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PERSPECTIVE ON TERTIARY EDUCATION IN NIGERIA

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CHAPTER EIGHT

IMPACT OF CLIMATE CHANGE ON TERTIARY EDUCATION IN NIGERIA

By

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Abstract

This chapter examines how climate change affects tertiary education in Nigeria and proposes institutional strategies for adaptation and mitigation. Tertiary institutions—universities, polytechnics, colleges of education and vocational institutes—perform teaching, research and community service roles critical to national development. Nigeria faces substantial climate risks: model projections under high-emission pathways indicate large regional temperature increases through the twenty-first century, the country is assessed as highly vulnerable and relatively low in readiness for adaptation, and recent extreme events (notably the 2022 floods) caused large loss of life, displacement and damage to infrastructure and farmland. These risks damage campus infrastructure, disrupt academic calendars, constrain research (especially fieldwork), exacerbate food and water insecurity among students and staff, and widen educational inequality. The chapter synthesizes evidence and proposes practical, actionable strategies for tertiary institutions: institutional climate risk assessments, climate-proof infrastructure (drainage, passive cooling, solar power), green campus and biodiversity actions, curricular integration of climate education, emergency preparedness, partnerships for technical and financial support, and student-led resilience initiatives. Implementing these measures will protect educational continuity and position universities as hubs for climate adaptation research and community outreach.

Keywords: Climate Change; Tertiary Education; Nigeria; Educational Infrastructure; Academic Performance; Research Disruption; Mitigation Strategies; Sustainable Development; Higher Education Policy; Adaptation;

Introduction

Tertiary education as a planned and organized educational system designed for the total development of man/woman and for the total transformation of the society through the utilization of teaching, research and provision of community service. The cardinal programme of tertiary institutions includes; teaching, researching and provision of community services (Ogunode, Edinoh & Okolie (2023). Tertiary education, also called post-secondary education, is any level of education pursued beyond high school, including undergraduate and graduate credentials. These credentials encompass certificates, diplomas or academic degrees. Tertiary education refers to specialized education in a specific field, taken on after finishing high school. Tertiary education is non-compulsory and provided in a specialist institution, usually a college, polytechnic or university. This form of education may be delivered virtually or at a distance (Top-hat, 2023).

According to Edinoh and Wali-Essien (2023), tertiary education is a social agent of progress and development in the society and aids technological advancement. It is designed to help in the development of nations by providing the high as well as the middle level manpower needed for the social, economic and political advancement through the programme of teaching, learning, research and community services. This function places tertiary education at the apex in the ranking of educational institutions and it is designed to accommodate knowledge acquisition and production. Tertiary education is an organized educational system that is consciously designed for manpower production, in-service training and national development. Tertiary education is an education that advances teaching, research and community services for national development. Tertiary education is an education industry that is meant for the production of manpower and national development via implementation of teaching, research and provision of community services (Ogunode, 2025).

The objectives of tertiary education includes; to provide higher education opportunities via effective teaching, researching and provision community services; to develop produce students with specialized knowledge and skills for solving personal problem and national problem; to prepare student for national workforce and to contribute to societal and community development; to provide academic program of various disciplines; to provide quality instruction in field of studies and to conduct researches to generate new knowledge for national development and to solve complex problems (Ogunode, 2025).

From the above, tertiary education in this chapter refers to the level of education that is pursued after completing secondary education that focus on teaching, research and provision of community services. It typically includes post-secondary education such as universities, colleges, vocational training, and trade schools. Tertiary education focuses on specialized and advanced knowledge in a specific field or discipline. It is often seen as a crucial step towards preparing individuals for their chosen careers and acquiring advanced skills and knowledge. Tertiary education enables individuals to gain expertise in their field of study and prepares them to enter the workforce with

the necessary qualifications. It also provides opportunities for personal growth and development through exposure to new ideas and perspectives. Overall, tertiary education plays a vital role in shaping individuals and equipping them with the necessary skills to contribute to society.

