

**IMPACT OF CLIMATE CHANGE IN NIGERIA USING NIGER DELTA AS A CASE
STUDY**

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CERTIFICATION

This is to certify that this project work was carried out by **David Ikenna IGWEGBE** in the Department of History and International Studies, Faculty of Arts, University of Benin, in partial fulfilment of the requirement for the award of Bachelor of Arts International Studies Degree.

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Ag. Head of Department

DATE

DATE

DEDICATION

This work is dedicated to Immaculate of Conception.

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TABLE OF CONTENTS

	Page
Title page - - - - -	i
Certification - - - - -	ii
Dedication- - - - -	iii
Acknowledgments- - - - -	iv
Table of Contents- - - - -	v
CHAPTER ONE	
Introduction - - - - -	1
Aim and Objectives - - - - -	4
Scope of Study - - - - -	4
Methodology - - - - -	4
Literature Review - - - - -	5
CHAPTERS - - - - -	7
Endnotes - - - - -	8
CHAPTER TWO	
LAND AND PEOPLE OF NIGER DELTA	
Introduction - - - - -	10
Defining Niger Delta region - - - - -	11
People of Niger Delta - - - - -	14
Climate - - - - -	15
Indigenous Economy - - - - -	16
Niger Delta and Conflict - - - - -	19
Endnotes - - - - -	22
CHAPTER THREE	
ENVIRONMENTAL IMPACT OF CLIMATE CHANGE	
Introduction - - - - -	25
Concept of Climate change - - - - -	25
Causes of Climate change - - - - -	26
Environmental impact of Climate change in Niger Delta. - - - - -	27
Endnotes - - - - -	35

CHAPTER FOUR

ECONOMIC IMPACT OF CLIMATE CHANGE IN NIGER DELTA REGION

Introduction	-	-	-	-	-	-	-	-	-	39
Economic impact of Climate change in Niger Delta	-	-	-	-	-	-	-	-	-	39
Adaptation Strategies for coping with the existing Impact of Climate change in Niger Delta region of Nigeria	-	-	-	-	-	-	-	-	-	46
Endnotes	-	-	-	-	-	-	-	-	-	50

CHAPTER FIVE

Conclusion	-	-	-	-	-	-	-	-	-	52
Recommendation	-	-	-	-	-	-	-	-	-	53
BIBLIOGRAPHY	-	-	-	-	-	-	-	-	-	55

CHAPTER ONE

Introduction

Globally, climate change is causing concern due to its negative impact on the environment. Human activities have resulted in certain unusual changes in the earth's climate system. These anomalies can be observed in the climate system. These anomalies include increase in the concentration of Green house gas in earth's atmosphere, which will ultimately lead to global warming¹.

The current climate change which started since the late 1960's has occurred at alarming speed and is attributed to human activities². According to Intergovernmental Panel on climate change defined climate change as a change in the state of the climate that can be identify by changes in means and variability of its properties and persist for an extended period³. According to the IPCC, climate change disproportionately affects the poor. Natural disasters such as floods and droughts have already caused significant harm and loss of life among poor populations globally.

Climate change has become one of the major threats facing the globe in the current century. The importance of climate change as a global issue has grown, and it is widely accepted as a major threat to sustainable development. Climate change is posing a great threat to development in virtually every country and subjecting a large proportion of world population to extreme shortages of food, water and shelter and in some cases perpetual poverty as a result of global warming⁴.

Climate change is a problem that needs to be addressed in the 21st century. Many international conferences and summits have been held by countries to address this issue. The United Nations Framework Convention on Climate Change is an international treaty that has been established to address climate change. It was adopted by 154 states at the United Nations Conference on Environment and Development (UNCED), informally known as the Earth Summit, held in Rio de Janeiro from 3 to 14 June 1992⁵. The summit brings together scientists and government officials to discuss and develop policies that allow ecosystems to adapt to climate change, protect food production, and promote economic development. These meetings help to ensure that the negative impacts of climate change are minimized.

United Nations Organization over the years has ensure high sensitization on climate change by allocating resources on the understanding of the phenomenon by establishing IPCC a agency responsible for creating awareness on human induced climate change, Making scientific evidence on climate change available to everyone through their assessment report, specifically to State leaders on importance of taking proper actions to manage and mitigate climate change. The 2009 Copenhagen summit resulted in the implementation of a global treaty on climate change that is not legally binding, with the goal of working towards a common objective of combating climate change.

The Niger Delta region in Nigeria is the foundation of the country's economy. It is an important source of oil and natural gas and contributes significantly to Nigeria's economic development. It generates over 90% of the nation revenue through oil production⁶. It's a

strategic economic base as far Nigeria economy is in question. The Niger Delta region is diverse and has many different ethnic groups with their own languages and dialects. The Ijaw people are the largest group, but there are also smaller subgroups such as the Itsekiri, Urhobo, Ibibio-efik, and Igbo.

The exploration and extraction of oil in Olobiri, Bayelsa State, which began in 1956, has contributed to the region's vulnerability to the negative impacts of climate change. The actions of multinational oil companies like Shell, Agip, Exxon Mobile, and others, including gas flaring and burning fossil fuels, have resulted in increased greenhouse gas emissions in the area.

Niger Delta is a densely populated region of about 40 million people and a coastal area is vulnerable to climate change⁷. The region experiences flooding, coastal erosion and health problems such as respiratory cardiovascular diseases, injuries and death related to extreme weather conditions due to climate change. In 2009 the average Carbon dioxide emissions in Nigeria emanating from Niger Delta was about 74.14 million metric tons⁸.

Human behavior, such as the use of fossil fuels and deforestation, has exacerbated climate change in recent years, causing lasting harm to the environment and the economy. Niger Delta is reported to have over 123 gas flaring sites, which increases the vulnerability of the environment and economy of the region to climate change adverse effects⁹.

This project is to examine the effects of climate change on the environment and economy of Niger Delta region of Nigeria and suggestions for possible adaptations shall be reasoned.

Aim and Objectives

The aim of this study is to examine the impact of climate change in Niger Delta region of Nigeria.

The Objectives are;

1. To study the land and people of Niger Delta.
2. To examine the meaning of climate change.
3. To study the environmental impact of climate change.
4. To examine the economic impact of climate change in Niger Delta.
5. To examine Climate change adaptation strategies in Niger Delta.

Scope of Study

The scope of this project covers the area of Niger Delta region of Nigeria and the impacts of climate change in the region between 2000 to 2015.

