



Climate Change And The Uneven Geography of Vulnerability In Nigeria: A Regional And Sectoral Assessment

Chioma Obiajuru

The Faculty of Law, University Of Benin, Nigeria

obiajuruchioma201918@gmail.com

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ABSTRACT

Climate change is widely treated in Nigerian scholarship as a single, undifferentiated national crisis, yet its lived effects diverge sharply by region and sector. This article draws on Climate Change Vulnerability Theory to examine how exposure, sensitivity and adaptive capacity combine to produce markedly different climate risk profiles in northern Nigeria (drought, desertification, farmer-herder conflict) and the Niger Delta in the south (sea-level rise, flooding, oil-pollution-compounded degradation). Using doctrinal and literature-based analysis, the article maps these regional impacts onto four cross-cutting socio-economic consequences — agriculture and food security, poverty, public health, and energy supply — to show that Nigeria's climate burden is not evenly distributed but concentrated among specific, identifiable populations. It argues that Nigeria's largely uniform national adaptation architecture is poorly matched to this differentiated vulnerability profile, and proposes region-specific adaptation measures as a corrective. The article contributes a vulnerability-mapped account of climate impact differentials in Nigeria that can inform more targeted adaptation planning.

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1. Introduction

Climate change ranks among the most consequential threats to human development globally, and its effects — while universal in origin — are not universally distributed.¹ Human activities, principally industrialisation, deforestation, fossil fuel combustion, gas flaring and unplanned urbanisation, have driven a sustained rise in atmospheric greenhouse gas concentrations, producing global warming and attendant disruptions to rainfall, temperature and sea level.² While these processes are global, their consequences fall disproportionately on developing countries with limited coping capacity, and Nigeria is a paradigm case.³

¹ AO Kehinde and Abifarin, *A Legal Framework for Combating Climate Change in Nigeria* (2022).

² See generally IPCC, *Climate Change* (Sixth Assessment Report, 2023).

³ HK Ayuba, UM Maryah and DM Gwary, 'Climate Change Impact on Agriculture'; PAO Odjugo and AI Ikhuoria, 'The impacts of climate change and anthropogenic activities'.

Nigeria's exposure to climate change is not monolithic. The country spans a Sahelian north, prone to aridity and desertification, and a Niger Delta south, characterised by low-lying coastal terrain and oil-industry-intensified pollution.⁴ Geographically, the effects of climate change in Nigeria track the country's vegetative zones: high precipitation in the Southwest and Southeast contrasts with low precipitation in the North, which drives aridity, drought and desertification.⁵ These geographic impacts interact with sectoral, demographic and security impacts to produce a national climate burden that is, in aggregate, severe, but whose composition varies enormously by locality.

This article addresses a specific gap in the literature. Existing Nigerian scholarship on climate change has tended to describe impacts at a national or thematic level — cataloguing effects on agriculture, health, security and the economy — without systematically explaining *why* the same climatic drivers produce such different outcomes in different parts of the country.⁶ The article's contribution is to apply Climate Change Vulnerability Theory to disaggregate Nigeria's climate burden by region and sector, and to trace the socio-economic consequences that flow from this differentiated exposure, in order to inform more precisely targeted adaptation policy.

The article proceeds as follows. Section 2 reviews the existing literature and situates the article's contribution within it. Section 3 sets out Climate Change Vulnerability Theory as the analytical lens. Section 4 describes the doctrinal, literature-based methodology. Sections 5 and 6 examine, respectively, the impacts of climate change in northern Nigeria and in the Niger Delta. Section 7 draws out four socio-economic consequences that cut across both regions. Section 8 discusses the implications of this differentiated vulnerability for adaptation policy, and Section 9 concludes with recommendations.