Nigeria, Africa's most populous country and one of the continent's leading economies, is at the forefront of the climate challenge. According to World Bank projections for a very high emissions scenario, Nigeria is likely to experience a significant rise in temperatures, reaching between 2.9°C and 5.7°C by 2100. The country ranks 154th out of 181 in the ND-GAIN 2021 index, which assesses vulnerability and resilience to climate change. Its dependence on agriculture makes it particularly sensitive to climate disruptions. According to the World Bank, around 78% of Nigeria's land area is devoted to agriculture, the majority of which is rain-fed (with less than 1% irrigated) and carried out by small-scale farmers using traditional methods. In addition, its varied geography exposes it to many extreme weather phenomena. Nigeria's vulnerability and readiness indicators place it among countries with substantial adaptation needs (World Bank, n.d.; Notre Dame Global Adaptation Initiative [ND-GAIN], 2023).

In the north, rising temperatures and desertification could exacerbate existing problems related to water supply and food security, which are already major challenges inthis region. For example, rising CO_2 levels in the atmosphere are expected to lead to a 17% drop in nutrients in rice, while fluctuations in temperature and rainfall will likely reduce rice yields. In the south, coastal areas and river basins are exposed to flooding, resulting in loss of life and damage to infrastructure. In 2022, according to the Nigerian Hydrological Services Agency (NIHSA), the worst floods on record destroyed more than 440,000 hectares of farmland, affecting more than 1.4 million people, causing more than 662 deaths and displacing thousands of residents. Direct economic damage is estimated at a median value of USD 6.68 billion. Rising sea levels are also threatening the Nigerian coast, particularly Lagos, with erosion, salinisation of land and flooding. According to an article by the Boston Consulting Group, Lagos could be flooded by extreme weather events under 1.5 metres of water, and up to 2.5 metres by 2050 (Safeguarding Coastal Cities from Climate Change, 15 mars 2023)

Climate change is accelerating the degradation of ecosystems in Nigeria, reducing the country's resilience to climatic shocks. Deforestation, driven by agricultural expansion, illegal logging and charcoal production, is leading to a loss of biodiversity, soil erosion and a reduction in the capacity of forests to absorb carbon. According to the Global Forest Watch (GFW) initiative, between 2001 and 2023, Nigeria lost 1.33 Mha of tree cover, equivalent to a 13% decrease in tree cover since 2000 and 724 Mt of CO_2 emissions (Safeguarding,2023). Climate change appears to have great impact on institutions directly and indirectly especially educational institutions. The tertiary institutions is a sub-set of the whole society that also appear to be feeling the impact of climate change.

Extreme weather and slow-onset changes are already affecting livelihoods and infrastructure: the 2022 floods were among the worst in a decade and led to hundreds of deaths, millions affected and extensive agricultural and infrastructural damage (National Hydrological Services Agency [NIHSA], 2022; UNICEF, 2022). Deforestation and forest degradation have also reduced ecosystem resilience (Global Forest Watch, 2024), while atmospheric concentrations of greenhouse gases continue to rise globally (NOAA, 2022). These environmental changes have cascading impacts on tertiary education through damaged campus infrastructure, interrupted academic calendars, constrained research and increased inequality in access and outcomes.

This chapter clarifies key concepts, summarizes main drivers of climate change, documents impact on tertiary institutions in Nigeria, and proposes mitigation and adaptation strategies suitable for universities and colleges.

Thus, this chapter is discussed under the following subheadings.

Clarification of concepts

- Climate change
- Causes of Climate Change
- -Impact of climate change on tertiary education in Nigeria;
- Identify mitigation strategies that can be adopted to mitigate the impact of climate change on education institutions in Nigeria
- Conclusion
- Revise questions

Concept of Climate Change

Climate change is a phenomenon that has engulfed all aspects of human endeavours, its ravaging and devastating effects abound all over the world. Climate change according to Akuegwu, Nwi-Ue, and Nwikina (2012) is an issue that is gaining wide spread apprehension and is taking central stage in virtually every human endeavour in the world today. Climate change reflects the variations in the average daily weather conditions such as temperature, humidity, rainfall and sunshine of a location over an extended period. Climate change in Nigeria threatens economic growth in sectors dependent on climatic conditions (Adams, Zubair, & Olatunde-Aiyedun, 2022).

Climate Change" refers to big, long-lasting changes in how the weather works all around the world. Global warming is a big part of this—it's like the Earth's atmosphere getting warmer because it's holding onto more heat from the sun. Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun’s activity or large volcanic eruptions. But since the 1800s, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil and gas. Climate change refers to long-term alterations

in temperature, precipitation, wind patterns, and other aspects of the Earth's climate system. These changes can occur over decades, centuries, or even millions of years and can be driven by both natural processes and human activities (Amarachi, Ihuoma, Ojiugo & Osmond, 2025).

