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Research Article

CLIMATE CHANGE IMPACTS ON NATURAL ECOSYSTEMS AND PRACTICAL ENVIRONMENTAL SOLUTIONS

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Abstract

World's global climate has been changing for many decades now. Natural events and human activities are the major contributors of climate change. The impacts are manifest through the adverse effects posed on environmental temperature rise, extinction of wild animals, status change in water resources availability, agriculture, vegetation, air quality and sea level. These are critically influenced by climate change and variability. Many studies by the Intergovernmental Panel on Climate Change (IPCC) suggest a discernible human influence on global climate change. While recent studies showed that human activities play a leading role in increasing climate change impacts. The projected results of these changes include flooding, damage to crops, soil erosion, adverse effects on surface and groundwater quality, water scarcity, water contamination, disease outbreak, loss of properties, disruption of the settlement, and other socio-economic challenges. In this paper the causes of climate change, the impacts on humanity and the remedies are discussed.

Keywords: IPCC, Renewable energy, anthropogenic emissions, climate change

INTRODUCTION

Climate change refers to long-term shifts in global temperatures and weather patterns. These shifts may be caused by natural or human activities. Human activities have been the main driver of climate change since 1800s, primarily due to the burning of fossil fuels such as coal, oil and gas, which produces heat-trapping gases. As greenhouse gases for example carbon dioxide (CO_2) emissions blanket the Earth, they trap the sun's heat, causing heat sensation on the earth surface usually referred to as greenhouse effect. This leads to global warming and climate change. The world is now warming faster than at any point in recorded history. Recent studies reported that human activities played a leading role in increasing climate change impacts and the projected results of these changes include flooding, damage to crops, soil erosion, adverse effects on surface and groundwater quality, water scarcity, water contamination, disease outbreak, loss of properties, disruption of the settlement, and other socio-economic challenges (IPCC.2007). Climate change and variability has received increased global attention in the last three decades. This is largely due to the risk it poses to the environment and hence the global community. Climate change has become an enormous challenge for developmental planning in many countries especially developing countries like Nigeria. These challenges could be remedied by the most embraced tool known as renewable energy technologies and adjustment of socio-economic activities of humanity to embrace nature. This is because renewable energy technologies have low specific emissions into the atmosphere relative to fossil fuels. This kind of energy is a useful tool for addressing climate change impacts. It is also sustainable

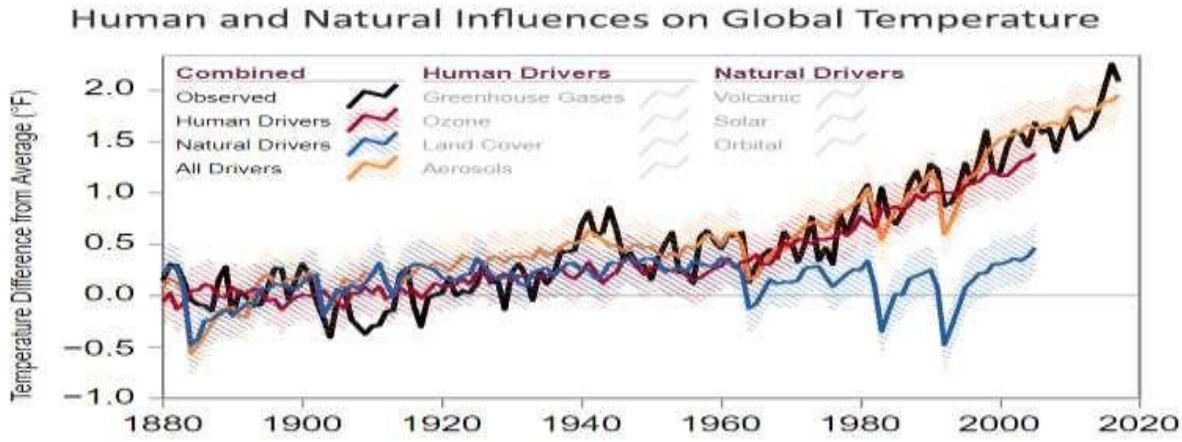
such that it is inexhaustible and does not damage the environmental setups while adjustment points to natural habitat of origin when animals and trees lived in harmony.

Historical Background and Impacts of Climate Change

The US Geological Survey of 2007 reports that all life forms on Earth, water and energy resources, agriculture, vegetation, air quality and sea level are critically influenced by climate change and variability. Geologically, life has existed on planet Earth for approximately four billion years. During this time, it can be understood that climate has swung between ice ages and warm periods. The Earth's atmosphere has generally been in chemical balance such that an increasing global demand for energy and natural resources to meet the need of the ever-growing population has been accepted as a trigger upsetting this atmospheric balance (Warner, 2007), and thus giving rise to climate change. Many studies by the Intergovernmental Panel on Climate Change (IPCC) suggest a discernible human influence on global climate change. Cclimate change and variability has received increased global attention in the last three decades. This is largely due to the risk it poses to the environment and hence the global community.

