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# The Judgment of Climate Change on Food Availability in Nigeria

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### KEYWORDS

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### ABSTRACT

*Climate change is a global phenomenon that has significant implications for food security, particularly in developing countries like Nigeria. This study is set to explore the nature of the relationship between climate change and food security and the various ways to address the impact of climate change on food availability in Ogun State, Nigeria. Relying on the green theory, this study investigated climate change's impact on the agricultural sector, compromising food security in Ogun State, Nigeria. This study's qualitative data collection methods include primary and secondary data sources. This study adopted the exploratory research design. Interviews were used to gather primary data, and existing literature was used to collate secondary data. This work covered the staff of the Ministry of Agriculture in the selected state, lecturers in the Department of Economics, Covenant University, and the faculty of agriculture at Obafemi Awolowo University. The thematic content analysis was adopted in analyzing the data in this study. The findings from the data revealed that there is a clear relationship between climate change and food security. It also revealed that climate change has a negative impact on food availability in Ogun State, Nigeria. In addition, strategies and policies put in place to address the issues of climate change and food security were discussed. It was concluded that climate change has affected Ogun State's food security between 2019 and 2023.*

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## Introduction

Food security has become a challenging issue at both a global and a national or state level (Matemilola and Elegbede, 2017). Climate change is vastly growing in the field of international relations with global attention, and there has been a widespread consensus in the literature over the past decades that the world would experience changing levels of temperature which would be accompanied by a series of effects (Santos et al., 2022). Significant changes in climate conditions pose a threat to food security through its impacts on global, national, and local food systems. Over 700 million people faced hunger in 2020. After remaining unchanged for five years, global malnourishment prevalence climbed to about 9.9 per cent as opposed to 8.4 per cent the previous year (FAO, 2021).

When people lack access to the necessary food and nutrition to meet their dietary requirements for a good and healthy living because of physical and economic forces, then food insecurity is said to be (World Food Summit, 1996). Therefore, it is only natural that when a country or region lacks the physical or economic ability to attain food resources required for standard living, such geographical area is prone to be disturbed by food insecurity. This physical or economic ability cannot be separated from the climate of the area.

The International Panel on Climate Change (IPCC) for a definition of 'climate'. Their fifth Assessment Report (IPCC, 2013, cited in Bothe, 2018)

.. viewed that "Climate in a narrow sense is usually defined as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization. The relevant quantities are often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system."

The climate of a place remains subject to change, which has made the issue of climate change a matter of concern. Climate change, as submitted, can be a natural process where temperature, rainfall, wind, and other elements vary over decades or more (Fast Facts-FF, 2016)

Climate is policy-relevant, and discussions on climate and climate change are valid for scientific purposes and individual views (Bothe, 2018). Friendly policies of regions, states, and countries on climate will ensure more productivity, especially regarding Agriculture.

Many African countries, including Nigeria, lack the adequate mechanisms to tackle the global weather predicament, have a climate-sensitive agricultural-based economy and are more vulnerable to food insecurities. Nigeria's high vulnerability is attributed to its coastline of 800km, which is vulnerable to rising sea levels and heavy storms (Apata, 2009).

In Delta state, for instance, because of the commercial quantity in which crude oil was discovered in 1954, following oil exploration and exploitation by multinational corporations, the region has been subject to environmental degradation, coupled with the reoccurring flood that has resulted in the loss of not only agricultural produces but also lives (Omofonmwan, 2009). Climate change is, therefore, a significant cause of food unavailability today in Nigeria and, consequently, negatively impacting Nigeria's economy and overall development.

Past studies on this area of study have laid focus on its impact on the environment at a global or national scale, leaving aside the economic repercussions it has on the economy of a state and its

effects on the livelihood, well-being, and financial sustenance of the general population of a country or region. Abdulkadyrova (2016) defines the global food problem as an economic phenomenon with political consequences. Similarly, many experts have claimed that increasing and leaping food prices are the root of the world's issues. In Essence, the urgent environmental and food crises caused by the climate conditions in Nigeria mainly victimize the economy of Nigeria, which is reliant on the climate-dependent agricultural sector that characterises Nigeria's economy.

It is exactly in this matter that this research aims to discover the climatic factors responsible for the rampaging food insecurity in Nigeria, which in turn damages the country's growing economy. This study aims to identify not only these climatic factors and their health, agricultural, and economic effects but also the necessary coping mechanisms that Nigeria could adopt to curb the high level of food insecurity.

This research highlights the need to determine these responsible climatic factors because knowing and understanding the challenges they pose to Nigeria's food and economic systems will create the necessary position to offer solutions or alternatives to the problem. It is indeed when a diagnosis has been given that necessary solutions, which their practicability would characterize, can be offered to the problem. In the case of the Nigerian food and economic system, determining these climatic factors and the provided apparatus to control them would serve as a pivotal step to addressing the crises.

### **Problem Overview**

Food security is a right, one that must be protected so that every human being can have physical and economic access to their necessary nutrition to ensure a healthy standard of living. A place where there is the availability of food unhindered by any weather or climatic issue, as well as the presence of the necessary resources like water for irrigation and lands devoid of degradation, stability, and utilization of food, is measured as food secure. The issue of food insecurity in Nigeria is a major consequence of the changing climate and environmental change rapidly increasing in the form of temperature, continuous rainfall, flooding, sea level rise, exaggerated weather events, and land degradation (Ebele 2016). In fact, (Madu, 2012) claims that the high vulnerability that the change in climate poses to the Northern states in Nigeria poses a peril to food security throughout the country.

Agbo (2012) maintained that these climate changes are accredited to the activities of humans which have altered the status of the earth. Nzewi (2009) blames agricultural activities, deforestation, wars, and high energy consumption for the issues that the environment is facing. Eze (2012) noted that environmental degradation from climate change is becoming more severe in Nigeria. Nwakama (2012) affirmed that the environmental issue of flooding in the Niger Delta which comes from abnormal rainfall patterns. Eze et al. (2012) vividly captured the situation in the country by noting that seasonal cycles and ecosystems are being disrupted, adversely affecting agriculture, water supply, and food production, which they claimed increases the level of poverty, malnutrition, and various socio-economic consequences.

Osuafor (2014) suggested that combating the issue would require an integrated approach involving stakeholders like the government, individual farmers, the private sector, and non-governmental organizations. Agbo (2012) noted that adopting agricultural technologies and innovations would be essential in giving attention to agriculture even in the face of the changing climate, claiming that involving disease and harsh climate-tolerant plants, irrigation technologies, and sustainable agricultural methods would reduce the impact of climate-related issues on crop production in Nigeria.



According to the United Nations, over 836 million around the world are living in dire poverty, and the International Fund for Agricultural Development (IFAD) claims that at least 70 per cent of these impoverished persons inhabit rural areas and rely on agricultural activities for their survival. A recent study also reveals that 70 per cent of Nigerian households engage in crop farming.

Another study shows that 80 per cent of Nigerians depend on local farms for their daily meals.