2. Literature Review and Research Gap

A substantial body of scholarship documents that Nigeria's climate is changing in measurable ways. Researchers have shown that Nigeria is increasingly plagued by ecological problems linked to ongoing climate change, evident in rising temperature, variable rainfall, sea-level rise and flooding, drought and desertification, land degradation, more frequent extreme weather, and stress on freshwater resources and biodiversity.⁷ Similarly, it has been observed that the duration and intensity of rainfall events have increased, producing large runoffs and flooding in many parts of the country, while droughts have become a persistent feature in northern Nigeria, driven by declining precipitation and rising temperature.⁸

On sectoral impacts, the literature identifies serious implications for human health arising from malnutrition due to food shortages, the spread of infectious and water-borne disease, increased air pollution, and a correlation between higher temperatures and increased incidence of conditions such as meningitis.⁹ Other scholarship emphasises that climate change does not affect regions uniformly but also affects demographic groups — income groups, occupational classes, age cohorts and genders —

⁴ D Adefalolu, 'Climate Change and Economic Sustainability in Nigeria' (paper presented at the International Conference on Climate Change and Economic Sustainability, Nnamdi Azikiwe University, Awka, 12–14 June 2007).

⁵ E.O. Oladipo, 'An Indication of Abrupt Change of Rainfall and its Potential Impact on Energy in Nigeria' in JC Umolu (ed), *Global Climate Change: Impact on Energy Development* (Damtech Nigeria).

⁶ NE Ebele and NV Emodi, 'Climate change and its impact in Nigerian economy'; Olaniyi and others, 'Review of climate change and its effect on Nigeria'.

⁷ Elisha and others, 'Evidence of Climate Change and Adaptation'; NE Ebele and NV Emodi (n 6); Olaniyi and others (n 6).

⁸ Eneta and others, 'Impacts of climate change on agricultural productivity in Nigeria'; RN Amanchukwu and others, 'Climate Change Education in Nigeria: The Role of Curriculum Review' (2015) 5(3) *Education* 71.

⁹ A Abdulkadir and others, 'Climate change and its implications on human existence in Nigeria: a review' (2017) 10(2) *Bayero Journal of Pure and Applied Sciences* 152.

differently, with individuals possessing fewer resources exhibiting lower adaptive capacity and therefore greater vulnerability.¹⁰

Despite this, the existing literature exhibits a specific gap: while many studies address climate change in Nigeria at a broad, national or regional level, comparatively few offer a systematic, theory-driven account of *why* particular regions and populations experience climate change so differently — that is, few move from documenting impacts to explaining the exposure–sensitivity–adaptive-capacity mechanics that produce them. This article addresses that gap directly by applying Climate Change Vulnerability Theory as an explanatory, rather than merely descriptive, framework, and by using it to derive region-specific policy implications rather than uniform national recommendations.

3. Theoretical Framework: Climate Change Vulnerability Theory

Climate Change Vulnerability Theory provides the analytical scaffolding for this article. The Intergovernmental Panel on Climate Change (IPCC) Third Assessment Report defines vulnerability as the degree to which a system is susceptible to, or unable to cope with, the adverse effects of climate change, framing it as a function of exposure, sensitivity and adaptive capacity.¹¹ Exposure denotes the extent to which a system encounters climate-related hazards such as rising temperature, sea-level rise or extreme weather; sensitivity captures how strongly the system is affected once exposed; and adaptive capacity refers to a system's ability to adjust, moderate damage, or exploit any beneficial opportunities that arise.¹²

Building on this, vulnerability scholarship distinguishes biophysical vulnerability — the physical impacts of climate change on natural and human systems, typically expressed in quantifiable terms such as biodiversity loss or reduced crop yield — from social vulnerability, which captures the socio-economic and political determinants (poverty, inequality, governance, resource access) that shape how a community actually experiences a given climatic shock.¹³ These two structures of vulnerability are not independent: a region's biophysical exposure interacts with its population's social vulnerability to determine the ultimate severity of impact. A drought of identical severity will produce a markedly different outcome in a community with diversified, irrigated agriculture and social safety nets than in one dependent on rain-fed subsistence farming with no formal safety net.

