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ORIGINAL RESEARCH ARTICLE

Impact of Climate Change on Food Security in Nigeria

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ABSTRACT

Climate change is one of the most significant global environmental challenges in both developed and developing countries, however its impact on food security is much more felt in developing countries such as Nigeria, especially among the poor and other vulnerable groups. Rising temperatures, erratic rainfall pattern, desertification, and extreme weather events have led to declining crop yields and loss of arable land. Nigeria, with its dependence on rain-fed agriculture, is particularly vulnerable to the ripple effects of climate change. About 70% of Nigeria's population depend on agriculture either directly or indirectly for their livelihood, and climate-induced disruptions thereby threaten livelihoods and economic stability. The aim of this paper is to assess the impact of climate change on food security in Nigeria. The objectives are to examine the nature and trend of climate change in Nigeria, examine the relationship between climate change and food security and identify adaptation and mitigation strategies to enhance resilience and ensure sustainable food security in the study area. Data for the paper were gotten through systematic review of extant literature to identify, evaluate and synthesize relevant research on climate trend and food security with a review to examine the impacts of climate change on food security. The findings indicate that climate change has led to reduced crop yields, increased desertification, frequent flooding, and disruptions in food supply chains. The study concludes that climate change significantly threatens food security in Nigeria, with worsening impacts expected in the future. To mitigate these effects, the paper among others recommend the adoption of climate-smart agriculture, investment in irrigation infrastructure, use of improved seed varieties, and improved storage facilities.

Introduction

Climate change is one of the global environmental challenges in both developed and developing countries. However, its impacts are much more felt in developing countries due to poor adaptive and mitigative strategies. Climate is the average weather conditions for a particular location over a long period of time, ranging from months to thousands or millions of years (WMO, n.d.). The World Meteorological Organization uses a 30-year period to determine the average climate of a particular location. Any change in

climate over time whether due to natural variability or as a result of human activity is

referred to as climate change. Despite widespread recognition of the phenomenon, there is still no universally accepted conceptualization of climate change among scholars. Suffice to say that, climate change is conceptualized from different academic backgrounds, environmental settings and disciplinary boundaries.

According to the United Nations Framework Convention on Climate Change (UNFCCC), climate change is a change which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and an addition to natural climate variability observed over comparable time periods (UNFCCC, 1992). There are many factors responsible for climate change, amongst these factors is the increased emission of carbon dioxide and other greenhouse gases which trap the energy in the atmosphere causing a "greenhouse effect." This greenhouse effect warms the earth causing extreme weather pattern, compromised food security, and increased vector-related and climate-related diseases and deaths.

Since the 1800s, human activities have been the main drivers of climate change, primarily due to the burning of fossil fuels such as coal, oil and gas. Burning fossil fuels generates greenhouse gas emissions that act like a blanket wrapped around the Earth, trapping the sun's heat and raising temperatures. Emission of greenhouse gases is one of the contributing factors of climate change in addition to carbon dioxide and methane. These come from using gasoline for driving a car or coal for heating a building (Climate Working Group, 2025). Clearing land and cutting down forests can also release carbon dioxide. Other contributors to emission of gases are activities from agriculture, oil and gas operations. Energy, industry, transport, buildings, agriculture and land use are among the main sectors causing greenhouse gases emission.

The average temperature of the Earth's surface is about 1.2^{o}C warmer than it was in the late 1800s (before the industrial revolution). The last decade (2011-2020) was the warmest on record, and each of the last four decades has been warmer than any previous decade since 1850. The consequences of climate change is characterized by intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity among others.

Climate change is one of the most pressing global issues, with far-reaching impacts on human livelihoods, ecosystems, and economic stability. Extreme weather is the most apparent effect of climate change as extreme heat waves and heavy rain storms are occurring with increase globally. Rising temperatures and more variable rainfall patterns are expected to reduce crop yields, compromising food security and worsening undernutrition. Climate change has ripple effects on malnutrition and increasing mortality rates by 5 to 20 times among others (Mulondo, Hege, Tsoka-Gwegweni and Ndirangu, 2025).