In conclusion, Nigeria depends severely on the agricultural sector, which is being threatened by climate change. The high increase in temperatures expands the rate of microbial decomposition, which, in the long run, negatively impacts soil fertility. As regards the changing climate conditions in Nigeria, there has been a push for measures to help tackle the negative effects that these conditions pose on the food system, health, and the economy. Any country's leadership style determines its success (Chukwudi et al., 2019). In other words, the government's efforts in managing climate change are very vital to the agricultural sector. According to Ogunjobi *et al.* (2021), heavy rainfall resulting from climate change has led to flooding in many parts of Nigeria, which damages crops and reduces yields. In addition, acid rain resulting from air pollution exacerbates soil infertility and degradation, further reducing the productivity of agricultural lands (Ogundiran et al., 2020).

These changes are particularly challenging for smallholder farmers who rely on rain-fed agriculture and have limited resources to adapt to the changing climate. As noted by Onyeneke and Emodi (2019), climate change exacerbates existing food insecurity challenges in Nigeria, including high levels of poverty, inadequate infrastructure, and limited access to markets. The combination of climate change, heavy rainfall, acid rain, soil infertility, and degradation poses a significant threat to Nigeria's economy, health, and social well-being. It is, therefore, crucial for the government to take urgent action to address the problem of climate change and food security in Nigeria. The primary of this study is to establish the importance of the need to devise the necessary mechanisms to curb the rampaging effects of Nigeria's changing climate, and the need for this to be seen as a serious issue by both the government and the general mass before meaningful solutions can be posed to these issues plaguing the food and economic system of Nigeria.

The conclusion of the above statement of the problem birthed the following objectives: examine the relationship between climate change and food security in Nigeria; examine the impact of climate change on food availability in Nigeria and assess the ways to address the impact of climate change on food availability in a selected area in Nigeria.

## Methodology

A qualitative method of data collection is adopted for this study. Existing secondary materials such as books, journals, conference proceedings, and internet sources. The primary data was obtained through in-depth interviews, and secondary data sources were obtained through existing literature.

Five people were purposively selected for the interview. The five interviewees were selected based on their knowledge of the subject of study. They know and have practised in different fields with a wealth of experience. The five interviewees were selected from the staff of the Ministry of Agriculture in the selected state (2 members of staff), lecturers in the Department of Economics Covenant University (2 members of staff), and the faculty of agriculture at Obafemi Awolowo University (1 member of staff). Thematic content analysis was adopted in analysing the data in this study. This study adopted the exploratory research design.

The study faced challenges in terms of funding. More funding for this work would have enabled the combined involvement of professionals such as meteorologists, agronomists, sociologists, and other

experts. The bringing of the different ideas would have been very good for the perfection of the work because of the intersection of climate change, agriculture, and food availability.

## **Literature Review**

### ***Concept of Climate Change***

At the root of the phenomenon called climate change is the greenhouse effect, a term used to explain the way that heat that would otherwise have been radiated upwards into space is trapped by certain atmospheric gases on Earth. However, the greenhouse effect is responsible for life on the planet, and if not for it, the Earth would be a glacial and inhabitable planet (Hulme, 2009).

During the 19th century, greenhouse gases began to be pushed to new levels, particularly because of human activities. This led to a warmer planet, which changed the natural weather pattern and cycle, further resulting in extreme heat, flooding, storms, and rising sea levels. These changes are known as climate change (Wearth, 2008).

Climate change falls under the many contentious topics in global politics in recent times. It is a change in the earth's weather pattern caused by anthropogenic activities that alter the configuration of the worldwide atmosphere and is an incorporation of natural climate changeability over periods (FCCC, 1992). Synonymously, it is a change in climate over time due to natural causes or human activities. Akande (2017) postulates that climate change extremities are majorly caused by anthropogenic activities. Similarly, Buba (2014) showed that anthropogenic factors are the main forces causing the diminution of the ozone layer. Emodi (2016) notes that humans cause climate change and mostly affect the poor, who contribute the least to the changes. It took almost a century of research and study of the phenomenon to convince a considerable majority of scientific minds that human activities could alter the earth's weather pattern. In the late 1950s, CO<sub>2</sub> readings offered some of the first data to verify climate change theory and show that it was not only real but posed serious consequences to the world. Scholars have described the effects of climate change on food availability and security:

The examination of the literature reveals that there are two distinct relationships between food security and climate change: on the one hand, all aspects of food security are impacted by climate change, while on the other hand, achieving food security has an impact on climate change. Regarding the availability and supply of food, it is generally accepted that climate change would lower crop yields and livestock production, particularly in the Global South. Food accessibility is impacted by factors such as production and availability, as well as by the effects of catastrophic weather events on the economy and physical environment (El Bilali et al., 2020: 2).

### ***Causes of Climate Change***

Although climate change displays great variations globally, Elisha (2017) identified two basic factors causing climate change- Natural or bio-geographical processes and anthropogenic factors. Throughout the Earth's existence, solar radiations and orbital changes have affected the Earth. According to NASA, the natural processes contribute to climate change but happen at a slow pace that cannot be credited for the rapid warming and effects that the earth has experienced over the decade.

The anthropogenic factors refer to activities done by human beings that affect the earth. This is popularly accepted as the primal driver of climate change by scientists and experts. The unmonitored burning of fossil fuels over the century has critically led to the increased presence of atmospheric

greenhouse gases like carbon dioxide. It has resulted in the ubiquitous ruination of forests and wetlands and the Carbon sinks that naturally help store carbon dioxide, stopping it from contaminating the atmosphere.

By continuously exposing the air to these gases, the earth's regular temperature has risen, bringing us to our current weather predicament. Anthropogenic activities that have played dominant roles in the state of the earth's weather cycle and pattern include:

### ***Transportation***

Transportation is essential for the movement of people and goods in the world today. Road transportation, especially, is a dominant means of movement in Nigeria, moving over 90% of internal goods and people across the country. However, this means of transportation is not energy efficient, hence a major source of GHG emissions in the country. The National Bureau of Statistics, in 2018, revealed that there were over 11 million vehicles in Nigeria, and this number rose to 13 million by 2021. The Nigerian government predicted that by 2035, greenhouse emissions from transportation sectors could increase by 50% and 100% by 2050.

### ***Industry and Manufacturing***

Nigeria is developing rapidly and has many major industries, consequently improving the quality of life for many individuals but also affecting the natural environment. This includes issues with oil spillage, deforestation, and other environmental predicaments associated with industrialization.

In the Niger Delta, oil spills are credited to pipeline and tanker incidents, lack of pipeline maintenance, as well as sabotage and non-functioning equipment. In 2011, the shell industry admitted to spilling 17.5 million litres of oil in the Niger Delta.

### ***Modernized Agriculture***

The presence of modernized and industrialized agriculture has altered the relationship between the earth's soil and the climate. 51.2% of Nigeria's greenhouse emissions are from agriculture- a sector that produces incredible amounts of gases for trapping heat. Slaughtering domestic animals in abattoirs all over the country contributes significantly to carbon emissions in the atmosphere. The disposal of animal waste is also a massive source of methane, which is emitted into the atmosphere daily.