Methodology

This study applied historical research methods in it data collection. This study made use of secondary sources in the conduct of this research, which includes published works,

books, articles, journals, newspaper, magazine and internet sources. Some of these materials were sourced from John Harris library in University of Benin, Edo state.

Literature Review

Climate change over the years has been a global issue. There have been much research on climate change, few researchers have taken the impact of climate change into considerations. In line with this literature review, this study will identify knowledge gaps unattended and add to the existing body of knowledge as it concern Climate change.

According to A.A Idowu *et al.*, in an article titled; "Impact of climate change in Nigeria ¹⁰ he stated that most of the environmental problem of climate change manifests as physical changes such as sea level rise, higher temperature rise, desertification and erosion etc. He further argued that climate change effect socioeconomic development and has harsh effect on the low income and marginalized poor people. To what extent can climate change have effect on economic life of the people? This question is yet to be determined by scholars and in addition, this study will examine some notable aspects of the economy which are vulnerable to adverse effects of Climate change within Niger Delta region of Nigeria.

Michael E. Ikehi *et al*, in an article titled " Farming families and Climate change issues in Niger Delta region: Extent of impact and adaptation strategies¹¹. The author stated that Agriculture plays a significant role in Nigeria's economy, with a large portion of the labor force involved at a subsistence level and contributing a significant percentage to the country's GDP. The author notes that agricultural practices are heavily influenced by weather,

and variations in weather conditions such as changes in the amount of rainfall can have significant impacts on agriculture. The study highlights that the economic consequences of climate change on agriculture have been significant, leading to financial loss for farmers and exacerbating poverty for their families. The research will also explore potential strategies for adapting to the negative effects of climate change in the Niger Delta region

Stephena Udimide Ighodosa, in an article titled " Climate change: Vulnerability of Niger Delta"¹². According to the speaker, climate change is a major public health crisis that is causing an increase in vector-borne diseases and extreme weather events, leading to various health issues including mental depression and malnutrition. This study will examine the direct and indirect effects of climate change on health in the Niger Delta region.

Aaron Sayne in his speech report to United States institute of peace titled "Climate change and conflict in Nigeria"¹³. According to the speaker, Nigeria is expected to experience significant changes in temperature, rainfall, storms, and sea levels throughout the 21st century. He believes that inadequate responses to climate change could exacerbate its effects. The speaker also argued that climate change has caused conflicts between farmers and herders due to shortages of resources.

According to Andrew G. Onkerhoraye in an article titled " Climate change and advocacy in adaptation strategies at the local level of Nigeria"¹⁴. The speaker believes that Nigeria, with its strong economy in Sub-Saharan Africa, is facing significant challenges from climate change in various ecological zones within the country. These effects are expected to

intensify over time. The study mentioned in this text aims to investigate the impact of climate change on the Niger Delta region of Nigeria, addressing a gap in the author's previous work which did not specify the focus at the local level in Nigeria.

J.C, in his presentation titled " Global Climate change: drivers of multiple causes of food insecurity in sun Sahara Africa"¹⁵. The author emphasized that the effects of climate change are not experienced equally among countries, regions, economic sectors, and groups. This is due to the unequal distribution of changes in temperature and precipitation and the uneven impact of climate change on resources and wealth around the world. However, the focus of the study will be on the specific environmental impacts of climate change in the Niger Delta region of Nigeria.

CHAPTERS:

This work is divided into Five Chapters, which are the followings:

1. **Chapter One:** Introduction.
2. **Chapter Two:** Land and people of Niger Delta.
3. **Chapter Three:** Environmental impact of climate change in Niger Delta.
4. **Chapter Four:** Economic impact of climate change in Niger Delta region.
5. **Chapter Five:** Conclusion

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CHAPTER TWO

LAND AND PEOPLE OF NIGER DELTA

Introduction

The location of Niger Delta region is both geographical and political. Geographically, Niger Delta region measured up about 200,000 square kilometers, hosting about 25% of the Nigeria population and it lies in the Southern part of Nigeria¹. In the Eastern part of the country it border Ondo and Ogun states which are located in the Southwest, in the Northern part, the region border Enugu, Ebonyi, Anambra, Kogi and Ekiti State. In the South the Atlantic ocean forms it general boundary². The Niger Delta region of Nigeria is triangular in shape, with it apex between Adoh and Ndoni, downward Eastward to Qua Iboe river at Eket (Cross River) and westward to Benin river. The base of the Region is along the Atlantic coast between the bight of Benin and Biafra³.

Nigeria Niger Delta region is blessed with massive minerals deposit arising from oil and gas and it is the major oil producing region in the country. Since oil is the major source of energy in the world, the oil and gas industry Is the leading sector in the country economy. The oil and gas sector account for more than 80% of the nation total export and more than 85% of Nigeria total revenue⁴. Nigeria's economy used to be primarily based on agriculture, but after the discovery of oil, the country became reliant on this resource and agriculture was neglected. Oil has had a significant impact on Nigeria's economy, society, and politics.

The Niger Delta communities are dependents on natural environment for survival. More than 70% of the people depends on natural environment for survival⁵. A disadvantage of this development is that the local population of Niger Delta is totally vulnerable to environmental changes, because they are left with few choices about life supporting ecosystem. The region is suffering from oil spillages and pollution which has cost loss of lives and properties in the region. Oil spillages destroyed aquatic life and rendered fishermen at times unemployed etc. This chapter is divided into six sections. The introduction, defining Niger Delta region, people of Niger Delta region, Climate, indigenous economy and Niger Delta conflict.

Defining Niger Delta region

The Niger Delta region of Nigeria has a long history of being described and analyzed by intellectuals, scholars, individuals, organizations, and authorities. World Bank define it as one of the world largest wetlands and Africa largest Delta covering 70,000 kilometers, formed by the accumulation of sedimentary deposit between Niger and Benue River⁶. Nigeria federal government defines Niger Delta region as part of the Nigeria State,

... Situated in the southern part of Nigeria and bordered to the south by the Atlantic Ocean and to the east by Cameroon. It occupies a surface area of about 112,100 square kilometers and represents about 12% of Nigeria's total surface area of Nigeria. The region has nine of

*Nigeria's constituent states. Abia, Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Imo, Ondo and Rivers*⁷....

About 2,370 square of the Niger Delta area consist of Rivers, Creeks, Estuaries and while stagnant swamp cover about 8600 square Kilometers⁸. The Niger Delta region is home to the largest mangrove swamp in Africa, which spans approximately 1900 square kilometers. The region is located within the tropical rainforest and is characterized by a diverse range of ecosystems that support a wide variety of plant and animal species, including both terrestrial and aquatic fauna. The Niger Delta can be divided into four distinct ecological zones: the coastal inland zone, the mangrove swamp zone, the freshwater zone, and the lowland forest zone. These different zones support unique ecosystems and are home to many different species. The ecological zones provide varigated opportunities for development which includes outlining the pattern of farming and non-farming activities as well as settlement pattern in the area⁹.