Food Security is multi-dimensional in nature. It is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (Peng & Berry, 2019). Climate change affects all dimensions of food security in terms of availability, accessibility, utilization, and food systems stability. Rising sea levels causes floods, damage crop and affect food production and food security. There is an established relationship between climate change and food security. For instance, rainfall and increasing temperatures reduce

crop yields as a result of increased crop failure and increase in population of pests in many developing countries where food security is already a problem (Xiao *et al.,* 2020). The changing sea and inland temperature, rising sea level, and changing precipitation and water availability affect the abundance, productivity, and distribution of freshwater aquatic species. The prevalence of malnutrition which currently causes 3.5 million deaths annually is expected to rise due to the decrease in the production of staple foods in many of the poorest regions as facilitated by the rising temperatures and variable precipitation.

In Nigeria, climate change has had severe consequences on the agricultural sector, which is the backbone of food security. Majority of Nigerian farmers rely on subsistence agriculture with over 90% of it depending on rain-fed agriculture. With a population of over 200 million people, Nigeria faces the challenge of ensuring food security while contending with the impacts of climate change (Emegha, Bosah, Idigo, & Ofobuike, 2025).

The agriculture sector, which employs about 70% of the population, is highly vulnerable to these climate variations, with serious implications for crop yields, livestock production, and food prices (Zhang, Niu and Yu, 2021). This paper explores the impacts of climate change on food security in Nigeria with specific reference to temperature and rainfall and food security in Nigeria. It is against the background that this paper seeks to assess the impacts of climate change on food security in Nigeria with specific reference to temperature and rainfall and food security in Nigeria. The objectives of the paper are to examine the trends of climate change variables (temperature and rainfall) in Nigeria; assess the trends of food security index in Nigeria and evaluate the impact of climate change on food security in Nigeria.

Materials and Methods

The study employed secondary sources of data. Data for the study were collected through the review of extant literature on the trend of rainfall and temperature from 1981-2024, as well as food security index and the socio-economic impacts of climate change in Nigeria. The literature centered around data from the annual reports, statistical bulletin and archival reports from Food and Agriculture Organization (FAO), the Nigerian Meteorological Agency (NiMet), and the National Bureau of Statistics (NBS) among others.

Results and Discussion

According to the World Meteorological Organization (WMO), in 2024 there was a global average surface temperature of 1.55 °C (±0.13 °C) above the pre-industrial (1850-1900) average temperature, is the hottest year on record. Similarly, the last ten decade (2015-2024) has also been declared as the warmest on record. (NiMET, 2025)