### ***Deforestation***

Deforestation is a massive problem in the world, including Nigeria. Trees are an essential part of nature but have continued to be subject to the actions and activities of human beings. However, the abuse of these forests has disadvantages to the environment, of which climate change happens to be a part. In 2018, Dr Muhtari Aminu-Kano, the Director-General of the Nigerian Conservation Foundation, stated that the loss of trees in Lagos due to deforestation accounts for about 96 per cent. He said that less than five per cent of Nigeria's forest cover remains and emphasized the need to increase it to 25 per cent within the next 30 years. According to the FAO Global Forest Resources Assessment, deforestation is defined as converting forest to other land use. Humans are walking and breathing carbon emissions, but their activities release large amounts of this carbon into the earth's atmosphere. Trees are natural absorbers of carbon oxide. In essence, burning down trees and cleaning out forests disrupt a natural prevention mechanism for carbon emission and add to it. This is because when deforestation takes place, the carbon absorbed into the trees gets released into the atmosphere.

## ***Impacts of Climate Change***

Developed states, which are the main drivers of climate change, suffer less severe consequences due to high adaptation methods, modernised agricultural systems, stable economic status, and research-backed-up policies (Mcguian, 2002). However, because developing countries like Nigeria lack all these factors, they are prone to suffer more than others. Haider (2019) identified four ways in which climate change impacts Nigeria: geographical impacts, sector impacts, demographic sector impacts, and security impacts.

### ***Geographical Impacts***

The problems associated with climate change differ across the country. The tropical climate in Nigeria has two precipitation regimes. While the North has low precipitation, the case is the reverse in parts of the South. According to Akande (2017), this has left the North to experience drought and desertification and the South to suffer from desertification and flooding. Madu (2016) states that an analysis of vulnerability demonstrates that Northern states suffer a higher degree of vulnerability compared to Southern states. The rising heat and reduced rain in the North made it vulnerable, quickened desert encroachment, and led to a fast reduction of surface water (Abdulkadir, 2017).

### ***Sectorial Impacts***

Sector refers to distinct parts or areas of a state that specialize in activities. Many sectors in Nigeria are affected by climate change. The agricultural, fisheries, health, and economic sectors have been affected by climate change.

#### ***Economic Sector***

Many Nigerian sectors are exposed to the effects of climate change. The agricultural sector, the health sector, the energy sector, etc. – all generally affect the growth of the economy (Ebele, 2016). In essence, it is the other sectors that determine the state of Nigeria's economic status. According to Anabaraonye (2019), people's livelihoods and the economy's condition depend hugely on agriculture. This is because crop yield and production affect Nigeria's gross domestic product (Solomon and Edet, 2018).

#### ***Agricultural Sector***

Because of the linkage of the agricultural sector to poverty, the concern about climate change concerning agriculture is heightened. Ebele (2016) anticipated that climate change's impact on the agricultural sector would fuel rural poverty. Timing and amount of rainfall can significantly affect agriculture because water deficit could take a toll on crop and livestock production (Usman, 2013).

Scoones (2005) noted that climate change has caused a deviation in cultivated crops in Northern Nigeria. Due to increasing rainfall, the farmers moved from the cultivation and production of guinea corn, groundnut, and maize to the production of millet, maize, and beans as a means of adaptation. Reducing agricultural and arable lands due to desert encroachment and dunes is another major problem of agriculture in Nigeria. Nkomo (2006) notes that livestock production is affected by an increased level of climate change-influenced diseases and pests that cut investment profit in livestock production by over 20% per annum.

#### ***Fishery Sector***

Evidence has shown that the coastal regions will be affected as climate change disturbs ocean currents and fisheries. According to the Nigerian Environment Study Action Team (NEST, 2004),

the loss of mangroves as sea level rises has consequences on fish spawning patterns because mangroves serve as a haven for young fish to mature. Similarly, rising sea levels and heavy rainfall have significantly reduced fishing activities in various eco-zones of Nigerian coastal areas. A significant waning in fish production businesses in these locations causes this.

### ***Health Sector***

According to the World Health Organisation (WHO), the absence of infirmity and disease is not the only parameter for measuring health but also the overall state of physical, psychological, and social well-being. Good health is essential for overall prosperity and well-being. Deprived or poor health, on the other hand, drives and facilitates poverty. Infectious microbial and parasitic diseases are primal contributors to poor health status around the world, occurring against the framework of socioeconomic underdevelopment, wars, poverty, low health sector investment, and changing climatic patterns.

Environmental health encompasses all the factors in man's physical environment that exert a dangerous effect on the survival, health, and overall physical development of human beings. It considers the various public health aspects determined by physical and biological environmental factors. Consequently, environmental changes upset the natural order, spreading disease agents and their contact with human life. Warming temperatures and extreme rainfalls will likely favour the outbreak of waterborne diseases.

### ***Demographic Impacts***

Climate change affects different populations and classes of people in gender, age and occupation. It affects women because many are poor farmers who depend on agricultural activities as a source of survival and livelihood. Due to limited access to rehabilitation and recovery, rural women are vulnerable and lack the means to adapt to climate change and natural disasters. Women face vulnerabilities in different forms- political, physical, emotional, and economic (Apeloko and Ayeni, 2012). Women find it difficult to find employment opportunities and lack access to economic resources. They suffer psychologically, which takes a toll on their body in the form of soreness, lack of sleep, and miscarriages.

Most climate change-induced diseases occur in developing countries and have been found to impact pregnant women, children, and the elderly (WHO, 2002). Furthermore, political vulnerability prevents proper representation of women in decision-making making, which limits their political power.

Children's bodies are still developing physically, making them vulnerable to climate-related issues like poor air and heat quality. Because they breathe faster, they get exposed to dangerous air pollutants (Gamble, 2016).

Climate change also impacts children's schooling because many are absent due to heavy rainfall and bad roads and landscapes. The ability of the children to learn can also be hindered by scarcity of food and consequent starvation and hunger. As their brains continue to grow throughout adolescence, children undergo emotional development. Consequently, storms, fires, and other extreme climatic events can impact their mental health.

### ***Security Impacts***

Nigeria is rich with ethnic diversity, and challenges regarding social needs and wants come with that. Failure to equally distribute limited resources has been associated with many violent conflicts in the country. Climatic challenges are a significant contributing factor to limited food and land resources.

Studies have shown that changing weather has played a crucial role in violent social challenges over the past century. Conflicts over resources in Nigeria are not a new component of Nigeria's social disorder. There is an estimate of the death of over 10,000 Nigerians due to communal violence, which is linked to climate change.

The farmer-herder clash is a contest over resources greatly attributed to climate change. More studies need to be conducted on the power that climate change has to disrupt the economy and destroy jobs. However, existing evidence suggests that climate change increases the risks of violence in youth-populated areas and that alienated youths who lack resources are most likely to join rebellions (Apeloko and Ayeni, 2012).

