

THE KYOTO PROTOCOL, CLIMATE CHANGE AND ENVIRONMENTAL SUSTAINABILITY IN NIGERIA

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Abstract:

The Kyoto Protocol is an international agreement established under the United Nations Framework Convention on Climate Change (UNFCCC) in 1997 in Kyoto, Japan. It represents a binding commitment for industrialized countries to collectively reduce greenhouse gas emissions by an average of 5.2% below 1990 levels. The protocol officially came into force on February 16, 2005, following ratification by key parties such as the European Union and its member states. It was designed as a major global response to climate change and global warming, though its effectiveness and enforcement have been widely debated. A central issue surrounding the Kyoto Protocol is the unequal responsibility between developed and developing nations. Industrialized countries, particularly the United States and members of the European Union, are the largest emitters of carbon dioxide, yet critics argue that they have not demonstrated sufficient commitment to deep emission cuts or to providing adequate financial support to developing countries. Some developed nations signed the treaty but delayed or avoided full ratification, raising concerns about the sincerity of global climate commitments. As a result, developing countries are often left to deal with the consequences of climate change despite contributing relatively little to global emissions. For countries like Nigeria, the impacts of climate change are already evident and potentially severe. Climate models suggest uncertain but significant changes in rainfall patterns, with some predicting decreases and others increases. These variations can negatively affect agricultural productivity, water availability, public health, and infrastructure, increasing the risk of flooding and disease outbreaks. The Kyoto Protocol also introduced mechanisms such as carbon trading, which aim to reduce emissions cost-effectively but have raised concerns about fairness and practical benefits for developing economies.

Introduction

The Environment:

The environment is the entire matrix in which men and all things exist. Akhilome and Idumokoro (2001) defined the environment to be all the interacting factors and circumstances that influence and direct the growth and behaviour of individual beings, groups, species and communities (Akhilome and Idumokoro, 2001; Steffen et al., 2020; IPCC, 2021).

Environmental Degradation.

Environmental degradation which is the process of reducing the environment to a lower rank occurs through man's constant interaction with natural resources of the ecosystem in their search for shelter, fuel and other resources and by the impact of discarded waste materials (UNEP, 2019; Akhionbare et al., 2022). Man has continued to exploit natural resources from the environment without addressing the protection and conservation of the environment. There has been an alarming increase in destructive deforestation and environmental degradation in developing countries like Nigeria in recent years (FAO, 2020; Eze et al., 2023).

Destruction of the environment has occurred as a result of:

- (a) Deforestation through uncontrolled felling of trees, and bush burning which leads to erosion and deforestation (FAO, 2020; Ogundele et al., 2022).
- (b) Improper waste and refuse disposal by domestic and industrial sources which leads to air and water pollution (UNEP, 2019; Akinbile and Oketola, 2021).
- (c) Oil spillage by bunkering and oil prospecting (Nwaichi and Wegwu, 2020).

(d) Desertification due to over-grazing, over-cultivation and poor irrigation practices (IPCC, 2021; Olaniyan et al., 2022).

Greenhouse Effects: A greenhouse is a house made of glass on all four sides including the roof and used for growing plants all the year round. In the greenhouse, sunlight goes through the glass into the glass house. The sun heats up the house but such heat does not escape. The plants receive sunlight energy for photosynthesis and warmth to provide optimum temperature for all year-round growth. Therefore, increase in concentration of greenhouse gases increases the heat that is trapped within the earth (Ukpene, 2020; IPCC, 2021; Masson-Delmotte et al., 2021). Greenhouse gases like nitrous oxide increase due to microbial processes and fertilizer use (Smith et al., 2019).