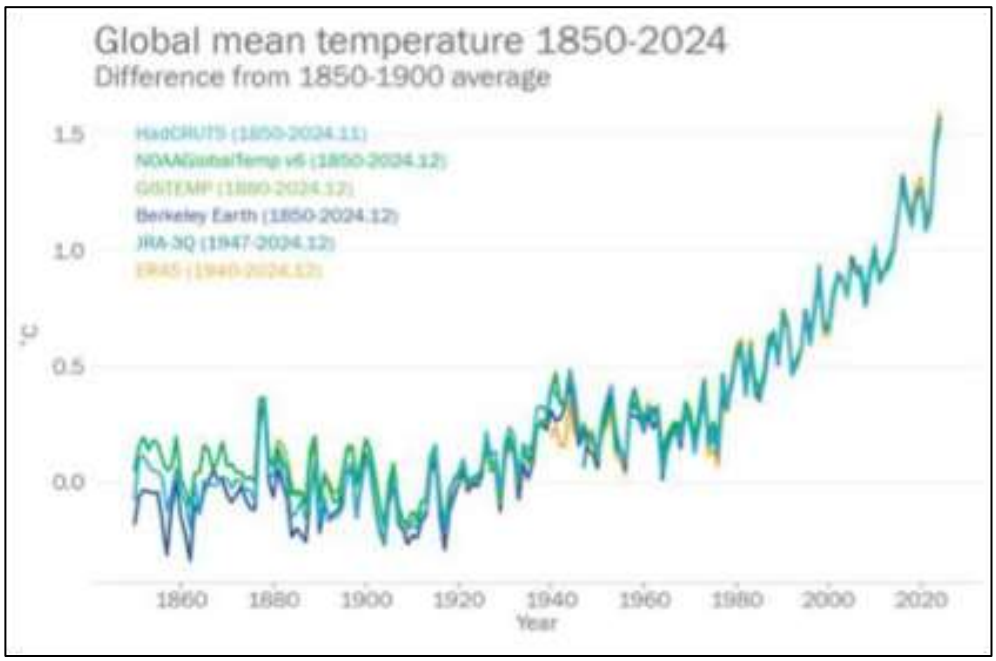

Figure 1: Global mean temperature from 1850 – 2024
Source: NiMET, 2025

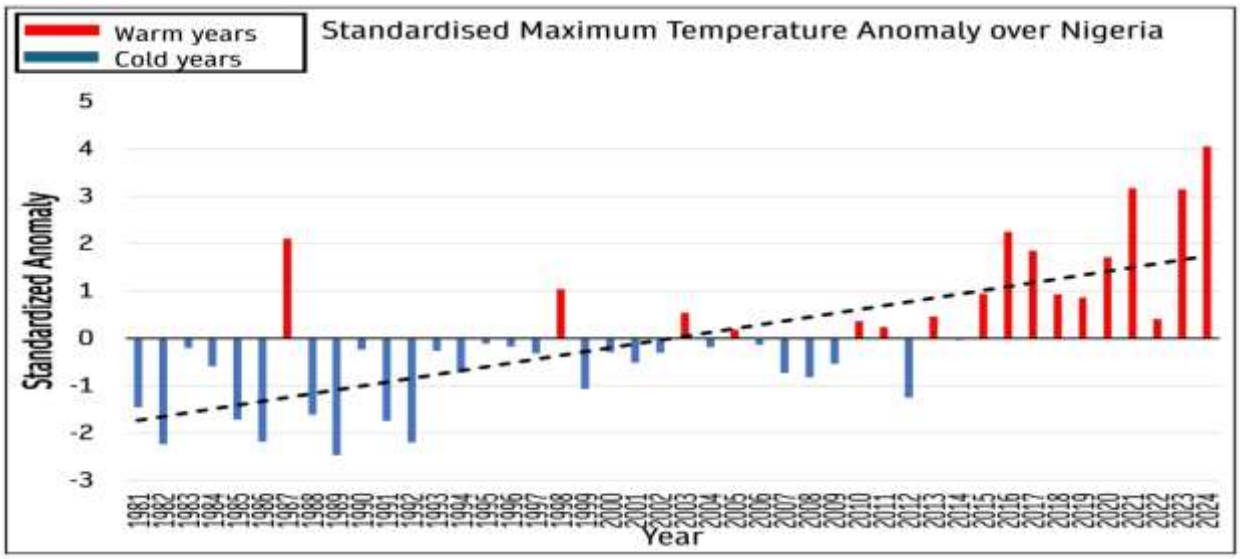

Figure 2: Standardised Maximum Temperature Anomaly over Nigeria from 1981 - 2024
Source: NiMET, 2025

