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**IMPACT OF CLIMATE CHANGE ON THE ENVIRONMENT AND HUMAN HEALTH IN NIGERIA: IMPLICATION FOR SUSTAINABLE DEVELOPMENT**

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**Abstract**

The study explored 'the impact of climate change on the environment and human health in Nigeria: implication for sustainable development. No doubt, environmental issues such as climate change have dominated both local and international discuss. The role environment plays in the developmental process of any nation cannot be relegated to the background. Apart from being the physical surrounding for natural habitats, the environment also provides the basis for human exploits in agricultural, technological, industrial, commercial, and tourism development of any society. The study considered the following; climate change and the Nigerian environment, **climate change and human health in Nigeria, common causes of climate change in Nigeria**, human activities that cause climate change (Emission of greenhouse gases from vehicles, burning of hydrocarbon products, deforestation). In addition, the study reviewed the **noticeable impacts of climate change in Nigeria**, the climate change act, and the implication for sustainable development and mitigation measures. The study revealed among other things that over-exploitation of the environment mostly by humans has resulted in natural disasters such as flood disasters, late onset of rainfall and early cessation of rainfall, reoccurring incidence of drought, increasing temperature, reduced river flow, declining water table, loss of some plants and animal species. In conclusion, it was noted that unless action is taken, climate change will be exacerbated and become a more serious threat to all beings on the earth. Education was recommended as the only way to mitigate this ugly threat to life and existence.

**Introduction**

In the last three to four decades, environmental issues have dominated both local and international discuss. The role environment plays in the developmental process of any nation cannot be relegated to the background. The environment apart from being the physical surrounding for natural habitats, it also provides the basis for human exploits in agricultural, technological, industrial, commercial, and tourism development of a society among others. No wonder environmental issues now occupy centre stage in academic discourse and other public fora both at the national and international levels. Although, environmental issues did not gain official recognition until the 1988 Koko toxic waste dumping saga which brought to the fore the need to establish the Federal Environmental Protection Agency (FEPA), Federal Ministry of Environment and other relevant agencies

in Nigeria to tackle environmentally related issues, in the country. Issues such as environmental pollution, sanitation, depletion of the ozone layer, desertification, flooding, erosion, poverty, bush burning, deforestation, soil conservation and so on.

#### **Climate change and Nigerian environment**

The 21st century is largely threatened by the problem of environmental degradation occasioned by climate change. Climate change is one of the greatest threats facing human kind today and it has lots of implications for the survival of mankind. Hence efforts geared towards environmental protection remain the main focus of most public discuss both locally and internationally. Evidence shows that the environment represents a wide range of external circumstances, conditions and the things that affect the existence and development of an individual, organism, group and/or society (Horton & McMichael, 2021). No doubt, climate change is one of the most important environmental issues facing the world today and Nigeria is not left out.

The United States Environmental Protection Agency (USEPA, 2014) defined Climate change as any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer. Climate change according to Omotosho(2015) is any long-term change in the patterns of average weather of a specific region or the earth as a whole. It is an abnormal variation in the earth's climate that usually occurs over durations ranging from decades to millions of years. Ojomo, Elliot, Amjad and Bartram (2015) pointed out that climate change impacts pose great dangers with consequences such as desertification, sea level rise, flooding, water salination, among others. These impacts could manifest in food security challenges, damage to infrastructure and social dislocation.

Additional impacts include threats to health as rising temperature could bring about diseases such as chronic heat rashes, Cerebra-Spinal Meningitis (CSM), stroke, malaria and other related diseases. Climate change affects every citizen, every part of our environment and our natural resources, and thus practically every aspect of our lives, our economy, our urban and sub-urban development patterns (Omotosho,2015). There are noticeable consequences of climate change in Nigeria such as intense thunderstorms, widespread floods and incessant droughts. According to Borokinni(2017), the increased rate of climate change has severe consequences associated with it such as desertification, drought, temperature rise, low agriculture yield, drying up of water bodies, flooding among others. Similarly, Igwebuike, et al. as cited in Ukala (2020) enumerated the effects of climate change including the melting of the polar ice which could lead to a rise in sea level. The rise in sea level could cause flood disasters (which can wash away farmland and crops, in addition to rendering the affected people homeless). The Director General (Mustapha Habib Ahmed) of the National Emergency Management Agency, (NEMA) disclosed that over 662 persons lost their lives, 3,174 suffered injuries and 2,430,445 individuals were displaced and an estimated economic loss of over \$9.12bn by the 2022 flood disaster in the country. Mustapha stated that rapid climate changes have increased the frequency of natural disasters across the nation, thousands of houses, hectares of farmlands, and several critical national assets were destroyed by the raging floods (Ogune, 2023).

