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# Climate Change and Environmental Degradation in the Niger Delta Region of Nigeria: Its Vulnerability, Impacts and Possible Mitigations

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**Abstract:** Climate change and global warming are now scientifically established facts. Climate change is a massive threat to human development and in some places, it is already undermining the achievement of the Millennium Development Goals (MDGs) and the international community's efforts to reduce extreme poverty. The issue of climate change is global. Nigeria is not excluded from its threats. Nigeria is reported to have 123 flaring sites in the Niger Delta region of the country. Making Nigeria one of the highest emitter of greenhouses in Africa. Carbon dioxide emission in the area are among the highest in the world. Some 45.8 billion kilowatts of heat are discharged into the atmosphere of the Niger Delta from flaring 1.8 billion cubic feet of gas everyday. It has been reported that gas flaring has raised temperatures of the region and rendered many areas uninhabitable. This study examines the scenarios of the climate change in the Niger Delta region, its vulnerability and impacts and provided possible mitigations to stem the tide of global warming and environmental degradations in the region.

**Key words:** Climate change, global warming, environmental degradations, vulnerability, mitigations, fossil fuel

## INTRODUCTION

Rising fossil burning and land use changes have emitted and are continuing to emit increasing quantities of greenhouses gases into the Earth's atmosphere. These greenhouses gases include Carbon dioxide ($CO_2$) and a rise in these gases has caused a rise in the amount of heat from the sun withheld in the Earth's atmosphere, heat that would normally be radiated back into space. This increase in heat has led to the greenhouse effect resulting in climate change.

The main characteristics of climate change are increases in average global temperature (or global warming), changes in cloud cover and precipitation particularly over lane, melting of ice caps and glaciers and reduced snow cover and increases in ocean temperatures and ocean acidity-due to seawater absorbing heat and $CO_2$ from the atmosphere.

The Fourth Assessment Report of the Intergovernmental Panel on climate change (IPCC, 2001) dispelled many uncertainties about climate change. Warming of the climate system is now unequivocal. It is now clear that global warming is mostly due to man-made emissions of greenhouse gases (mostly $CO_2$). Over the last century, atmospheric concentration of $CO_2$ increased from a pre-industrial value of 278 parts per million to 379 parts per million in 2005 and the average global temperature rose by 0.74°C (IPCC, 2001). According to scientists, this is the largest and fastest warming trend that they have been able to discern in the history of the Earth.

An increasing rate of warming has particularly taken place over the last 25 years and 11 of the 12 warmest years on record have occurred in the past 12 years.

The IPCC Report (IPCC, 2001) gives detailed projections for the 21st century and these show that global warming will continue and accelerate. The best estimates indicate that the Earth could warm by 3°Cby 2100. Even if countries reduce their greenhouse gas emissions, the Earth will continue to warm. Predictions by 2100 range from a minimum of 1.8°C to as much as 4 Crise in global average temperatures.

The major impacts and threats of global warming are widespread. Increasing ocean temperature cause thermal expansion of the oceans and in combination with melt water from land based ice, this is causing sea level rise. Sea levels rose during the 20th century by 0.17 m. By 2100, sea level is expected to rise between 0.18 and 0.59 m.

The effects of climate change imply that the local climate variability that people have previously experienced and have adapted to is changing and changing at relatively great speed.

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Africa is already a continent under pressure from climate stresses and is highly vulnerable to the impacts of climate change. Many areas in Africa are recognized as having climates that are among the most variable in the world on seasonal and decadal time scales. Floods and droughts can occur in the same area within months to each other. For example, one third of African people already live in drought prone areas and 220 million are exposed to drought each year (IPCC, 2001).

Many factors contribute and compound the impacts of current climate variability in Africa and will have negative effects on the continents ability to cope with climate change. These include poverty, illiteracy and lack of skills, weak institutions, limited infrastructures, lack of technology and information, low levels of primary education and health care, poor access to resources, low management capabilities and armed conflicts. The over-exploitation of land resources including forests, increases in population, desertification and land and environmental degradation pose additional threat.