There are three different ways in which the Niger Delta region can be defined. The first is the scientific definition, which refers to the area associated with the Lower Niger River and its tributaries. The second is the historical definition, which takes into account the region's past and the cultural and societal influences that have shaped it. The third is the political definition, which considers the Niger Delta in terms of its governmental and The Escravos and River Nun, it emanted from Benin basin up to Agbor and to Imo Rivers¹⁰. Historically, Niger Delta is made up of people during 1958 clamoured for special attention

that begot the Inauguration of the Sir Henry Willink Commission. It comprises of the Ogoni Province, Degema province etc¹¹.

Politically, the Niger Delta region is composed of nine states in Nigeria that are known for their oil production. These states are Abia, Akwa Ibom, Edo, Rivers, Cross Rivers, Imo, Delta, Bayelsa, and Ondo. These states are further divided into 185 local government areas and around 800 communities. Together, these states and communities make up the Niger Delta region as it is defined politically. It is important to note that the Niger Delta region is not limited to the southern geopolitical zone of Nigeria. Instead, it refers to those states in Nigeria that have oil deposits, regardless of their location within the country. Only eight of the nine states in the Niger Delta region are known for their oil production. Cross River is the only state that is not an oil-producing state due to the cession of oil rich bakassi peninsular to Cameroon after International court of Justice verdict¹². These states produce more than 65% of the oil produced in the region and in Nigeria in general.

Table showing projected population of Niger Delta by state 2013-2015

Niger Delta State	2013	2014	2015
Abia	3,345,769,	3,531,408	3,628,055
Akwa ibom	4,950,568	5,121,408	5,298,916
Bayelsa	2,088,154	2,149,517	2,212,894
Cross River	3,549,120	3,648,404	3,755,757
Delta	5,144,961	5,312,262	5,485,004
Edo	3,906,039	4,012,983	4,235,595
Imo	4,913,660	5,073,440	5,238,416
Ondo	4,269,668	4,399,637	4,533,626
Rivers	6,595,859	6,823,767	7,059,764
Total	33,613,568	40,073,199	41,448,027

On population the above table shows the population of the nine States in Niger Delta¹³.

The population of 1991 census shows that Niger Delta States had a population of 22,002,423, then the 2006 census shows a rise of the population of the Niger Delta region reaching 31,277,901¹⁴. Note that these latter figure only show the expected population of the region and not the exact population of the region because census has not been carried out since after 2006 national census. The Niger Delta region is rich in natural resources, including oil and gas, as well as renewable resources such as construction materials, wildlife, and water resources. It also has a abundance of non-timber resources that can be used for food, spices, condiments, and medicinal herbs, and has great potential for agricultural development. However, despite its natural wealth, the region has struggled with poverty and underdevelopment. The extraction of oil in the region has caused significant environmental damage, which has had negative impacts on the social and economic activities of the region and has contributed to increased poverty. The region's coastal location also makes it vulnerable to the negative effects of climate change in the 21st century.

People of Niger Delta

The Niger Delta region is diverse in terms of culture and people. There are five main linguistic and cultural groups in the region, including the Ijoid, Edoid, Delta Cross, Yoruboid, and Igbooid, which are further divided into several subgroups. The Ijoid are the largest ethnic group in the Niger Delta and have the most complex linguistic structure. Each clan within the

Ijoid has its own unique language and cultural characteristics. The Ijaw is the oldest settlers in the region and a population of about 8 million people ¹⁵.

The Edoid group consists of the Isoko and Urohobo from Delta State, the Edo people from Edo State, the Enganni and Appie-Attissa from Bayelsa State. The Urohobo is the largest subgroup within the Edoid group. The Delta Cross group includes the Ogoni, Ogba, Abua and Ibibio, Oron, and Ibeno of Akwa Ibom. The Ibibo are the largest subgroup within this group. The main Yoruboid groups are the Iteskiri of Delta State and the Ilaje and Ikale of Ondo State. The popular Igboid groups are the Egbema in Imo State, the Ikwere, Ndoni, Ogba, and Ekepeye in River State, and the Ukwuani and Anioma of Delta State

Before modern times, there were already interactions between different groups in the Niger Delta region, particularly among those in the core Niger Delta area. These interactions were mainly in the form of trade, warfare, and marriage. One significant way in which these groups interacted was through trade, with the Ijaw people in the coastal region trading their fish for agricultural products from farmers in the hinterland. Until recently, Iteskiri women traders played a key role in facilitating this trade. Intergroup marriage have being so important, particularly among the Urohobo, Iteskiri and Western Ijaw, that a large population in some areas are multicultural¹⁶. There is a potential for conflict between different ethnic groups in this area due to competition for resources and land. The conflict in Warri between the Ijaw and Iteskiri is a prime example of this, as it arose from a disagreement over who had control over the oil-rich city of Warri. The land disputes between the two groups became so

intense that it led to violent clashes and fatalities. The presence of crude oil in the region may have exacerbated these inter-ethnic conflicts.

Climate

Niger Delta region experiences equatorial type of climate in southern coastal area and sub-equatorial in the northern part of the region¹⁷. The climate in this region is characterized by high humidity and semi-warm temperatures, with significant variations across different parts of the area. There are two main seasons in this region: a rainy season and a dry season. The raining season start from February/March to November with over 90% of the annual rainfall in the area¹⁸. The raining season is marked by short period of semidry season in July/August in the Niger Delta, this period is associated with serious decline of rainfall¹⁹. The mean monthly temperature ranges from 20 to 29 c and annual rainfall from 2,000mm to 4,000 mm²⁰.

Indigenous Economy

Prior of oil discovery in the region, there have been various economic activities that has being thriving in Niger Delta Region. Crude oil which changed the course of the economic activities in the region is a nascent development. The economy of most of the areas, although basically Agrarian, also spurred the growth and development of agro-allied industries, both of which, in turn stimulate robust economic activities²¹.

The people of Niger Delta have for ages engaged in economic activities that encourage growth and development in the area. These activities could be categorized into four which includes; Agriculture, Fishing, Trading and indigenous technology.

