



Impact of Climate Change in Nigeria

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Abstract: Climate change is an adverse environmental phenomenon that is causing enormous concern all over the world. It refers to some anomalies in the climate system that is a result of human activities. These anomalies include increase in the concentration of GHGs, HFCs and CFCs in earth's atmosphere, which will ultimately lead to global warming. In fact, global warming has already begun, as earth's temperature has risen between 0.4 and 0.8°C in the last 100 years. Nigeria is one of the world's most densely populated countries with a population of 180 million people, half of which are considered to be in abject poverty. Nigeria is recognized as being vulnerable to climate change. Climate change and global warming if left unchecked will cause adverse effects on livelihoods in Nigeria, such as crop production, livestock production, fisheries, forestry and post-harvest activities, because the rainfall regimes and patterns will be altered, floods which devastate farmlands would occur, increase in temperature and humidity which increases pest and disease would occur and other natural disasters like floods, ocean and storm surges, which not only damage Nigerians' livelihood but also cause harm to life and property, would occur. The paper provides a strong starting point and a useful guide for further investigations and solution finding projects, both at the local and international levels which focus on more specific issues like public health, food security, energy, adaptations and barriers to them.

Key words: Impact % Climate change % Nigeria

INTRODUCTION

Climate change refers to some observable variations in the climate system that are attributable to human (anthropogenic) activities, especially those that alter the atmospheric composition of the earth and ultimately lead to global warming. Global warming is closely associated with climate change especially as a co-traveller in the interplay of the equilibrium between the natural and man-made components of the Green House Gases (GHGs) that have been eminently adjudged globally as the culprit for the warming of the Earth's atmosphere and oceans.

Global warming is the term used to describe the gradual increase in the average temperature of earth's atmosphere and its oceans [1] a change that is permanently changing earth's climate forever [2]. Global warming is caused by increase in the emission of GHGs through the burning of fossil fuels (oils, natural gas and coal), burning of wood, wood products and solid wastes,

raising of livestock and the decomposition of organic wastes in solid wastes landfills; combustion of solid wastes and fossil fuels in industrial and agricultural activities; bush burning; and deforestation. All these human (anthropogenic) activities contribute to alter the balance of the equilibrium between the natural GHGs (water vapour, carbon dioxide, methane and nitrous oxide) and the man-made GHGs (sulfur hexane fluoride-(SF₆); hydro-fluorocarbons-(HFCs); and perfluorocarbons (PFCs) in Earth's atmosphere thus promoting the warming of both the atmosphere and the oceans since they are heat-trapping gases.

The level of these GHGs has increased beyond natural level [3]. There is a scientific consensus that the average temperature of Earth has risen between 0.4 and 0.8°C in the last 100 years [2]. The increased volume of carbon dioxide and other GHGs released from the burning of fossil fuels, deforestation, agriculture and other human activities are sources of global warming that have occurred in the last 50 years [2].

GHGs are good absorbers of heat radiation coming from Earth's surface acting like a blanket over its atmosphere, keeping it warmer than it would be. Enhanced GHGs effect however, is not natural as it acts to destabilize Earth's radiation balance due to anthropogenic accumulation in Earth's atmosphere of radioactive GHGs especially tropospheric ozone and chlorofluorocarbons (CFCs) [1]. It has been suggested that if the current trend of anthropogenic GHG emissions continue through 2030, Earth is likely to experience an average rise in temperature ranging from 1.5 to 4.5°C [4].

The projected impact on the Earth's environmental stability and hence changes in global climate would include: disruption of temperature distribution, precipitation, evapo-transpiration, clouds, air-currents and consequential shifts in the vegetation belts; melting of polar ice-caps, rise in sea level that could adversely affect low-lying areas and the synergy among these discrete effects. All of these have grave implication for fresh water resources, agriculture and food supply, natural ecosystems, biodiversity and human health [5].

Global warming with regional variations has capacities for increases and decreases in rainfall resulting in floods, landslides and droughts, melting of polar ice-caps, thermal expansion, surges and acidification of oceans with resultant oceanfront flooding.