The theory's central insight for this article is that identical climatic stimuli can generate divergent outcomes depending on the exposure and coping capacity of the system in question, and that vulnerability, properly understood, intersects closely with environmental justice principles, since it highlights the importance of addressing underlying vulnerabilities in marginalised or resource-limited communities and directs attention toward the specific populations and regions in most urgent need of adaptation resources.¹⁴ Applied to Nigeria, the theory predicts — and this article confirms — that the drought-prone, agrarian, low-infrastructure north and the flood-prone, oil-industrialised, ecologically fragile south will manifest climate change in qualitatively different ways, even though both sit within the same national legal and policy framework.¹⁵

¹⁰ Amobi and Onyishi, study on demographic differentials in climate change vulnerability in Nigeria; IA Madu, 'Rurality and Climate Change Vulnerability in Nigeria: Assessment Towards Evidence-Based Rural Development Policy' (paper presented at the 2016 Berlin Conference on Global Environmental Change, Freie Universität Berlin, 23–24 May 2016).

¹¹ IPCC, Third Assessment Report (TAR), cited in Nick Brooks, *Vulnerability, Risk and Adaptation: A Conceptual Framework* (Tyndall Centre Working Paper, 2003) 38.

¹² *ibid.*

¹³ Nick Brooks (n 11).

¹⁴ *ibid.*

¹⁵ IA Madu (n 10).

4. Methodology

This article adopts a doctrinal, library-based research methodology consistent with legal and policy scholarship on environmental issues. It draws on primary sources — including the Constitution of the Federal Republic of Nigeria 1999 (as amended) and relevant statutes — and secondary sources comprising peer-reviewed journal articles, institutional reports (including IPCC, FAO, World Bank and Nigerian Bureau of Statistics data), and government policy documents. Regional impacts are analysed comparatively across northern and southern Nigeria, and socio-economic consequences are then synthesised across both regions to identify cross-cutting patterns. Sources were selected for their direct bearing on documented climatic, agricultural, health, security and economic outcomes in Nigeria, with particular weight given to peer-reviewed and institutional sources over informal commentary. As doctrinal legal-policy research, the study does not involve primary field data collection, sampling or statistical hypothesis testing; its evidentiary base is the existing documented record, analysed and synthesised through the lens of Climate Change Vulnerability Theory.

5. Climate Change Impacts in the Northern Region

Northern Nigeria forms part of the Sahel, a zone of pronounced climate variability, and vulnerability analysis consistently shows that its high degree of rurality corresponds with a high degree of climate exposure.¹⁶ The combination of rising heat and declining rainfall has accelerated desert encroachment, contributing to the loss of wetlands and a rapid reduction in surface water, flora and fauna resources across the region.¹⁷ Four impact pathways are especially salient.

5. (Kehinde & Abifarin, 2022) Environmental and climatic change. The region has experienced rising average temperatures, erratic rainfall, and advancing desertification, with a measured 25% average decline in precipitation over the last three decades in the Sahel belt of Nigeria. Lake Chad's surface area contracted from roughly 4,000 km² to roughly 3,000 km² between 1960 and 2007, a shrinkage attributed to climate change and emblematic of broader land degradation across the north. Rising temperature has intensified heatwaves, with direct implications for both human welfare and livestock survival.

5. (Intergovernmental Panel on Climate Change [IPCC], 2023) Agricultural productivity. Agriculture is the economic backbone of the north, sustaining over 75% of the population, yet the region's short wet season — typically following a seven-to-eight-month dry spell characteristic of the wider Sudano-Sahelian zone — has become increasingly unreliable, driving successive reductions in crop yield and rising livestock mortality since the 1970s. Staples such as millet, sorghum and maize have been particularly affected, and the combined effect of reduced yields and livestock losses has exacerbated hunger and malnutrition across the region.