### ***The Concept of Food Security***

The primal biological function of human beings is to survive and reproduce, and to survive, humans need to eat food. There needs to be good quality and quantity of food for an individual to live a healthy and sustainable life. Hence, countries that have a large number of hungry people lack food security. This is prevalent in global Southern nations of Africa and Asia, with Africa having 18 out of the 23 most undernourished countries (Ogbonna, 2013).

The phenomenon of food security diversifies into the social, economic, and environmental spheres of life. At the World Food Conference in 1974, the term "food security" emerged and was defined as the assurance of availability and price stability of essential food resources at national and global levels. 23 years later, at another World Food Conference summit, it was agreed upon that food security exists when there is access to safe, sufficient amounts of food to meet their dietary and health requirement. The definition classified food accessibility into physical and economic access. Individuals should be able to get a hold of food resources and be physically able to acquire their food. Economic access is the financial capability to acquire physically available food resources.

According to FAO, there are four components or categorizations of food security. These components form the basis of the definition of food security. The four components are availability, accessibility, utilization, and stability.

### ***Availability***

According to FAO (2008), food availability is defined by the level of food production, stock levels, and net trades. In essence, food availability addresses the supply and presence of food resources in a geographical location.

### ***Accessibility***

The availability or supply of food resources does not necessarily connote a secure location because access to these food supplies for consumption is still needed. Policies addressing income, market, food prices, and economic access to food would need to be implemented to improve accessibility to food.

### ***Utilization***

Food utilization is defined by how individuals utilize and make good use of food to meet their dietary requirements and, thus, a healthy lifestyle. Appropriate food utilization speaks well about the nutritional status of individuals.

### ***Stability***

Constant or periodic fluctuation or break in the flow of food availability, supply, and production signals poor stability of food production. Food instability can result from famine, economic recession, and bad weather conditions. Conclusively, food stability is characterized by a constant, steady, and continuous flow of food production in a place.

### ***Causes of Food Insecurity***

Food insecurity is antithetical to food security, and while the latter refers to a state of adequate access, availability, utilization, and stability of food resources, the former represents a state of lack or scarcity of food resources and the presence of hunger and malnutrition.

According to the American Diabetic Association 1998, food insecurity is “limited or uncertain availability of nutritionally and adequate safe food”. The definition broadens to the ability to “acquire acceptable foods in socially acceptable ways”. There are diverse causes of food insecurity, which are:

### ***Population and Urbanization***

Despite Nigeria's vast population and steady growth in demography, agricultural production has experienced a decline (Eboh et al., 2012). In a comparative analysis conducted on Nigeria in contrast with other countries by Abdul Rahman (2012), between 2000 and 2012, Nigeria witnessed a 0.99% increase in population. Thomas Mathias (1978) posited that humans would always face problems relating to food production as long as there is a growing population. In essence, food shortage can often be attributed to a vastly rising population due to limited resources to tend to everyone.

### ***Environmental Degradation***

The environment encompasses all living and non-living elements occurring naturally and their effects influencing human life. It refers to the natural and external conditions that affect life forms' situation, development, and survival.

Environmental degradation occurs when the natural environment becomes compromised due to the depletion of resources like water and soil, reducing biodiversity and the general health of the environment. More than often, attributed to anthropogenic activities, environmental degradation has become a problem for the natural environment.

The environment is under pressure through the constant release of sulphur dioxide, nitrogen oxides, and steam-loaded emanations from toxic emissions of non-renewable energy and fossil fuels (Akella, 2009). Attention has been diverted to eco-friendly activities to curb the damage contributed by human or industrial activities. Some scholars have even tried to establish a connection between economic development and the quality of the environment. The increased use of energy is considered the main contributor to increased industrial production through non-renewable energy sources.

The Delta region is one of the most ecologically sensitive ones in the world because of the early stage in which oil and gas resources were discovered, leading to its dominance as the country's economic pillar and the main source of revenue for Nigeria (Uyigüe, 2007).

The Nigeria Environmental Study Team (2004) reported that sea level erosion would worsen the issue of erosion, which rampaged the Nigeria Delta, increasing food insecurity and destroying the ecosystem and agriculture, including fisheries. In their first report in 1990, evidence was produced to show that anthropogenic activities caused changes like this in a region's environment.

Omotonwan (2009) attributed the environmental degradation in Delta to the oil exploration and exploitation done in commercial quantities after the discovery in the colonial era. Hence, some

studies have linked trade and commerce with economic growth and environmental degradation (Ertugrul, 2016). Uyigue (2007) noted that the link between toxic emissions and commercial activities takes into consideration how pollution is attributed to the production of goods and their consumption. Ayobanji (2020) concluded that trade liberalization may not have a positive impact on the pollution level of a country. The hazard that oil spillage poses to the environment cannot be over-emphasized. The Niger region is evidence of the effects that oil spillage has on the ecosystem. A huge amount of Nigeria's oil is produced in Niger Delta, and while it serves as Nigeria's biggest source of income, it poses a variety of issues on the environment. Because oil infrastructures and operations are cited in ecological areas like fishing grounds and tropical forests, these areas are often exposed to oil leaks. The smoke released by these industries also affects the livelihood of people and exposes them to respiratory illness and death. Oil spillage affects the human population, wildlife, and aquatic life. When oil is spilled in water, spreading immediately occurs, and the hazardous components evaporate, causing soil contamination which affects terrestrial, aerial, and aquatic life (Etuonovbe, 2009).

### ***Environmental Degradation and Food Insecurity***

According to Dutse and Ibrahim (2013), the impact of environmental degradation and climate change is seen in food availability, accessibility, and utilization in countries. Over five hundred thousand people in tropical and subtropical states are not food secure (UNO, 2010). Harsh climatic and environmental conditions lead to the loss of crops and livestock. These conditions challenge food security, which affects the overall health of individuals and their livelihood, as well as household purchasing power, as crops make up over 90 per cent of the agricultural sector in Nigeria. Some areas in Nigeria are experiencing a decrease in the growing rate of crops like millet, rice, guinea corn, and maize due to rising temperatures, which degrades the necessary resources for rich and fertile land. Egbetokun and Ogundipe (2016) posit that the impact of environmental degradation on food production includes farmland depletion, reduced yields, changes in planting and harvesting, reduction in yields, decrease in arability, and pest threats.

Apart from the consequent natural disasters, wildfires, droughts, and other environmental issues that make it strenuous to grow food crops, among its impacts is the predicament of food insecurity and malnutrition, which directly and indirectly impact Nigeria's economy and hinder productivity. Recent studies have shown that fast-growing population countries are more prone to the effects of environmental degradation because as population increases, there is expected to be a rise in anthropogenic activities, which is, however, dependent on the level of industrialization and modernization in the country. Essentially, for a growing economy like Nigeria, the implication of this is the presence of slums and poor standard of living, which result from an increase in industrialization (Ogundipe, 2018).