The resultant natural disasters such as hurricanes, bush fires, ocean surges and landslides cause economic losses, population displacements, communal crises, forced migrations (promoting ecological refugees), desertification and widespread soil erosion /depletion effects.

Livelihoods in Nigeria: Nigeria lies between longitudes 2°49'E – 14°37'E and latitudes 4°16'N-13° 52'N and is in the humid tropics. It has a land area of 923, 850 km². Over 70% of Nigeria's population is engaged in agriculture as their primary occupation and means of livelihood. Small-scale, resource-poor farmers operating in 0.1 to 5 hectares with low-level traditional technologies dominating this large population.

The Nigerian's agricultural activities are rain-fed and the farmers are engaged in crop production, livestock rearing, fisheries and post-harvest activities.

Crops Production: The crops planted in Nigeria include: annual crops such as cassava, melon, yam, rice, groundnuts, peppers, onion, plantain, vegetables, etc. The cash crops are: cocoa, oil palm, cashew, mango, coconut rubber, cotton and other fruit crops like

pineapple, guava, pawpaw, etc. All the above crops depend on rainfall. Where rain is abundant especially in the southern parts of the country, crops that require much rain are planted and in the northern part of the country, crops that do not require much rain are cultivated. Food production on the whole has not kept pace with Nigeria's population increases.

Climate change affects crop production in a number of ways, for example, uncertainties and variation in the pattern of rainfall, floods and devastated farmlands, cause pest and diseases migrate in response to climate change while high temperatures smother crops.

Irregular and unpredictable rainfall and sunshine hours (albedo and photoperiods) continue to take the toll on hitherto low-level harvests of rice, maize, cassava, melon, sorghum and yam with at least 2.5% decline of harvests per annum. Cocoa, cashew, oranges, kola nut, oil palm, rubber, cotton and coffee production suffer severe setbacks under reduced photoperiods with flower and fruit abortion trends that shot down annual yields by 5.5 metric tonnes/ha. Pest and disease incidences which become varied and uncontrollable under extreme weather events continue to cause decline in crop harvests, especially that of cowpea, tomatoes, pepper and groundnuts. Drought and flood extremes feature prominently north wards of the country, affecting crops farming and harvests as well as livestock production, the feed of which are mostly crop-based. Flooded farm lands/wetlands expansion cause arable land losses for crops within the areas with limited crop facility capacities and thus reduce root/tuber crops harvest (yam, cassava, sweet potatoes, Irish potato and cocoyam) by at least 0.25 million metric per annum.

Livestock Production: Climatic variations between the Northern and Southern parts contribute to the distribution of animals in the country. Generally, the large ruminants, geese, guinea fowls and turkeys are more common in the Northern parts of the country where rainfall and humidity are lower, the dry season is longer the diurnal and seasonal temperature fluctuations are wider.

The availability of natural grasses for grazing is very limited and highly dependent on rainfall which is low in most parts of the North. The Southern parts of the country which have more rainfall and more grazing are wetter and have more parasites and endemic diseases. This is because; high temperature and high humidity increase the rate of growth of parasites outside their host.

Climatic stress reduces feed, water intake, grazing time and hence rate of growth and productivity.

High temperatures have hindered livestock (sheep and goat, cattle, poultry and piggery) production through retarded reproductive cycles, reduced meat and milk outputs, as well as their grazing lands. Livestock mortalities (stock losses) have increased in poultry, piggery and rodentary production systems to the level of at least 15% per annum.

Animal production as well is affected by increases in disease and pests (including PPR, foot rot, mange, etc.) under the influence of climate change impacts that cut investment profits in livestock production system by more than 20% per annum.

Fisheries: Fisheries activities in Nigeria take place in marine, brackish water (Estuarine), lakes (Lacustrine) and riverine (Rivers) biotopes that account for the varied fisheries locations countrywide [6]. A coastal livelihood is mainly fisheries. The national fish demand of about 2.0 million metric tons per annum is satisfied by a domestic supply of about 0.85 million metric tons. The balance of 1.15 million metric tons as short fall is often supplied through fish imports for the protein intake of at least 55% of Nigeria citizens.