Global Warming: The natural gas flared indiscriminately into our atmosphere, the uncontrolled deforestation of forests and uncontrollable oil spillages noticed in most parts of the Niger Delta affect the ozone layer and gradually lead to climate change (IPCC, 2021; Obioha et al., 2022). Warming of the globe would give rise to tropicalization of the earth. The result is that large ice in the polar regions would melt causing a rise in sea level (NASA, 2023). A rise in sea level would be disastrous for much of the world population living near or below sea level. Increase in flooding would cause nutrients in the soil to be washed away leading to leaching. Farmers would use more fertilizer as a consequence (IPCC, 2021; Olorunfemi et al., 2022).

The Kyoto Protocol Explained

The Kyoto Protocol provides a “cap and trade” system which imposes national caps for emissions of Annex I countries. It requires countries to reduce carbon emissions by 5.2% below 1990 baseline over the 2008 to 2012 period. These are national level commitments; in principle countries will devolve their emissions target to individual industrial entities, such as power plants or paper factories. One example of a cap-and-trade system is the European Union Emissions Trading Scheme (EU ETS) (UNFCCC, 2020; Ellerman et al., 2021).

The ultimate buyers of credits are often individual companies that expect emissions to exceed quotas. Typically, they will purchase credits directly from another party with excess allowances or from brokers and exchanges. Governments with net deficits of allowances also buy credits, often through carbon funds such as the World Bank Prototype Carbon Fund (World Bank, 2020; Tietenberg and Lewis, 2019). Since allowances and carbon credits are tradable instruments, their pricing supports market liquidity and investment planning. The carbon market has grown substantially, reaching hundreds of billions of dollars in value (ICAP, 2023).

Support for the Kyoto Protocol

Advocates of the Kyoto Protocol state that reducing emissions is crucial because carbon dioxide is a major driver of global warming. This is supported by attribution studies (IPCC, 2021). Prominent advocates include the European Union, environmental organizations, and United Nations scientific advisory bodies. Global climate movements continue to support stronger climate commitments (UNEP, 2021; Steffen et al., 2020).

Criticisms against Kyoto Protocol

One criticism is that the Kyoto Protocol does not go far enough to curb greenhouse emissions (Knutti et al., 2019). Many environmental economists argue that the costs outweigh the benefits, while others view its targets as overly optimistic (Nordhaus, 2019). Some argue the agreement is inefficient and insufficient to significantly reduce emissions (Stern and Stiglitz, 2021). Others suggest alternative policy frameworks beyond Kyoto are needed. There is also controversy surrounding the use of 1990 as a baseline year and not accounting for per capita emissions differences across countries (IPCC, 2021; Raupach et al., 2020).

Implications of Kyoto Treaty for Climate Change

The Kyoto Protocol bares a stark picture for African countries like Nigeria (Toulmin, 2009; IPCC, 2023). Existing emissions of greenhouse gases is expected give rise to average global temperature of at least two degrees Celsius the next 20 to 30 years (Toulmin, 2009; IPCC, 2023; United Nations Environment Programme [UNEP], 2024). If urgent action is not taken soon, the world would be faced with a rise of four degrees Celsius or more (Toulmin, 2009; IPCC, 2023). The forthcoming United Nations Summit in Copenhagen, at the end of 2009, is looking to fix this problem, but the Summit will need to extricate promises of actual cuts in greenhouse emissions from the European Union and US, as well as to find ways to help developing countries to adapt to climate change (Toulmin, 2009; Bodansky, 2016; UNFCCC, 2023). Climate change adds new urgency to the search for new, productive land in the developing countries (Evans, 2009; FAO, 2023).

Experts believe that agriculture in Africa will be hard hit since farming in developing countries is constrained by climatic conditions, unlike parts of Russia and Canada which may benefit from warmer global temperatures (Toulmin, 2009; IPCC, 2023; Sultan and Gaetani, 2016). Many of the impacts of global warming are due to changes in water availability (IPCC, 2023; World Meteorological Organization [WMO], 2024). Rainfall is expected to decline significantly in Southern Africa and across North Africa (Toulmin, 2009; IPCC, 2023). Conversely, East Africa is expected to become wetter, with rain falling in more intense storms, thus causing greater risk of flooding (Toulmin, 2009; Niang et al., 2014; IPCC, 2023).