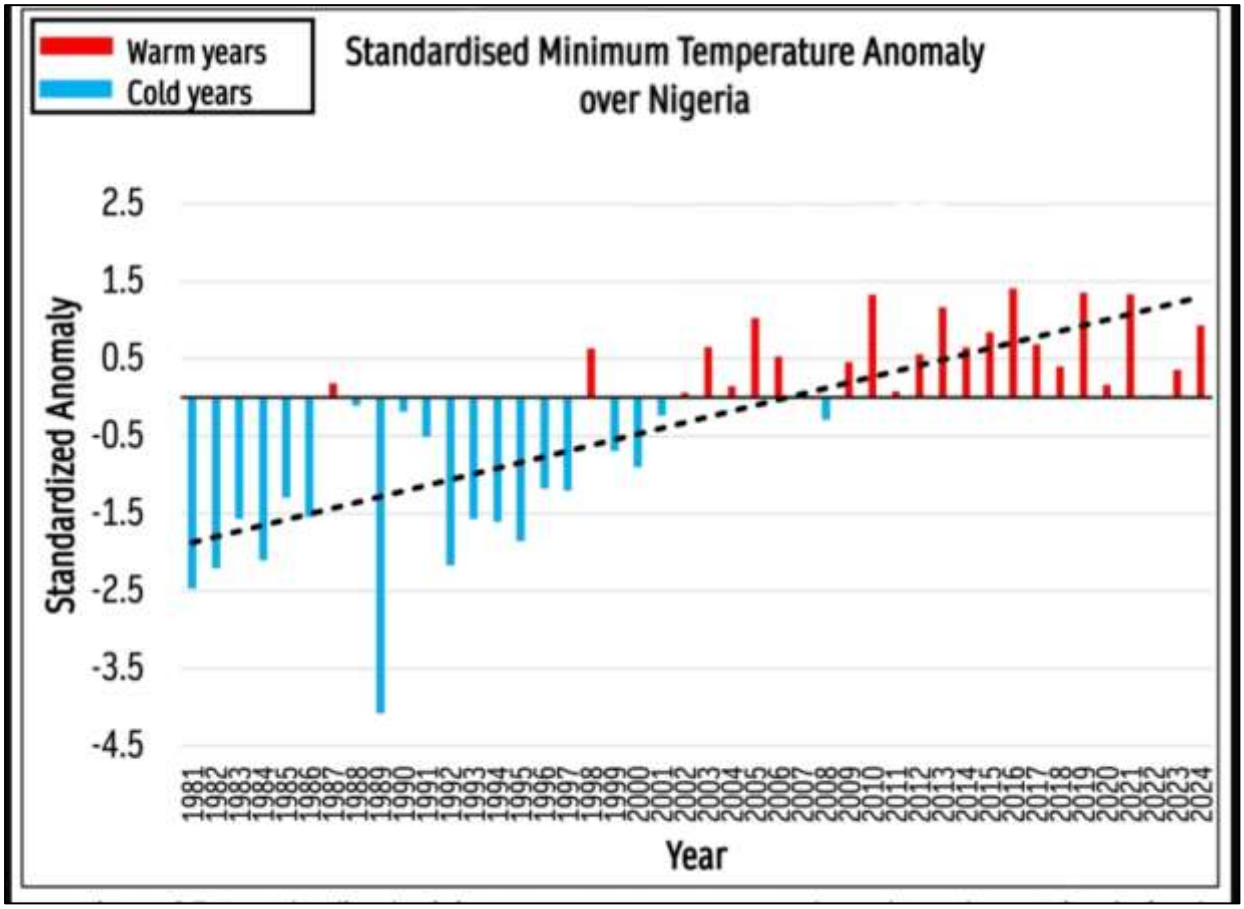

Figure 3: Standardised Minimum Temperature Anomaly over Nigeria from 1981 – 2024
Source: NiMET, 2025

The future climate projections in Nigeria portray a rise in temperatures of 1.1–2.5°C by 2060 with extreme heat anticipated in the North. The number of extreme heat days increase projection discloses 260 days by 2100 up from only 10 days in 1990. A significant reduction in the number of cold days and nights is estimated at near zero by 2090. (Sambo & Sule, 2024).

This is further supported by Akinsanola and Ogunjobi (2014) that found out that standardized decadal anomalies of air temperature in Nigeria in the first decade of 1971-1980 has negative anomalies. However, in the second decade, stations like Jos, Maiduguri, Ikeja, Oshodi and Warri were cooler than normal with corresponding negative anomalies. In contrast, Nguru, Calabar and Benin show positive anomalies. The third decade of 1991-2000, stations such as Yelwa, Osogbo, Ikeja, Nguru all have negative anomalies, while larger parts of the country shows positive anomalies.