Nigeria's fisheries (domestic production) profile include; Artisanal (coastal) fishing (80%) industrial coastal (trawl) fishing (10%), Artisanal inland fishing (6%) and Aquaculture (4%). Most of fisheries activities therefore, occur in the coastal states of Nigeria that account for 960 km of the coastline (Ayansanwo, 2003). This is shared by Lagos State (230 km); Ogun State (18 km) Ondo State (88 km) Delta State (126 km) Bayelsa/River States (390 km) and Akwa Ibom/Cross River States (108 km).

The artisanal fisheries in Nigeria involve the livelihoods of the resource poor fishers with a population of about 40 million spread across the eight (8) maritime states.

The Artisanal fishing operations in Nigeria has an output of 680,000 metric tons per annum. While the Industrial Coastal (trawl) fishing nets about 85,000 metric tons/annum. The Artisanal inland fishing produces 56,000 metric tons per annum while aquaculture accounts for 34,000 metric tons per annum. A decline in catch per unit effort (CPUE) of 0.85-0.45 metric tons/fisher/year between 2004-2008 has been reported from Field Survey of Coastal Fisheries Activities [7] and is a reflection of the impact of

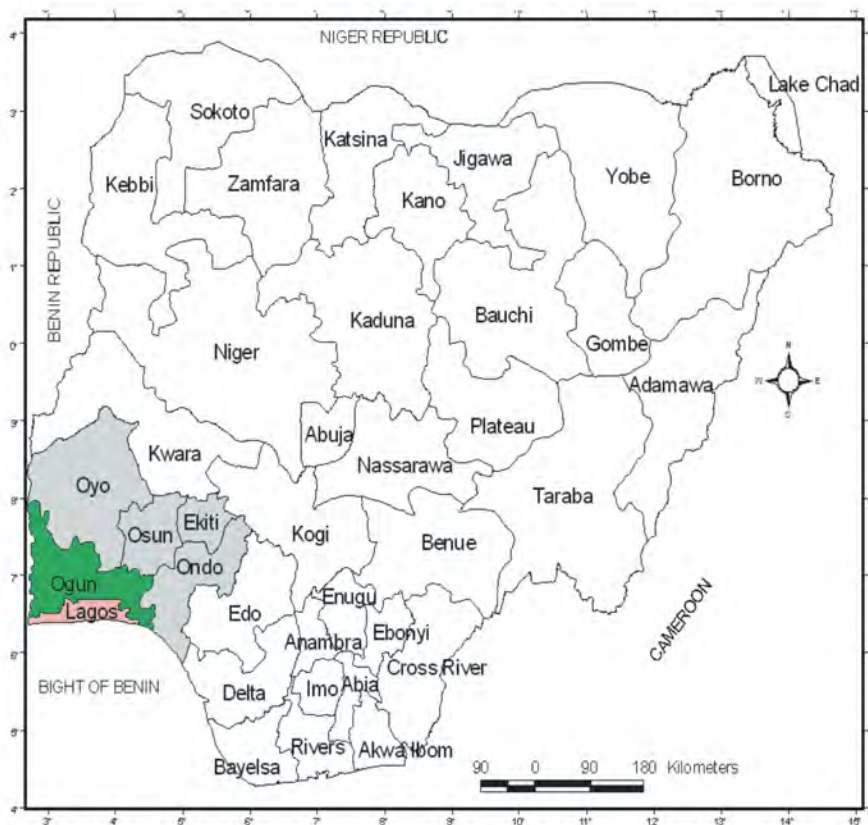


Fig. 1: Map of Nigeria showing the coastal areas



Plate 1: Flood devastated farmland occasioning farming community displacement and emergence of ecological refugees

climate change. Others effects are the flooding of fish ponds especially those sited in wetlands and farmlands nationwide. While the most noticeable impact of climate change is seen in Nigeria's coastal areas as erosion of coastline beachfront (especially in Lagos State), the deposition of beach sands (on the Ogun State coastline) and mud deposition coastal features (as in the coastal areas of Ondo, Bayelsa, Rivers, Akwa Ibom and Cross River States).