This study reviews the impacts and vulnerability of the global warming and the attendant environmental degradation in the Niger Delta Region of Nigeria and suggest possible mitigations to stem the tide.

## MATERIALS AND METHODS

The methodology used for this research work was a quantitative research technique. However, quantitative statistical data was used to support the qualitative analysis. Secondary data and information were used for the study. A number of articles, books and statistical records were analysed to verify the impacts and vulnerability of climate change and environmental degradation in Nigeria particularly in the Niger Delta region of the country. The statistical data provided information on different issues such as the ranking of environmental issues in the Niger Delta region, analysis of oil spill in the region among others.

The qualitative technique which is exploratory in nature to understand the concepts adopted and issues of interest was used for interpreting and review of information from the articles, journals, books and other literatures used in the study.

The author acknowledges all the authors of various materials used for the study as listed in the reference.

Qualitative analysis was carried out in the study. The qualitative statistical data used was extracted from the literature materials while the quantitative statistical data used was presented using bar graphs pie charts, tables and multiple graphs (Creswell, 2003; Tashakkori and Teddle, 1998).

## RESULTS AND DISCUSSION

**Climate change and the impacts in the niger delta region**

**Coastal erosion and floods:** The Niger Delta region is a coastal environment. The rise in sea level has been linked with global warming by the IPCC. According to IPCC (1990), working with records over the last 100 years, have shown that a strong correlation exist between greenhouse gases emission and climate change and between global temperature and sea level rise. Global temperature is expected to rise by between 0.2°C-0.5°Cper decade. The rise in temperature is expected to cause thermal expansion of sea and melting of polar ice. These will cause the sea level to rise about 3-10 cm per decade during the next century.

Another report by the IPCC (2001) revealed that the large scale loss of land ice and thermal expansion of sea water has very likely contributed to the observed sea level rise. According to the International Federation of Red Cross (IFRC, 1999), sea level rise and flooding are already affecting millions of people worldwide. IFRC report revealed that an estimated 10 million people are at constant risk of coastal flood and floods in general are making 3 million people homeless every year and that the number of people affected by sea level rise is on the increase annually.

The occurrence of coastal erosion has been reported in the Niger Delta by Okoh and Egbon (1999). The report of Udofa and Fajemirokun showed a rise in sea level along Nigerian Coastal water. They did a mechanical analysis of tide data from 1960-1970 and reported mean sea level rise to be 0.462 m above zero level of the tide gauge. Agboola and Olurin (2003) reported that the World Bank ranked Coastal erosion as needing moderate priority attention in the Niger Delta (Table 1). Also, the Nigerian Environmental Study/Action Team, reported that sea level rise and repeated ocean surges will not only worsen the problems of coastal erosion that are already a menace in the Niger Delta, the associated inundation will increase problems of floods, intrusion of sea-water into fresh water sources and ecosystems destroying such stabilizing system as mangrove and affecting agriculture, fisheries and general livelihoods.

**General flooding:** Apart from coastal erosion, flood in general has impacted negatively on the livelihood of many communities in the region. Flood and erosion remove top soil, destroy roads, affect fresh water resources and threaten lives and properties. Many people have been rendered homeless by floods and several roads have been made impassable. The usefulness of several roads has become seasonal, only passable during the dry months of the year.

Table 1: Ranking of environmental issues in the Niger delta by the world bank

| Category | High priority | Moderate priority | Lower priority |
|---|---|---|---|
| Land-resource degradation | Agricultural land degradation,flooding (moderate high) | Coastal erosion,river bank erosion | Sea level rise |
| Renewable resource degradation | Fisheries depletion Deforestation, biodiversity loss, Water hyacinth expansion | Fisheries, habitat degradation | Mangrove degradation nype palm axpension |
| Environmental Pollution | Sewage, Vehicular emissions, Municipal solid wastes Toxic and hazardous substances | Oil pollution, industrial effluents, Industrial air emissions, Industrial solid wastes | Gas Flaring |

