUDY

Introduction

Nigeria, as a developing nation is particularly sensitive to the effects of climate change. A large part of the economy of the country depends on natural resources, which are particularly vulnerable to climate change. When those resources are affected, communities are implicated.[1] Disease, loss of livelihoods and settlements can force entire communities into relocation or complete extinction and even refugee status. As critical as the effect of climate change is, it is not clear whether Nigerians are aware of what climate change is or its effects. Perhaps the biggest obstacle is the lack of awareness and knowledge.[2] this study examines the impact of of climate change on the people of Edo State, Nigeria.

In Benin City essential climatic elements particularly rainfall, temperature, humidity are neither incorporated into its complex environmental planning processes nor utilized in its continuous urban development activities. The dynamic nature and characteristics of the climate in the study area have not been assessed from authentic scientific perspectives. These integrated weaknesses, have given rise to serious challenges on the physical environment which relate to floods, infrastructural damages, traffic delays, prevalence of water-borne diseases, poor commercial activities, and residents protests over dissatisfaction with the government performance. Hence, adequate

and authentic climate information, no doubt, could be utilized for carrying out important urban activities which could be long-lasting and life-preserving.[3]

Benin City is selected for a close assessment owing to important reasons. It has recognized characteristics of an urban settlement which include social infrastructures, dense human populations, complex urban canopy layers, and numerous small-scale firms and industries with lucrative financial and commercial institutions.[4] It has one basic meteorological station which is currently operated by the Nigerian Meteorological Agency (NIMET) where recent and authentic climate data can be obtained for utilization in both theoretical studies and empirical planning activities. The city has experienced climatic changes because of increased urbanization over the years, and these include modifications in its dense vegetal and rich fauna species, geomorphic, atmospheric, thermal, and hydrological characteristics.[5]

Currently, the climate of Benin City has not been assessed adequately by environmentalist on beneficial scientific guidelines. Specifically, the essence of rainfall in the development process of the city has not been considered by the planning authorities. Hence, the urgent need to bridge this development vacuum based on permanent recognizance, incorporation and utilization of climatic elements.[6]

Benin City is located at latitude 06° 19 E with an average elevation of 77.8 m above sea-level. Benin City is a″ 00′to 5° 44 pre-colonial city, the capital of defunct Bendel State and the present day Edo State. Benin City is underlain by sedimentary formation of the Miocene-Pleistocene-age often referred to as the Benin formation.[7] The

city is located in the humid tropical rainforest belt of Nigeria with a population of 762,717 according to the 1991 national population census with a projected population of 1.3 million by 2010 at 2.9% growth rate. The rainy season in Benin begins in March/April and ends in October/November. Rainfalls are of high intensity and usually double maxima with a dry little spell in August usually referred to as 'August Break'.[8]

Aim and Objectives

The aim of the study is to examine the impact of climate change on the people of Edo State, Nigeria, while the objectives includes;

i. To examine the historical antecedence of climate change in Nigeria.
ii. To examine the nature of climate change in Edo State.
iii. To examine the effects of climate change on the socio-economic of the people of Edo state.
iv. To examine the efforts of the Nigeria and Edo state government in curbing climate change.
v. To examine the challenges face by Edo State government in curbing climate change.

Scope of the Study

The study covers the impact of climate change on the people of Edo State, Nigeria from 2001 to 2022. The study also covers the effects of climate change on poverty and income inequality linkage in Edo State Nigeria.

Research Methodology

The method of writing this study will be historical method. The study has relied on data from both primary and secondary sources.

Primary Sources: The primary sources include interview with government official in the ministry of Environment in Edo, interview with victims of climates in Benin City, old newspapers from the Nigerians Observer.

Secondary Sources: The secondary sources include books, journals, articles and newspapers, unpublished work and online sources.

Literature Review

There are various literatures that will be very useful in this study and to start with is Floyd, A. C., Oikpor's article titled "An Assessment of Climate Change in Benin City, Edo State, Nigeria,"[9] examines how climate of Benin City affects significant changes in its climatic variables. Findings from the study reveal that average temperature from 1981-2015 showed a significant trend as years 1981 through 1990 had the least temperature which increased with time as seen in the years 2001 through 2010. The trend shown for the average annual rainfall also showed a significant trend. The average annual rainfall in the study increased with time as the trend rose from 153.66mm in years 1981 through 1990 to 211.57 in the years 2011 through 2015 when compared using one way of variance. Based on these findings, the study concludes that the climate in Benin City has significantly changed.[10]

Egbe O. Eguavoen, book titled, *Modeling Land Cover in Edo and Delta States, Nigeria,*[11] the book cover how land surrounding Edo and Delta states have continuously changing, requiring satellite images and extensive field assessment to monitor and manage. The author capture information significant in mapping and identifying the temporal and spatial patterns of land use and land cover change, especially with the ongoing conflict regarding oil activities and illegal logging. The author also identifies the key driving forces of land use and land cover change in Edo and Delta states and the results indicate that the forests are being lost at alarming rate of 3.7%, due to a number of socio-economic and political factors driving these changes. The model projections tested various scenarios of land cover change. These models also analysed the relationship between population and land use and land cover changes (agricultural land to be exact).[12]

Evelyn Nwamak's article titled "Climate Change, Poverty and Income Inequality Linkage: Empirical Evidence from Nigeria,"[13] the existence of a feedback relationship between climate change and income inequality in Nigeria. The author revealed that there is a feedback substantial connectivity between climate change and income inequality. The impact of climate change on income inequality conformed to the U-shaped hypothesis. Other factors of climate change were population growth, economic development, and emission of carbon dioxide. Hence, the author pertinently advocates and recommends effective population control, reduction of income inequality through the provision of employment and education, and the supply of modern and efficient energy in the purse of economic growth and development.[14]

Raffaello Cervigni, book titled *Toward Climate-Resilient Development in Nigeria*,[15] This book provides a comprehensive overview of the likely impacts of climate change on sectors that are strategic for the growth of our economy, such as agriculture, livestock, and water resource management. It alerts us that increases in temperature, coupled with changes in precipitation patterns and hydrological regimes, can only exacerbate existing vulnerabilities. The book also highlights the fact that there are promising opportunities to build resilience into the fabric of our economy. Exploring those opportunities by focusing our efforts where they matter the most: for example, in agriculture, which contributes about 40 percent of our GDP, and employs more than half our workforce.[16]

A. Z. Al-Hasan work titled "Assessment of Climate Change Effects on Rainwater Harvest in Edo State, Nigeria,"[17] presents the climate change (cc) impact on Edo State, Nigeria's rainwater harvesting system. Future daily precipitation was statistically-downscaled from an ensemble of three (3) general circulation models (GCMs) derived with climate change scenario (RCP 4.5) for the 2040s (2030-2060) and 2080 (2070-2100). The author capture climate change (cc) may negatively affect every sector of the economy, and water resource is not an exception. This study evaluated the possible effect of cc on the performance of the rainwater harvest (RWH) system across Edo State using a set of GCMs under RCP 4.5.[18]

I. U. Siloko's, article "An Investigation on Interdependence between Rainfall and Temperature in Ekpoma, Edo State, Nigeria,"[19] focuses on the interdependence between

rainfall and temperature and their joint effect. Rainfall and temperature are vital climatic variables for agricultural productivity and other human activities. Also captures that despite the importance of rainfall and temperature, there are difficulties associated with accurate analysis of their joint distribution due to the possibility of interrelationship between the variables. This study employs the statistical approach in investigating the interdependence between rainfall and temperature in Ekpoma, Edo State, Nigeria for a period of five consecutive years from 2016 to 2020 using Gaussian kernel estimator. The author also demonstrates that the performance of years with high standard deviations are better than that of low standard deviations. Again, the performance of years with high negative correlation coefficients and high negative covariance of rainfall and temperature is better than years with weak correlations and low covariance.[20]

O.A. Olaniyi,'s work titled "Review of Climate Change and Its Effect on Nigeria Ecosystem,"[21] examines the issue of climate change and its impact on the environment and how the effects of man's activities as well as those of natural phenomena on global warming, climate change and the environment are presented and discussed. The author identifies the options that are available as response to global warming: mitigation, adaptation and possible human suffering as consequences of what cannot be avoided by mitigation and adaptation are presented. The author then underscores the need for governments at all levels to adequately fund geo information production and cultivate the culture of its usage for adequate and proactive response to global warming, sustainable environmental management and national development.[22]