Agriculture: Agriculture is the mainstay of Niger Delta economy and mostly practiced in the forest zone. The agricultural practices in the region comprised of farming and animal husbandry. Due to the arable land that's fertile, farmers cultivate varieties of crops such as maize, yam, cocoyam, plantain and palm oil. palm oil as a vital agricultural produces has been exporting during the colonial period. That was the reason Niger Delta is sometimes refers as palm oil region. The palm oil is considered to be among other principal item of trade around Benin from the 15th century to the Advent of the colonists²², although they later embraced other new crops such as cocoa and kolanut which were introduced from tropical Southern America and West Indies²³. In terms of labour, men, women, children, and sometimes hired labourers helped in the farm. It's women duty to carry the produces to the market to sell either by barter or money. Farming remains the major occupation of the forest zone to this present day.

Fishing: Fishing in Nigeria is a basic piece of the country sustainability particularly to the people of the Niger Delta Region²⁴. Fishing is a thriving economic activity in this region, particularly for those living in the riverine areas. It is one of the major occupations in the Niger Delta region. Fishing contributes immensely to the indigenous Economy due to economic and health benefits accrue from fish. Fish serve as protein and therefore on high

demand both from people within and outside the region. The Ijaw communities in the region are mostly known for fishing and have utilized the occupation as their source of livelihood. Fishing contributes significantly to their economic activities through sale at the local markets and also distant Market in Okundi, Ugep and Ogoja²⁵. The instruments used for fishing are manufactured locally by the people such as fishing net, hook, canoe.

Indigenous Technology: The Niger Delta people had a vast technological base which supported the indigenous Economy²⁶. The people are involved in blacksmithing which enable them to produce tools and help meets the need of the people. Blacksmithing thrived in the area with the mining of iron that was used to manufacture implements for farming, hunting, and fishing activities in the area²⁷. These implements include fishing hook, kitchen wares, local guns, traps, hoes and Spears. The people of the Niger Delta are involved in craft work. Craft work stood the test of time despite technology advancement; people are still using raffia palms in roofing of houses, making of hat, mat, and basket which are mostly seen in the remote villages. These craft works sustain Economic development in the region because of its entrepreneurial nature, in which people learnt it through the process known as apprenticeship. Manufacturing of canoe became important aspect of craft work in the region, it became lucrative because it was used for transportation between communities especially Oron and Calabar and other coastal communities in the region. Canoe helped in carrying people and goods to markets and served as a means of transportation to the people of the region.

Trade: The people of Niger Delta were engaged in trade as one of their occupations. Many people are involved in trading, both local and distance trades in the region. Trading is also seen as part time activities because many people that are involved in trading are also farmers. People sells okro, vegetables, palm fruits, pepper etc within their communities and some produces are taking to local markets for their potential buyers. Distance trade has to do taking their produces outside their region and commodities such as yam, banana, palm oil, rubber, fish, plantain, were taking to places such as Oturkpo, Onitsha, Kano, Jalingo. Even after the coming of the Europeans indigenous trade flourish and still contribute immensely to the indigenous Economy of people of Niger Delta.

Niger Delta and Conflict

Niger Delta from time immemorial has a turbulent history of conflicts rising from intra and inter-ethnic conflicts. The most popular conflict in the region was the rise of militant groups against multinational oil companies and Federal government. The conflict is considered popular because it got global attention and cut across the nine States that are in Niger Delta.

Niger Delta has been the economic backbone of Nigeria since oil was discovered in the region. Oil from the region is the main source of revenue for Nigeria and a major source of foreign exchange. The discovery of oil in Niger Delta was viewed as a blessing by the people of the region, as they hoped it would bring development and prosperity similar to what other oil-producing countries have experienced.

Oil, which was expected to bring prosperity, has instead brought hardship to the Niger Delta region. Companies such as Shell, Chevron, and Agip have caused environmental damage through their operations. The area lacks basic infrastructure and economic opportunities, and has experienced a lack of progress or development. The Region is one of the least developed in the nation²⁸. It has 2% of Federal road and less than 30%/40% of the settlement have electricity²⁹. The Region is ridden with poverty and suffering on top of immense wealth.

These neglects and underdevelopment triggered protest and agitation in the region against Federal government and oil companies. On December, 1998, the Ijaw youth council in it Kaima declaration issues an ultimatum to all the oil companies in the region to suspend operation and leave the region by 31st December, 1998³⁰. The early stages of unrest led to the formation of militant groups such as the Movement for the Emancipation of the Niger Delta (MEND), Jombolo boys, and the Joint Revolutionary Council, which posed a threat to the Nigerian government and oil companies operating in the region. The militants engaged in unconventional activities such as sabotaging oil facilities through blowing off pipeline and oil installations, kidnapping of expatriates and incessant killings etc. These activities had a gross effect in Nigeria Economy. Between 2005 and 2008, oil revenue went down by 40%³¹. The initial government response was the used of Joint military to repress the militant activities. The military approach rather than de-escalating the conflict escalated it. Personnel's of both sides were killed and properties worth millions were lost during the conflict.

It became clear that military approach was not a right response to control the violent militant activities in the region given its increasing intensity³². In order to restore peace in the region, late president Musa Yarugba on 8th of September, 2008, set up a committee called Niger Delta Technical committee to recommend appropriate measures to control the militancy in the region³³. In January 2009, Late President Yarugba granted State amnesty to all militant groups who are ready to lay down their weapons and surrender. The amnesty included unconditional state pardon, promise of monthly allowance, vocational training, scholarship and some were sent abroad to study. The amnesty initiative minimized the violent tempo in the region, bringing peace to once violent Region. In the end, 192 militants had surrendered their weapons consisting of 2,760 arms of different types to the amnesty committee³⁴.

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CHAPTER THREE

ENVIRONMENTAL IMPACT OF CLIMATE CHANGE IN NIGER DELTA

Introduction

The annual report from the IPCC has reported that environmental threats exist. Climate change has had a significant impact on human life and has had negative effects on the environment. This chapter will examine the environmental impacts in the Niger Delta region of Nigeria.

Concept of Climate change

Climate change refers to changes in a region's or country's average weather conditions. Climate change is defined as a change in the state of the climate that can be identified by change in means and variability of its properties and persist for an extended period¹. Climate change is said to occur over decades or millennia². Variability has been one of the characteristics of climate change. Climate change impacts different regions in various ways. In northern Nigeria, there are problems with drought, aridity, and desertification, while in the southern part of the country, there are issues with flooding and sea level rise. The indications that climate change is occurring are consistent increases in temperature, varying rainfall patterns, more frequent extreme weather events, sea-level rise, rapidly changing seasons, ocean acidification and glacial melting, these changes are being felt around the world and are already having considerable socio-economic effects in addition to very significant ecological impact³.