The study further revealed that during the first decade of 1971 to 1980 Yola, Bauchi, Jos, Kaduna, Zaria, Gusau, Sokoto, Nguru, Calabar, Warri, Benin and Ondo experiences decreasing trend in air temperature with values ranging from -0.04 to -0.07 ^{O}C/decade while Lokoja, Minna, Lagos and Ibadan shows

increasing trends of about 0.05 to 0.08 ^{O}C/decade. In the second decade of 1981 to 1990, the areas that experiences increase in temperature trend extended to Zaria, Warri, Nguru, Kaduna and Gusau, while Bida and Jos shows decreasing trends. During the third decade of 1991 to 2000, only Ibadan, Ikeja and Oshodi shows decreasing trend while Nguru, Zaria and Bida increased with high values of about 0.2 ^{O}C/decade. Result further shows that the entire country experiences increasing trend in air temperature of about 0.036 ^{O}C except for Jos which shows a decrease in trend of about -0.02 ^{O}C while cities such as Nguru, Yelwa and Enugu are just normal. In the same vein, Odjugo (2010) and Oguntunde et al. (2012) reported separately that the spatial and temporal variations in temperatures were noticed in Nigeria where air temperature has been on the increase gradually since 1901 and with significant increase from 1970.

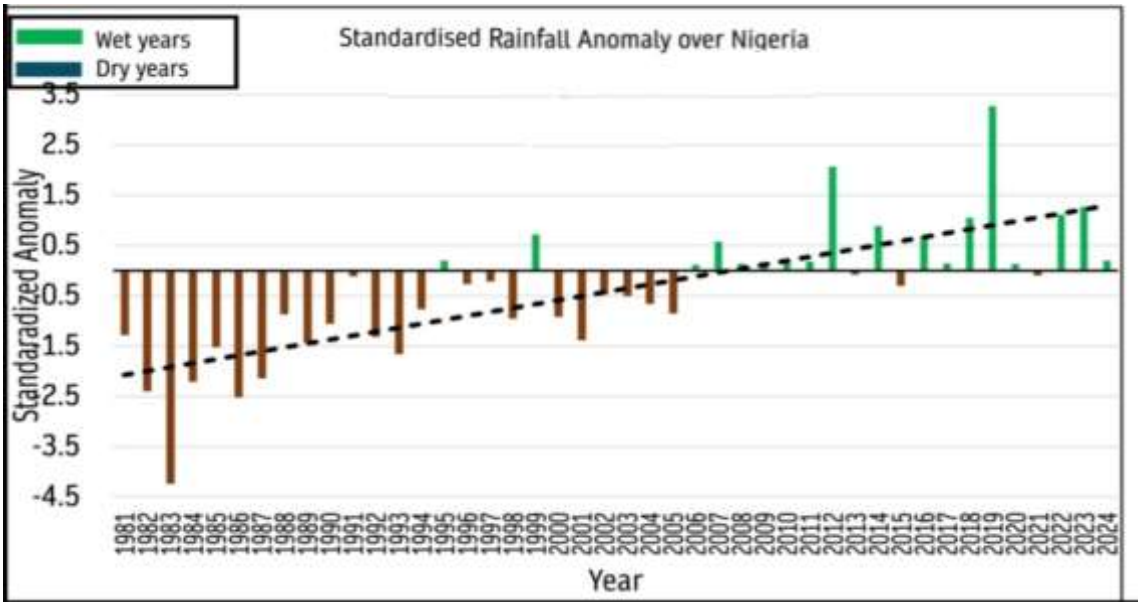

Figure 4: Standardised Rainfall Anomaly over Nigeria from 1981 - 2024
Source: NiMET, 2025

The Standardized Rainfall Anomaly Analysis in Nigeria

The standardized rainfall anomaly analysis in Nigeria in the year 2024 shows a continuing upward trend. With a standardized rainfall anomaly of 0.2, 2024 ranks as the eleventh wettest year since 1981. Additionally, since 2006, Nigeria has experienced consistent wet years, with the exceptions of 2021, 2015, and 2013.