Climate models show mixed results due to climate change because West Africa's rainfall will be affected; some experts predict a fall and others a rise in rainfall levels (Toulmin, 2009; Sylla et al., 2018; IPCC, 2023). These shifts in rainfall bring major impacts on the ground in terms of crop yields, water availability, disease incidence and flood damage (Toulmin, 2009; IPCC, 2023; WMO, 2024).

The Challenges of Climate Change

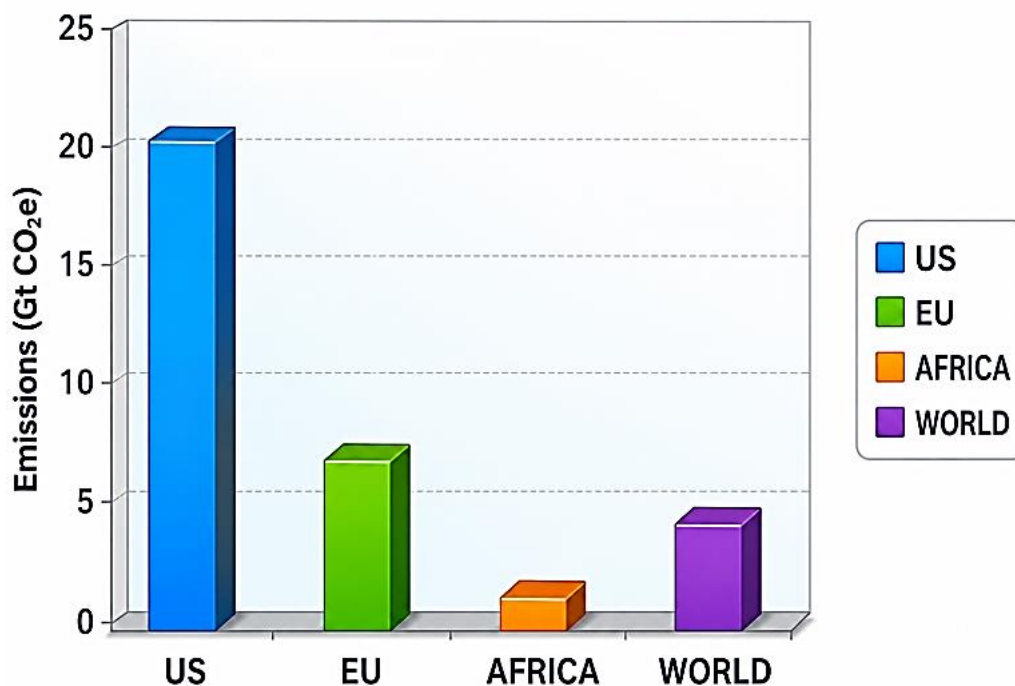
Many of Africa's major rivers such as the Nile, Niger and Zambezi are shared between a number of countries (Toulmin, 2009; UNEP, 2024). These are critical for providing water for cities, irrigated agriculture, fisheries and hydroelectric power (Toulmin, 2009; FAO, 2023). If there is less rainfall, this could mean greater competition and a risk of conflict over resources (Toulmin, 2009; IPCC, 2023; United Nations, 2024). In addition, some of Africa's big cities are particularly vulnerable to a rise in sea level such as Lagos, Accra, Durban and Alexandria (Toulmin, 2009; IPCC, 2023; Nicholls et al., 2021).

There is hope that as a successor to the current Kyoto Protocol which expired in 2012, the Copenhagen document would establish new and more binding targets for cutbacks to greenhouse gases among developed European Union countries and the United States (Toulmin, 2009; Bodansky, 2016). The Copenhagen Summit was expected to secure firm commitments as well from the rich countries (Toulmin, 2009; UNFCCC, 2023). It would also need to offer a variety of options for helping other countries like India, China and Brazil pursue a pattern of economic growth which minimizes emissions in the future (Toulmin, 2009; United Nations, 2023). Science tells us that global emissions need to fall at least 50 percent by 2050 in comparison with 1990 levels if we are to limit the risk of dangerous climate change (Toulmin, 2009; IPCC, 2023; UNEP, 2024).