Godwin O. Atedhor,'s work titled "Changing rainfall and anthropogenic-induced flooding: Impacts and adaptation strategies in Benin City, Nigeria,"[23] The author show evidence of global warming around 1978 with a corresponding above normal rainfall, particularly since 1988. The perceived causes of flooding in the selected flood areas are mainly increasing rainstorms, obstruction and absence of drainage systems, disruption of socio-economic activities, loss of properties, inaccessibility and reduction of the aesthetic quality of the environment largely form the impacts of flooding. The adaptive measures in place include emigration, construction of wooden bridges and elevated shops, embankments, construction of raised pedestrian ways with old vehicle tires filled with sand, use of netted doors, windows and rubber footwear. The need for appropriate drainage channels in Benin City is recommended as more lasting solution.[24]

E.M. Okon in his article titled "Systematic Review of Climate Change Impact Research in Nigeria: Implication for Sustainable Development,"[25] highlighted the need for knowledge-based strategies to help plan adequate mitigation and adaptation measures for the country. One of the basic requirements to ensure such strategies is the development of a database of national CC research. The present study used standard, systematic, and bibliographic literature reviews to analyse the trend, focus, spatial variability, and effectiveness of published research on CC impacts in Nigeria. The author suggests that it would be useful to advance CC research in Nigeria beyond perceptive approaches to more quantitative ones. This is particularly important for highly vulnerable animals, crops, locations, and for better planning of adaptation strategies.[26]

However, the literature captures the historical antecedence of climate change in Nigeria, but it is obvious that none had taken in detailed the nature and manifestations of climate change in Edo State. Therefore, it is this vacuum this project essay aim to fulfill.

CHAPTER ONE

BACKGROUND TO THE STUDY

This chapter gives a preamble of this study. The chapter gives an introduction of climate change in Nigeria, aim and objectives, scope of the study, methodology and literature review.

CHAPTER TWO

BREIF HISTORY OF CLIMATE CHANGE IN NIGERIA

This chapter examines the historical antecedence of climate change in Nigeria; the chapter also identifies the various features and effect of climate change in Nigeria.

CHAPTER THREE

NATURE AND ACTIVITIES OF CLIMATE CHANGE IN EDO STATE

The chapter elucidates the origin and nature of climate change on the people of Edo State. The chapter also reveals the various geographical locations in Edo state where climate change has affected.

CHAPTER FOUR

GOVERNMENT'S EFFORTS IN CURBING FLOODING IN EDO STATE

The chapter examines the socio-cultural and economic impact of climate change on Edo State people. The chapter captures the efforts of government in curbing the climate in Edo State and Nigeria at large.

CHAPTER FIVE

CONCLUSION

The chapter examines the general overview of the entire research work.

Endnotes

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CHAPTER TWO

BREIF HISTORY OF CLIMATE CHANGE IN NIGERIA

Introduction

Climate change is increasingly becoming a serious challenge to Nigeria's socio-economic development. Various manifestations of its impact are evident in Nigeria, which include increase in draught, scarcity of food instigated somewhat by irregularities in rainfall and over flooding. The implications of these challenges range from hunger and ill-health to migration.[1] This chapter draws attention to the increasing degree of the impacts of Climate change in Nigeria.

Concepts in Climate Change

Climate change Climate change simply refers to the change in the climatic condition of a place after a given period of time. These include the temperature, humidity, precipitation and wind. Natural events and human activities are believed to be contributing to an increase in average global temperature. Certainly, the reasons for climate change may be natural; however, it is mainly caused by human undertakings.[2] Human activities often lead to the release of green house gases into the air which has the ability to easily retain excessive heat in the earth space. Activities that involve burning of fossil fuels, including transportation and energy production, are increasing the concentrations of greenhouse gases (GHGs) in the atmosphere, trapping heat and causing global warming.[3]

The Climate Change Phenomenon

Global Climate Change is a subject that has attracted substantial prominence in recent times. It is caused by the accumulation of green house gases (GHG) in the lower atmosphere. The global concentration of these gases is increasing, mainly due to human activities, such as the combustion of fossil fuels (which release carbon dioxide) and deforestation (because forests remove carbon from the atmosphere).[4] The atmospheric concentration of carbon dioxide, the main greenhouse gas, has increased by 30% since pre-industrial times. Global GHG emissions increased by 70% between 1970 and 2004. In 2005, the atmospheric concentrations of carbondioxide (CO_2) and methane (CH_4) greatly exceeded the natural level of concentration in the previous 650, 000 years. The largest contributors of GHG emission worldwide since 1970 are the energy sector, followed by industry, forestry, agriculture and transport sectors. This global picture is not quite different when compared with the situation in Europe where the major drivers of GHG are the energy and transport sectors with forestry having little or no contributions. GHGs trap heat from the sun more readily than they let it out, leading to a rise in the earth's temperature, also called "global warming".[5]

Incidence of Climate Change in Nigeria

Like other continues in the world, Nigeria is directly exposed to climate change through changing weather patterns and indirectly through changes in water, air, food quality and quantity, ecosystems, agriculture, livelihoods and infrastructure. For instance, annual rainfall has declined over time and space with the reduction of between 100-

311mm depending on location and topography. The result also shows fewer wet days and higher rainfall intensities as well as shortened crop growing periods. Between 1970 and 2000, many parts of Nigeria had witnessed variations in onset and retreat of rainfall relative to the period 1941-1970.[6]

Similarly, many parts of the country currently experience warmer conditions. A number of sectors have been severely affected by climate change in Nigeria namely; agricultural and forestry resources, as well as human, energy, water and coastal/shelf resources. In the rainforest and coastal agro-ecological zones of South-Eastern Nigeria, the common ecological problems are those affecting agriculture and forestry, water resources and energy resources especially fuel woods.[7] For instance, soil erosion is one of the most striking features of the land surface of the South-Eastern Nigeria which has impacted negatively on overall land use in the region. Floods are a common and recurrent phenomenon in the coastal riverine areas, where coastal and marine erosion and land degradation have also been recorded. The Ogunpa flood disaster which occurred in the 1980s in Oyo State is a typical example of the devastating consequences of climate change in Nigeria. Similarly, recent flooding events have been recorded in about 25 villages in Ringim Local Government Area of Jigawa State located along the bank of Tiga River and in some village in Akwa Ibom State along the bank of the Cross River.[8] Desertification is a problem in the northern fringes of Nigeria. Also increased evaporation has resulted in significant loss of surface water in Northern Nigeria as is the case with Lake Chad, which is Nigeria's major lake. Furthermore, drought is fast

becoming a common feature in many part of the country with decreased incidence of rainfall and prolonged dry season. This has affected agricultural activities with concomitant reduction in food production and supply.[9]

Consequences/Concerns of Climate Change in Nigeria

The irony of climate change as a global problem is that developing countries who contribute least to the cause of the problem are the most vulnerable to its impacts. Developing countries would suffer the heaviest degree of damage from climate change because they are the least endowed with resources to combat the problem and their economies are based largely on natural resources-dependent sectors that are climate-sensitive.[10] Nigeria belongs to this group of countries.