Source: Agboola and Olurin (2003) in Etiosa and Matthew (2007)

In Egor and Ogada communities in Edo State, several houses have been abandoned by the owners due to floods and many more areas in the region are vulnerable to floods. Occupants of some houses who are unable to relocate for financial reasons but have to cope with the situation later found themselves vulnerable to different kinds of water-related disease such as malaria, dysentery, cholera, diarrhea etc (Etiosa and Mathew, 2007). Floods also paralyse economic activities in many towns and cities in the region. Many roads, some linking states are flooded causing hardship to motorists. When the roads were constructed, the flooding problems were not there and the companies that constructed the roads probably did not anticipate the problem. One common consequence of flooding is increase in transport fare. Commercial drivers, to make up for the distance they drive to avoid flooded roads, usually increase their fare putting the burden on their passengers and causing the general increase in the cost of goods and services.

**Change in rainfall pattern:** Meteorological data have shown that rainfall pattern in Nigeria has changed in the past decades. Oladipo (1995) reported that the decline in rainfall in Nigeria started at the beginning of the 1960s when a decade of relatively wet years ended. According to him, the persistence of below-mean rainfall in the last two decades in Nigeria is an indication of an abrupt change in climate. The Niger Delta lie predominantly in the tropics having two seasons-the wet and the dry seasons. The wet season occur from May to September, while the dry season begins in October and ends in April.

Food security has been defined as the ability of people to grow and obtain food (Sarah La Trobe, 2002). The agricultural sector in Nigeria is highly sensitive to rainfall pattern especially in Southern Nigeria where rain-fed agriculture is mainly practiced. It has been predicted that climate change will pose serious threat to food security. Climate change creates uncertainty in the rainfall pattern (in timing and amount) and affects agricultural activities. Agriculture in the Niger Delta is highly dependent on rain and irrigation is seldom practiced. The changes in the rainfall pattern have greatly affected the agriculture in the region. Farmers in the region begin cultivation at the end of the dry season, when the rain begins to fall. They plant their crops after the first or second rain in the month of March and sometime in April. After the first rain, the rain falls periodically till the months of June/July (the peak of the rainy season), when rainfall more or less continually. The periodic rainfall pattern before the peak in June enables farmers to cultivate various crops.

Because of the change in rainfall pattern, farmers who plant after the first or second rain run into huge loss when the rains are delayed beyond the usual due to climatic changes. The crops are scotched, causing huge economic loss. Before this time, farmers can predict the rain and they know precisely when to plant their crops. The crops after they are planted are watered periodically by rain before the peak of the rainfall in June. The amount of rainfall within the period before the peak is necessary for the optimum performance of many crops most especially the maize which is widely consumed in every part of Nigeria.

**Change in vegetation:** One important feature observed in the region is the almost complete absence of primary forests. This may be partly due to climate change and partly due to human activities. Uncontrolled logging, agricultural activities, acid rain, oil exploration and exploitation, urbanization and mining activities contributed to loss of vegetation. The vegetation of some part of the Niger Delta is dominated by grasses and shrubs with few scattered trees and they were mainly palm trees. In other parts, trees grow close to one another to form thick canopy over undergrowths.

The changes in vegetation will have great implication for biological productivity which may consequently affect biomass production. It will lead to the impoverishment of biodiversity and various plant species presently growing in the region may die off. The regeneration rate of biomass may also decline significantly affecting the amount of fuel wood available for local people. Fall in the availability of biomass for local energy generation will bring more hardship to local people. Many will have to travel for long distance in search for fire wood, women and children will be affected the most since they are traditionally charged with the responsibility of fetching fire wood for the house.