5. (Ayuba et al., 2013; Odjugo & Ikhuoria, 2009) Forced migration and displacement. Climate-induced livelihood loss has driven rural-urban migration, cross-border migration, and internal displacement. Farmers unable to sustain their livelihoods have migrated to urban centres, straining already stretched urban infrastructure, while some affected communities have migrated across borders into neighbouring countries, intensifying regional migration pressures. Floods, droughts and desertification have together displaced thousands of people, producing humanitarian crises in some affected areas.

5. (Adefalolu, 2007) Insecurity and conflict. Diminishing pasture has intensified farmer–herder competition for land and water, a dynamic identified by the United States Institute of Peace and corroborated by Odoh and Chilaka as a significant driver of violent clashes between Fulani herders and farming communities, with consequences that in many cases have proven fatal. Environmental stress, poverty and displacement have also created conditions exploited by extremist groups such as Boko

¹⁶ *ibid.*

¹⁷ MO Dioha and NV Emodi, 'Energy-Climate Dilemma in Nigeria: Options for the Future' (2018) *IAEE Energy Forum*.

Haram for recruitment among vulnerable, unemployed youth, and north-south migration pressures have been identified as a contributing factor in the broader emergence of such groups.

5. (Oladipo, 2009) Health. Rising temperatures have increased heat stress and dehydration, particularly among vulnerable populations, while flooding and poor water management have driven outbreaks of cholera and typhoid. Changing temperature and rainfall patterns have also expanded the range of vector-borne diseases such as malaria. The Nigerian Meteorological Agency has linked rising northern temperatures to increased cardiovascular, respiratory and cerebrovascular disease, diabetes-related conditions and heatstroke, with disproportionate hospital admissions among the elderly, newborns and children.

6. Climate Change Impacts in the Southern Region (Niger Delta)

The Niger Delta presents a contrasting vulnerability profile, shaped less by aridity than by coastal exposure and decades of oil-industry activity. The region generates over 90% of Nigeria's national revenue through petroleum production, yet bears an outsized share of the country's climate and pollution burden, arising principally from anthropogenic oil-related activity — gas flaring and oil spillage — layered atop the region's underlying climatic exposure.¹⁸

6. (Kehinde & Abifarin, 2022) Coastal erosion and sea-level rise. As a low-lying delta, the region is acutely exposed to rising sea levels; one projection estimates the Niger Delta could lose over 15,000 km² of land by 2100 under a one-metre sea-level rise scenario. Shoreline erosion persistently threatens infrastructure, homes and businesses, and rising sea levels have caused saltwater to infiltrate freshwater resources, contaminating drinking water supplies and agricultural land and thereby reducing crop productivity.

6. (Intergovernmental Panel on Climate Change [IPCC], 2023) Flooding and wetland degradation. Flooding — occurring in coastal, riverine and urban forms — has intensified across the Niger Delta as a consequence of heavy downpour, thermal expansion of ocean and river systems, and glacier melt driving sea-level rise. These flooding events, compounded by human activity, are degrading the wetlands that would otherwise serve as natural flood buffers, thereby reducing their protective effectiveness and displacing populations while disrupting economic activity.

6. (Ayuba et al., 2013; Odjugo & Ikhuoria, 2009) Agriculture and fisheries. Erratic weather and flooding have reduced yields of cassava, rice and plantain, while rising water temperature and pollution have depressed fish stocks on which many delta communities depend for livelihood; saltwater intrusion has rendered swathes of farmland infertile, forcing many farmers to abandon their land. Oil spillage contaminates land and water, destroying aquatic ecosystems and reducing agricultural productivity, while continuous gas flaring releases substantial greenhouse gas volumes, intensifying both local air pollution and global warming; improper industrial and domestic waste disposal further clogs waterways, increasing flood risk during heavy rains.