Recent studies show that Nigeria should be concerned about the impacts of climate-change for a number of reasons including particularly the following:

i. The country is highly vulnerable because of its location in the tropics. In addition it has a long (800km) coastline that is prone to sea level rise especially with most of the adjoining land lying within 3 meters of the coastline. Calculations show that a 0.2m rise in sea-level will inundate 3,400km^2 of our coastland; a 10m rise wise will cover 18,400km^2. Incidentally, the whole of the Niger Delta is less than 6,000km^2 and the total mangrove area in the country is about 8, 000km^2 .

ii. Its water resources are under threat which will affect energy source such as Kainji and Shiroro dams.

iii. Rain–fed agriculture and fishing activities upon which about two–third (2/3rd) of the Nigeria population depend primarily for food are under serious threat with climate change.

iv. Nigeria has a very high population density of an estimated 167 million people surviving on the physical environment through various activities within an area of 923,000 sq km.

v. Nigeria lacks the financial capacity and technological expertise to combat the postulated negative impacts of climate change.

vi. Nigeria does not yet have a fully established institutional and legal framework nor systematic approaches and policies targeted at combating the impacts of climate change.

vii. The health system is inadequate to cope with the threat of vector-borne diseases and other emerging diseases of public health significance.[12]

In consideration of the above concerns, it becomes imperative that coordinated and concerted action must be put in place urgently to address the issues of climate change in Nigeria. If this is not done, the impacts of climate change may severely constrain Nigeria's long term development priorities of poverty reduction as expressed in such cardinal policy documents as those of the "Seven-point Agenda", "Vision 20 2020", "MDGs" and now SDGs.[13]

Climate Change and Its Direct Impacts on Environmental Health

Climate change directly affects five components of the environment namely: water, air, weather, oceans and ecosystems. A complicated relationship exists between climate change, the environment and human health. However, there is no doubt that climate change is currently affecting environmental health and indeed public health through myriad environmental consequences such as rise in sea-level, changes in precipitation resulting in flooding and drought, heat waves, changes in intensity of hurricanes, storms and degraded air quality. In a tally that included just four diseases (cardiovascular disease, malnutrition, diarrhoea and malaria) as well as floods. The World Health Organization (WHO) estimated 166,000 deaths and about 5.5 million disability adjusted life years (Dalys, a measure of overall diseases burden) were attributed to climate change in 2000.[14] To date, the majority of analyses on climate change and health have focused on diseases that predominantly affect people in the developing world and therefore are perceived as less relevant to more developed countries. However, the recent pandemic of the H_1N_1 virus has shown that diseases do not respect international boundaries. Thus climate change can be a driver for disease migration.[15]

Examples of environmental health directly affected by climate change include, water resources management, air quality management, pest and vector control, diseases control, waste management and sanitation, protection of marine ecosystem etc.[16]

Climate Change: Effects on Water Quality and Quantity

Changes in rainfall pattern and other precipitation, changing temperature and melting of summer ice cap are occurring and has created changes in the availability and quantity of water across much of the planet over the next 30 years.[17] In United States for example water security or the reliable availability of water for drinking, agriculture, manufacturing, and myriad other uses, is becoming a pressing issue. This is particularly true in the Western half of the country, where water shortage are exacerbated by reduced mountain snowpack due to warming, and in the south where severe drought have become a more frequent occurrence in recent years.[18] Water quality is also affected in many regions due to extreme weather events such as hurricane and flooding. These same events, often associated with sea-level rise and increased storm surges, can heavily damage human communities and alter complex coastal ecosystems with consequences for both water and food quality and supply. Flooding can affect health through the spread of diseases since no sanitation technology may be completely safe when covered by flood water, as faecal matter could mix with flood water and become spread with the movement of the contaminated water.[19]

Generally, water sanitation and health are linked in many ways. For example:

i. Consumption of contaminated water may result in water-borne diseases such as typhoid, cholera, dysentery, infective hepatitis and other diseases that cause diarrhoea.

ii. Scarcity of water may affect personal hygiene, and may influence the spread of skin and eye infections like scabies, conjunctivitis and trachoma.

iii. Water-based diseases and water-related vector-borne diseases can result from water supply projects (including dams and irrigation structures) that inadvertently provide habitats for mosquitoes and snails that are intermediate host of parasites that cause malaria, *Schistosomiasis, Lymphatics filariasis, Onchocerciasis* and Japanese *Encephalitis*.

iv. Consumption of water supplies that contain high amounts of certain chemicals (like arsenic) can cause serious diseases.[20]

More specifically poor water supply, sanitation and hygiene tend to account for a large part of the burden of illness and death in developing countries. Examples include the following:

i. Approximately 4 billion cases of diarrhoea per year cause an estimated 2.2 million deaths with majority of causalities being children under the age of five.

ii. Diarrhoea also accounts for 4.3% of the total global disease burden (62.5 million DALYs) and an estimated 88% of this burden is attributable to unsafe drinking water supply, inadequate sanitation and poor hygiene. These risk factors are second, after malnutrition, in contributing to the global burden of disease.

iii. Intestinal worms affect about 10% of the population of the developing world, and can lead to malnutrition, anaemia and retarded growth.

iv. Six million people are estimated to be blind from trachoma and the population at risk is about 500 million people.

v. Three hundred million people are estimated to suffer from malaria.

vi. Two hundred million people are estimated to be infected with *schistosomiasis*, with about 20 million suffering severe consequences.[21]

Climate Change and Air Pollution

The complex atmospheric chemistry that governs air quality is modulated by heat, humidity, degree of ultraviolet radiation and many other factors. Changes in any of these can directly reduce air quality, particularly in urban areas by increasing air concentration and human exposure to a variety of toxic air pollutants including chemicals, fungi and aero-allergens. Similarly, droughts and wildfires which are consequences of climate change will reduce general air quality and increase human exposure to a variety of pollutants, with resulting increase in asthma, cardiovascular diseases and other respiratory ailments. Climate change by changing pollen production may affect timing and duration of seasonal allergies.[22]

Climate Change and Pest Vector Control

Climate change may be directly associated with many pest habitats and disease vector. The influence of climate change on vector-borne parasitic diseases can be direct or indirect on vector biology. The direct effects according to Rueda *et al* include temperature, humidity, precipitation and wind. For instance an increase in temperature accelerates the vector's metabolic rates, which consequently affects the nutritional

requirement of the vector. Under such conditions, the blood sucking vectors feed more frequently, leading to increased egg production. This in turn increases the transmission potential of these vectors. Since the geographical distribution and survival of arthropod vectors are limited by minimum and maximum temperatures (and humidity), temperature variation has direct effect on their distribution and survival. Furthermore, high relative humidity directly favours the metabolic process and natural history of many vectors. However, such high relative humidity creates favourable conditions for the arthropod vectors to be susceptible to fungal and bacterial infection, which could reduce their population and transmission.[23]

Climate Change and Disease Control

The major vector-borne parasitic diseases and the likelihood of change in their distribution as a result of climate change have been assessed by Leovinsohn, WHO, Martens, McMichael and Bundy amongst others. By this assessment and ranking, the geographical distribution of malaria is likely to be affected by climate change. The distribution of other diseases such as *Schistosomiasis, Onchocerciasis*, dengue and yellow fever are likely to be affected by climate change too. Malaria stands out in this group of diseases because the transmission of malaria like most other infectious and parasitic diseases is closely related and in fact controlled mainly by rainfall, temperature and air humidity. These regulate the biology of development of both vectors and pathogens.[24] Hence, de Zulueta reported that climatic changes of the past have indeed greatly affected the distribution of malaria. One report suggests an additional 100-700

million (to the current 2.4 x 10^6 at risk) people could be at risk from malaria caused by human-induced climate change by 2050. This malaria situation is provoked mainly by expected global increase of the seasonal transmission potential of the disease vectors. This phenomenon according to Martin and Lebevre would bring about the encroachment of seasonal zones on perennial ones and by the expansion of seasonal malaria into areas formerly free of the disease.[25]

Climate Change and Waste Management and Sanitation

Intense hurricanes and flooding occasioned by climate change may exacerbate a wide range of health effects including contamination of drinking water with raw sewage as a result of damage to water infrastructure and the washing of waste (including human excreta) into bodies of water. Human excreta are important sources of pathogenic organisms. Contamination of portable water supply with sewage may result in a number of water-borne diseases such as typhoid, diarrhoea, cholera, etc. Consequently, environmental sanitation is undermined and serious challenges are posed to healthcare management.[26] For example, excessive flooding of the environment in the rainy season throws up an abundance of waste water with loads of germs and parasites plus other organic or biochemical agents most of which may be detrimental to good environmental healthcare. The situation is worsened by the lack of adequate or effective drainages. Likewise, poor and inadequate waste disposal systems contribute substantially to problems of environmental sanitation.[27]

Climate Change and Marine Ecosystem Management

Global climate change is visible and profoundly affecting oceans and seas with serious impacts on human health. The warming of ocean waters contributes to increases in incidence and severity of toxic algal blooms, alternations in aquatic and estuarine food webs and seafood quality and availability, plus effects on sentinel aquatic species. High concentrations of carbon dioxide in the atmosphere increase the amount that is dissolved into the ocean, leading to acidification and disruption of ecosystems. As large portions of the world's populations, including those in the Niger Delta region of Nigeria live in coastal areas and many depend on marine protein for daily subsistence, the consequences of perturbing delicate ocean and coastal systems will be far-reaching.[28]