Human and Natural Influences on Global Temperature

According to U.S. Global Change Research Program (2017), human and natural factors both influence the earth's climate, but the long-term trend observed over the past century can only be explained by the effect of human activities on climate. Fig. 1 illustrates this phenomenon. Drivers of Global rise in temperature include combined influence of human and natural events, human influence like greenhouse release from burning of carbon fuels, natural events such as volcanic explosion, solar radiation and orbital change.



Source: U.S. Global Change Research Program, Fourth National Climate Assessment, Chapter 2: Our Changing Climate EXITEXIT EPA WEBSITE, 2017.

Human activities are increasingly influencing the climate and the earth's temperature by releasing large amount of carbon dioxide (CO_2) through fossil fuels burning, cutting down forests and farming of crops and livestock.

This adds enormous amounts of greenhouse gases to those naturally occurring in the atmosphere, increasing the greenhouse effect and global warming. It has been shown that 89% of global emissions comes from fossil fuels and industrial activities. Yet in 2020, the production and burning of coal, oil and gas was subsidized by US$5.9tn. This number is expected to rise to US46.4tn in 2025. Stopping fossil fuel subsidies could reduce emission by one third. This is one way of mitigating the impacts of climate change on earth. By this, world leaders have an enormous role to play by banning fossil fuel patronage and transit to clean energy utilization in order to make the world a safe and clean place to live on.

Climate Change Variability and Vulnerability

The challenge climate change imposes can however be expressed in various forms. The IPCC confirms climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (Bates et al., 2008). Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Climate variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). Huge information and knowledge gap on climate change and variability, as well as the potential impacts still exist in most part of Africa. Nigeria is widely recognized to be vulnerable to climate change and variability.

There are evidences of extreme weather events and changes in Nigeria. Between 2014 – 2018, rising high temperatures above 40^{o}C had been observed in some central and northern parts of the country while a case of heat wave was reported at Lagos in 2016 (Olewuike and Ugochukwu, 2019). Extreme lowest night temperatures 6.9^{o}C, 7.8^{o}C and 8.3^{o}C were reported for Bauchi, Kano and Jos respectively while some towns recorded prolonged night time temperatures. There were increasing rainfall in coastal areas and decline in rainfall in the continental areas as well as drought, desertification, rising sea levels, erosions, flood, thunderstorms, bush fires, landslides, radiation and loss of biodiversity reported (Olaniyi et al., 2019).

The industrialization of developed and developing countries has increased the concentration of greenhouse gases (GHGs), which has enhanced climate variability (Worku, 2015). Climate change has become an enormous challenge to health and developmental planning in many countries socioeconomic wellbeing for example in Nigeria. According to UNDP 2020 retrieve, NIMET predicted an increase of malaria due to climate change, and other diseases that will be higher in areas with temperatures ranging between 18 – 32^{o}C and with relative humidity above 60%. The IPCC report of 2007 showed that an increase in the frequency of extreme rainfall is likely to occur in most areas during the 21st century with different emissions scenarios. Recent studies by (Chen, X. et.al, 2017) reported that human activities played a leading role in increasing climate change impacts and the projected results of these changes include flooding, damage to crops, soil erosion, adverse effects on surface and groundwater quality, water scarcity, water contamination, disease outbreak, loss of properties, disruption of the settlement, and other socio-economic challenges (IPCC.2007).

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The changes in the hydrological characteristic have majorly been attributed to impacts from climate change (MA et al. 2010; WANG et al. 2009), resulting in the occurrence of extreme weather and variability in precipitation and temperature patterns (Awotwi et al. 2017; Lehmann et al. 2017), and observed increased rates in runoff (HUO et al. 2008).

In recent times, Efforts to provide adequate water resources for most developing countries will confront several challenges, including population pressure, land use related problems such as erosion/ siltation, and possible ecological consequences on the hydrological cycle. Climate change will make addressing these problems more complex. The human population explosion largely concentrated in and around the coastal belt has now become earth's most significant environmental phenomenon. Over 90% of the earth living and non-living resources are found within a few kilometers of the coast (Ahove, 2001), where more than 4 billion people live, predictions have also stated that there would be an incremental rise to 75% by 2030. Thus, coastal populations are growing at a rate of about 1 million people per day and 80% of the world biodiversity is concentrated within the coastal region, much of it undiscovered (IYO, 1998). As human population approaches 7 billion, the impacts, especially the coastal belt, have continued to push out other forms of life. Although it seemed the impact should stop at the ocean's edges, but that has proved contrary. The pressures of the anthropogenic activities and climate change are gulping the coastal ecosystem and the wealth of biodiversity that they harbor.