Post Harvest Activities: Handling and processing of agricultural products are gender specific. The women apart from assisting their husbands to harvest and carry farm products from the farm also dominate the processing operations of farm to produce various end products. They process their agricultural products like cassava into *garri*, starch and cassava flour, yam into yam flour, oil palm seed into palm oil and palm kernel, paddy rice into processed parboiled rice, cocoa into dried seeds and processing of fish and livestock products. They also dominate the distribution and marketing of these agricultural products. Other means of livelihood include; hunting, blacksmithing, tailoring, carpentry, commodities harvests, marketing (coconut, etc), driving automobiles and equipment repairing and trading, etc.

Impacts and Vulnerabilities: Climate change affects both the livelihoods activities of the farmers as well as sustaining the support activities (fishing, coconut harvests, trading, mat- weaving, shell fish collection etc.).

Climate change has influenced on labor investments, occupational health, fish landing distance to smoking sheds, water use/irrigation, transportation/communication access, resources availability, fuel wood, coconut harvest, food crops abundance, reduced fish catches decline livestock production and consequent losses of income.

The impacts of climate changes on the population and livelihoods of Nigeria's farming communities include the following:

Floods: Floods that occur with sea transgressions sometimes with heavy rainfall become the cause of road tracks inundation (Plate1), house losses, public health hazards and losses of potable water owing to saltwater intrusions into wells and seaside beels (with losses of 0.1mt /fisher/annually), farmland losses and population displacements (0.18%) and ultimate livestock mortalities.

Ocean Surges: Ocean surges occur as a result of periodic spilling and plunging sea waves extremes that rapidly inundate the seashores. Ocean surges cause erosion of farmlands, landslides (between 250-750 m²/year), sand deposition, mud-accumulation, salination of irrigated farmlands and damage to general soil fertility.

Public Health: The attendant impact of climate change on the public health of the Nigeria's citizens' farming communities (over 70% of the population) was reported as follow [7]:

- C Respiratory diseases due to increases in the level of pollutants.
- C Malaria (in more widespread levels within the population (70% annually).
- C Skin ailments (45% annually).
- C Heat stroke (4% annually).
- C Loss of productivity (40% annually).
- C Portable water shortages (60% annually) due to floods and/or saltwater intrusion.

Storm Surges: Climate change has always influenced the wind distribution patterns especially caused by storm surges that frequently affect Nigeria's farming communities. Storm surges result often in losses of

housing units (40% annually), loss of post-harvest sheds (30% annually) and processed fish (25% annually), poultry/piggery sheds (12% annually) and farmstead stores (4% annually).

Loss of Forest Resources: Climate change impacts cause the loss of forest resources such as: medicinal plants, mushrooms, cane, etc. The loss have been directly attributed to storm surges, drought, deforestation, bush fires, uncontrolled lumbering and forest exploitation (including firewood procurement) which has been proceeding in Nigeria at the annual depletion rate of 400,000 hectares (Plate 2 and 3).



Plate 2: Chunk of wood on transportation, result of deforestation.



Plate 3: Firewood carried by a Gwari woman in a deforested part of northern Nigeria

Livestock Mortalities: Severe livestock (poultry, piggyery, etc) mortalities occur under the impact of global pests and diseases such as avian influenza, Swine fever, Swine influenza (flu), etc, all of which jointly reduce livestock (animal) production by at least 25% annually.

Fish Beel Intrusions: Fish beels that are community fisheries resources often become inundated with the intrusions of seawater with drastic salinity changes and the loss of biodiversity (including fish).

Mangrove: The loss of mangrove forests gradually is yet another climate change influenced impact that affect various biodiversity and hence livelihoods. The mangrove that was hitherto more than 1,000,000 hectares had been reduced to 977,700 hectares. Aggressive exploitation for firewood and shellfish procurement, etc, has been contributory.

Loss of Roads /Road Tracks: Loss of roads/road tracks as a result of floods is yet another impact of climate change especially in the farming communities of Nigeria. This has always caused some losses of farmlands, crops, livestock, fish ponds and hence livelihoods. At least, 5 months of inundations/year occur and when experienced, women cannot market their smoked fish, crops or livestock regularly and children are prevented from attending schools. Losses of lives of pupils due to turbulent flood and inundated road tracks have also been reported.