However, it should be noted once again that climate change has become one of the most challenging environmental concerns of the 21st century with significant health impacts both domestically and globally. Although some gaps exist in full understanding of the relationship between climate change and environmental health, there is ample evidence that both interact to produce environmental consequences that are detrimental to health. Some of the environmental health indicators directly affected by consequences of climate change include water resources management and sanitation, waste management, pest, vector and disease control, air quality management, marine ecosystem management etc. Several adaptation and mitigation strategies are applied in the management of climate change in Nigeria. Similarly, a few environmental health actions have been suggested to address climate change. These include building capacity of the workforce, strengthening

of health system intelligence, partnership, risk communication and public health education, research, mitigation of environmental health system contribution to climate change and influence enactment/ legislation of laws and regulations that protect health and ensure safety from climate change.[29] As a result of the devastating impacts of climate change in Nigeria as we have seen from this lecture, it has become expedient to ensure the sustenance of urgent actions to address this menace. This is especially important if Nigeria hopes to achieve her developmental priorities of poverty reduction and re-creation of wealth prosperity for her citizens as envisioned in the "Seven-point Agenda", "Vision 20 2020", "MDGs" and now SDGs.[30]

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CHAPTER THREE

NATURE AND ACTIVITIES OF CLIMATE CHANGE IN EDO STATE

Introduction

The implications of climate change are becoming more and more obvious as they threaten the economy, culture, and societal institutions in addition to having profound effects on the physical environment and people's daily lives.[1] The Intergovernmental Panel on Climate Change (IPCC) of the United Nations concluded that human-caused greenhouse gas emissions are responsible for global warming and that this phenomenon is endangering ecosystems, civilizations, cultures, and economies all over the globe.[2]

In Edo state as in many parts of Nigeria, climate change could include greater and more rapid sea level rise than previously projected, more frequent coastal storms, threatening the lives and livelihoods of coastal communities; the increased incidence of extreme weather events; substantial reductions in surface water resources leading to accelerated desertification in sensitive and zones; and greater threats to health, biodiversity and agricultural production a predicted decline of 12 per cent in production in Nigeria by 2020.[3] River channels and basin watersheds serve as the natural border markers between states, and the majority of the main rivers cross international borders.[4] These are vulnerable to even small drops in precipitation, which are anticipated for much of the northern, western, and southern states. Such reductions could lead to an increase in intercommunal and inter-state conflicts over scarce water resources and threaten the sustainability of hydroelectric power generation.[5]

The projected impacts of unmitigated climate change in Edo state are likely to have significant impacts on human livelihoods, health, water resources, agricultural production and food security as well as nature-based tourism. All of this will weaken the social and economic projections of many states.[6] Most development agencies in Edo State are the least able to effectively respond to and manage these negative impacts. Majekodunmi noted that climate change-sensitive systems are ecosystems, agriculture, supply water, and food production, among others.[7]

In Edo, a large number of people are currently experiencing poverty, pollution, natural disasters, and humiliation firsthand. Agriculture, forestry, and fisheries are directly accountable for their means of subsistence and food security. Due to the increased frequency of droughts, floods, and storms brought on by climate change, their economy would suffer the most.[8] There is an actual risk that climate change could create new hindrances to achieving the Sustainable Development Goals (SDGs) in research.[9] According to Stern (2017), the poor responses to resource shortages have impacted human development negatively, which has resulted in the displacement of persons, sickness and hunger, fewer jobs, and ultimately poor economic growth. Some empirical research from Nigeria has examined the way climate change can affect the country's economic growth. However, previous studies have failed to identify systematic and causal relationships between human development impacts of climate change that require intervention strategies.[10]

Nature of Climate Change in Benin City

In Benin City essential climatic elements particularly rainfall, temperature, humidity are neither incorporated into its complex environmental planning processes nor utilized in its continuous urban development activities. The dynamic nature and characteristics of the climate in the study area have not been assessed from authentic scientific perspectives.[11] These integrated weaknesses, have given rise to serious challenges on the physical environment which relate to floods, infrastructural damages, traffic delays, prevalence of water-borne diseases, poor commercial activities, and residents protests over dissatisfaction with the government performance. Hence, adequate and authentic climate information, no doubt, could be utilized for carrying out important urban activities which could be long-lasting and life-preserving.

Benin City is selected for a close assessment owing to important reasons. It has recognized characteristics of an urban settlement which include social infrastructures, dense human populations, complex urban canopy layers, and numerous small-scale firms and industries with lucrative financial and commercial institutions. It has one basic meteorological station which is currently operated by the Nigerian Meteorological Agency (NIMET) where recent and authentic climate data can be obtained for utilization in both theoretical studies and empirical planning activities. The city has experienced climatic changes because of increased urbanization over the years, and these include modifications in its dense vegetal and rich fauna species, geomorphic, atmospheric, thermal, and hydrological characteristics. Currently, the climate of Benin City has not

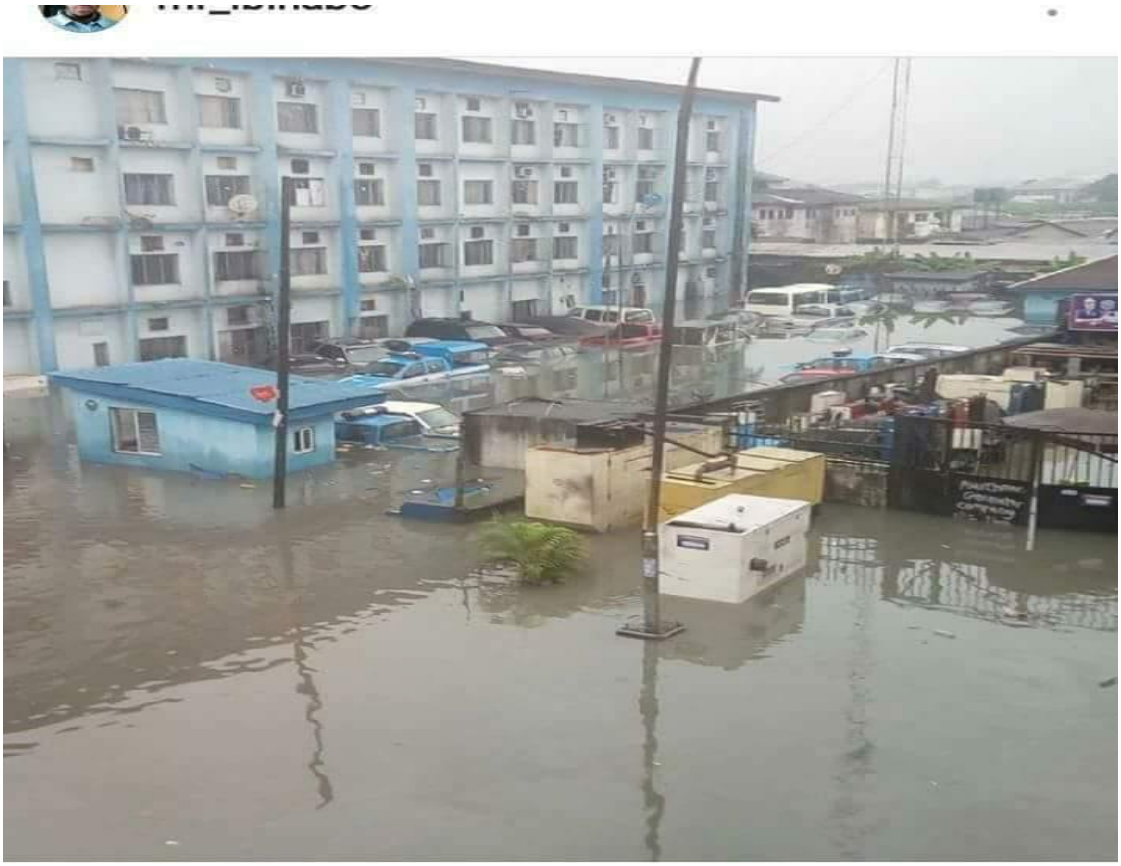
been assessed adequately by environmentalist on beneficial scientific guidelines. Specifically, the essence of rainfall in the development process of the city has not been considered by the planning authorities. Hence, the urgent need to bridge this development vacuum based on permanent recognizance, incorporation and utilization of climatic elements.[12]