Impacts of Climate Change On Environment and Economy Of Nigeria

Impact of climate change on Agriculture

Nigeria's agricultural sector is faced with many challenges which have impacts on its overall productivity. These challenges are either directly or indirectly contributing to climate change impacts on the environment. The challenges include; poor land tenure system, bush burning, low level of irrigation farming, chemical usage in crop production, herdsmen-farmers clash, communal clashes, land degradation resulting from oil and gas exploration and exploitation. Others are poor technology of fossil fuel applications, high hydro carbon transportation and distribution costs, limited financing, high post-harvest losses and poor access to markets.

These challenges have stifled agricultural productivity affecting the sector's contribution to the nation's GDP as well as increased food insecurity due to herdsmen-farmers crisis thereby declining levels of food sufficiency. Menace of herdsmen-farmers crisis include reduction in agricultural productivity and poor income of farmers/nomads, post-harvest losses, displacement of farmers, high cost of food stuffs and importation, loss of farm lands, properties and infrastructural damages. Cost of Food importation and domestic prices increased between 2016 and 2019. Within the period, Nigeria's cumulative agricultural imports stood at N3.35 trillion, four times higher than the agricultural export of N803 billion. Nigerian economy has suffered two recessions and the prices of basic necessities such as food stuffs have skyrocketed since 2016 as a result of climate change, weak government policies, environmental degradation and insecurity.

Environmental protection, climate change mitigation and food security can only be achieved dramatically by a change in attitude towards the environment and how we produce what we eat. Nigeria's greenhouse gas emissions

arise from the use of fossil fuel in power plants, industrial sectors and agricultural processing activities. The use of renewable energy technologies could be a turnaround in these sectors, to mitigate climate change in animal production environment the University of Nigeria, Nsukka, Nigeria has devised a measure of using solar energy application in poultry production for poultry egg hatching, day old brooding and poultry manure drying in Nigeria today. Through this method carbon footprint in poultry production systems and the environs has been reduced to the minimum.

Impact of Climate Change on World Economy due to COVID-19 Pandemic

The recent outbreak of COVID-19 infection has not only impacted public health crisis and low global economy but has also exposed world's environment as a microscopic unit. What started as a breakup in a community later affected the whole world environment. Significant economic impact of COVID-19 across the globe includes low productivity, loss of life, business closures, trade disruption, and decimation of industrial sector as well as low economic down run of nations. The global changing pandemic narrative threw some daunting challenges in the recognition of role the change in business climate can play in economic growth of nations. The fallout was shutdown of world's economic environment momentarily. An estimated 2.2 million people died of the pandemic while about 100 million people contracted the virus worldwide. Nigeria's economic growth declined to -1.8% in 2020 while Africa as a continent posted a -2.1% growth rate in GDP, lowest in two decades. According to the International Monetary Fund, the global economy shrunk by 3.5 per cent. Primarily, the pandemic may have long-term impacts globally that may need prompt and proactive actions. The enduring increase in commodities and products prices, global poverty and food insecurity are the immediate impacts. The World Bank estimates that COVID19 has pushed an additional 88 to 115 million people into extreme poverty last year. According to the State of Food Security and Nutrition in the World 2021 report, the pandemic may have added between 83 and 132 million people to the total number of undernourished in the world in 2020. This calls for a scale up of the world food production output.

Recovery from the pandemic effects more especially in the African content calls for urgent intervention towards adaptive infrastructural development and building of quality health care systems that can protect the continent's population against future occurrences. The need to develop and build world-class local industries based on renewable technologies to accelerate transition away from fossil fuel based powered technologies is important therefore. Presently, Nigeria's oil and gas industry is more of fossil fuel based powered technology. Cost of importation of refined petroleum products in Nigeria is less compared to cost of local production of the same products. Extracting one barrel of crude oil in Nigeria costs as high as US$30. This is incredibly high compared to US$4 to countries. Nigeria's Niger Delta mangrove forest is the largest in Africa and third largest in the world. Environmental pollution arising from oil and prospecting and exploration in Niger Delta region of Nigeria has impacted negatively on the biodiversity of the area. Oil spillage and gas flaring contaminate, degrade and destroy the mangrove forests, farm lands and water bodies of the Niger Delta areas causing serious environmental destruction of biodiversity of the region as a result of leakages of crude oil, gas flaring and chemicals used in the production processes. Oil and gas drilling in Nigeria could be environmentally benign through introduction of

modern technologies of renewables for environmental safety. The proposed investment of $3 billion by the African Development Bank in support of local pharmaceutical industries in Africa including Nigeria could be extended to cover oil and gas exploration industries partly to enhance environmental cleanup and booster local vaccines and crude oil production suitable for Africans and the environment.