Ekezie (2010) stated that the rise in temperature as a result of climate change could lead to drought, desertification, declining water table, loss of some plant and animal species, low crop yield and outbreak of climate-related diseases like malaria and meningitis. These consequences of climate change according to the Intergovernmental Panel on Climate Change (IPCC, 2007) could persist for a longer time as a result of human continuous emission of greenhouse gases into the atmosphere. In view of the above, Ukala and Osuafor (2019), United Nations Development Programme (UNDP, 2010), Omotosho (2015) and Ojomo et al (2015), and argued that if human continuous perpetuation of acts that caused the excessive emission of greenhouse gases such as bush burning, indiscriminate cutting down of trees (deforestation), constant burning of fossil fuel among others, the earth's temperature may pose a serious threat to life and the environment.

In line with the above, UNESCO (2016) argued that the change in weather patterns, rise in sea level, and increase in atmospheric temperature are at their highest levels in history due to the uncontrollable emission of greenhouse gases into the atmosphere. They warned that without some deliberate actions, the world's average surface temperature is likely to surpass 3 degrees centigrade this century. This warming of the world's climate has been linked to higher concentrations of carbon dioxide and other greenhouse gases (GHGs) in the atmosphere, which are dominantly of anthropogenic origin such as fossil fuel combustion, land use and deforestation (Stevenson, Nicholls & Whitehouse, 2017). All our material needs and many of our emotional and spiritual ones, are met from our biophysical and social environments. The quality of the environment affects the quality of our lives. Our actions as producers, consumers, and procreators have a cumulative impact on the quality of the environment and health of organisms.

The World Health Organization (WHO, 2010) traced emergent diseases and leading causes of death globally to environmental changes. NIMET as cited in UNDP (2020) has predicted an increased incidence of malaria due to climate change, and other diseases that will be higher in areas with temperatures ranging between 18–32 °C and with relative humidity above 60%. Another area of interest that is greatly affected by climate change in Nigeria is the agricultural sector. Agriculture remains the mainstay of the Nigerian economy in spite of oil as it employs two-thirds of the entire working population (Stevenson et al., 2019). This is because the practice in this sector is mainly rain-fed agriculture which makes it subject to weather vagaries. Therefore, farmers find it difficult to plan their operations due to unpredictable rainfall vagaries.

#### **Climate change and human health in Nigeria**

Over the years, human beings have relied on the environment for existence and sustenance in a way that man's survival is determined by his interaction with the environment brought about by the activities of man. One of the global events that arise from man's interaction with the environment is climate change. Climate change has become the subject of debates and discourse among scholars and experts, making it one of the most topical issues in the world agenda today. In Africa today, the reality of climate change and frequency of its unpleasant consequences constitute significant threats to human lives across different regions especially in Nigeria (Ani, Anyika & Mutambara, 2020).

Nigeria faces many challenges in her effort to advance its socio-economic and environmental development. A particular challenge is climate change that continues to portend serious threat to the achievement of sustainable development goals (SDGs) in the country. This is because Nigeria is strongly predisposed to severe negative impacts of climate change due to its fragile economy, weak resilience, and low adaptive capacity, as much of the economy is dependent on climate sensitive ecosystems and natural resources. The adverse outcome of climate change has necessitated global concerns and efforts at mitigating its effects as well as advocacy for measures that would restrict human actions that induce climate change.

Climate change refers to changes in the mean variability properties of the climate, which persists over an extended period of time, typically within decades or longer. Omotosho (2017) defined climate change as a change in climate, attributed directly or indirectly to human activities such as burning, farming, mining and others that have the propensity to alter the atmospheric composition of the earth and to lead to global warming. According to Intergovernmental Panel on Climate Change (IPCC, 2007) climate change is a change in the state of the climate that can be identified by using statistical tests by changes in the mean and variability of its properties, and that persists for an extended period typically decades or longer. Climate change refers to any change in climate overtime, which may be due to natural variability or as a result of human activity.

The 2017 Climate Change Vulnerability Index (CCVI) published by the UK-based risk company, Verisk Maplesoft, classifies Nigeria as a region of high risk and indicated that the country is one of the topmost vulnerable countries in the world. In agreement with the above, Fuertes (2020) opined that scientific evidence has revealed that climate change is an all-encompassing threat and is considered the most serious ecological threat to the survival and sustainable development of humanity.