The rainy season in Nigeria in 2024 was marked by rainfall-induced hazards. High-intensity and high- frequency rainfall have resulted in river overflows and flash floods in many parts of the country. Moreover, according to the Relief web and the National Emergency Management Agency (NEMA), as of 17 September 2024, 31 states and 180 Local Government Areas (LGAs) were severely affected. Over 1,083,141 individuals have been impacted by the relentless rains, leading to widespread displacement, loss of lives, and destruction of homes and livelihoods. The report further shows that floods have left 641,598 persons displaced, 285 people dead,

and 2,504 injured. Houses, farmlands, and critical infrastructure have been devastated, with 98,242 homes affected.

Figure 5: Nigeria's Global Food Security Index Scores and Rank (2012 - 2019)
Source: Idris *et al*., 2020

As revealed by Idris et.al., (2020), Nigerian's ranking in Global Food Security Index has continued to increase since 2012 (ranked 80 among 107 countries with a score of 34.8/100) and reached a disturbing rank of 94 among 113 countries with a score of 48.4 in 2019. The study further showed that in 2018, Nigeria overtook India to become the world poverty capital with the highest number of populations in extreme poverty.

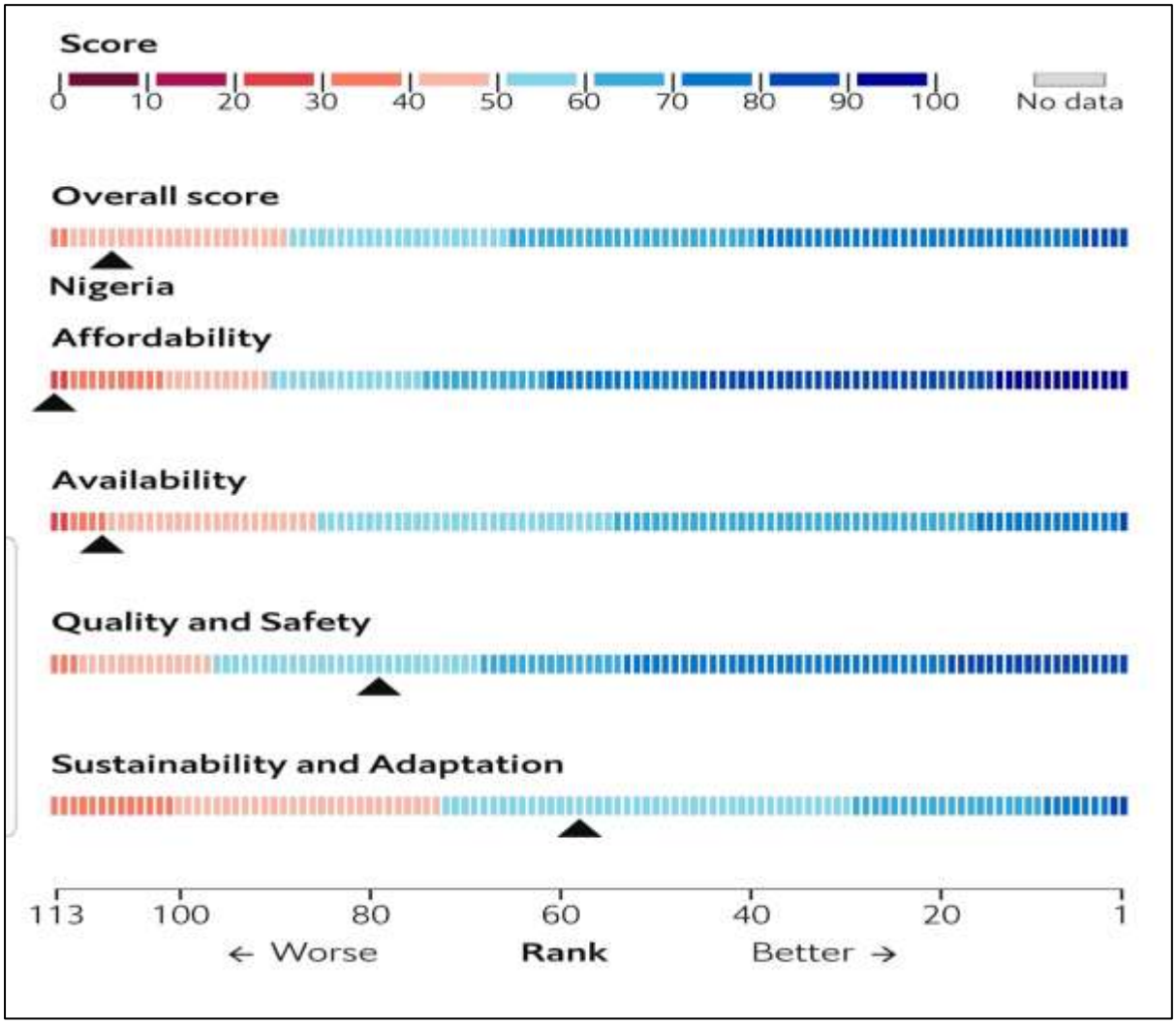

Figure 6: Nigeria's Global Food Security Index Scores and Rank 2022
Source: Economist Impact, 2022

According to Economist Impact (2022), Nigeria ranks 107th out of 113 countries with an overall GFSI score of 42, with the lowest score globally in the affordability category due to changes in food cost, inadequate food safety-net programs and high proportion of the population under the poverty line. The report further showed that Nigeria ranked 113 in the affordability index with a score of 25 points, highlighting major concerns surrounding affordability of food in the country and 108 in the availability index with a score of 39.5 which is very weak (0 -39.9).

Impact of Climate Change on Food Security in Nigeria