When a weather of a particular Region is altered between two different times, Climate change is said to have occurred⁴.

Causes of Climate change

Climate change is primarily caused by human activities. These activities, such as industrial processes, deforestation, transportation, and household energy use, contribute to the increase of greenhouse gases, particularly carbon dioxide, in the atmosphere. These gases trap heat from the sun, leading to rising temperatures and other changes in the climate. Scientist are confident about the fact of Climate change due to human activities⁵. Greenhouse gases produced by human activities disrupt the natural balance of the atmospheric greenhouse, which helps to regulate the temperature of the Earth by trapping heat from the sun. Some of the greenhouse gases that are significantly affected by human activities include carbon dioxide, methane, nitrous oxide, chlorofluorocarbons, and ozone. These gases trap more heat in the atmosphere, leading to rising temperatures and other changes in the climate. These gases are released into the atmosphere through the following ways:

1. **Deforestation:** When forests are cleared for human activities like farming or settlement, the carbon dioxide stored in the trees is released into the atmosphere. This process, known as deforestation, decreases the amount of carbon dioxide that is absorbed from the atmosphere by plants. Additionally, smaller plants like grasslands and crops are not as effective at removing carbon dioxide from the atmosphere as

forests are. Deforestation can contribute to climate change by increasing the amount of carbon dioxide in the atmosphere and decreasing the ability of plants to absorb it.

2. **Slash and burn Agriculture:** the burning of forest to create ranchlands that occurs in the tropics, releases the Carbondioxide stored in forests. Developing countries account for 74 percent of agriculturally related greenhouse gases⁶.
3. **Fossil fuel burning:** is the most dominant among these activities. The increase of industrial uses of fossil fuel releases Carbondioxide that have been stored in the earth, hereby causing Climate change.
4. **Fertilizer application:** .The storage of liquid manure in large tanks leads to an increase in the amount of methane released into the atmosphere.

Environmental impact of Climate change in Niger Delta

Human activities have a negative impact on the environment, and many of the worst disasters in the world are related to weather or climate. Our news channels often report on these events, such as flooding, erosion, sea level rise, displacement, extreme weather, and drought. The Niger Delta region, located in the coastal area of Nigeria, is particularly vulnerable to the negative effects of climate change. Several studies have identified the Niger Delta region as highly vulnerable to impacts from climate change, stemming from sea level rise, increased precipitation, and intensive industrial activities from oil exploration⁷. The followings are the environmental effects of Climate change in Niger Delta

Sea level rise is attributed to Climate change and is expected to be higher in the coastal region. Niger Delta region being a coastal area is vulnerable to sea level rise and is considered to be less than 20 feet above sea level⁸. Niger Delta has been experiencing sea level rise increment of almost one foot in the past five decades with indications forecasting that the increment could be as three feet in next 9 decades⁹. Sea level rise is causing a number of communities in the region to be threatened by flooding. Communities like Uzere in Delta State have been submerged by water and many people have fled from their homes¹⁰. Sea level rise will cause more frequent and severe flooding, both from rivers and the ocean, leading to the displacement of people, migration, and the disruption of coastal wetlands. Sea level rise of 1 meter could result in loss of about three quarters of the land of Niger Delta¹¹. It has been estimated that rise in sea level by up to 59cm by 2100 will result in the submersion of several States in Niger Delta¹². With the increment of the sea level in Niger Delta 80% of the people will be displaced due to low land of the region¹³. Rising sea levels will exacerbate the issue of saltwater contamination in both above and below-ground water sources, which can be harmful to aquatic life that cannot tolerate high salt levels. Coastal areas have experienced significant loss of land due to sea level rise. Climate change and rising sea levels have had a negative impact on the Niger Delta region, including the loss of biodiversity, degradation of land, and reduced water availability due to damage to catchment areas and underground water sources.

Flood: While climate change will lead to increase aridity and desertification in northern Nigeria, it will lead to increase in flooding in the southern part especially in the coastal regions¹⁴. Flood due to intense rain can be devastating to human life, property and to the environment. Due to flooding, a number of individuals have had to evacuate their homes and local roads have been rendered unusable. The flood has caused damage to the infrastructure in certain areas and made them unsafe to live in, and it has also led to an increase in harmful disease-carrying insects such as mosquitoes. In Egor and Ogida community in Edo State, several houses have been abandoned by their owners due to flood and many more areas in the region are still vulnerable to flood¹⁵. In Awka Ibom State which is one of the Niger Delta State in Nigeria, Ikot Ibom Itam Community experience heavy rainfall which led to the disappearance of about four local streams, leaving the people with limited source of freshwater¹⁶. Flooding in the region leads to frequent changes in the river's path, making it unreliable as a means of transportation. The floods also hinder the regeneration of forests, as they wash away vital nutrients from the soil. The 2012 flood in the Niger Delta region was the most recently recorded flood episode that was attributed to Climate change¹⁷. It was reported that the flood was very high in terms of human, material and production loss, with 363 people killed, 5,851 injured, 3,891,314 affected and 3,871,530 displaced¹⁸. Niger Delta Region contributed significantly to this statistics, as four States (Bayelsa, Delta, Edo and Rivers) in the region were significantly impacted¹⁹. The victims most times suffer from Traumatic experience such as hypertension as a result of their losses.

Coastal erosion: Heavy rainfall events, which may be exacerbated by climate change, could worsen soil erosion, coastal erosion is a serious environmental problem in Niger Delta region²⁰. Coastal erosion has caused problems for people living on many islands in Niger Delta. The erosion of beach ridges has gotten worse, leading to the displacement of communities who have had to move elsewhere. In some places, especially in Forcados, some oil wells have been lost to the ocean due to erosion²¹. Coastal erosion is a concern in the Niger Delta region because it has an impact on the local economy, particularly the agriculture and fishing industries. The Niger Delta is a significant source of fish for Nigeria, and erosion in the area has had a significant impact on this resource.

Coastal vegetation especially the mangroves have been lost to coastal erosion²². Coastal erosion has led to loss of habitat and productive land in the region and in the coastal plains of Ondo and Cross River States, gully erosion is also taking a toll²³. The Niger Delta has experienced increased rainfall-induced erosion in many areas due to more frequent heavy rain. This problem is likely to worsen as climate change causes more frequent and prolonged periods of heavy rain.