Human health defined as the complete state of physical, social, and mental well-being and not merely the absence of illness, disease, or infirmity, is as vital a resource as water, food, or energy (Benjamin, Ngozi, & Kelachi, 2022). Human health is increasingly threatened by rapid and widespread changes in the environment and climate, including rising temperatures, air and water pollution, disease vector migration, floods, and droughts. Human health is one of the most important factors influencing economic development in any economy. Most important and immediate consequences of environmental degradation in the world take the form of damage to human health. Evidence has established that people's health can be affected by climate change (Hathaway & Maibach, 2018). They identified vulnerable populations to include but not limited to young children, pregnant women, older adults, individuals with chronic sickness and disabilities and individuals with fewer resources are at high risk.

The consequences of climate change on human health, especially, in Nigeria could be direct and indirect. Omoruyi and Onafalujo (2011) explained that one of the direct consequences of climate change in Nigeria includes cerebra-spinal meningitis, cardiovascular respiratory disorder of the elderly people, skin cancer, high blood pressure, malaria, cholera and child and maternal health issues. Cerebra-spinal meningitis is one of the infectious diseases likely to be caused by climate change. Incidences of meningitis, for instance, have been on the rise in Nigeria due to excessive heat. According to Akingbade (2010), cases of meningitis have been reported to have increased in Nigeria as a result of

excessive heat. The World Health Organization has revealed that 35% of reported meningitis outbreaks in Africa between 1996 and 2020 are from Nigeria, with statistics showing 95% of this disease happening in the northern region of Nigeria (Abdussalam et al., 2014). Meningitis is a disease caused by an infection due to bacteria, viruses and protozoa, of the meanings which is the thin lining that surrounds the brain and the spinal cord.

#### **Common causes of climate change in Nigeria**

The major causes of climate change are either natural or anthropogenic factors. According to Rasak (2013), climate change is caused by two basic factors, which include natural processes (biogeographical) and human activities (anthropogenic). These astronomical factors are the changes in the eccentricity of the earth's orbit, changes in the obliquity of the plane of ecliptic and changes in orbital precession while the extraterrestrial factors include solar radiation quantity. The anthropogenic factors in climate change are directly linked to man-environment transactions whose consequences result in the emission of large amount of greenhouse gases into the atmosphere that depletes the ozone layer or activities that reduce the amount of carbons absorbed from the atmosphere.

Researchers have provided evidence that for the past decades, anthropogenic factors such as urbanization, deforestation, population growth, industrialization and the release of greenhouse gases are major factors responsible for the depletion of the ozone layer. Nigeria as one of the most populous nations with over 173 million people in Africa is not exempted (Adepoju, 2023). Nigeria has been adversely affected by climate change due to its vulnerability and low coping capacity (During, 2017) Also, the peculiarity of the country as one of the leading exporters of crude oil faces the danger of balancing global energy demands and engulfs on the need to address climate change and environmental considerations (World Health Organization [WHO], 2023)

#### **Human activities that cause climate change**

The human impact on climate change is the most frequently misunderstood aspect of climate science. There are several possible reasons why students may resist the conclusion that humans are altering the climate. This concept may be uncomfortable to students due to feelings of guilt, political resistance, or a genuine lack of scientific understanding despite its overwhelming evidence. Humans are responsible for climate change largely due to greenhouse gas emissions. Human activities result in emissions of four principal greenhouse gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and halocarbons (a group of gases containing fluorine, chlorine and bromine). These gases accumulate in the atmosphere, causing concentrations to increase with time.

1. **Emission of greenhouse gases from vehicles:** The main driver of climate change is the greenhouse effect. Greenhouse gases trap heat from the sun as it passes through Earth's atmosphere. There are some natural greenhouse gases, such as water vapor and carbon dioxide (CO<sub>2</sub>). But over time, humans have added more to the atmosphere, creating a massive heat trap. The three largest greenhouse gases are carbon dioxide, methane, and nitrous oxide.
2. **Burning of hydrocarbon products:** Burning fossil fuels aka, coal, oil, and natural gas produces carbon dioxide and nitrous oxide. The problem with this is that, for

more than a century, we've relied on burning these fuels to power our cars and travel across continents in a matter of hours. Fossil fuels also power our homes, keeping the lights on and our rooms warm. Our Internet habits are also responsible here. The largest known contribution comes from the burning of fossil fuels, which releases carbon dioxide gas into the atmosphere. Every email sent, movie streamed, or question Googled adds carbon dioxide to the ecosystem. Although, this is a tiny amount for each activity online, but, when added up for everyone that uses the internet.