Staple crops such as rice, maize, yam, and cassava have been affected by climate variability. Drought conditions, desertification, heatwaves in northern Nigeria have reduced millet and sorghum yields, while excessive rainfall, erosion and flooding in southern Nigeria has led to post-harvest losses in cassava and rice (IPCC, 2023). The livestock sector is affected by heat stress, water scarcity, and pasture degradation. Cattle herders in northern Nigeria are forced to migrate to south in search of grazing land,

leading to conflicts with farmers (World Bank, 2022). Fisheries are also at risk due to rising water temperatures and ocean acidification, reducing fish stocks (Food and Agriculture Organization of the United Nations, 2022). Climate change disrupts food transportation and storage systems, leading to supply shortage and increased food prices. For example, the 2022 floods in Nigeria destroyed over 400,000 hectares of farmland, causing food inflation to rise by 24% (National Bureau of Statistics, 2022).

According to the World Food Programme Impact Evaluation Forum (2023), Nigeria as Africa's biggest economy and most populous country has the world's fifth highest burden of people experiencing food crisis or worse, exceeded only by Yemen, Ethiopia, Afghanistan and the Democratic Republic of the Congo. Nigeria's human development potential remains unfulfilled and its most vulnerable people continue to suffer critical levels of food insecurity and malnutrition driven by persistent conflict, organized violence, recurrent climate shocks and broad exposure to the impact of climate change.

Moreover, substantial increase in food prices has put more Nigerians on the edge as food inflation for November 2023 surged to 32.84 percent on a year-on-year basis. It was 8.72 percent points higher than the rate (24.13 percent) recorded in November 2022 (Edeh, 2023). The National Bureau of Statistics report (2023) indicates in its analysis on food insecurity that food inflation has soar to 31.5 percent made it more worrisome in the recent times. The report also showed that approximately nine million children are at risk of suffering from acute malnutrition or waste. Of these, an alarming 2.6 million Children could face severe acute malnutrition and require critical nutrition treatment. This has increased the rate of poverty as a result of food shortage. The National Bureau of statistics estimates the number of poor people in Nigeria at 133 million, representing 63 percent of the Nigerian population.