**Other causes of environmental degradation**

**Acid rain:** The major cause of climate change or global warming as the case may be is the release of greenhouses gases (GHG) such as $CO_2$, nitrous oxides, chlorofluorocarbon, hydrocarbons such as methane, ozone, aldehydes and water vapour into the atmospheres. Some of these gases especially $CO_2$ and the oxides of nitrogen are dissolved in rain water and fall to the earth as acid rain. $CO_2$ dissolves in water to form carbonate acid while nitrous oxides dissolve in water to form nitric acids. Because of the high level of ionization of these acids, they erode metallic surfaces and destroy biodiversity. Acid rains erode roofing sheets of houses at alarming rate, that the people of the Niger Delta are force to change their roofing sheets every now and then. Money that would have been spent on other areas of the home that will improve the standard of living of the people is used for changing the roofs of houses. This further impoverishes many, especially those in the rural communities.

**Acid rains leads to loss of biodiversity:** Forests and economic crops are destroyed by acid rain. The dominance of grasses and shrubs in some part of the Niger Delta is an indication of loss of natural forests. This may be mainly due to acid rain, although other factors such as agricultural activities and exploration activities of multinational oil companies may also lead to this. Many of the farmlands are already destroyed and are therefore not suitable for cultivation of crops.

**Gas flaring:** The flaring of gas has been practiced in the Niger Delta region for over four decades. Today, there are about 123 flaring sites in the region, making Nigeria one of the highest emitter of green house gases in Africa. Carbondioxide emissions in the area are among the highest in the world (Iyangi, 2004). Some 45.8 billion kilowatts of heat are discharged into the atmosphere of the Niger Delta from flaring 1.8 billion cubic feet of gas every day (Agboola and Olurin, 2003). Gas flaring has raised temperatures and rendered large areas uninhabitable. Between 1970 and 1986, a total of about 125.5 million cubic meters of gas was produced in the Niger Delta region, about 102.3 (81.7%) million cubic meters were flared while only 2.6 million cubic meters were used as fuel by oil producing companies and about 14.6 million cubic meters were sold to other consumers (Awosika, 1995).

Gas flaring is environmentally unethical and has contributed significantly to the degradation of the environment in the region. Acid rain is caused by the flaring of gas. The concentration of acid in rain water appears to be higher in the Niger Delta region and decreases further away from the region, there is need to do more research on this. The practice may have altered the vegetation of area, replacing local vegetation with "stubborn" grasses, grasses that can grow in very harsh environment. The presence of these grasses connotes that the soil where it grows is no longer fertile for cultivation of crops.

**Oil spill:** The Niger Delta environment is continually degraded by frequent oil spills. Seismic blasts and the discharge of untreated effluents directly into water bodies, some of which serve as the only sources of water for the people are common in the region. Water bodies polluted with oil affects the amount of dissolved oxygen in the water, which consequently impacts the lives of aquatic plants and animals. Oil spreads over the water surface preventing contact with atmospheric oxygen. Oil spill occurs with high frequency in the region. Records revealed that between 1976-1990, the region experienced 2,676 cases of oil spills and an annual average spills in Rivers, Bayelsa and Delta States are 300 cases. The devastating 'impacts of these incidents on the farmlands, crops, economic trees, creeks, lakes, fishing equipment is such that the people can no longer engage in productive farming and fishing.

Several major rivers are heavily polluted and also farmlands are under acid rain and oil spills. Oil canal and network of pipelines is making it impossible and dangerous for people to undertake economic activities on it. It is estimated that between 1976 and 1996, a total of 2,369,470.40 barrels of crude oil was spilled into the rivers and lands of the Niger Delta (Table 2).

From the Table 2 between 1976 and 1996,4,647 cases of oil spills were recorded. Iyangi (2004) opined that the figures are bound to be much higher if taken into account. What he described as official lying index. According to him, the official lying index indicates the degree to which official figures are deliberately falsified to vary from the real facts on the ground. The official lying index is proportional to the level of corruption of a regime and the emotional involvement of its leaders in maintaining their version of reality as the truth. Thus, official figures therefore need to be multiplied by a certain factor in order to arrive at the correct estimate of the level at which the situation actually exists. By suggesting an official lying index of 1.5 and multiplying it by the official figure, Iyangi (2004) calculated the actual number of oil spills during the period to be in the neighbourhood of 6,971 with a total volume of 3,554,205.6 barrels of crude oil spilled. Table 3 shows the major transnational oil companies operating in the Niger Delta Area of Nigeria and the percentage of national productions. Each of this company without exceptions is liable to oil spill.