3. **Deforestation (cutting down forests):** Trees help to regulate the climate by absorbing CO<sub>2</sub> from the atmosphere. When they are cut down, that beneficial effect is lost and the carbon stored in the trees is released into the atmosphere, thereby increasing the greenhouse effect.
4. **Increasing livestock farming.** Cows and sheep produce large amounts of methane when they digest their food. Methane is a more powerful greenhouse gas than CO<sub>2</sub>, but has a shorter atmospheric lifetime.
5. **Agricultural activities:** The use of Fertilizers containing nitrogen produce nitrous oxide emissions. Nitrous oxide, like CO<sub>2</sub>, is a long-lived greenhouse gas that accumulates in the atmosphere over decades to centuries.
6. **Industrial emissions:** Industrial emissions are one of the primary air pollutants. It presents a serious threat to natural ecosystems and human health both at global and regional levels. Industrial emissions, apart from consequent odor issues, safety and occupational health of employees, damaging the company's image in public becomes a significant concern. Industries such as petro-refineries, latex processing, bulk drug and pharmaceuticals, tanneries, waste treatment plants, poultry farms, and fish processing facilities release air that has both volatile organic compounds (VOCs) and volatile inorganic compounds (VICs). Therefore, air emission control is essential not only from the public nuisance point of view but also for the removal of VOCs and VICs and for the general well been of individual and the environment.

#### **Noticeable impacts of climate change in Nigeria**

Nigeria is recognized as being vulnerable to climate change impact, particularly due to its geography, climate, vegetation, soils, economic structure, population and settlement, energy demands and agricultural activities. The impact of climate change is felt across the country as different areas suffer from such natural disasters as: flood disaster, late onset of rainfall and early cessation of rainfall, reoccurring incidence of drought, increasing temperature, reduced river flow, declining water table, loss of some plants and animal species and outbreak of some climate related diseases such as malaria and meningitis. Also, climate change is contributing to slower-onset environmental shifts that can force human migration, such as desertification, sea-level rise, ocean acidification, air pollution, rain pattern shifts, and loss of biodiversity. Increase in the number of refugee camps leading to high rates of diarrheal diseases, measles, acute respiratory infections, malaria and other vector-borne diseases, sexually transmitted infections, malnutrition, and chronic disease complications. Climate change also increases mental health disorders due

to weather disasters, forced migration, food insecurity, and extreme heat waves. Posttraumatic stress disorder, depression, domestic abuse, general anxiety, and substance abuse have all been associated with climate change in recent times.

According to During (2017) one major event revolving around climate change in Nigeria is the drying up of Lake Chad. The southern part of Lake Chad is part of the section of the lake that lies inside Nigerian territory. During added that some years back, Lake Chad covered an estimated area of over 40,000 km, while presently it covers 1300 km<sup>2</sup>. Adepoju (2017) posited that the impacts of climate change in Nigeria include rising temperature, more intense and frequent weather events and sea level rise. Due to Nigeria's population, the consequences are increased water and food shortages, higher exposure to heat stress and ultraviolet radiation (Adepoju, 2017). Thus, climate change has a lot of implications on human health. For instance, Nwoke, Nwoke and Ukpai (2015) have linked climate change to higher temperatures, which enhance production of various secondary pollutants and, thereafter, increase in the frequency of allergic and cardio-respiratory disorders and deaths caused by these air pollutants. The outcomes of climate change have been felt across the vegetative regions of the Nigeria. Research has shown that climate change is increasingly becoming a major threat to agricultural productivity in Nigeria

#### **Climate change act**

The Climate Change Act was signed into law by President Buhari in 2021 and provides the legal and institutional backing for Nigeria's climate-related programs and activities. The Act establishes a National Council on Climate Change comprised of the President, Vice President, several Ministers, and representatives from the private sector and civil society. The Council is responsible for setting targets and mitigation measures for Nigeria's GHG emissions, developing a carbon budget for Nigeria, and developing a process for carbon tax and emissions trading. An important innovation of the Act was the establishment of a Climate Change Fund financed jointly by appropriations from the National Assembly, funds obtained from international sources, and receipts from carbon taxes and emissions trading. The Climate Change Act provides a useful framework for coordinating Nigeria's climate-related activities. However, the nation need greater international support to finance Nigeria's emission reduction campaign efforts and also to drive implementation at the sub-national levels.