In 2024, high-intensity rainfall was recorded in most parts of the country resulting in flooding in no fewer than 34 states across the six geopolitical zones of Nigeria. The northeast was the region most affected by floods. Over 1,346,413 persons were affected, out of which 729,310 persons were displaced, and 320 were lost. In the month of August, 2024, 10 Local Government Areas in Jigawa state recorded 2,744 hectares of farmlands been washed away by flooding. Similarly, in Madagali council area of Adamawa state, 1000 hectares of land were submerged. In September, 2024, 1000 hectares of farmlands were completely or partially destroyed in 33 communities in Gombe state as a result of flooding. In the same vein, farmers in Adamawa, Gombe, Taraba, Plateau and Nasarawa states had earlier in the year complained over mild drought threatening crop growth on their farms. Climate change pose significant threat to national security, because the changing environment is causing resource conflict including farmers–herders clashes and ethno-religious crises in a bid to compete over scarce resources (Sule *et al*., 2024).

According to United Nations Office for the Coordination of Humanitarian Affairs (2023), many people are food insecure in Nigeria, of the 18.6 million people who experience food insecurity in recent times, 3.3 million live in the North-Eastern States of the Bauchi, Adamawa and Yobe region. This number might rise to 26.5 million nationwide by the height of the 2024 lean season (and to 4.4 million in Bauchi, Adamawa and Yobe States).

The analysis of climate change impacts on food security in Nigeria reveals a complex interplay of environmental, economic, and social factors. Nigeria's agricultural

productivity has declined by an estimated 21% over the last decade, largely due to climate-induced stressors (FAO, 2023). The economic dimension of food insecurity is further complicated by the depreciating naira and rising input costs, while malnutrition rates are rising, particularly among vulnerable groups.

Conclusion

Climate change poses a significant threat to food security in Nigeria through its direct and indirect impacts on agriculture, livestock, fisheries, and socio-economic instability. The increasing rate of temperatures, erratic rainfall, floods, desertification, and drought have collectively reduced crop yields, degraded land quality, disrupted livestock production, and led to rising food prices. Vulnerable populations, particularly women, children, and the rural poor, are the most affected. Climate change has exacerbated existing development challenges such as poverty, malnutrition, and insecurity, particularly in conflict-prone regions like the Northeast and Northwest. Despite several climate adaptation policies and international support, these problems still persist as a result of weak implementation, inadequate funding, inadequate robust coordination among government institutions and international donor agencies, and inadequate early warning systems continue to hinder progress.

Recommendations

Based on the findings, the paper recommends the following in finding sustainable solutions to the impacts of climate change in Nigeria:

1. Federal and state governments should make concerted efforts to strengthen the adoption of Climate-Smart Agriculture (CSA) practices by the use of drought-resistant crop varieties, improved irrigation systems, and agroforestry. Agricultural extension workers should be involved to train farmers on the adoption of climate smart agriculture.
2. Government at all levels should develop a robust community-based early warning system in sharing relevant information related to preparation for climate shocks, planting season among others.
3. Land Management strategies such as soil conservation, reforestation, irrigation system and anti-desertification programs, should be encouraged among farmers. This is to enhance agricultural productivity among farmers.
4. Government at all levels should invest more in research and development to have up to date data on the pattern, trend, modelling of climatic data. This would help in forecasting climatic data, develop adaptive and mitigating measures in addressing the adverse effects of climate change on food security.
5. Government at all levels should strengthen the capacity to increase farm inputs such as seedlings, fertilizers, irrigation scheme among others at a subsidized rate to ensure food security. This would protect small scale farmers from climate-related losses and encourage small scale farming.

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