Nature and Manifestations of Flooding in Ovia North East

Flood menace has become a perennial occurrence in Ovia, Edo state and the battle seems endless. Still fresh in the mind is the 2012 flood crisis which ravaged almost all parts of Edo state including Ovia North East, especially areas like Okada community. According to The Child Protection Network of Edo State (CPNAS) (2013), in the later part of 2012 between the months of July and September, Okada community faced an unprecedented flood disaster which resulted to loss of lives and property running into billions of Naira.[13] Several villages within Ovia North East were affected of which Okada was one of the most affected community. The disaster affected eight communities with Ovia North East, with Okada worst hit. According to the National Emergency Management Agency (NEMA), the floods were termed as the worst in 40 years and affected an estimated total of seven million people.[14] 10000 homes were fully or partially submerged by the flood with reported cases of death. Leading industries in Ovia North East of the Okada Metropolis were also affected by the flooding resulting to destruction in socio-economic activities. This flood disaster paralyzed economic activities, created

social turbulence, and rendered people homeless and this flood situation in Okada has continued to take a turn for worst.[15]

Pic: Showing Flood Disaster in Okada Metropolis



Sources: https://www.academia.edu/search?q=impact%20of%20flood%20in%20Omoku,

As a result of flood, the entire area was often submerged, thereby creating a huge colony of displaced people and jeopardizing the socio-economic livelihood of the people of Okada. According to News Agency of Nigeria, the experience while touring the affected communities in Okada was shocking and sympathetic following the colossal damages that occurred in the area.[16] The pathetic story about the disaster was that

majority of the victims are predominantly farmers and they have lost virtually all they have. All primary, post primary and tertiary schools in Okada were temporarily closed down in reaction to the flood disaster in the area. The floods caused displacement of people from their usual dwelling places resulting into varying impacts on infrastructure, crops, health, education, environment as well as damage to property.[17]

Pic: Showing Popular Road ravaging with flood in Okada

Sources: https://www.academia.edu/search?q=impact%20of%20flood%20in%20Omoku

The government, stake holders and Non-governmental organization has made some efforts by setting up State Emergency Management Agency (SEMA), Internal Displaced Person's Camp (IDPC) located in different areas. Despite these efforts, flood crisis has continued. All the 16 communities within Ovia North East were not left out as they were within the water level. According to one of the community leader of Okada,

Mr Osazee Nosayaba, the destruction of property, farm, farm produce and livelihood of people were massive.[18] He also said that they are close to where they found themselves in 2012 when water height was 12.84metres, the water height was 11.80m. In 2018, over 138 people were affected by flood disaster across Ovia North East communities. Okada has the highest number of affected persons with 230, followed by Ekpirih with 140 while Egi 136 has the least with people.

Although an increase in frequency and magnitude of floods, no impact assessment study on the socio-economic livelihoods of the people has been directed to the entire LGA to establish the underlying causes of their vulnerability, as well as identify coping mechanisms employed by the people during floods and strengthen positive coping strategies.[19]

Impact of Flooding in Okada

The case of urban flooding in Okada, a coastal community in Nigeria has been a typical example of man-made flood disaster. Okada has been afflicted by very devastating flood incidents since 2012 till date, when rivers Niger drowned houses of those living on its banks. During flooding water is contaminated. Clean drinking water becomes scarce. Unhygienic conditions and spread of water-borne diseases result. People, buildings, infrastructure, agriculture, open recreational space and the natural world were at risk. In extreme cases flooding has cause a loss of life in Okada. Torrential rains pushed rivers over their banks, collapsed mud houses and washed away livestock in Okada. The economy was also be severely affected by flooding. Businesses in Okada

lose stock and patronage. Disruption to utilities and transport infrastructure can have knock-down effects on a wider area.[20]

Pic: Showing Popular Road ravaging with flood in Okada

Sources: https://www.academia.edu/search?q=impact%20of%20flood%20in%20Okada

Tourism, farming and livestock was equally affected. Vital infrastructure was also damaged or disrupted. Road links, railways, canals etc., be blocked causing disruption to the wider transport network. The beneficial effect of flood was when the river overflows, and the flood waters flow into the banks, sand, silt and debris were deposited into the surrounding land. After the river water subsided and go back to its normal flow, the

deposited materials help to make the land richer or more fertile.[21] The organic materials and minerals deposited by the river water keep the soil fertile and productive. Flooding adds a lot of nutrients to lakes and rivers which leads to improved fisheries for a few years, also because of the suitability of a floodplain for spawning (little predation and a lot of nutrients). Fish like the weather fish make use of floods to reach new habitats. Together with fish also birds profit from the boost in production caused by flooding.[22]

Pic: Showing Resident ravaging with flood in Okada

Sources: https://www.academia.edu/search?q=impact%20of%20flood%20in%20Okada

Some of the impacts of climate-induced flooding on the built environment of Nigeria include: -

i. Erosion of beaches, inundation of coastal lands which could bring about additional costs to protect the affected coastal communities. This will ultimately lead to loss of revenue from tourism in areas such as Edo state.

ii. More surface runoffs will be expected in the urban areas. This is so because buildings, roads infrastructure and other paved areas within the built environment prevents rainfall from infiltration into the soil. Heavy rain and/or prolonged rainfall will produce very large volumes of surface water, which could overwhelm drainage systems and consequently aggregate the risk of flooding.

iii. Destruction of buildings and other infrastructures in the built environment due to heavy rains and flooding. This could amount to several billions of naira in monetary terms.

iv. High oceans surges will cause water pollution due to salt water intrusion and damage to sewers and sewage system leading to disease outbreak and contamination.

v. Water supply scarcity for urban dwellers due to contamination and pollution can be a major challenge to city dwellers.

vi. Many cities, which had been developed without consideration of the risks that climate change will induce, could become vulnerable for people who live and work in them. For example, the nonavailability of space for evacuation and emergency vehicle access as in the case of slum areas can generate a lot of risks.

vii. Most Urban dwellers will be forced to evacuate their homes as a result of excessive flooding and damage to their houses. This could spur internal

migration and exert enormous pressure on government in coping with humanitarian services and emergencies.

viii. There could be internal conflict among the population arising from competition of available facilities including water and food in areas less vulnerable to floods18 and other hazards associated with extreme weather.

ix. The damage to homes and urban infrastructure due to increased floods could have knock-on effect on insurance premiums and mental health.

x. There may also be loss of staff working time due to inaccessibility of some areas to work places, death of some members of the urban population and ill-health.

xi. xi. Pipelines conveying crude, sewage etc. may be damaged and sanitation could be affected. Flood waters may be contaminated by the overflow from point sources such as pit latrines, which is a common source of toilet in Nigeria, and toilets linked to sewers may become unusable without water supply. The contamination of urban flood water with faecal material could present a substantial threat of enteric disease.

xii. There could also be some health risk associated with the lack of disaster preparedness to limit the impact of an extreme weather event when it occurs.

xiii. Climate-induced flooding will also impact negatively on agricultural land particularly at the coastal areas due to rising sea level and increased precipitation, which could have large impact on the livelihoods of the inhabitants around those areas

vulnerability assessments of the potential impacts of floods and other extreme weather events in all part of the country. Spatial maps illustrating the potential effects of sea level rise on key urban regions particularly in the coastal areas should be prepared.

xiv. It is also suggested that government at all level initiate a flood defence budget to tackle the menace of flooding and protect homes from its devastating effects.[23]

Conclusion

Though flood disaster has diverse effects associated with it both in developed and developing world. These effects such as economic devastation, property loss, environmental disease and untimely death can be reduced and properly managed by adopting both remedial and preventive action to combat the problem of flooding as both approaches are needed to run concurrently to achieve success in dealing with flood. Thus, the next chapter will be address the effort by government in curbing flood disaster in Okada.