Climate change is a major challenge and requires a big shift in investment and consumption patterns for rich and poor countries (Toulmin, 2009; Stern, 2007; IPCC, 2023). Parallel to these cuts in emissions, there will also need to be increased support for developing countries as they try and adapt to climate change (Toulmin, 2009; UNDP, 2024). Many of the countries of Africa have contributed the least greenhouse gases to the atmosphere (Toulmin, 2009; IPCC, 2023). For example, in 2007, the average person in Africa emitted one tonne of carbon dioxide compared to a world average of 4.37 tonnes (Toulmin, 2009). The average per person emission in the United

States was about 20 tonnes, followed by the European Union with seven tonnes and China with three tonnes (Toulmin, 2009). In a fair world, all people should have equal rights to the atmosphere and an equal say in how negotiations proceed (Toulmin, 2009; United Nations, 2024). One of the perversities of the climate change talks is that it is the high emitters who largely determine the rules, including the United States, European Union, China, India and Brazil (Toulmin, 2009; Okereke and Coventry, 2016). It is therefore inevitable that the deals reached among these major powers will pay particular attention to their current and future interests (Toulmin, 2009; Falkner, 2016). There is concern that the post-Kyoto treaty could be shaped primarily by those with the greatest bargaining power, while countries at the bottom of the global hierarchy, with little to trade but the most to lose from climate change, may remain marginalized (Toulmin, 2009; Okereke and Coventry, 2016). Indeed, a grouping of the poorest countries, many of which are in Africa, would likely craft a very different kind of treaty if their concerns were fully represented (Toulmin, 2009; United Nations, 2024). These populations need a much louder and more representative voice in climate negotiations (Toulmin, 2009; UNDP, 2024). This can be achieved by strengthening the perspectives of urban dwellers, herders, farmers and forest peoples across their respective nations (Toulmin, 2009; FAO, 2023; UNDP, 2024).

Profile of Emissions by Countries



GLOBAL GREENHOUSE EMISSIONS

COUNTRY	1992-2008	2007	2008 PER CAPITAL CO ₂ EMISSIONS METRIC TONNES PER PERSON	2007	STATE OF WORLD WIDE CO ₂ EMISSIONS	2007
CHINA	-177.5%	154.42	5.3	4.72	22.2%	21.01
USA	+16.8%	18.09	18.6	19.94	17.8%	20.08
INDIA	124.1%	110.99	1.5	1.25	5.5%	4.68

RUSSIA	-23.1%	-17.41	11.3	11.83	5.0%	5.59
JAPAN	8.5%	17.13	10.3	9.91	4.1%	4.22
GERMANY	-17.0%	-7.09	9.4	10.13	2.4%	2.79
CANADA	20.5%	21.62	17.0	17.91	1.8%	1.97
UK	-6.8%	-2.62	8.9	9.28	1.7%	1.89
SOUTH KOREA	81.8%	75.34	10.8	10.69	1.6%	1.72
IRAN	98.5%	108.83	7.5	7.5	1.5%	1.64
SOUTH AFRICA	36.0%	40.11	9.1	9.35	1.4%	1.51
SAUDI ARABIA	52.6%	84.29	15.5	15.73	1.4%	1.45
BRAZIL	84.1%	67.22	2.1	2.05	1.3%	1.33
REMAINING COUNTRIES	45.1%	31.29	3.0		23.7%	
WORLD TOTAL	41.7%	39.22	4.7	4.52	100.0	100%

Source: Us Census Bureau's International Data Base Energy Information Administration (EIA) Of Us Dept. Of Energy (DOE)

To date, African countries have gained little from the new economic opportunities associated with climate policy, such as carbon trading, but there are positive signs that the proposed payment of compensation for reduced deforestation could bring substantial resources to countries like the Democratic Republic of Congo which has a large area of tropical moist forestlands. Nigeria can also benefit in like manner, with proper climate policy measures.