From the above, climate change refers to the long-term alteration of the Earth's climate, particularly the increase in the Earth's average temperature due to human activities such as burning fossil fuels, deforestation, and agricultural practices. This gradual change in temperature has significant effects on the Earth's ecosystems, weather patterns, and human societies. The scientific community agrees that climate change is primarily caused by the greenhouse effect, which is the trapping of heat in the Earth's atmosphere due to the increase in greenhouse gases like carbon dioxide. Climate change has severe consequences, including rising sea levels, more frequent and intense natural disasters, and disruptions to food and water supplies. It is a global issue that requires urgent action to mitigate its impacts and prevent further damage to our planet.

Causes of Climate Change

- Greenhouse Gas (GHG) Concentrations in the Atmosphere

Levels of atmospheric carbon dioxide (CO2), methane (CH4), Carbonflourocarbon (CFCs), and nitrous oxide (N2O) continue to rise. The temporary reduction in CO2 emissions in 2020 during the pandemic had little impact on the growth of atmospheric concentrations (what remains in the atmosphere after CO2 is absorbed by the ocean and biosphere). Data from all global locations, including flagship observatories at Mauna Loa (Hawaii, USA) and Cape Grim (Tasmania, Australia) indicate that levels of CO2 continued to increase in 2021 and 2022. In May 2022, CO2 concentration at Mauna Loa reached 420.99 ppm (419.13 ppm in 2021) and at Cape Grim 413.37 ppm (411.25 ppm in May 2021). Global fossil CO2 emissions in 2021 returned to the pre-pandemic levels of 2019 after falling by 5.4% in 2020 due to widespread lockdowns. Preliminary data shows that global CO2 emissions in 2022 (January to May) are 1.2% above the levels recorded during the same period in 2019, driven by increases in the United States, India, and most European countries. Despite a strong fluctuation in global emissions over the past two and a half years, fossil CO2 emissions fell significantly in 23 countries (many European countries, Japan, Mexico, and the USA) during the pre-pandemic decade of 2010–2019. A quarter of GHG emissions from land-use change are associated with the trade of food between countries, of which more than three-quarters are due to land clearing for agriculture, including grazing.

Deforestation

Deforestation is the loss of tree cover, usually as a result of forests being cleared for other land uses such as farming or ranching. Some limit the definition of deforestation to the permanent conversion of forests to another habitat. Others add to this definition by including the conversion of natural forests to artificial forests such as plantations. Trees may be cut down to clear lands for

building houses, industries, and factories, for growing crops, for grazing cattle, sheep, horses, etc. Deforestation could lead to soil erosion, flooding, and desertification. There is increasing evidence that climate change is affecting forests and forest ecosystems in Africa, as well as the livelihoods of the forest-dependent communities and the national economic activities that rely on vegetation services.

Hunting of Animals or Wildlife (Loss of Biodiversity)

Biodiversity is the variability among living organisms, including the genetic and structural differences between individuals and within and between individuals and within and between species. The world's biodiversity has a total of 1,263,500 species of plants and animals. It provides us with all the necessities of life and sustains and nourishes us. Biodiversity plays a direct role in climate regulation. Climate always changes resulting in evolutionary changes in the species. Millennium Ecosystem Assessment (MEA) predicts climate change to be the principal threat to biological diversity. The average global temperature has increased by 0.6°C since the mid-1800s and is predicted to rise by 1.4 - 5.8°C by the year 2100. The global mean sea level has risen by 10 to 20cm (8) and may further rise to 88 cm. The thickness of Arctic ice has decreased by about 40%. Many areas are facing the problem of water shortage. Climate change has resulted in the extinction of animals like the golden toad and the Monteverde harlequin frog. More frequent heat waves of longer duration and greater intensity are projected globally. Extreme climatic events (heat waves, storms, and hurricanes) and tropical vectorborne diseases (malaria) are predicted to increase which leads to loss of biodiversity. One million of the eight million species on the planet are at risk of extinction. Forests and oceans are polluted and destroyed (IPCC, 2018; Olatunde-Aiyedun,, Olatunde & Ogunode 2025).