Biodiversity loss: Biodiversity in Niger Delta region consist of various species of Fauna and Flora including reptiles, amphibians, micro-organisms, mosses, liverwort and dicotyledon plants²⁴. Biodiversity provides shelter and habitat for microorganisms, serves as a source of energy (e.g. firewood), and can be used for educational purposes, clothing, home utensils, and medicine. It can also generate income through eco-tourism. Climate change has reduced

the efficiency of agriculture, causing people to rely more on biodiversity as a source of income. This in turn, increases the risk of extinction for many species in the region. Climate change has had a negative impact on biodiversity, with numerous plant species in the region potentially at risk of extinction.

The stresses caused by Climate change, added to other stresses on biodiversity (e.g land conversion, land degradation, oil spillage and deforestation) threatened substantial damage to or a complete loss of biodiversity and the Extinction of some endangered species²⁵.

Warmer temperatures caused by climate change will result in some species moving to new locations. Changes in rainfall patterns will also disrupt species behavior, such as nesting and food chains. The loss of biodiversity not only degrades the environment for plants and animals, but also impacts humans. The loss of biodiversity leads to a decline in plants and various animal species that are important for the subsistence practices of certain communities who rely on them for survival.

Changes in Rainfall: Changes in Rainfall and other precipitation will be one of the most critical factors determining the overall impact of Climate change²⁶. Meteorological data has indicated that the rainfall patterns in Nigeria have undergone changes in recent decades²⁷. The reduction in the amount of rainfall started at the beginning of the 1960s when the year of relative wet years ended²⁸. The constant reduction of rainfall in Niger Delta is cause by Climate change. The Niger Delta has two seasons: the dry season and the rainy season. The rainy season runs from May to September, while the dry season begins in October and ends

in April. Climate change has resulted in unpredictable rainfall patterns in the region, which can negatively affect plant growth in the area. Food security has been defined as the ability of people to grow and obtain food²⁹. Climate change is expected to pose a serious threat to the security of our food supply. As a result of climate change, we may experience irregular changes in the timing and quantity of rainfall, which can adversely impact agricultural production. As noted earlier, agriculture in the Niger Delta is highly dependent on rain and irrigation is seldom practiced³⁰. The alterations in the pattern of rainfall have had a significant effect on agriculture in the area. Farmers in the region usually plant their crops during the rainy season, which starts in April. Some farmers seize this chance to sow their crops. The rain falls periodically till the month of June/July (the peak of the rainy season), when rain fall more or less continually during the day³¹. The periodic rainfall pattern before the peak in June enables farmers to cultivate various crops³². In the past, people were able to predict rainfall patterns with some accuracy, but due to climate change, these predictions have become more difficult to make.

Heat wave: Heat waves are the most dangerous weather events, and they have become more common and longer in recent times. A heat wave is a prolonged period of excessively hot weather, relative to what is expected for that location³³. Extreme heat has garnered a lot of attention recently. Climate change can contribute to extreme heat events by increasing the probability of very hot days and nights. Extreme heat has been affecting most part of Nigeria including Niger Delta with temperature above 38c³⁴. The weather has become very

hot in most part of Niger Delta, affecting the environment. Extreme heat can cause discomfort for Families and children are principally victims as they develop rashes and become uncomfortable at night. Increasing heat contribute to smog formation and worsening air quality, both are evident problem in urban and rural enviroment³⁵. However researchers have explained that the current hot days, hot Night and intense heatwave are consequences of unabated global Climate change³⁶.

Human health: Climate change affect the social and enviromental determinants of health, these includes clean air, safe drinking water, sufficient food and secure shelter³⁷. The Niger Delta region is particularly vulnerable to the negative impacts of climate change on human health due to the limited availability of adequate health facilities, ineffective emergency response systems, and the overall poor health of the population. Many people in the region depend on natural resources for their livelihood, which are susceptible to the impacts of climate change. When these resources are severely impacted by climate change, it can have negative consequences on the health of the people. Climate change has exacerbated and worsened existing health issues, leading to illness, death, and injuries. Rising temperature, rising sea level and changes in rainfall pattern, which can predisposed people to infection and health challenges³⁸. Climate change is making it easier for diseases carried by vectors, such as malaria and cholera, to spread. Floods and standing water caused by climate change can create conditions for mosquitoes to breed and transmit malaria to new areas. Furthermore heavy rain can also lead to the contamination of drinking water with sewage, industrial waste,

and chemicals, resulting in the spread of infections.". High temperatures can trigger incidences of tropical diseases, such as heat cramps, heat strokes, cerebrospinal meningitis, and malaria³⁹

In Niger Delta region windstorm, extreme rainfall and flood can cause injuries, drowning, death and severe physical and mental trauma, particularly for citizens who lives in along major river Delta's, on island and low lying coastal areas⁴⁰. In parts of the region, for example, flooding from sea level rise has contaminated freshwater aquifers, rivers, and stock-watering points. This has increased salinity in these bodies of water and polluted them with sediment and sewage⁴¹

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CHAPTER FOUR

Introduction

Climate change has varying impacts on different parts of the world, including the Niger Delta region of Nigeria. This coastal area is known for its abundant natural resources, including oil and gas, which contribute significantly to Nigeria's foreign exchange. However, the region is vulnerable to the negative effects of climate change due to its reliance on climate-sensitive economic activities. In this chapter, we will explore the economic sectors in the Niger Delta that are affected by climate change, and discuss the measures that are needed to minimize and mitigate these negative impacts on the region's economy.

Economic impact of Climate change in Niger Delta

The effects of climate change on the economy of the Niger Delta region cannot be underestimated. The people of this area have experienced harm to their economic well-being due to the frequent occurrences of climate change in the region. It is crucial that we examine and discuss the various economic activities that have been affected by climate change in the Niger Delta region.

Agriculture:

Agriculture is a sector that is particularly vulnerable to the effects of climate change. In the Niger Delta, various crops are grown and the type of crop that is grown depends on the amount of rainfall in a particular area. When there is sufficient rainfall, crops that require a lot of water to grow can be planted. However, climate change has had an impact on

agriculture in the Niger Delta, which has affected the livelihoods of some of the people in the region who rely on farming for their income. The unpredictable rainfall as a result of Climate change makes it difficult for farmers to plan their operation and reduces the cropping seasons and length of growing days¹. Some crops are sensitive to even tiny shifts of rainfall and temperature². The amount of rainfall that occurs during the planting season is crucial for a successful harvest. If there is not enough rain or if there is too much rain, it can lead to significant economic losses for farmers and can result in higher food prices and shortages in the market due to poor crop yields. Climate change can affect the amount and distribution of rainfall, which can have a negative impact on agriculture and the economy.

The effects on agriculture are mostly beared by the rural population who are mostly subsistence and smallholder farmers. They may be effected in the following ways.