The Nigerian Environment

The Nigerian environment is of concern as far as climate change goes (NEST, 2003; IPCC, 2023). The environment consists of a complex of substances or processes that involve a combination and recombination of resources, and cycles that ensure the utilization and renewal of natural resources (NEST, 2003; UNEP, 2024). It is a common resource for all life forms, including man, animals, plants, and other less noticeable living creatures (NEST, 2003; United Nations, 2024). Thus, the environment of any nation should be protected from any sort of damage or degradation (NEST, 2003; IPCC, 2023; UNEP, 2024).

Environmental degradation has become a serious impediment to economic development, since poverty reduction and alleviation in developing countries largely depend on environmental sustainability (NEST, 2003; World Bank, 2024). Even security, health, the level of nutrition, water availability, and aesthetic beauty depend on the environment (NEST, 2003; UNEP, 2024; WHO, 2024). A case in point is the environmental degradation in the Niger Delta communities where there is deep loss and deprivation (NEST, 2003; UNEP, 2022; Okonkwo et al., 2023). The Niger Delta communities are suffering from human, ecological, and agricultural damages on account of the operations of oil exploration companies, notably the Shell Petroleum Development Company (SPDC) (NEST, 2003; UNEP, 2022; Adekola et al., 2024). Other environmental problems in Nigeria include the issue of desert encroachment in the northern parts of the country, coastal erosion, gully erosion in the South-Eastern states, and deforestation in the South-Western and Middle-Belt states (NEST, 2003; Olorunfemi, 2023). NEST (2003) and Ofomata (2002) identified deforestation, soil degradation, drought, and desertification as major environmental challenges confronting the country (NEST, 2003; Ofomata, 2002; IPCC, 2023).

Climatic Change and Environmental Sustainability in Nigeria

The environmental problems have negative effects in the country, particularly among the rural and urban poor (NEST, 2003; World Bank, 2024). The environmental threat from drought and desertification in the desert-prone parts of Northern Nigeria remains an ever-frightening prospect (Erhabor, 2007; IPCC, 2023; WMO, 2024). Desert conditions result from unstable rainfall patterns

and the concentration of rains within a short period of the year (Erhabor, 2007; IPCC, 2023). With climate change, this situation will be compounded in states bordering the desert such as Sokoto, Borno, Yobe, Katsina, Jigawa, and Kebbi States (Erhabor, 2007; IPCC, 2023; Nigerian Meteorological Agency [NiMet], 2024).

Deforestation leads to loss of wildlife and biological diversity, leading to the loss of animal protein, income, and forest resources (World Bank, 2003; FAO, 2024). Since agriculture depends on rainfall that can be altered by climate change positively or negatively, the sustenance of forests and their resources is particularly important in stabilizing the environment (World Bank, 2003; IPCC, 2023; FAO, 2024). The forest is an asset because of the threat posed by climate change in Nigeria (World Bank, 2003; UNEP, 2024). The forest therefore has to be sustained (FAO, 2024; IPCC, 2023).

Incessant sourcing for fuel wood by women and children deprives communities of trees whose sheltering foliage serves as a protective shield against climate change (World Bank, 2003; FAO, 2024). More time and effort are expended in sourcing for fuel wood than farming and food production (World Bank, 2003; FAO, 2024). Inadequate rainfall for arable cropping and shorter growing seasons would all be worsened by climate change (IPCC, 2023; WMO, 2024). Widespread drying up of vegetation cover and socio-geographic displacement would result from climate change and worsen the impoverishment of local communities (IPCC, 2023; UNEP, 2024). Soil degradation portends ominous consequences for food security (FAO, 2024; IPCC, 2023).