Some possible causes of climate change include:

a) **Greenhouse gas emissions** - The burning of fossil fuels, deforestation, and intensive agriculture are all major contributors to greenhouse gas emissions. These gases trap heat in the atmosphere and cause the Earth's temperature to rise. The rise in CO_2, CH_4 and N_2O from fossil fuel use, agriculture, and industrial processes is the primary driver of recent warming. Atmospheric CO_2 concentrations reached record monthly averages in recent years (NOAA, 2022).
b) **Land-use change and deforestation:** Conversion of forests to agriculture, logging and charcoal production releases carbon and reduces carbon sinks; Nigeria has experienced substantial tree-cover loss since 2000 (Global Forest Watch, 2024).
c) **Increase in global population** - As the world's population continues to grow, so does the demand for resources and energy. This leads to increased emissions and a greater strain on the Earth's natural systems.

d) **Industrial processes** - The production of goods and services often involves the release of greenhouse gases, such as carbon dioxide and methane. The use of industrial processes has significantly increased over the past century, contributing to climate change.
e) **Natural factors** - While human activities are the main cause of climate change, natural factors such as volcanic eruptions, solar activity, and ocean currents can also impact the Earth's climate.

Understanding and addressing these causes is crucial in mitigating the effects of climate change. By reducing greenhouse gas emissions, promoting sustainable land use practices, and finding innovative solutions for industrial processes, we can work towards a more stable and sustainable future. Volcanic eruptions, solar variations, and internal variability modulate but do not explain the long-term warming trend (IPCC, 2018).

Impact of Climate Change on tertiary education and Strategies to mitigate climate change on tertiary institutions in Nigeria.

There are many impacts of climate change on tertiary institutions in Nigeria. Some of these impacts includes;

Destruction of Facilities

The effects of climate change on tertiary education in Nigeria are significant and far-reaching. As temperatures continue to rise and extreme weather events become more frequent, the education sector in Nigeria is facing numerous challenges (Idowu, Ayinde,, Michael, Olatunde-Aiyedun, & Ogunode 2021). One of the main effects of climate change on tertiary education is the impact on infrastructure. The changing climate has led to increased flooding, landslides, and erosion, which can damage or destroy school buildings and equipment. This not only disrupts the learning environment but also causes financial strain as schools must repair or rebuild damaged infrastructure (Ohibime, & Kingsley (2023).. Additionally, extreme heat can also make it difficult for students to attend classes or concentrate on their studies (Abubbakar, 2024). Climate change has affected the infrastructure of universities, with buildings and facilities being damaged by extreme weather events. This has resulted in increased maintenance and repair costs, which can ultimately take away funding from academic and research programs (Niyi, 2023; Chime. 2021).

Disruption of academic calendar

The impact of climate change on tertiary education in Nigeria is multifaceted and significant. Firstly, climate change has led to extreme weather conditions such as floods and droughts, which have disrupted the academic calendar and resulted in the closure of schools. This has not only affected students' learning and academic progress, but also the ability of universities to carry out research and other scholarly activities (Adeyemi, 2022; Ekpo & Aiyedun 2018).

Poor academic performance

Climate change has also worsened food and water scarcity in Nigeria, which has a direct impact on the well-being and performance of students. Many tertiary institutions have reported an increase in the number of students experiencing hunger and malnutrition, which has led to decreased productivity and academic achievement. This is particularly concerning for low-income students who may already struggle to afford basic necessities (Adeyemi, 2022; Ekpo, & Aiyedun, 2019). The changing climate has also affected the availability of resources needed for practical learning and research, such as agricultural land and natural resources. This has not only hindered the quality of education in fields such as agriculture and environmental sciences, but also limited the ability of universities to contribute to finding sustainable solutions to climate change (Onyeneke, Amadi, .& Njoku, 2022).

Wider higher education accessibility

Moreover, climate change is also affecting the availability and quality of resources for education, such as electricity and water. Droughts, reduced water levels, and power outages can disrupt the functioning of schools and hinder the use of technology and other educational resources. This can also lead to inequalities in education, as schools in more affluent areas may have better access to resources and be less impacted by climate change than schools in more vulnerable communities (Abubbakar, 2024). Climate change has also exacerbated existing socio-economic inequalities in Nigeria. Disadvantaged communities, many of whom lack access to quality education, are often the most vulnerable to the impacts of climate change. This means that students from marginalized backgrounds may face greater challenges in accessing and completing tertiary education, perpetuating the cycle of poverty and hindering the country's overall development (Adeyemi, 2022). According to recent studies, climate change has had a significant impact on universities in Nigeria. The rising temperatures and extreme weather conditions have resulted in decreased agricultural productivity, loss of biodiversity, and increased risks to human health. Furthermore, these changes have also led to challenges in energy security and disrupted the academic calendar due to frequent floods and droughts (Olajire, Matthew, Omotara, & Aderanti, 2019).