1. There is a strong possibility that the crops will not grow or produce as expected.
2. Agricultural land has been lost due to flooding and erosion caused by climate change
3. Climate change is creating competition for limited resources, resulting in insecurity for individuals whose livelihoods rely on these resources. This has led to instances of conflict between herders and farmers due to diminishing pasture and water. As climate change persists, conflicts related to scarce resources are likely to become more frequent, potentially leading to increased violence and societal unrest as people try to protect their access to necessary resources. To address these issues, it is important for governments, communities, and individuals to work together to find

ways to manage competing interests and reduce the risk of resource-based conflicts, such as implementing conservation measures, investing in sustainable agriculture, and developing alternative sources of income for individuals affected by climate change.

4. Heavy rain and flooding can remove important nutrients from the soil, causing it to become less fertile and productive. This can harm agricultural yields and plant growth.
5. Rapid deterioration and wastage of farm produces
6. Heat stress can negatively impact the ability of farm workers to perform their duties, reducing the amount of labor that can be utilized on the farm and leading to slower productivity.
7. Selling agricultural products at a disadvantageous price due to the deterioration of farm products.

Under extreme weather conditions, crop and plant yields will suffer due to the presence of pests and diseases. Some pests, such as rice stink bugs and lima-bean pod borers, may also expand their range as a result of climate change. In the year 2012's flood, many hectares of land were submerged by flood, damaging the crops grown in the region, flooded farmland and loss of arable land for crops within the region thus reducing tuber crops harvest such as cassava and yam by at least 0.25 million metric per annum³. Due to Climate change, agriculture in the region will likely suffer greatly in terms of income, food production, and employment in agriculture-related industries. The impacts will be severe.

Fishing:

Fishing is a significant contributor to the economy of the Niger Delta region. It is a prosperous industry there. The region being a coastal area has abundant of water, which the locals utilize for fishing. An estimated of 50% of fishes consumed in Nigeria comes from Niger Delta region⁴. The blackish water in the region is an habitat for several species of aquatic animals like fish and as well favourable breeding ground for several migratory ones⁵. Over 75% of the 30 million inhabitants of the Niger Delta lives along the coastal area and survive mainly by fishing⁶. Changes in sea level, such as rising or falling, can impact the quality of the water and the fish in the Niger Delta region. These changes can have negative consequences for the fishermen and traders who rely on these resources for their livelihoods. The increase in sea level in the region has caused salt water from the sea to invade both surface and underground water sources, leading to the death of aquatic animals and fish that cannot tolerate the high levels of salt. The salination of the brackish waters in the region has been greatly affected by flooding and sea water intrusion leading to lose of indigenous aquatic species⁷. Severe storms will threaten fishing vessels and crew, affecting fish farmers on board⁸. Fishing has become less successful and profitable in many areas due to lower catches and decreased income.

Forestry:

Climate change has had a negative impact on the forestry industry in this region, which is an important contributor to the local economy. The community in the region relies greatly on the various non-timber resources found in the forest for a range of purposes,

including firewood, fibers, leaves, pigments, fruit, herb plants, food spices, palm wine, wild game, and other products. These resources are used for both personal needs and for sale in the market. However, the effects of climate change have made it more difficult for them to access and utilize these resources. Climate change effects forestry due to Erosion and excessive wind reduces the amount of forestry produce, such as wood and cane, consequently reducing income and increasing the costs of building and furniture materials⁹. Forests are facing numerous challenges, including climate change, population growth, and resource demand. These pressures are leading to the loss of indigenous forests and difficulties in tree planting and maintaining species diversity. In addition, climate change is causing tree death and a decrease in forest regeneration, which may lead to a shortage of fuel wood for local communities. This could have negative impacts on rural populations who rely on wood for energy.

Energy sector:

The Niger Delta region's energy sector is likely to be greatly affected by climate change. Energy is essential for businesses and industries in the region, as it is necessary for industrialization and supports small and medium enterprises. Many businesses and industries rely on electricity to operate and be productive, and climate change is making the already poor energy supply in the region even worse. Damage or destruction of transmission lines and substation equipment, due to sea level rise, erosion, flash floods and other extreme weather events, can disrupt service and incur Economic loss to businesses who depend on

electricity for productivity¹⁰. Climate change, with its associated impacts like rising temperatures, erosion, and flooding, can pose a significant risk to oil and gas facilities in the region. If these facilities are threatened, it could lead to job loss for the workers in the area. The Liquefied natural gas (LNG) pipeline which serve as cooking gas can be affected also, which can throw more hardship on the people due to its domestic uses at home and food vendors in the region who depend on it for their productivity. Food vendors makes uses of these gases in their daily activities and any impact on the pipeline, can lead to certain degree of economic loss.

Mining:

Mining, including oil and gas extraction, sand mines, and quarrying, plays a significant role in the economy in the region and provides a means of income for its residents, those in riverine areas who are involved in sand mining. However, climate change has had direct impacts on mining sites in the region, such as flooding and erosion, which can lead to the submerging of mining sites and the loss of operational equipment. This can result in job losses and an increase in unemployment in the region, as well as significant economic losses in terms of investments and development, particularly in oil and gas industries and the damage to infrastructure and social amenities.

Transportation:

The transportation sector is likely to be significantly affected negatively by climate change. Transportation is a vital aspect of the economy that involves the movement of goods, people, and services through air, land, and water transportation systems. It is an essential component of economic interactions and overall economic activity. Climate change is expected to have a particularly detrimental effect on the transportation infrastructure in the Niger Delta due to its already inadequate and poorly constructed state. Extreme weather events like floods and erosion could make roads in the region impassable and disrupt economic activity. Those who rely on transportation for their livelihood, like truck and bus drivers, could also be impacted. Increased temperatures may also expose these vehicles to increased hazards of road accidents¹¹. Changes in wind patterns or heavy rainfall can affect the efficiency and safety of flights, which can have negative impacts on the transportation sector and cripple economic activity. This is because the transportation sector is a vital component of the economy that facilitates the movement of goods, people, and services, and disruptions in this sector can have wide-reaching consequences for economic activity.

Industries:

Many industries in the Niger Delta region are negatively impacted by problems caused by climate change. These industries include those that manufacture products such as food and drinks that rely on local resources for their raw materials. Climate change can impact the amount of resources that industries depend on through changes in weather conditions, leading to negative consequences for those industries. Variations in the

production costs of crops, domestic animals, fish, wood, water and mineral resources due to climate change and sea level rise, would affect, for instance, industries processing agricultural products, hydroelectricity generation and aluminum industry¹². The alteration of biodiversity caused by climate change could impede the development of agricultural and pharmaceutical products, which could negatively impact the industries that produce them. This could result in the relocation of these industries, a decrease in revenue, and the cessation of operations, potentially contributing to increased poverty among individuals who depend on these industries for their livelihoods.