Population Displacements and Emergence of Ecological Refugees: Climate change impact on the farming communities in Nigeria has had to do with population displacements and relocations with immediate village abandonment (usually occasioning farmland losses) and hence farm occupation decline. At least, 32,000 farmers are affected annually in Nigeria's farming communities.

Energy: Hydro electric power generation is the energy source and most likely to be affected by climate change. It is sensitive to the amount, timing and geographical pattern of precipitation as well as temperature. High temperatures and low rainfall reduce transmission capabilities of hydro-electric power stations nationwide. Excessive drought leads to high evapo-transpiration, which adversely affects water volume and the reduction in hydroelectric power generating capacities and hence reduced energy distribution for all stakeholders' uses.

Food Security: Nigeria, at present does not enjoy food security and therefore is more vulnerable to the effect of climate change. The climatic threats to food security are due to the following factors:

- I Extreme weather events, e.g. drought, floods and erosion, all of which pose danger to farmlands and hence food production.
- II Variability in the onset and cessation of rainfall and rainfall amounts.
- III Proliferation of pests and diseases affecting agricultural production.
- IV Effects of high temperature which hinder livestock and fisheries production, reduce weight gains, feed conversion efficiency and depress the production of arable crops.

Barriers/limitations for Adaptations: The barriers/limitations for adaptation to climate change impacts in Nigeria include:

- i. Limited access to credit facilities by the farmers to replace lost farm equipment, farm crops, livestock mortalities, fish smoking sheds/processed fish and reduced marketing opportunities.
- ii. Capability deprivation/limited skills and knowledge for assuring the pursuit of sustainable livelihoods of the farmers e.g. information communication on climate change risks through billboards, posters, campaigns, mobilization and sensitization.
- iii. Limited trades organizational opportunities (Co-operatives, etc) for supporting productive farming livelihoods, especially in the farming communities and around inland wetlands and farm locations.
- iv. Inappropriate public policy provisions for promoting adaptation of relevant stakeholders to climate change.
- v. Inadequate presence/interactions of state and local governments in the coastal states and inland farming communities for multivariate livelihoods support improvements in extension services delivery systems and the strengthening of local governments' presence through health facilities provision and sustenance.
- vi. Absence/limited participatory development planning programs for promoting widespread employment opportunities and sustainable livelihoods.

- vii. Widespread poverty (over 70% by income index) that continue to cause the exclusion of federal, state and local governments needs to be improved on development provision and mitigation of climate change impact in all farming communities.
 - viii. Governments' insensitivity/non-chalance to climate change impacts in resource-poor areas in the coastal and inland farming communities, improved mobilization, sensitization of federal, state and local governments will be useful.
 - ix. Limited research information/data, limited awareness and communication of the knowledge of climate risks and its impacts to all stakeholders.
 - x. Lack of balance between risks and benefit arrangements of industrial and economic development projects for mitigating the impacts of climate change on the development projects in coastal (including oil producing communities) and other inland farming communities.
- v. Provision of appropriate community-led management for seaside/ coastal areas (particularly in the oil producing communities) to assure improved agricultural production through:
 - ⊆ Shrimp culture
 - ⊆ Cage fish culture
 - ⊆ Beel fisheries
 - ⊆ Equipment and inputs provision
 - vi. Support for stakeholders through empowerment, training, equipment provision, credit assistance and training workshop support/provision.
 - vii. Strengthening of support for service providers at the community level through:
 - ⊆ Credit assistance for seaside vehicle transportation systems especially for coastal oil producing communities.
 - ⊆ Boat haulage systems
 - ⊆ Establishment of technology development centers (for all agricultural sub-sectors: crops, livestock and fisheries alongside the gender-specific processing and preservation operations).
 - viii. Provisions and strengthening of skill acquisition/development initiatives for all stakeholders through:
 - ⊆ Agricultural extension training/workshops.
 - ⊆ Health extension training/ services.
 - ⊆ Equipment and inputs demonstration.
 - ⊆ Seed-money provision for poverty reduction.
 - ⊆ Community based organizations' support initiatives.
 - ⊆ Skill development centers' provision.
 - ⊆ Community markets provision/expansion.
 - ix. 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 impacts.
 - x.. The federal, state and local governments should establish participatory community consultation systems for farming communities in Nigeria especially in the coastal oil producing states for assuring cost-effective, renewable and sustainable projects, planning and implementation that can help mitigate the impacts of incessant climate change.