This problem of environmental degradation would bring about an increase in the costs of food due to a decrease in crop yields. For a country like Nigeria, still undergoing development and struggling with inequality and poverty, it is more difficult for people to afford food, which would result in illness, malnutrition, and even death. It also impacts climate change and causes sea level rise, which leads to excessive soil moisture and reduced oxygen levels that affect the breathing process of the plants and make their roots weak, which causes them to die.

### ***Green Economy***

The green economy concept has become a foundational policy framework in developing states. In a conference on sustainable development, the United Nations defined green economy as one of the several instruments to attaining sustainable development, as it would eliminate poverty, sustain economic development, encourage social inclusion, and promote human living standards while



conserving the healthy function of the world's ecosystem. Green policies are primarily executed in energy, industry, agriculture, water, and waste management. Studies have shown that transitioning into a green economy would improve the standard of living, reduce inequalities, and prevent exposure to environmental issues (Schmitz et al., 2013). By stimulating agricultural productivity and enabling good ecosystem management, green economic policies would have a huge jolt on Nigeria's stability and availability of food resources.

If Nigeria adopts a green economic system, the policies will affect the accessibility of food by promoting infrastructural development and green job opportunities, thereby stimulating economic growth. Developing countries like Nigeria have an infrastructure deficit, which results in food insecurity and slowed economic growth.

### ***Climate Change Adaptation***

Climate change adaptation is defined as adapting to the adverse effects of climate change, which means anticipating and expecting the impact of climate change, following the necessary procedures, and taking actions required to minimize or prevent the damage the cause. It is simply adjusting to the existing problems and effects of climate change. This could include changes or adjustments in infrastructures to prevent sea level rise or human behavioural shifts such as reduction of waste.

### ***Development of Climate-resilient Housing and Infrastructure***

The housing and construction industry needs to adapt to the new predicaments that tag along with climate change, as well as develop sustainable building practices to prevent environmental degradation. The location, construction, and energy consumption of houses and building infrastructures directly affect the level of greenhouse emissions and climate change. Similarly, the degrees of exposure to and protection from climate-related risks and hazards are offered and determined by the location of the housings and how they are constructed. The building processes of the residential construction industry constitute about ten per cent of globally consumed energy, of which most are derived from non-renewable sources.

Mitigation of climate change is simply tackling the impacts of climate change, making it less severe by reducing greenhouse emissions. In essence, it is an intervention to manage the triggers of climate change and the sources of greenhouse emissions that affect the climate and the environment. Instances of this include the invitation of clean energy and increasing the size of forests. The energy sector is essential for the mitigation of climate in Nigeria and for overall economic growth and development. Controlling the emission of greenhouse gases through renewable energy adoption is crucial in Nigeria.

### ***Climate-Smart Agriculture***

According to Ozor (2011), agricultural activities contribute a huge amount to climate change as they are just below energy consumption in enhancing greenhouse emissions. Agriculture emissions account for 15 per cent of greenhouse gas emissions, and land usage contributes about 8 per cent overall. (Ozor and Nnaji, 2011).

Agriculture is the economic pillar in most African countries. In 2021, the agricultural sector generated more than 20 per cent of Nigeria's gross domestic product. This makes Nigeria vulnerable to the effects of climate change. Because Sub-Saharan African countries are affected by increased drought, changes in soil components, and flooding, agricultural activities are under threat, which affects the economy. According to the IPCC (1998), the predicament is worsened due to widespread poverty, limited capital, inappropriate infrastructure, etc.

## **Theoretical Framework**

This study adopts green theory as the best theoretical framework that investigates the impacts that climate change has had an impact on the agricultural sector, thereby compromising food security in Ogun State, Nigeria. Green theory has its foundation in addressing environmental issues in a disciplinary way based on the analogy of “the tragedy of the commons” as suggested by Garrett Hardin, who stated that ordinary people are threatened by the misuse of the environment (Gunar, 2021).

The basic assumptions of green theory are the interconnectedness of ecosystems, limitation to success caused by the disruption of the ecosystem and the value of nature which are independent of their use by humans (Dyer, 2018). In application, climate change is a natural system that has affected food availability in Nigeria.

The green theory emphasises the notion of ecosystem services, and there are advantages that humans derive from ecosystems. Ecosystem services, including pollination, soil fertility, and water management, are critical to agricultural systems (Onofri, 2022). Climate change may disrupt these functions, impacting crop yields and total agricultural productivity. Acknowledging and comprehending the complex relationships that exist between agriculture and ecosystems is made more accessible by studying green theory.

Green theory advances the notion of sustainability by highlighting actions that preserve or improve the long-term health of the environment. This is essential for agriculture dealing with the effects of climate change. Permaculture, organic farming, and agroecology are examples of sustainable agriculture methods that support resilience against climate-related disturbances and are consistent with the ideas of green theory (Tittonell et. al., 2022).

The different ways of human abuse of the environment have affected food availability in Nigeria, thereby leading to food insecurity. However, the nature of the environment can still affect the outcome of food availability in Nigeria irrespective of the utility by Nigerians. According to Dyer (2018), a green theory understands climate change as a direct consequence of human collective choices. In other words, the activities of Nigerians cannot be disconnected from the food insecurity experienced in Nigeria.

Green theory has been criticized for not prioritizing human interest in the environment. The Green theorists have been accused of a lack of synergy on how decentralization of green theory should be since some held on to local organizations and others posit on global organizations (Edin, 2022). Despite the criticisms, green theory remains the best theoretical framework for this study.

## **Data Presentation And Analysis**

### **Objective One**

*Examination of the nature of the relationship between climate change and food security in Nigeria*

### **The Cause and Effect Relationship**

Climate change threatens food production, risking grain, vegetables, fruits, livestock, and fisheries. It affects food availability and food accessibility. It also impacts human health and livelihood, as well as changes in market flows.

One of the respondents, an expert in economics, had this to say about the relationship between climate change and food security:

There is a strong connection between climate change and food security. Whatever changes experienced in weather patterns would affect crop yield, affecting Nigeria's food security. It affects food availability, food accessibility, and food affordability. This is as shown by low agricultural output. A lot of Nigerians are malnourished due to food insecurity, which is accredited to climate change. Poor yields lead to the unavailability of food, which changes the market flow for available food and makes it inaccessible and unaffordable to many. There is a cause-and-effect relationship between climate change and food security. (Respondent 1, 2023).

Respondent 4 holds the same view as Respondent 1, noting that climatic activities are connected to the problems being faced in the agricultural sector. All the variables of climate change contribute to the issue of food productivity and availability in Ogun State. She mentioned that:

The major source of income for about 70 per cent of the population of the nation is agriculture. Nigerian agriculture is majorly fed by rain, and farmers find it difficult to organize their operations due to rainfall variance. Cropland reduction, reduced agricultural productivity, droughts, and desertification have all affected crop production. (Respondent 4).