In Nigeria, oil spillage and oil exploration have ruined productive land and valuable water resources (UNEP, 2022; Adekola et al., 2024). Oil spills in the Niger Delta occur due to a number of causes, including corrosion of pipelines and tankers, sabotage, and oil production operations (UNEP, 2022; SPDC, 2023). Corrosion of pipelines and storage facilities remains one of the leading causes of oil spills in the region (UNEP, 2022; SPDC, 2023; Ebegbulem et al., 2023). The largest contributor to oil spill incidents is the rupturing or leakage of aging production infrastructure that often lacks adequate inspection and maintenance (UNEP, 2022; Ebegbulem et al., 2023).

A reason that corrosion accounts for such a high percentage of all spills is that, as a result of the small size of oilfields in the Niger Delta, there is an extensive network of pipelines between the fields, as well as numerous small networks of flow lines carrying oil from wellheads to flow stations (UNEP, 2022; SPDC, 2023). This extensive network creates many opportunities for leaks, especially in onshore areas where most pipelines and flow lines are laid above ground (UNEP, 2022). Pipelines with an estimated lifespan of about fifteen years are often old and susceptible to corrosion (UNEP, 2022; SPDC, 2023). Many of the pipelines are as old as twenty to twenty-five years (UNEP, 2022). Even Shell Petroleum Development Company admits that many facilities were constructed between the 1960s and early 1980s and would not be built in the same manner today (SPDC, 2023).

Sabotage is performed primarily through what is known as "bunkering," whereby the saboteur attempts to tap pipelines and, in the process of extraction, damages or destroys them (UNEP, 2022; Ebegbulem et al., 2023). Oil extracted in this manner is often sold illegally (UNEP, 2022). Sabotage and theft through oil siphoning have become major issues in the Niger Delta States (UNEP, 2022; Adekola et al., 2024).

Annual forest fires, bush burning, and flooding lead to the destruction of farmlands and crops (NEST, 2003; FAO, 2024). It is also important to note that climate change will compound these problems further through increased temperatures, changing rainfall patterns, more frequent extreme weather events, and heightened environmental vulnerability (IPCC, 2023; WMO, 2024; UNEP, 2024).

Recommendations

1. Investment in Renewable Energy

Nigeria should increase investment in renewable energy sources, particularly solar energy, due to the country's abundant sunshine resources. Solar energy can provide a reliable and

sustainable source of electricity for both urban and rural communities. The adoption of small-scale solar energy systems has the potential to improve the living standards of people in villages and small towns that are not connected to the national electricity grid. Furthermore, solar photovoltaic systems can support essential services such as refrigeration for vaccines and medicines, thereby improving healthcare delivery in rural areas.

2. Promotion of Food Security and Sustainable Biofuel Development

While biofuels present significant opportunities for economic growth and energy diversification, their development should not compromise food production or the rights of local farmers. There is a need to ensure that agricultural lands traditionally used for food cultivation are protected from excessive conversion to biofuel production. The government should implement policies that balance biofuel investments with food security objectives and encourage sustainable agricultural practices to safeguard national food supplies.

3. Poverty Reduction as a Climate Change Mitigation Strategy

Poverty remains a major driver of environmental degradation in Nigeria, as economically disadvantaged populations often depend heavily on natural resources for survival. Consequently, comprehensive poverty reduction programmes should be strengthened at both federal and state levels. By improving livelihoods, employment opportunities, and access to social services, pressure on the environment can be reduced. Addressing poverty will also enhance the resilience of vulnerable populations to the adverse effects of climate change.

4. Environmental Education and Farmer Awareness

There is a need to educate farmers and rural communities on the interdependent relationship between human activities and the natural environment. Environmental awareness programmes should emphasize sustainable land-use practices, conservation of natural resources, and climate-smart agricultural techniques. Such initiatives will promote food security, improve rural welfare, and reduce environmental degradation resulting from unsustainable farming practices.