Adaptation Strategies: In order to assuage the impacts of climate change in Nigeria, the under listed adaptation strategies should be undertaken:

- i. Provision of foot-bridges across road tracks/roads and road passages for use in times of floods especially in the farming communities.
- ii. Rain-water collection systems should be provided for all stakeholders. Boreholes should also be provided outside the flood reaches of the possible flood belts and waterfronts.
- iii. Improved presence of local government personnel to promote:
 - ⊆ Enlightenment/campaigns on public health needs of the communities.
 - ⊆ Provision of Insecticide Treated Nets (ITNs) and screened windows for households in the farming communities.
 - ⊆ Provision of revolving drugs fund for meeting the public health needs of stakeholders in the communities.
- iv. Provision of government subsidized (at least 50%) of all Agricultural Inputs (Seeds, Fertilizers, Agro-chemicals, improved local breeds of livestock, Outboard Engines, fishing nets, etc.) for all stakeholders in the farming communities. Community cooperative groups' formation, credit assistance and varied support for Women-in-Agriculture involved in post-harvest operations should be greatly improved.

- xi. Governments should intensify efforts on tree planting. Trees have the capacity to trap carbon dioxide which would have otherwise escaped into the atmosphere. Trees can also reduce storm effects, loss of houses, processing sheds, etc.
- xii. Governments' new irrigation schemes to dry lands to improve water use efficiency and minimize moisture stress for crops particularly in the northern parts of the country should be greatly improved in scope, numbers and frequencies of provision for farming communities.

Recommendation: The federal, state and local governments in Nigeria and other relevant partners in consultation with the farming communities in Nigeria should keep promises and management options so far developed on the policies and agricultural project strategies for assuring cost-effective adaptation by stakeholders on the impacts of climate change in this context.

CONCLUSION

In conclusion, it is possible to promote and actualize the strategies for limiting and adapting to the impacts of climate change in Nigeria and globally provided cost-effective and sustainable collaboration between governments, development partners and stakeholders can be assured for mitigating the consequences of incessant climate change on the environment and the livelihoods of all.

REFERENCES

1. Awosika, L.F., G.T. French, R.T. Nicholls and C.E. Ibe, 1992. The impact of sea level rise on the coastline of Nigeria [O' Callahan J. (E.d.)] In: Global climatic change and the rising challenge of the sea. Proceedings of the IPCC workshop of Margarita Island Venezuela, 9-13 March 1992. National Oceanographic and Atmospheric administration, Silver spring, M.D., U.S.A, pp: 690.
2. IPCC. 2005. Global Warming; Early Signs on Climate change Retrieved online (<http://www.climatehotmap.org>.)
3. NEST. 2004. Executive Summary of Five Multi-Sector Survey on Nigeria Vulnerability and Adaptation to Climate Change. N.E.S.T. Ibadan, Nigeria.
4. Porter, G. and J.W. Brown, 1991. Global Environmental politics: Dilemmas in World politics. Colorado Washington Press,
5. IPCC. 1996. Climate Change, 1995. Impacts, Adaptation and Mitigation of Climate change 1995, Impacts, Adaptation and Mitigation of Climate change. Cambridge. Cambridge University Press. England.
6. Ayansanwo, T.O., 2003. Fisheries Development in Nigeria with Reference to Ogun State. Report submitted at TCDC International Training Center in Jiangsu (Wuxi city) China, pp: 1-30.
7. OGADEP. 2009. Report of the National Fish Frame Catch Assessment Survey in Ogun State (2004-2008). Ogun State Agricultural Development Programme (OGADEP), Abeokuta, Nigeria.