6. (Adefalolu, 2007) Environmental degradation and pollution. Decades of oil exploration have produced sustained pollution of air, land and water, with the Delta's mangrove forests — critical for coastal protection and carbon sequestration — significantly depleted; these environmental impacts can usefully be grouped into three interlinked categories: air pollution and nuisance from gas flaring, and combined land and water pollution from industrial waste, both of which render affected areas unsuitable for agricultural production and safe consumption.

¹⁸ I Etim and A Folarin Alonge, 'Niger Delta Region of Nigeria, Climate Change and Way Forward' (2009 Bioenergy Engineering Conference, ASABE, 11–14 October 2009) 2.

6. (Oladipo, 2009) Health. Pollution-linked health effects include respiratory illness, birth defects, early menopause and reduced life expectancy; average life expectancy in the Niger Delta is estimated at around 46 years, roughly a decade below the national average, with fossil-fuel-linked pollution implicated in a substantial proportion of excess air-pollution deaths from otherwise avoidable human sources, and black soot from pollution specifically implicated in birth defects among children born in affected communities. Declining availability of marine resources further contributes to malnutrition among populations dependent on fishing.

7. Cross-Cutting Socio-Economic Consequences

Beyond these regional profiles, four socio-economic consequences recur across both the north and the south, illustrating how biophysical vulnerability translates into social vulnerability nationally.

7. (Kehinde & Abifarin, 2022) Agriculture and the economy. Agriculture employs roughly 70% of Nigeria's population and contributed 22.35% of GDP between January and March 2021, yet climate-driven disruption — drought in the north, flooding in the south — has undermined productivity nationally. Nigeria cultivates only around 43 million of its estimated 70. (Enete, 2014; Amanchukwu et al., 2015) million hectares of arable land, with low incidence of irrigation farming, and public officials have themselves expressed concern at the country's low cultivated share of arable land amid worsening drought, flood and limited irrigation capacity. Agricultural imports have run several multiples ahead of agricultural exports in recent years — Nigeria's cumulative agricultural imports between 2016 and 2019 stood at ₦3. (FAO, 2022) trillion against agricultural exports of ₦803 billion over the same period — reflecting a widening food-production deficit that climate stress has helped to entrench.

7. (Intergovernmental Panel on Climate Change [IPCC], 2023) Poverty and inequality. Climate shocks — flooding in Bayelsa, Rivers and Lagos, drought in the north — have pushed affected populations into poverty by destroying homes and livelihoods, while wealthier Nigerians can more readily afford adaptive measures such as relocation or flood-resistant construction, leaving poorer communities to bear a disproportionate share of climate impact. An estimated 40% of Nigerians live below the international poverty line of US\$2. (Madu, 2016) per day, according to World Bank estimates, and Nigerian Bureau of Statistics data corroborate a similar figure, which climate change is expected to worsen.

7. (Ayuba et al., 2013; Odjugo & Ikhuoria, 2009) Food insecurity. Climate change affects food security through four interlinked channels — availability, access, utilisation and stability — each of which is compromised by drought, flooding, rising temperature, increasing aridity and soil acidity, and elevated CO₂ emissions. Malnourishment prevalence in Nigeria rose from 6% in 2006 to 13.45% in 2018, and roughly 31% of households reported food scarcity in 2021; the north-east geopolitical zone is especially affected, with an estimated 8. (Adefalolu, 2007) million of the region's 26 million people at risk of food shortage and nutrition crisis requiring humanitarian intervention. Rising temperature has also been found to accelerate post-harvest decay of crops such as yams, potatoes, tomatoes and onions, with an estimated 2,000 tonnes of yams and 2,500 tonnes of vegetable crops lost annually to decay — a loss significant enough to prompt the construction of a 200,000-tuber-capacity yam storage facility in Benue State.

7. (Adefalolu, 2007) Public health and energy. Beyond the region-specific health effects already noted, climate change threatens Nigeria's already constrained electricity supply. Reduced rainfall lowers hydroelectric output, illustrated by the Kainji Dam's diminished capacity during extended drought, while rising temperature reduces thermal transmission capacity and simultaneously increases cooling demand for fans and air conditioning. Coastal infrastructure — transmission lines and substation equipment — faces additional risk from sea-level rise, erosion, flash floods and extreme weather, while high winds and storms create risk for oil and gas investment in Nigeria's coastal and offshore zones.