Another respondent also said this about the context of climate change and food security:

Climate change has a connection to food security not only in Ogun state or in Nigeria but in all parts of the world. It harms food production in general. When food production is affected, it leads to food insecurity. Its relationship with food security is a negative one. It does not have a positive connection to it. All the climate activities affect food availability- carbon emissions, environmental pollution, flooding, which washes off parts of soil and land, and deforestation. They all affect food production and availability (Respondent 2, 2023).

Climate change is undeniably connected to the issue of food insecurity. It has lingering implications for the food system in the state. All the respondents agreed that climate change and food security have a cause-effect relationship. Climate burdens the livelihoods in Nigeria, such as crop production, because rainfall patterns will be altered, and floods that devastate farmlands will occur, which would affect not only the livelihood of Nigerians but also their health and standard of life.

Another respondent commented on the nature of the relationship between climate change and food security:

Climate change and food security are intertwined. Climatic activities drastically affect food and crop production in Ogun State. In Ogun State, climate variables like rainfall patterns and temperature influence crop growth and compromise crop yields. Low crop yield spells food unavailability, which would mean poorer people would find it harder to access food because of the market flow of crops and food. (Respondent 3, 2023).

These climatic conditions are major factors undermining food security and threatening people's livelihoods. Variable rainfall, heat stress, and drought can harm food production and cause food shortages. The nature and character of freshwater supplies, on which many Nigerians rely, are

impacted by climate change. Fishing will be affected by weather extremes and rising sea levels. Rising salinity poses a threat to the fisheries.

### ***Unaffordability of Food***

One of the most visible impacts of climate change on food security is the disruption of stable food prices. The impact of climate change on Nigeria's food system disrupts the market flow of crops. Food is very unaffordable to the poor and even inaccessible to others.

A respondent gave insight into how climatic activities have affected the stability of food prices and affordability.

Unfavorable climate conditions reduce crop yields and prevent yield abundance, affecting the total food output. If food is available, it would be affordable for people to buy. Climate change reduces crop productivity, making certain foods unaffordable to many in the state. But if there is the availability of food, the price would be cheaper and more palatable to those in the lower income class in Ogun State (Respondent 1, 2023).

Numerous studies have found that the unfavourable effects of climate change on agricultural productivity result in reduced production outputs. This circumstance has caused food shortages, disruptions, and a significant increase in pricing. Similar to the previous example, a shortage of food due to climate change causes an increase in food costs in the state, worsening the already dire condition of food security. Climate change can lead to more frequent and severe droughts and floods, reducing crop yields and damaging infrastructure, such as roads and bridges, that are crucial for transporting food. This can lead to higher transportation costs and food shortages, which can drive up prices.

### ***Objective Two***

*Examination of the impact of climate change on food availability in Nigeria*

### ***Damaged Agricultural Sector***

All of the respondents agreed that the food system has become unstable and that the agricultural sector has been badly impacted by climate change. Respondent number five said:

Climate change has led to changes in rainfall patterns, with some areas experiencing prolonged dry seasons and others experiencing excessive rainfall. This has affected crop yields and led to crop failures in some areas. For example, farmers in Ogun State who rely on rain-fed agriculture have reported a decline in crop yields due to irregular rainfall patterns. It has also led to an increased incidence of pests and diseases: Climate change has led to the proliferation of pests and diseases that were previously not present in Ogun State. For example, the fall armyworm, a pest that was previously not found in Nigeria, has now become a major threat to maize production in Ogun State. (Respondent 5).

Respondent 2 shared similar views with Respondent 5, claiming that:

Climate change has caused changes in rainfall patterns in Ogun State, Nigeria, resulting in prolonged dry seasons or excessive rainfall, leading to a decline in crop yields. Additionally, pests and diseases that were not

previously found in the region, such as the fall armyworm, have proliferated, posing a significant threat to maize production. (Respondent 3).

Respondent 3 noted not only climate change's impact on crops and vegetables but also its adverse effects on livestock and fisheries. She added

Climate change has also led to changes in the species composition of fish populations in Ogun State. For example, some species of fish not previously found in the area may now be present, while others that were once abundant may have declined. Climate change has led to increased water scarcity in some areas, affecting irrigation systems and water availability for livestock. For example, farmers in areas with limited access to water resources have reported difficulties in accessing water for irrigation and livestock production. Climate change has also affected livestock productivity in Ogun State. For example, the high temperatures and increased incidence of diseases have led to reduced milk production in dairy cattle. (Respondent 3)

Respondent 4 added to the negative effect that climate change has on the agricultural sector, emphasizing flooding and how it destabilizes the crops and changes the soil, mentioning that:

Flooding can lead to soil erosion, which can wash away topsoil and nutrients, reducing soil fertility and affecting crop yields. This can result in lower crop yields and reduced income for farmers. Floodwaters can cause waterlogging in fields, which can limit oxygen availability to plant roots, leading to reduced crop growth and yield losses. This can also increase the susceptibility of plants to pests and diseases. (Respondent 4)

Respondent 1 shares similar responses to the other respondents, adding that:

Crop yields, soil fertility, and livestock output have all suffered due to climate change in Ogun State. The issues that farmers in the state face are a result of changing rainfall patterns, soil erosion, and degradation, as well as a rise in pests and illnesses. (Respondent 1)

The impact of climate change on the agricultural sector is evident in crops and vegetables and livestock and animals. Like respondent 3, respondent 2 gave insight into the context of climatic activities on livestock production, noting that:

High temperatures and increased humidity associated with climate change have led to heat stress in livestock, which can affect the growth, productivity, and reproductive performance of livestock, reducing meat and milk production. It has led to increased water scarcity in some areas, which has affected the availability of water for livestock. This can lead to dehydration, reduced feed intake, and lower productivity.

Climate change has increased the incidence of some livestock diseases in Ogun State, which can affect cattle productivity and herd health. (Respondent 2)

According to respondents, climate change harms the agricultural sector in Ogun State. These consequences include livestock loss, crop failure, and reduced production rates of harvests. Respondent 2 also went further to state how the effects of climate change on the agricultural sector of Ogun State ultimately undermine the economy, stating that:

The agriculture industry, a main driver of Ogun State's economy, has been significantly impacted by climate change. Farmers are facing issues as a result of the changing climate's impact on water availability, soil fertility, and crop output. As a result, agricultural output has decreased, which may have an impact on farmers' livelihoods and incomes as well as those of other parties involved in the agricultural value chain. Additionally, the prevalence of pests and diseases may rise due to climate change, which might harm crops and lower yields, further reducing agricultural output. (Respondent 2)

Respondent 1 attributed a specific climatic variable, carbon emissions, to be a major contributor to the distortion of the soil and failure of crops, mentioning that:

Carbon emissions have a significant impact on the agricultural sector in Ogun State, Nigeria. Carbon emissions are one of the primary drivers of climate change, which has led to changes in temperature, rainfall patterns, and weather extremes that affect the availability of water, soil fertility, and crop productivity in Ogun State. In this essay, I will discuss the effects of carbon emissions on the agricultural sector in Ogun State, as well as some of the strategies that can be used to mitigate these impacts. (Respondent 1)

### **Objective Three**

*Assessment of the ways to address the impact of climate change on food availability in a selected area in Nigeria.*

### **Adapting to Agriculture to Climate**

The third research question aimed at finding strategies in which the issue of climate change and its effect on food security can be addressed. The participants reviewed strategies that could be adopted to help mitigate the issue and reduce the burden climate-related activities have on the food system in Ogun State. Respondent 1 had a government-focused approach to addressing the issues. He stated that:

The government can encourage farmers to adopt sustainable farming practices such as crop rotation, conservation tillage, and agroforestry. These practices can help increase soil fertility, reduce erosion, and conserve water resources.