5. Modernization of Industrial Facilities

Industrial facilities and manufacturing plants should be modernized and maintained regularly to improve operational efficiency and reduce greenhouse gas emissions. The replacement or refurbishment of outdated machinery and obsolete industrial infrastructure will help minimize environmental pollution, improve energy efficiency, and contribute to national efforts aimed at mitigating climate change.

6. Strict Enforcement of Environmental Regulations

Industries should comply fully with environmental laws, regulations, and standards governing the discharge of wastes, emissions, and pollutants. Regulatory agencies should strengthen monitoring and enforcement mechanisms to ensure that industrial activities do not pose risks to public health or the environment. Effective compliance with environmental regulations will contribute significantly to sustainable development and environmental protection.

7. Strengthening Afforestation and Alternative Energy Programmes

The Federal Government should intensify ongoing afforestation and reforestation programmes to replace trees lost through deforestation, bush burning, and other human activities. Tree planting initiatives should be expanded nationwide to enhance carbon sequestration, reduce desertification, and improve ecological stability. In addition, the promotion of alternative energy sources, particularly solar energy, should be encouraged to reduce dependence on fuel wood and minimize pressure on forest resources.

8. Enhanced Regulation of Oil Exploration Activities

Greater attention should be given to monitoring and regulating the activities of multinational oil companies operating in Nigeria. Effective environmental management practices should be enforced to minimize pollution, oil spills, gas flaring, and other forms of environmental degradation. This will help ensure the preservation of ecological systems, promote public

health, maintain social stability, and support sustainable development in oil-producing communities.

9. Increased Funding for Climate Change Research and Environmental Management

Government and relevant stakeholders should provide adequate funding for research on climate change, flooding, erosion control, environmental pollution, and ecosystem restoration. Research findings should be utilized in the formulation of evidence-based policies and adaptation strategies. Furthermore, efforts should be directed toward environmental protection, pollution control, and the rehabilitation of degraded environments to promote sustainability, enhance food security, and improve the overall quality of life for present and future generations.

Conclusion

This paper has extensively examined the Kyoto Protocol, climate change, and the imperative of sustaining the Nigerian environment. The central objective has been to highlight the fact that environmental problems pose serious threats to Nigeria's sustainable development and that these challenges are likely to be further aggravated by the impacts of climate change. Such consequences have significant implications for the country's agricultural resource base, which remains a vital sector of the economy and a viable alternative to dependence on crude oil exploitation. Therefore, the need to adopt decisive and sustainable measures aimed at protecting and preserving Nigeria's environment for present and future generations cannot be overemphasized. Addressing these challenges requires effective policy formulation, strong institutional commitment, and the timely implementation of environmental protection strategies at all levels of government. Climate change does not occur in isolation; rather, its effects interact with existing socio-economic and environmental challenges. Its impacts are likely to compound the effects of poverty, food insecurity, environmental degradation, competition over scarce land and water resources, public health challenges, and ongoing social conflicts in many vulnerable regions. The poorest segments of society are often the most severely affected because they are highly dependent on natural resources for their livelihoods and generally possess limited capacity to adapt to environmental changes. In many cases, inadequate social protection mechanisms further increase their vulnerability to climate-related risks. Consequently, international climate agreements and negotiations must give special consideration to the needs and circumstances of developing countries and vulnerable communities. The agreement expected from the Copenhagen Summit at the end of 2009 was anticipated to recognize the principle of climate justice by paying particular attention to the poorest countries and populations. These countries have contributed the least to the accumulation of greenhouse gases in the atmosphere, yet they are among those most exposed to the adverse effects of climate change. Achieving meaningful progress in addressing climate change therefore requires global cooperation, equitable responsibility-sharing, and increased support for vulnerable nations to strengthen their resilience, promote sustainable development, and safeguard their environmental resources for future generations.

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