8. Discussion: Differentiated Vulnerability and Implications for Adaptation Policy

8. (Kehinde & Abifarin, 2022) Confirming the theory, refining the policy. The evidence assembled above confirms the central prediction of Climate Change Vulnerability Theory: identical global climatic drivers produce divergent regional outcomes in Nigeria because exposure, sensitivity and adaptive capacity differ systematically between the north and the south. The north's vulnerability is rooted in biophysical exposure to aridity interacting with low-infrastructure, rain-fed agrarian livelihoods — a combination that channels climatic stress into food insecurity, displacement and conflict. The Niger Delta's vulnerability, by contrast, is compounded rather than purely climatic: sea-level rise and flooding interact with decades of oil-industry pollution to produce a uniquely severe health and ecological burden, despite the region's central importance to national revenue. This divergence has a direct implication for adaptation policy: a uniform, nationally undifferentiated adaptation strategy is structurally mismatched to Nigeria's actual vulnerability geography.

8. (Intergovernmental Panel on Climate Change [IPCC], 2023) Policy implications. Measures suited to the north — drought-resistant crop varieties, water harvesting, rangeland management to reduce farmer–herder conflict, afforestation to slow desert encroachment — address a different causal chain than measures suited to the Delta, where adaptation must contend simultaneously with sea-level rise and industrial pollution remediation, including coastal defences, wetland restoration and stricter enforcement of gas-flaring and spillage controls. Treating “climate adaptation in Nigeria” as a single policy problem risks under-serving both regions: resources allocated to generic national programmes may fail to reach the specific mechanism of harm operating in a given locality. A vulnerability-mapped approach, of the kind developed in this article, offers a basis for allocating Nigeria's National Climate Change Action Plan resources in closer proportion to documented regional risk.

8. (Ayuba et al., 2013; Odjugo & Ikhuoria, 2009) Limitations and directions for future research. As a doctrinal, literature-based study, this article's conclusions rest on the currency and completeness of the secondary sources reviewed; primary quantitative vulnerability indices for Nigerian sub-regions, where available, would allow future research to move from the qualitative regional comparison offered here toward a more granular, spatially disaggregated vulnerability index. Future research might also usefully extend this framework to Nigeria's Middle Belt and southwestern coastal cities, which fall outside the north–south comparison developed here but may exhibit their own distinct vulnerability profiles.

9. Conclusion and Recommendations

Climate change in Nigeria is not a single national phenomenon but a set of regionally and sectorally differentiated risks, shaped by the interaction of exposure, sensitivity and adaptive capacity. The north faces a biophysical crisis of aridity translating into agrarian collapse, displacement and conflict; the south faces a compounded crisis of sea-level rise interacting with industrial pollution. Both converge on shared national consequences for food security, poverty, public health and energy supply.

Accordingly, this article recommends: (i) region-specific adaptation strategies, including drought-resistant crop varieties and rangeland conflict-mitigation measures for the north, and coastal defences and pollution remediation for the Niger Delta; (ii) investment in resilient energy infrastructure less exposed to hydrological and coastal risk; (iii) targeted social protection for populations — smallholder farmers, fisherfolk, women, children and the elderly — identified by this analysis as bearing disproportionate sensitivity; and (iv) integration of vulnerability mapping of the kind undertaken here into Nigeria's National Climate Change Action Plan, so that adaptation resources are allocated in proportion to documented regional risk rather than distributed uniformly. A national climate strategy that fails to distinguish the Sahelian north from the industrialised, coastal south will, by construction, misallocate scarce adaptation resources; regional differentiation is accordingly not an optional refinement but a precondition for effective Nigerian climate policy.

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