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CHAPTER FOUR

GOVERNMENT'S EFFORTS IN CURBING FLOODING IN EDO STATE

Introduction

This chapter examines the government efforts in curbing climate change in Edo State. Basically, governance is about the way state manages the affairs of the people and this is central to management of disaster. Every affected state reacts to climate change in diverse ways but the objective is supposedly one.[1] To mitigate and ameliorate the consequences of disaster for humans and prevent future reoccurrences.

> We captured how the Edo state responded to flood in Benin City for pragmatic implications. It was gathered that: When floods occurred here in Benin City where we are, the reaction of government was generally aimed at distribution of relief materials to affected victims. The relief materials included roofing sheets, clothing, and a host of other tokens. I was there when it happened. What the government is doing recently here is commendable because it has a will, have a lasting impact and prevent future reoccurrence of disastrous floods like it was in the past; and that is reconstruction of bridges. Reports reaching us also show that government is planning to construct dual carriage roads to ease movement of people in the area. To me, these actions of the government would not only help to placate the victims of past flood disasters, but also to prevent future reoccurrence of such incidents.[2]

Climate Change and Social Development in Nigeria

As a developing country, Nigeria is mainly vulnerable to the effects of climate change because its economy is based on natural resources. Entire communities may migrate or disappear entirely due to disease, loss of livelihoods and facilities, and may

even obtain refugee status. As significant as the effects of climate change are, Nigerians do not know what climate change is and what its overwhelming effects are.[3] According to Adeniji, Nigerians need to be educated and informed about climate change and how it can impact our lives drastically. For example, in 2014 former Lagos Governor Raji Fashola warned of the impact Hurricane Sandy would have on the state. The Nigeria Meteorological Agency has also warned that more natural disasters are likely to occur in the coming days due to unfavourable weather conditions. Experts recently warned that preparedness is vital in the event of man-made and natural disasters.[4]

Climate change has been an environmental, social and economic challenge on a regional scale. It can be exacerbated by human-induced actions such as the widespread use of land, the broad scale of deforestation, the major technological and socioeconomic shifts with reduced reliance on organic fuel, and the accelerated uptake of fossil fuels.[5] It is worth noting that frequent price hikes and shortages of basic domestic fuels such as kerosene are likely to have a significant impact on the Nigerian government's reforestation programme. Chandran and Sandya maintain that climate change is one of the human development issues which undermines expanding human potential, developing capabilities and enlarging freedom; with the tendency to erode human freedom, limits choice thereby questioning the principle of human progress and the greatest challenges confronting the world and impacting negatively on the aspirational goals of the majority of developing countries today. According to the Intergovernmental Panel on Climate Change (IPCC), climate change is manifested by rising temperatures, changes in rainfall,

rising sea levels and intensification of natural disasters such as hurricanes, floods, droughts and landslides.[6] Climate change was fundamentally complicating Nigeria's human development challenges. Agriculture and other socio-economic activities in our country depend on climate patterns. The speedy expansion of the Sahara south made access to water more difficult, increased the frequency of droughts and deserts, and exacerbated the degradation of cropland and production. Increased gully erosion in the southeast and coastal erosion in the south is destroying the livelihoods and livelihoods of over 50 million Nigerians living in low-lying coastal areas and could pose a threat to Nigeria's oil exploration assets based in the region.[7]

Over Views of Strategies Adopted in Addressing Flood Risk Hazards

In response to the devastation arising from flooding in Benin City, series of workshops and symposia have been held in the community town hall and other locations in Edo state. These were in April, 2005 in Okada, November 2009 in Auchi, and August 2001 in Egor secretariat all sponsored by the state government and foreign companies located within the communities, to come up with strategies in overcoming the menace of flood. In December 2016, an adaptation strategy for improved flood management symposium was held in Benin City.[8]

In that same year, a federal government consultation workshop on the impacts of floods, drought and other water disasters was held in Benin City with key speakers advocating the balanced use of structural and non-structural measures to tackle the problems of flood. Some regional and national programmes towards addressing flood

hazard include the landuse planning in Edo state, the Water storm project of 2015 by the state government, the River State Flood Disaster Reduction plans of 2016. One objective of these events and policies was to create comprehensive guidelines that could be used by government, and individuals to help avert losses from flooding.[9]

For the city of Benin City, urban floods and tidal surges are a constant feature in the raining seasons, thus the Rivers State Government documented Guidelines and Standards for Flood Control in 2002 (RSMENR, 2002). Shortly after, in 2005, the Federal Government of Nigeria formulated the National Policy on Erosion and Flood Control (FMEnv, 2005)[10]. Some of the objectives of the National Policy on Erosion and Flood control include:

i. To put in place appropriate mechanism and structures for flood prevention, control and water conservation.
ii. To undertake flood hazard assessment including mapping and risk evaluation
iii. To undertake flood forecasting and warning on flood prone areas
iv. Promote community education on the appropriate and simple techniques for flood control and water conservation, etc.[11]

Getting the National Policy on Erosion and Flood Control to work was require for both structural and non-structural measures of flood management; this was important because five years after, the strategies and targets set in the National Flood and Erosion Control Policy might not have been met. Structural Measures are the tools altering the physical characteristics of the floods. Wisely applied, the impact of flooding can be

greatly reduced.[12] However, structural measures on their own alone cannot get rid of flooding, and they can be costly and disruptive to the environment. The success of minor flood protection embankments has led many communities to attempt to control much larger floods. They are culturally attached to the economic gains of the flood such that many have become vulnerable to the negative effect of flooding. It is suggested that the best approach to flood management in Nigeria is one that seeks a balance application of both structural and nonstructural measures. Non-structural measures may include the raising of public awareness through better education and capacity building in the organizations responsible for managing river basins. The involvement of communities in planning flood control, i.e., any effort at controlling flood at the national or regional level must consider the people who are directly affected by the floods.[13]

Flood Resilience: The Role of Federal Ministry of Environment (FMENV), Department of Erosion, Flood and Coastal Zone Management (EFCZM)

Given the FMENV's mandate to supervise all environmental activities in Nigeria, it is the central authority for activities related to flood resilience issues. The FMENV's overall core functions include:

(1) defining the policy, legal and regulatory framework for environmental management, including assisting in collaboration with sectoral ministries and stakeholders;

(2) environmental monitoring, data collection, and analysis;

(3) EIA review, training, and clearances, including environmental education and public awareness;

(4) managing ecosystems and promoting sustainable use of natural resources; and

(5) setting and enforcing environmental quality norms, standards and rules.

The Ministry was created by incorporating environmentally relevant units from numerous sector ministries, such as Water Resources, Agriculture, and Works, and it comprises five technical departments. These include: (i) Forestry; (ii) Drought and Desertification; (iii) Erosion, Flood, and Coastal Zone Management; (iv) Environment Assessment; and (v) Pollution Control and Environmental Health. At first, the Department of Soil Erosion and Flood Control of the Federal Ministry of Water Resources was transferred to the now-defunct Federal Environmental Protection Agency (FEPA). Later, with the creation of the Federal Ministry of Environment, the Department merged with the Flood and Erosion Control Division of the Federal Ministry of Works to form the current Department of Erosion, Flood, and Coastal Zone Management (EFCZM) in the Federal Ministry of Environment in 1999.[14]

The EFCZM Department consists of four divisions: Coastal Zone Management; Soil Erosion Monitoring & Control; Flood Forecasting, Monitoring, & Control; and Water Management & Harvesting. The EFCZM Department is involved in policy formulation, as well as implementation of erosion projects funded by the federal government, Ecological Fund, and international donors. The EFCZM Department receives funding from the federal budget, the Ecological Fund, and international donors. Ecological Funds has been the main source of funding for erosion projects. Funding is allocated according to project proposals approved by the Fund.[9] The federal budget

allocations for environmental management have often been limited, since what is approved and what is disbursed do not often match. For example, a project is designed according to the allocated funds, however once work on a project commences the allocated funds are not released or may be reallocated to another project. This has led to projects getting implemented at 50 percent or less in certain cases.[15]

Farmers and Community Efforts to Mitigate Floods

Flooding which is a yearly occurrence has become more severe and farmers are becoming more vulnerable due to adverse effects of climate change. In a study carried out in the states of Akwa Ibom, Ondo and Rivers states, it was observed that land management practice particularly the use of mounds was commonly used by farmers to mitigate effects of flooding. A total of 30% of male farmers and 39% of female farmers adopt this method. In the wetland regions of Ondo state, farmers plant flood resistant or flood tolerant varieties of crops.[16] Farmers have also diversified their income earning activities to cope with environmental hazards. Fishing communities in Akwa Ibom, Ondo and Rivers state adapt to flooding and sea level rise by fishing farther away from the shore than they use to and carry deep freezers to preserve their catch during the long period they will be at sea. Another study conducted by Fabiyi & Oloukoi among the Okada, Ilajes, Itshekiris and ijaw tribes who live in coastal rural communities discovered that these communities have undocumented knowledge of local meteorologies which are based on observation and traditional practices and belief systems.[17] This local knowledge helps them to predict flooding on seasonal and long term basis.