#### **Implication for sustainable development**

Education is central to effectively addressing of both the causes and the impacts of climate change. Rabia and Esra (2018) emphasized that science education should be central to promote students' understanding of global climate change and for sustainable development. Sustainable development is seen as development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. No doubt, science teachers have the content and subject matter knowledge to provide climate change information to learners for sustainable development. Therefore, the role of science teachers is crucial to connect what students know, what students can do and what students understand. Although, the overall level of public awareness on issues related to climate change in Nigeria is considered to be low. There is great need to improve public

understanding of the potential impact of climate change. Stakeholders in the education system (such as academics, researchers, teachers, students, and policy-makers) have roles to play in national programmes to achieve this goal for sustainable development.

According to IPCC (2014) unless action is taken, climate change will be exacerbated and become a more serious threat to all beings on the earth. Education system itself are being impacted by climate change, affecting school facilities and activities, school attendance, and learning (Francis, 2014). The most serious consequences of climate change resulting in climate emergency are rising sea-level, melting glaciers, violent storms, desertification, biodiversity loss, ecosystem collapse, and species mass extinction (Ilevbare, 2019). In addition, climate change is altering temperature, precipitation, and sea levels, and will adversely impact human and natural systems, including water resources, human settlements and health, ecosystems, and biodiversity. However, Changes in climate should not be confused with changes in weather.

Weather is observed at a particular location on a time scale of hours or days, and exhibits a high degree of variability, whereas climate is the long-term average of short-term weather patterns, such as the annual average temperature or rainfall. Creating awareness about climate change through school programmes enables learners to move away from emotional and opinion driven approaches to climate change issues and to draw upon scientific knowledge to understand climate. Also, science based climate education could play an essential role in raising awareness about the climate emergency for both present and future populations (Ilevbare, 2019).

### **Mitigation measures**

The mitigation and adaptive measures against the negative impact of climate change is very critical for Nigeria to reduce the health risks brought about by this global threat. The health sector from primary, secondary and tertiary health institutions should identify the major regional health hazards caused by climate change and ensure that the development of risk-lessening adaptations are employed. Hence, effective adaptive strategies should involve collaboration among diverse government sectors, research institutes, various disciplines and communities. Another way of mitigating this ugly threat to life and existence is through Education. Teachers especially science teachers are encouraged to teach those environmental related topics in school curriculum (conservation of natural resources, pollution, weather, climate change and sanitation among other) with enough scaffolding and teaching aids that establishes the foundations of the process of science and the underlying principles of climate science.

There is the need to protect the environment; hence, there should be awareness of the potential health risks associated with climate change. Relevant agencies and institutions should create awareness among citizens including disaster and emergency workers about climate change impacts and how they affect vulnerable populations like children, aged and pregnant women. This could be achieved by providing basic training, workshops and sensitization programmes to raise awareness and promote climate change adaptation through school.



### Conclusion

The environment apart from being the physical surrounding for natural habitats, it also provides the basis for human existence and exploits in agricultural, technological, industrial, commercial, and tourism development of a society among others. Due to over exploitation of the environment and natural resources mostly by humans, the natural balance has been seriously broken leading to serious threat to human existence and climate change. Climate change can be defined as any significant change in the measures of climate lasting for an extended period of time. Nigeria no doubt is vulnerable to climate change impact due to its geography, climate, vegetation, soils, economic structure, population and settlement, energy demands and agricultural activities. As a result, the impact of climate change is felt across the country as different areas suffer from such natural disasters as flood disaster, late onset of rainfall and early cessation of rainfall, reoccurring incidence of drought, increasing temperature, reduced river flow, declining water table, loss of some plants and animal species and outbreak of some climate related diseases such as malaria and meningitis among others. Among other things, human health is increasingly threatened by rapid and widespread changes in the environment.

### Recommendations

Based on the theoretical evidence provided by this study, the following recommendations are hereby put forward:

1. There should be an urgent and deliberate actions by all stakeholders towards the protection of the environment.
2. The government and all other stakeholders should organize awareness campaign regularly to sensitize the populace on the potential health risks associated with climate change.
3. Relevant agencies, institutions and education ministries should create awareness among citizens about climate change impacts and how it affects vulnerable populations like children, aged and pregnant women.
4. Government should through schools (teachers) organize basic training, workshops and sensitization programmes to raise awareness and promote climate change adaptation.

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