Disruption of research activities

The effects of climate change have also been felt in the education sector, as changes in weather patterns have made it difficult for students and faculty to access remote areas for research and field work. This has hindered the quality and relevance of research being conducted in universities.

Strategies to Mitigation Impact of Climate Change in Tertiary Institutions

Strategies for Mitigating and Adapting to Climate Change in Tertiary Institutions

A. Institutional planning and risk assessment

- Conduct a campus climate risk and vulnerability assessment (mapping flood zones, critical infrastructure, power and water dependencies; update annually).
- Integrate climate risk into institutional strategic plans, budgets, and capital projects (World Bank, 2024).

B. Infrastructure resilience and green engineering

- Improve drainage, flood barriers, erosion control and raised foundations for key buildings.
- Invest in passive cooling (building orientation, shading, insulation, natural ventilation) and retrofit lecture halls to maintain thermal comfort during heat extremes.
- Install decentralized renewable energy (solar + battery) to reduce dependency on grid and fuel generators.
- Protect water supply (rainwater harvesting, storage, filtration) and upgrade sanitation systems.

C. Green campus and ecosystem restoration

- Reforestation, native species planting and protected green belts reduce erosion, sequester carbon and improve campus microclimate (Global Forest Watch, 2024).

D. Emergency preparedness and continuity

- Develop and regularly test emergency plans (evacuation, temporary housing, continuity of teaching).
- Create digital backup systems and blended learning plans so teaching can continue during campus closures.

E. Curricular integration and research agenda

- Integrate climate change and resilience topics across disciplines (engineering, education, agriculture, health, social sciences).
- Establish interdisciplinary research hubs that link outputs to community outreach (UNESCO, n.d.; World Bank, 2024).

F. Student engagement and community outreach

- Support student-led greening projects, climate clubs, and community awareness campaigns.
- Use university extension services to transfer climate-smart practices to surrounding communities.

G. Partnerships and finance

- Seek partnerships with government agencies (NIHSA, NEMA), donors and NGOs.
- Apply for adaptation finance (Green Climate Fund readiness grants, World Bank programmes) to co-finance resilience upgrades.

Research and Innovation:

Universities can also play a crucial role in mitigating the impact of climate change through research and innovation. This can include conducting studies on the effects of climate change in Nigeria and developing solutions to mitigate these effects.

Engage in Community Outreach:

Another strategy is for universities to engage in community outreach programs to raise awareness and educate the local community about climate change and its impact. This can also involve collaborating with local communities to implement sustainable practices and adapt to the effects of climate change.

Green Campus Initiatives:

Universities can also implement green campus initiatives such as planting trees, creating green spaces, and promoting sustainable transportation options. These initiatives can contribute to reducing the carbon footprint of the university and promoting sustainable living practices.

Encourage Student Involvement:

Universities can encourage student involvement in climate change mitigation efforts. This can include incorporating sustainability into the curriculum, supporting student-led initiatives, and providing opportunities for students to participate in research and projects related to climate change.

Summary

This chapter examined the impact of climate change on tertiary education in Nigeria. The paper concluded that destruction of facilities, disruption of academic calendar, poor academic performance, wider higher education accessibility and disruption of research activities are some of the impacts of climate change on tertiary education in Nigeria. On migration strategies tertiary

institutions can adopt to mitigate against the impact of climate change in the institutions, increment in awareness and education, adoption of sustainable practices; implementation of Climate Change adaptation plans, collaborate with Government and NGOs, research and innovation; engage in community outreach; Green Campus Initiatives and encouragement of student involvement in climate change programme are suggested and identified as some of the migration strategies tertiary institutions can adopt to mitigate against the impact of climate change in the institutions.

Revise questions

1. Define climate change and explain its principal anthropogenic drivers.
2. List five causes of climate change and provide one Nigeria-specific example for each.
3. Discuss five ways climate change impacts tertiary education in Nigeria, using evidence from recent events.
4. Identify and critically evaluate five mitigation and adaptation strategies tertiary institutions in Nigeria can adopt to reduce climate risk.

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