Adaptation Strategies for coping with the existing Impact of Climate change in Niger Delta region of Nigeria

It is clear that the people of the Niger Delta region of Nigeria are facing the negative environmental and economic effects of climate change. The unique location and characteristics of the Niger Delta have prompted individuals and groups to search for ways to mitigate the impact of climate change. Adaptation refers to all the responses to Climate change that can be used to reduced the Impacts ¹³. In order to reduce the impacts of Climate change the following strategies are to be followed:

1. **Provision of solid infrastructure:** It is important for governments to invest in solid infrastructure, such as bridges, tracks, and roads, to help reduce the impact of floods. In particular, having a good drainage system can be effective in mitigating the effects of floods. This type of infrastructure is especially important in areas that are prone to

flooding and can help to ensure that transportation and other essential services can continue to function during times of flood.

2. **Information and Awareness:** Government should endeavor to create the awareness of Climate change to the public. In the Niger Delta, for example, results of a household survey indicate that the level of awareness of local communities of climate change impacts is low, with close to 60 percent of respondents knowing little or nothing about climate change and its impacts¹⁴. Understanding the causes and consequences of climate change allows people to be aware of their actions and how they may contribute to climate change. By educating people about climate change, we can work towards reducing activities that contribute to it.
3. **Environmental law:** Reducing greenhouse gas emissions is essential for combatting climate change and preserving the environment. One way to do this is by limiting gas flaring in the Niger Delta region. Governments, such as Nigeria's Ministry of Environment, can play a significant role in this by implementing and enforcing laws and regulations that reduce emissions. It is important for the government to address this problem and collaborate with industry and other interested parties to find ways to decrease emissions and safeguard the environment.
4. **Tree planting:** Governments should increase efforts to plant trees, as they have the ability to capture carbon dioxide that would otherwise be released into the atmosphere. Trees can also reduce the impact of storms and protect buildings and other structures.

5. It is a good idea to promote community-led management of coastal areas, as this can help to improve agricultural production and support the livelihoods of local people. Providing equipment and inputs to support activities such as shrimp culture, cage fish culture, and beekeeping can help to increase productivity and contribute to the local economy. It is important to ensure that these resources are used in a sustainable way, so that they can provide long-term benefits to the community and the environment. It may also be helpful to provide training and technical assistance to help people in the community develop the skills and knowledge they need to effectively manage these activities.
6. Providing subsidies on agricultural inputs such as seeds, fertilizers, agrochemicals, and livestock can help to reduce the costs associated with farming and make it more accessible to smallholder farmers and other stakeholders in the farming community. It is important for the government to carefully consider the potential costs and benefits of such a program, and to ensure that the subsidies are targeted effectively to reach those who will benefit most from them. It may also be helpful to consider other measures that can support the development of the agricultural sector, such as providing training and technical assistance, improving infrastructure, and promoting access to credit. Community cooperative groups' formation, credit assistance and varied support for Women-in-Agriculture involved in post-harvest operations should be greatly improve¹⁵.

7. The federal, state and local governments should engage in participatory community projects' implementation through the management of policies and regulations relevant for the moderation of agricultural production laws that can assure sustainable livelihoods and as well help mitigate change impacts¹⁶.

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CHAPTER FIVE

Conclusion

Climate change is indeed having a significant impact on the Niger Delta region of Nigeria. The activities of oil companies and illegal refineries have contributed to the emissions of greenhouse gases, which contribute to climate change. The resulting environmental impacts, such as sea level rise, flooding, erosion, and changes in rainfall patterns, are threatening human development and existence in the region. These impacts have displaced people from their homes, increased waterborne diseases and malaria, and altered the ecosystem of the region, leading to loss of biodiversity and species of animals and other organisms. These impacts are likely to continue in the coming decades unless action is taken to address the root causes of climate change and to mitigate and adapt to its effects. It is important for the government and other stakeholders to take steps to address these issues and to find ways to protect the people and the environment of the Niger Delta region from the impacts of climate change.

It is true that the people of the Niger Delta region depend on nature for their livelihoods, and that climate change is a threat to these livelihoods. Changes in rainfall patterns and the increased risk of flooding can have a negative impact on agricultural production, leading to economic losses for farmers. This is particularly concerning in a less developed country like Nigeria, where the economy is not yet industrialized and may not have the technology and resources to effectively adapt to the impacts of climate change. However, there are a number of adaptation options that can help to mitigate the impacts of climate change in the Niger Delta region. These options could include measures such as

improving infrastructure and agricultural practices to increase the resilience of the region to climate-related risks, promoting the use of climate-smart agriculture techniques, and developing early warning systems to help people prepare for and respond to extreme weather events. It is important for the government and other stakeholders to work together to develop and implement these adaptation measures to help protect the people and the environment of the Niger Delta region from the impacts of climate change.

The people living in Niger Delta, Nigeria are becoming more vulnerable to the impacts of climate change. In order to address this, it is necessary for all relevant parties, including both public and private sector organizations, to provide more support in order to alleviate these negative effects.

Recommendation

1. The governments at both the federal and regional levels in Nigeria should take swift action to address the actual impacts of climate change in the Niger Delta region.
2. The Federal Ministry of the Niger Delta and the Niger Delta Development Commission (NDDC) should create policies to address the pressing needs of coastal communities in the region that are vulnerable to sea level rise, flooding, and coastal erosion. These policies should focus on emergency preparedness, environmental rehabilitation, and protection of the shores, water, schools, healthcare facilities, and hospitals in the region. One way to address coastal erosion would be to implement measures to control it.

3. Effective media coverage of climate change can increase public awareness and understanding of the causes and impacts of climate change, as well as the strategies for mitigating and adapting to it. This includes coverage of disaster management, emergency preparedness, and the needs of vulnerable groups. By raising awareness about these issues, the media can play a vital role in promoting action to address climate change.
4. The government should provide support to local communities in the Niger Delta region by offering credit facilities and building the capacity of community members to better adapt to climate change and other environmental degradation. This can improve the adaptive capacity of these communities and help them to better cope with the challenges they face.
5. In order to address the impacts of climate change in the Niger Delta region, the Federal Government of Nigeria should invest in renewable energy sources such as solar and wind power. They should also consider implementing an early warning system for vulnerable areas that utilizes sound technology. These measures can help to reduce the risks associated with climate change and increase the resilience of communities in the region.

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