Table 2: Time series analysis of oil spill in the Niger delta

| S/No | Year | No. of spill | Qty Spilled (Barrels) | Qty recovered (barrels) | Net volume cost to the environment (barrels) |
|---|---|---|---|---|---|
| 1. | 1976 | 128 | 25,157.00 | 7,135.00 | 19,021.50 |
| 2. | 1977 | 104 | 32,879.25 | 1,703.01 | 31,176.75 |
| 3. | 1978 | 154 | 489,294.75 | 391,445.00 | 97,849.75 |
| 4. | 1979 | 157 | 94,117.13 | 63,481.20 | 630,635.93 |
| 5. | 1980 | 241 | 600,511.02 | 42,416.83 | 558,094.19 |
| 6. | 1981 | 238 | 42,722.50 | 5,470.20 | 37,252.30 |
| 7. | 1982 | 257 | 42,841.00 | 2,171.40 | 40,669.60 |
| 8. | 1983 | 173 | 48,351.30 | 6,355.90 | 41,995.40 |
| 9. | 1984 | 151 | 40,209.00 | 1,644.80 | 38,564.20 |
| 10. | 1985 | 187 | 11,876.60 | 1,719.30 | 10,157.30 |
| 11. | 1986 | 155 | 12,905 | 552.00 | 12,358.00 |
| 12. | 1987 | 129 | 31,866.00 | 25,757.00 | 25,757.00 |
| 13. | 1988 | 208 | 9,172.00 | 1,955.00 | 7,207.00 |
| 14. | 1989 | 228 | 5,956.00 | 2,153.00 | 3,803.00 |
| 15. | 1990 | 166 | 14,150.35 | 2,785.96 | 12,057.80 |
| 16. | 1991 | 258 | 108,367.01 | 2,785.96 | 12,057.80 |
| 17. | 1992 | 378 | 51,187.90 | 1,476.70 | 49,711.20 |
| 18. | 1993 | 453 | 8,105.32 | 2,937.08 | 6,632.11 |
| 19. | 1994 | 495 | 35,123.71 | 2,335.93 | 32,787.78 |
| 20. | 1995 | 417 | 63,677.17 | 3,110.02 | 60,568.15 |
| 21. | 1996 | 158 | 39,903.67 | 1,183,807 | 38,716.86 |
| | Total | 4,647 | 2,369,470.04 | 549,060.38 | 1,820,410.50 |

Source: Agboola and Olurin (2003)

Table 3: Major transnational oil companies in the Niger delta

| No. | Oil Company | Shareholders (%) | Operators | Share of National Production (%) |
|---|---|---|---|---|
| 1. | Shell Petroleum Development (SPDC) | NNPC-55<br>Shell 0 30<br>Elf-10<br>Agip-5 | Shell | 42.0 |
| 2. | Mobil producing Nigeria | NNPC-50<br>Mobil-42 | Mobil | 21.0 |
| 3. | Chevron Nigeria | NNPC-60<br>Chevron-40 | Chevron | 19.0 |
| 4. | Nigeria agip oil | NNPC-60<br>Agip-40 | Agip | 7.5 |
| 5. | Elf petroleum Nigeria | NNPC-60<br>Elf-40 | Elf | 2.6 |
| 6. | Texaco overseas (Nigeria) petroleum | NNPC-60<br>Texaco-20<br>Chevron 20 | Texaco | 1.7 |
| | Total | | | 93.80 |

Source: Iyangi (2000)

Table 4: Cases of pipeline vandalisation in the Niger delta region

| Year | No. of Cases |
|---|---|
| 1996 | 7 |
| 1998 | 23 |
| 1999 | 57 |
| 1999 | 497 |
| 2000 | 600 |

Source: Okecha, 2003

Table 5: Record of deaths from pipeline vandalisation inferno

| Year | Location | No. of deaths |
|---|---|---|
| 1998 | Jesse Village | 1,000 |
| 1999 | Eleakpamre Village | 12 |
| 2000 | Nngiji and Umuegbede (Abia State) | 50 |
| 2000 | Egborode (Delta State) | 300 |

Source: Okecha, 2003

**Pipeline vandalisations and communal conflicts:** Pipeline vandalisations are caused by youth restlessness from the economic hardship in the Niger Delta.