The government can provide support for the adoption of climate-smart technologies such as drought-resistant crop varieties, improved irrigation systems, and renewable energy sources. These technologies can help farmers adapt to the changing climate and reduce their greenhouse gas emissions. (Respondent 1)

Similarly, respondent 2 attributed these methods to be government-focused, noting that most of the strategies could be easily adopted if the government oversees them. He noted that:

Several techniques could be used to address the issues of food security and climate change in Ogun State. Promoting sustainable agriculture is one tactic. To do this, it is possible to motivate farmers to use sustainable farming techniques, including crop rotation, conservation tillage, and agroforestry. These methods can aid in preserving water resources, reducing erosion, and improving soil fertility.

Aiding climate-smart technologies is another tactic. This would entail giving farmers stronger irrigation infrastructure, drought-resistant agricultural varieties, and sustainable energy sources. These innovations can aid farmers in reducing greenhouse gas emissions and adapting to climate change.

It's also essential to invest in research and development. The government can fund research to create new crop kinds that are more productive and adaptable to the changing climate. As a result, food security can be maintained despite climatic change. It's also crucial to build infrastructure that is climate resilient. The government can make investments in infrastructure that can withstand climate change effects like flooding and rising sea levels. As a result, agricultural lands and food production systems may be protected. Last but not least, supporting community-based adaptation strategies can be successful.

Respondent 5, however, suggested that communal effort to adopt agricultural adaptive measures would help improve the situation, noting that:

Communities may implement adaptation strategies, including agricultural diversification and soil conservation techniques. This can lessen the susceptibility of food systems to climate change and aid in local resilience building. Overall, addressing climate change and its impact on food security in Ogun State can be accomplished through a holistic strategy that integrates these tactics.

Respondent 3 added that:

The agriculture sector may effectively combat climate change by using sustainable farming methods. Crop rotation, conservation agriculture, and agroforestry are some techniques that can assist in enhancing soil health, lowering greenhouse gas emissions, and boosting carbon sequestration. Farmers can implement these methods by utilizing organic fertilizers, minimizing tillage, and planting cover crops.

## **Discussion of Findings**

### ***The Relationship between Climate Change and Food Security in Nigeria***

Based on the responses from the interviews conducted by the researcher, it was discovered that an adverse correlation exists between climate change and food security, and the green theory emphasized the importance of climate on the ecosystem, thereby affecting agriculture and food security. This discovery is consistent and in line with most scholars researching the topic. Firstly, one of the discoveries in this research work is that the relationship between the two variables is a cause-and-effect one. Essentially, the issue of food insecurity in this context is attributed to climate change. It was discovered that climatic activities can lead to reduced agricultural productivity, crop failures, and food shortages and reduce food availability and accessibility.

Just like Olawale (2020) noted, the discoveries from this research affirmed that climate change has impacted agricultural productivity in Ogun State by causing variations in rainfall patterns and increasing the frequency of extreme weather events such as droughts and floods.

The findings explained that the changing rainfall patterns have caused a reduction in crop yields and quality, leading to a decline in food production and insecurity. Farmers in Ogun State have reported

that the rainy season has become shorter and less predictable, which has made it difficult for them to plan their farming activities. In addition to this, the findings showed that the presence of climate change had a direct impact on the Ogun State food system.

Furthermore, it was confirmed that the shorter and less predictable rainy season has made it difficult for farmers to plan their farming activities, while the increasing rainfall intensity has led to soil erosion and loss of soil nutrients. The findings from the responses suggested that droughts and floods have caused plant withering and death, soil erosion, crop damage, and loss of farmland, resulting in a loss of livestock and fisheries, which are important sources of income for many farmers in the state. Therefore, it is necessary to develop strategies that can help farmers adapt to the changing climate, such as the use of drought-resistant crops, irrigation, and improved soil management practices, to increase resilience and sustain food security in the region.

It is important to note that the discoveries in this research attribute carbon emissions as one of the main contributors to climate change, which in turn affects food security in Ogun State. Carbon emissions from industrial activities, transportation, and energy production contribute to the increase in global temperature and changes in precipitation patterns, which affect crop yields and food production. Therefore, reducing carbon emissions through sustainable practices and policies can help mitigate the impact of climate change on food security in Ogun State and other vulnerable regions. Similarly, scholars like Akinbode and Ogunniyi (2018) state that climate change and carbon emissions have significant impacts on food security in Nigeria, including Ogun State. The findings from this research stated that the effects of climate change, such as changes in rainfall patterns and extreme weather events, have led to a decline in agricultural productivity and food security in the state. The study also highlighted the contribution of carbon emissions to climate change and the need to reduce emissions to mitigate the impacts on food security.

Ogunniyi et al. (2019) emphasized the need to reduce carbon emissions from the food system to achieve sustainable food security in Nigeria. The study suggested promoting sustainable farming practices, such as agroforestry and intercropping, as well as reducing food waste and improving diets to reduce emissions and increase resilience to climate change.

Olaoye and Adeyemo (2020) also found that carbon emissions from energy production, transportation, and land-use change, as well as deforestation, contribute significantly to greenhouse gas concentrations and climate change in Nigeria, impacting food security. The study recommended reducing carbon emissions with renewable energy, improved transportation systems, and sustainable land-use practices to mitigate the impacts on food security.

### ***The Impact of Climate Change on Food Availability in Ogun State, Nigeria***

Based on the responses of the different respondents, it is evident that climate change has had a significant impact on the agricultural sector in Ogun State, Nigeria. The changes in rainfall patterns, soil degradation, erosion, and increased incidence of pests and diseases have all contributed to the challenges that farmers in the state face. The negative effects of climate change are not only limited to crops and vegetables but also extend to livestock and animals. High temperatures and increased humidity associated with climate change have led to heat stress in livestock, which can affect their growth, productivity, and reproductive performance, reducing meat and milk production. Additionally, climate change has led to increased water scarcity in some areas, affecting irrigation systems and the availability of water for livestock. This can lead to dehydration, reduced feed intake, and lower productivity. Overall, the impact of climate change on the agricultural sector in Ogun State is significant and requires urgent attention and action to mitigate its effects.



Due to its detrimental effects on food security, climate change has become a significant concern for the agricultural industry in Ogun State, Nigeria. Climate change has altered rainfall patterns, increased the prevalence of pests and diseases, degraded the soil, and caused erosion, which has decreased agricultural productivity. Animal husbandry and fisheries have also been impacted by the effects of climate change on agriculture, in addition to crops and vegetables. Ogun State's economy heavily relies on the agriculture sector; therefore, the effects of climate change have far-reaching implications.