Efforts Made by Institutions and Government Agencies to Mitigate Flood

After the 2012 floods, institutions and government agencies saw the need to put in place adequate flood prevention measures. Some well-meaning agencies also contributed farming inputs to help farmers restart their lives after the devastating flood. In River state of Nigeria, the International Institute of Tropical Agriculture (IITA) was called in to help farmers. A team of IITA experts visited the state to determine the extent of damage. The team held meeting with officials of the state and pledged to send improved cassava cuttings, plantains and maize to the state within one month. The maize varieties to be deployed are early maturing and will help farmers adjust quickly by offering them food on the table.[18]

The Edo state government of Nigeria assisted internally displaced farmers by distributing high yielding cassava cuttings, yam seedlings and farming inputs to alleviate their sufferings. Several workshops were organized in different parts of the country to brainstorm on flood management technique that would be at par with global best practices.[19]

The Flood Research Group of the Federal university, Edo state situated in the Niger Delta region which was among the states hit in the 2012 flood held a Post flood management workshop in collaboration with the Edo state government of Nigeria. The Flood impact, control and mitigation approaches recommended include proper drainage systems, building of buffer dams in strategic areas, building of houses to avoid blockage of natural drainages and waterways, preventing siltation of creeks, rivers and other water

bodies by dredging, setting up a well planned community flood preparedness, sensitization and management programme to be conducted across the state.[20]

The programme include regular monitoring of soil saturation and water levels, effective grassroots awareness of weather reports, requisite evacuation drills, and emergency self-help and survival orientation for communities. In order to reduce the impact of flood disasters in the country, the federal government launched the early warning system after flood disasters in major cities like Lagos, Kano and Kaduna. This system was upgraded in 2014. The federal ministry of environment installed 307 web-based flood warning systems all over the nation. Community-based flood warning systems were also installed in Edo, Ondo, Niger, Cross River, Imo, Anambra, Lagos, Oyo, Osun, Ogun, Nassarawa, Rivers, Kwara, Akwa Ibom, Abia and Enugu states. The Ministry also acquired and installed four stand-alone automated functional flood early warning facilities along rivers Alamutu, Eruwa and Owena River basins.[21]

In order to alert the public on the imminent dangers of flooding, the federal government equipped the Nigerian Meteorological Agency (NIMET) to enable it provide accurate weather forcast. Also, the sum of N17 billion was released to the affected states and other relevant stakeholders to cushion effects of the 2012 floods. There are plans to build Kashimbilla/gamovo multipurpose dam, Ose Dam and hydropower project in Taraba state to accommodate the excessive flow of water from cameroun whenever it occurs. The dams will serve the purpose of mitigating flood, generate electricity, create employment, improve irrigation and boost agricultural production in Nigeria. The

government has made efforts to relocate people in flood prone areas. Forty communities in South- eastern Benue were relocated by government authorities to safer places. The Kogi state government advised residents of communities along the river banks to relocate sequel to a warning that water would be released from Kainji and Jebba Dams. The government also called on the people of the state to clear their drainages to allow for free flow of water and to avoid flooding.[22]

The lessons learnt from the 2012 flood helped Agencies like the Red cross to improve its emergency response. The Nigerian Red Cross trained 22,000 volunteers and stocked warehouses with relief materials. The National Environmental Management Agency urged dam management officials to lower water levels early enough and should not wait for water levels to breach the dams before releasing it in order to minimize flooding risks. Flood prone communities were trained and provided with basic equipment to aid quick evacuation.[23]

The National Space Research and Development Agency (NASRDA), produced a floodplain and vulnerability map that was used by the National Emergency Management Agency (NEMA) to rehabilitate those affected by the 2012 flood. This year, the National Emergency Management Agency (NEMA) organised a pre-flood awareness campaign for relevant stakeholders in Illorin, Kwarra state capital in North Central Nigeria. Participants were advised to heed early warning systems and desist from blocking waterways through illegal dumping of refuse while the state government was implored to clear all waste bins across the state for a cleaner and healthier environment.[24]

Measure of Flood Control

The general consensus among environmental scientists is that flooding being a natural phenomenon can only be managed and not totally stopped. “A first step is to identify as accurately as possible the area at risk. Careful mapping with accurate stream discharge data should allow identification of those areas threatened by floods of different recurrence intervals. Land that could be inundated often-by Twenty five year floods, perhaps might best be restricted to land uses not involving much building. The land could be used for example for livestock grazing pasture or for parks or other recreational purposes.[25]

The use of retention ponds can also help to control or minimize the effect of flooding. Retention ponds are suitable where there is open land to reduce flood hazard along a stream. These ponds are large basins that trap some of the surface runoff, keeping it from flowing immediately into the stream. They may be elaborate artificial measures, old, abandoned quarries or in the simplest cases, fields damned by dikes or piled up soil. Diversion channel can also be used as stream stage rises.[26] The diversion channel can be used to redirect some of the water flow into areas adjacent to the stream where flooding will cause minimal damage. The diversion of water might be into farmland or recreational land and away from built up areas, to reduce losses of live and property damage.

One major cause of flooding is poor maintenance of dam. The size of a dam is a function of the quantity of the water to be retained and the usage. There is however, a

maximum height that the water in a dam should safely reach and dams are built with adjusted gate valves, which allow for the safe gradual release of water. Flooding occurs whenever a dam is no longer safe, when the maximum water level has been reached and the opening of the gate valves becomes necessary. Where this is not done in a controlled and gradual manner, it could lead to even more devastating consequences.[27]

It is pertinent to point out that "several of the country's dams (Nigeria) are in states of disrepair, many are silled up, have non-functioning machinery and are under perfunctory supervision. When these dams overflow, the consequences are usually devastating. There is no doubt that proper control of dam water involving periodic release of the water is a sure way of preventing the dams from collapsing. An effective method of controlling floodwater is to construct coordinated groups of dams and reservoirs on the headwaters of the streams that lead into the main rivers, so that water can be stored during periods of heavy runoff and released gradually during dry seasons.[28]

To control the water that is released from the dam, a well designed earth channel, preferably trapezoidal in shape should be constructed to guide the water from the dam to the nearest water body or outfall. There should also be a minimum setback of 50 metres to serve as a buffer zone on either side of this channel with no development contemplated in the zone. It is also suggested that a retention basin be constructed behind the dam outlet gate. The basin will give suitable room for the gradual release of water, and hence prevent sudden flooding of the downstream areas. Routine de-silting and maintenance of

the main water body or outfall where the channel discharges will prevent future back up and over flooding.[29]

Those who live near rivers especially in the riverine areas bear some responsibility for flood disaster. In Nigeria, the people in the Niger Delta area apart from those living on water build house on flood plains which ought to be free of all construction. Such citizen worsen the tendency for rivers to silt up by throwing domestic waste and other rubbish into them. The Ogunpa flood disaster in Ibadan, Oyo State of Nigeria in 1981 was caused mainly by the blockage of the channel which caused the river bank to over flow. Channelization is a general term for various modifications of the stream channel itself that are usually intended to increase the velocity of water flow, the volume of the channel, or both.[30] These modifications thus increase the discharge of the stream and hence the rate at which surplus water is carried away.