Key Remedy to Climate Change-Posed Effects

In many discussions on climate change and the posed effects many solutions have been offered ranging from mitigation to adaptation so to remedy the impacts and the effects of climate change.

Adaptive Measures

The negative impacts imposed by climate change on the environment can be minimized by adaptive measures such as:

- Diversification and extension of protected areas such as national parks, wilderness areas, community conserved areas, nature reserves that are mainstay of biodiversity conservation that contribute to people's livelihoods, particularly at local level due to their recognized natural, ecological or cultural values.
- Maintaining ecological structure and processes at all levels and reducing existing pressure on natural ecosystems
- Reducing population and ecosystem vulnerability to climate change and re-orientation of their evolution towards higher resistance to the changes
- Incorporating biodiversity conservation into adaptation strategies in the other sectors of the Nigerian economy
- Establishment and maintenance of protected area
- Active management of wild populations outside of protected areas
- Development and implementation of programs for restricted areas and buffer zones, resource harvesting on a sustainable basis, ecological restoration, sustainable management and Agro ecosystems
- Monitoring to evaluate species and ecosystems stability from climate change perspective.

Mitigation Measures

Mitigating climate change involves reducing the release of greenhouse gas emission into the environment. Strategies for climate change mitigation include adoption of renewable energy resources. Such resources include renewable technologies like solar, wind and small hydro, sustainable transportation systems, biofuels, and promotion of more sustainable uses of land and forests. Renewable energy has been a central focus as a major driver for remediation. This is because renewable energy sources don't emit greenhouse gases that become so detrimental to global welfare.

About 1.4 billion people around the world rely on traditional fuels like coal and wood to meet their basic energy needs. This is very harmful to the environment that can lead to premature deaths for millions of people. By 2035, global energy demand is projected to grow by more than 50%, and even faster in developing countries. IPCC (2018) special report stated that global emissions will need to peak by 2030 and rapidly decrease to net-zero by 2050 if we are able to stay within the safe limits established by the Paris Agreement. To achieve this goal, a

coherent strategy on how to implement 100% RE as part of Sustainable Low Carbon Development (LCD) and Poverty Reduction Goals among people has to be established. To this end, inclusive and interactive approach engaging local stakeholders and key decision-makers in the energy transformation process is imperative in this order:

- inspire stakeholders and build up hands-on knowledge on how 100% renewable energy (RE) adds value to local economic development and community sustainability
- strengthen synergies, networks and platforms for multi-stakeholder dialogue and follow up at the national level among government, parliamentary committees, policy-makers, civil society, trade unions, churches and media on LCD, poverty reduction and 100% RE.
- identify necessary legislation and policy reforms.

However, it's interesting to note, the societies require energy services to meet basic human needs (e.g., lighting, cooking, space comfort, mobility, communication) and to serve productive processes. The quality of energy is important to the development process (Cleveland et al., 1984; Brookes, 2000; Kaufmann, 2004). For development to be sustainable, delivery of energy services needs to be secure and have low environmental impacts.The IPCC Fourth Assessment Report (AR4) reported that fossil fuels provided 85% of the total primary energy in 2004 (Sims et al., 2007), which was the same value in 2008 (IEA 2010). Furthermore, the combustion of fossil fuels accounted for 56.6% of all anthropogenic GHG emissions (eq) in 2004 (Rogner et al., 2007). To maintain both a sustainable economy that can provide essential goods and services to the citizens of both developed and developing countries, and to maintain a supportive global climate system, requires a major shift in how energy is produced and utilized (Nfah et al., 2007; Kankam and Boon, 2009). Most rrenewable energy technologies have low specific emissions into the atmosphere relative to fossil fuels, which makes them useful tools for addressing climate change. For a rrenewable energy resource to be sustainable, it must be inexhaustible and not damage the delivery of environmental goods and services including the climate system. For example, to be sustainable, biofuel production should not increase net emissions, should not adversely affect food security, or require excessive use of water and chemicals or threaten biodiversity. However, energy must also be economically affordable over the long term; it must meet societal needs and be compatible with social norms, now and in the future (IEA 2010a).

CONCLUSION

In conclusion, the global situation begs for a remediation not only by abstinence but both adaptive and mitigation measures to combat the devastative effects of climate change. Earlier measures will improve and enhance socio-economic activities as well as protect the earth's environment for safe livelihoods. For now, renewable energy innovations look more attractive to make our environment safe and friendly to inhabit.

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