From the Table 4 the cases were increasing in bounds. The dramatic increase of cases of pipeline vandalisation from the 1990s-2000 is suggestive that the more the people are deprived of their means of livelihood, the more restless they become. Another reasons youths engage in pipeline vandalisation in the region may be to express their grievances over the destruction of their environment by the multinational oil companies without adequate compensation from these companies.

Pipeline vandalisation in many cases is associated with fire outbreak and leading to loss of lives and properties. Table 5 shows cases of reported deaths associated with fire outbreak from pipeline vandalisation.

Other impacts of pipeline vandalisation are deforestation, destruction of vegetation, pollution and loss of revenue. Nigeria lost an estimated 4.4 billion Naira (34.6 m Dollars) in 400 pipeline damages in oil producing states of the Niger Delta between January and August 2000 alone (ANEEJ, 2004).

**Possible mitigations:** It can be seen from the above that the people of the Niger Delta region of Nigeria are faced with myriads of environmental problems caused by climate change and the activities of the multinational oil companies operating in the region. There is therefore a need for an integrated approach in solving these myriads

of problems. By integrated approach, a combination of several development strategies packaged into one piece in a way it will be more effective is advocated. Such integrated approach must be participatory. The local people are the primary targets of development and development can only be precisely defined by them. Thus every development strategy must seek to view development from the perspective of the local people. The UN Declaration on the Rights to development of 1986 recognised that the human person is the central subject of the development process and that development policy should therefore make the human being the main participant and beneficiary of development.

Such integrated approach must x-ray the needs of the local people, the men, women, youths and children and design an all-encompassing strategy to address them.

The needs of the various communities within the region should be addressed in order of priority, starting from the most important to the least. For example, if the priority need of a particular community is the provision of portable drinking water, the people may not be happy if they are provided with electricity.

An in-dept understanding of how individual, communities and natural system can prepare for and respond to changes in climate and non-climate shocks is important to reducing vulnerability to adverse changes in the environment.

In such integrated approach, all actions should be involved-the government, international organizations, civil society based organizations, non-governmental organizations, the private sector, academia, agencies of the United Nations and the financial organizations like the World Bank. The government as the Facilitator and the primary developmental partner should work closely with grassroots organizations that are privileged to have good knowledge of the communities.

While it is agreed that industrialization enhances socio-economic development, it is important to note that industrialization without the right technologies is unsustainable and may become inimical to the local people. This is the case in the Niger Delta. Industrial development should be accomplished into technologies that are environmentally friendly. The multinational oil companies operating in the region should develop technologies that will minimize the impact of their activities on the environment. For instance, old-fashioned flaring of gas can be replaced by converting the gas into other useful products. Chemical experts are of the opinion that instead of flaring gas, it can be converted into alcohol and put into diverse uses. The government and the multinationals should be involved in environmental restoration activities. Such activities may include aforestation, support for sustainable agriculture and fishery, establishment of environmental management institutions and research institutions and policy formulation for the preservation of wildlife and other endangered species.

## CONCLUSION

Oil exploration as at today is the major source of foreign exchange earning to the Nigerian nation. However, the great danger poised by such exploration activities such as gas flaring, biodiversity damage, environmental degradation to mention but few deserved urgent attention particularly in the Niger Delta region.

Efforts should shift towards the use of technologies that will promote safe and healthy environment and that environmental resources are managed in the most sustainable way to achieve socio-economic development in the region.

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