The channel can be widened or deepened, especially where soil erosion and subsequent sediment deposition in the stream have partially filled in the channel. Care must be taken, however that channelization does not alter the stream dynamics too greatly elsewhere. Alternatively, a stream channel might be enrouted for example by deliberately cutting off meanders to provide a more direct path for the water flow. Such measure do tend to decrease the flood hazard upstream from where they are carved out. Channelization is not a onetime effort. Constant maintenance is required to limit erosion in the straightened channel sections and to keep the river in the cut offs. Channelization has ecological impacts as well. Wetlands may be drained as water is shifted more

efficiently downstream. Stream bank habitat is reduced as channels are straightened and shortened, and fish may adapt poorly to new stream flow patterns and streambed configuration. Also by causing more water to flow downstream faster, channelization often increases the likelihood of flooding downstream from the alterations.[31]

The heavy and sustained rainfall witnessed in many countries of the world has been attributed to the rise in the ocean level caused by climate change. One of the ways of protecting the environment is by planting trees to reduce the effect of climate change. Through the centuries people have created and contributed to flood problem by cutting down trees and digging up the vegetable cover of the soil, thus increasing the soil erosion. Cultivation decreases the ability of the soil to retain water and increase runoff.[31]

Vast land areas along the headwaters of rivers throughout the world have been laid waste by intense cultivation and subsequent erosion. Flood control in these areas has been directed to restoring vegetation and instituting efficient methods of soil management such as crop rotation and contour flowing. In the developing countries of the world, the consumption of wood increases day by day. Trees are fell for construction purpose in the building industry. The peasants rely on wood as source of energy for cooking, bakeries and dry cleaners rely on charcoal from wood. All these put pressure in the environment.[32]

In Nigeria, the Federal Government over the years introduced a programme for afforestation. Proper urban planning is lacking in many of the developing countries. The government should step up effort to ensure that illegal structures are not allowed to exist

in the flood plains. Comprehensive Environmental Impact Assessments should be carried out. Hazards are exogenous but disasters are endogenous. While flooding is a hazard, our inability to cope with the consequences of floods contribute to a major disaster. Development planning in every nation particularly the developing countries of the world must be holistic.[33] Land use, urban development, industrial activities and water management must be coordinated. Geographers and town planners are equipped with sufficient knowledge of the terrain that is best suited for certain activities. Land use plan must be properly prepared and strictly enforced. It should be noted that flood plains are ideal and suitable for agriculture whereas industrial complexes should not be constructed in flood plains. Floods of unprecedented magnitude have taken place in all the states of the Federation of Nigeria in the recent past. For each of these floods, billions of naira damages to infrastructure are recorded and subsequently such amounts are needed for rehabilitation.[34]

Conclusion

Flooding has been a yearly occurrence in Nigeria and is expected to increase due to climate change. The Federal government of Nigeria failed to heed early warning s by relevant agencies and was unprepared to manage the 2012 flood which was one of the most devastating in the country. Efforts towards mitigating adverse effects of flood has mostly bordered on treating the symptoms rather than addressing the root causes Farmers across the country, on their part are planting early maturing varieties of crops and flood resistant varieties of staple crops in their regions. some also depend on indigenous

meteorological knowledge These efforts, though laudable are not enough to protect farmers in the likelihood of severe flooding in the near future. The federal government has made some efforts to mitigate flood but there is the need to do more. Setting up the early warning system is a good development but there is need for more sensitization of farmers to heed to early warnings. Farmers should desist from blocking waterways and building on flood plains. They should also insure their crops. The government should be proactive and invest massively in flood mitigation methods such as building of dams, dredging of rivers, clearing of drainages and natural waterways etc. Finally, relevant flood prevention agencies should be well funded and the funds carefully monitored to avoid mismanagement.

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CHAPTER FIVE

CONCLUSION

This study investigated the impact of climate change on social development programmes in Edo State, Nigeria. Through this study, it was found that climate change have a significant impact on the social development and economic activities of the Edo people. In the study area, flooding, garden/forest degradation and brush burning were found to collectively plunder natural resources and the environment. For other stakeholders to check the negative impacts of climate change, serious adaptation measures must be put in place.

This research has examined in historical perspective, the economic and social impact of flooding in local communities in Edo State, with a main focus on how Edo State has been experiencing climate change consequences like flood disasters as a result of many factors such as 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. Findings in this study have contributed to our knowledge of further exposition of all the economic and social impact of flooding disaster in Edo State.

The study has also explored how the flood menace became a perennial occurrence in Okada in River State. The 2012 to 2022 flood that ravaged almost all parts of Edo State including Benin City, and Okada affected the people livelihoods, social and

economic activities. Commenting in the 2012 flooding, the Child Protection Network of Edo State (CPNAS) (2013), in the later part of 2012 between the months of July and September, Ovia North East community faced an unprecedented flood disaster which resulted to loss of lives and property running into billions of Naira.[13] Several villages within Ovia North East and its environs were affected of which Okada was one of the most affected communities. The disaster affected eight communities with Benin City, with Okada the worst hit. According to the National Emergency Management Agency (NEMA), the floods were termed as the worst in 40 years and affected an estimated total of seven million people.

Another important findings in the study was that farmers adopted practices to avert the reoccurrence of the flooding such as planting of resistant trees/varieties, building of manual embankments and use of indigenous knowledge. Furthermore, the Nigerian government established the early warning systems to alert farmers on impending floods. There is the need to do more in the area of educating and encouraging farmers to heed to early warning systems, relocating farmers from flood prone areas and encouraging farmers to insure their crops.[2]

This study has reviewed flooding and flood risk management (FRM) in Nigeria. Some characteristics and challenges were discussed. It was discovered that while the increased incidence of floods in recent times has increased levels of awareness and raised the tempo of FRM activities in Nigeria, as well as general lack of coordination and integration across several important FRM systems and processes.[3]

The study has elucidated on the floods of unprecedented magnitude that had taken place in virtually all the states of the Federation in the recent past. For each of these floods, billions of naira damages to infrastructure are recorded and subsequently such amounts are needed for rehabilitation and how the Federal Ministry of Environment in Nigeria has adopted the following strategies for flood management. The general consensus among environmental scientists is that flooding being a natural phenomenon can only be managed and not totally stopped. “A first step is to identify as accurately as possible the area at risk. Careful mapping with accurate stream discharge data should allow identification of those areas threatened by floods of different recurrence intervals. Land that could be inundated often-by Twenty five year floods, perhaps might best be restricted to land uses not involving much building. The land could be used for example for livestock grazing pasture or for parks or other recreational purposes.[4]

However, one of the major trusts of this study was on to ascertain the level socio-economic damage of flood disaster in Nigeria. We have identified that one of the major causes of flood occurrence in Nigeria and has increase due to climate change; and that the Federal government of Nigeria failed to heed early warning s by relevant agencies and was unprepared to manage the 2012 flood which was one of the most devastating in the country. Efforts towards mitigating adverse effects of flood has mostly bordered on treating the symptoms rather than addressing the root causes Farmers across the country, on their part are planting early maturing varieties of crops and flood resistant varieties of staple crops in their regions. some also depend on indigenous meteorological knowledge

These efforts, though laudable are not enough to protect farmers in the likelihood of severe flooding in the near future. The federal government has made some efforts to mitigate flood but there is the need to do more. Setting up the early warning system is a good development but there is need for more sensitization of farmers to heed to early warnings. Farmers should desist from blocking waterways and building on flood plains. They should also insure their crops. The government should be proactive and invest massively in flood mitigation methods such as building of dams, dredging of rivers, clearing of drainages and natural waterways and so.. Finally, relevant flood prevention agencies should be well funded and the funds carefully monitored to avoid mismanagement. Government at all levels need to shift from being reactive to being proactive in responding to flood menace. There is also the need for government at all levels and its agencies to fund and map out contingency plans and emergency preparedness plans to prevent flood outbreaks crisis in Nigeria. Therefore, it is concluded that climate change challenges have likewise paved the way for various social development and economic programs to mitigate the difficulties caused by climate change. And that government need to do more to curb the menace.

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Odili, Celetine	67yrs	Civil Servant,	Ovia North East LGA	22nd July 2023,
Clement Eze Ockuko	56yr	Traditional Palace Chief,	Ovia North East LGA	22nd/May/2023
Osita, Clement	53yrs,	Civil Servant,	Benin City	21/July/2023
Mike Ikemowo,	49yrs	Public Servant,	Benin City	222nd/May/2023
Deborah Amadi,	61yrs,	Civil Servant	Ovia North East LGA	24th July, 2023
Osita Amechi,	66yrs,	Trader,	Ovia North East LGA	222nd/May/2023

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