Carbon emissions are one of the main causes of climate change. Extreme weather occurrences, global warming, and the building of greenhouse gases in the atmosphere are all caused by carbon emissions.

Respondent 1 attributed carbon emissions to be a significant contributor to soil degradation, which affects crop yields. Carbon emissions lead to soil erosion, which can wash away topsoil and nutrients, reducing soil fertility and affecting crop yields. Floodwaters can cause waterlogging in fields, which can limit oxygen availability to plant roots, leading to reduced crop growth and yield losses.

Respondent 2 noted that climate change has also affected livestock production in Ogun State, with high temperatures and increased humidity leading to heat stress in livestock, which can affect their growth, productivity, and reproductive performance. The increased incidence of some livestock diseases in Ogun State can affect cattle productivity and herd health. Respondent 3 added that climate change has also led to changes in the species composition of fish populations in Ogun State, with some species that were not previously found in the area now present, while others that were once abundant may have declined.

Respondents 4 and 5 highlighted the impact of climate change on crop yields in Ogun State. Respondent 4 noted that flooding can lead to soil erosion, which can wash away topsoil and nutrients, reducing soil fertility and affecting crop yields, while floodwaters can cause waterlogging in fields, which can limit oxygen availability to plant roots, leading to reduced crop growth and yield losses. Respondent 5 added that climate change has led to changes in rainfall patterns, with some areas experiencing prolonged dry seasons and others experiencing excessive rainfall, leading to crop failures in some areas. The increased incidence of pests and diseases, such as the fall armyworm, has also affected maize production in Ogun State.

The impact of climate change on the agricultural sector in Ogun State has far-reaching consequences. The agricultural sector is a significant contributor to the economy of Ogun State, and climate changes have affected the availability of water, soil fertility, and crop productivity, leading to challenges for farmers and other stakeholders in the agricultural value chain. The reduced agricultural output affects the income and livelihoods of farmers and other stakeholders in the agricultural value chain.

Several strategies can be used to mitigate the impact of climate change on the agricultural sector in Ogun State. The findings suggested reducing carbon emissions with renewable energy, improved transportation systems, and sustainable land-use practices. Respondent 2 recommended promoting sustainable farming practices, such as agroforestry and intercropping, as well as reducing food waste and improving diets to reduce emissions and increase resilience to climate change. Respondent 3 suggested improving irrigation systems for crops and livestock and promoting sustainable fishing practices to increase resilience to climate change.

### ***Strategies to Address the Issue of Climate Change and Food Security in Ogun State, Nigeria***

The discoveries identified several strategies that could be adopted to address the issue of climate change and its effect on food security in Ogun States. The government-focused strategies included

promoting sustainable agriculture, providing support for climate-smart technologies, investing in research and development, creating a climate-resilient infrastructure, and encouraging community-based adaptation measures.

Promoting Sustainable Agriculture could encourage farmers to adopt sustainable farming practices such as crop rotation, conservation tillage, and agroforestry. These practices can help increase soil fertility, reduce erosion, and conserve water resources. Sustainable farming practices are an effective way to mitigate climate change in the agriculture sector as they help to reduce greenhouse gas emissions, improve soil health, and increase carbon sequestration.

Providing Support for Climate-Smart Technologies could provide support for the adoption of climate-smart technologies such as drought-resistant crop varieties, improved irrigation systems, and renewable energy sources. These innovations can aid farms in climate adaptation and greenhouse gas emission reduction.

New crop varieties with higher yields and climate adaptation could be created by investing in research and development. As a result, food security can be maintained despite climatic change. The government might make investments in infrastructure that is resistant to climate change effects like rising sea levels and flooding. As a result, agricultural lands and food production systems may be protected.

The government can promote community-based adaptation measures that can effectively build resilience at the local level and reduce food systems' vulnerability to climate change. The community-focused strategies included communal efforts to adopt agricultural adaptive measures such as crop diversification and soil conservation practices.

The findings suggested that communities can adopt adaptation measures such as crop diversification. This can help build resilience at the local level and reduce the vulnerability of food systems to climate change.

More discoveries from the responses were that farmers can adopt sustainable farming practices by using organic fertilizers, reducing tillage, and planting cover crops. These practices can help to reduce greenhouse gas emissions, improve soil health, and increase carbon sequestration.

### ***Suggestion for further studies***

Further studies should focus on the best ways that farmers in Ogun state can adopt to avert the negative implications of harsh climatic conditions that are common to the area and reduce farmers' vulnerability.

### **Conclusion**

This research was conducted to examine the relationship that exists between climate change and food security. The study's outcome aligned with green theory as it became apparent that food security affects crop production and every facet of the natural environment. This issue of climate change must be taken seriously as it has long-term implications and negative impacts on the state of the country. Many individuals have lost their source of livelihood, and others do not have access to the basic food resources required to live a healthy life. Food insecurity has now become one of the very serious challenges that Nigeria needs to address. If the agricultural sector is going to thrive, conscious effort needs to be put into policies and agricultural practices to help reduce the impact that climate change has on food availability and production.

Because of uncontrollable natural causes and human negligence in the form of industrialization and modernization, the environment has been put under serious restraint and has affected many sectors in the state, including the agricultural sector. This has made food inaccessible, unaffordable, and unavailable for many people in the state, thereby increasing hunger and the poverty rate in the country. This also makes it difficult for the country to meet the basic economic and sustainable requirements, pushing it further into a state of underdevelopment. This led to a battle over resources and agitations throughout the country, adding to the already existing security threats.

This study offers solutions and recommendations to curb the issue of climate change and its effect on the food security of the country. Aligning with other successful countries will open more ground for success in achieving food security. The government should engage scientists to establish findings that will favour different types of economic and valuable plants in the environment.

### ***Policy Implication of the Study***

Policymakers should make policies on investing in better meteorological services and equipment so that farmers may receive timely and reliable weather information.

Policymakers for Ogun state and researchers should focus on creating and supporting early warning systems to assist farmers in anticipating and preparing for changes in rainfall patterns, allowing them to make well-informed decisions about when to sow and harvest.

Develop training programs to help Ogun State farmers become more capable and provide them with the information and abilities they need to adjust to shifting weather patterns.

Policies and Researchers should encourage neighbourhood-based programs that motivate farmers to exchange insights and strategies for addressing climate-related difficulties.

The study will help policymakers in Ogun state to focus on the development and implementation of strategies that will help farmers adapt to the changing climate conditions.

The study highlights the value of promoting and implementing food security programs through policies that will ensure a stable and sufficient food supply, especially during periods of climate-related difficulties.

Climate change is a global issue that needs global attention. This study will inform regional and international decisions on issues of climate change and human utility in areas different from Ogun state.

Policies and research in Ogun state should be made to encourage community involvement and awareness-raising initiatives to inform nearby communities and farmers about the effects of climate change and available adaptation options.

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