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Sustainable Agriculture in Benue State, Nigeria - A solution to end hunger and achieve food security

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Abstract

The importance of sustainable agriculture cannot be overstated, particularly for achieving food security in a country. Addressing the major issues facing agriculture in Nigeria is crucial as their effects are becoming increasingly important. This study investigated how sustainable agriculture can influence food security in Benue. Both primary and secondary data were utilised, and the findings indicate that adopting sustainable agriculture will improve food production in the state. Climate change poses a significant threat to food security in Benue State, primarily affecting crop production due to alterations in temperature and rainfall patterns, resulting in decreased crop yields. It was also discovered that sustainable agriculture is key to ending hunger given its positive impact on reducing hunger and improving food security. Additionally, this study revealed a low level of education among farmers, which could have contributed to lower productivity. Therefore, adaptive climate change measures should be implemented to reduce these effects. It also adds that educating farmers on the importance of sustainable agriculture is crucial for ensuring greater food security.

Language: English

Keywords: Sustainable agriculture, Climate change, Food Security.

Contents

1 Introduction

Food security and ending hunger have become major global concerns, as evidenced by the UN Nations' Sustainable Development Goal 2 (SDG 2), which seeks to ensure food security and find sustainable solutions to eradicate all forms of hunger by 2030. Food security is defined as having consistent access to sufficient food, both physically and financially, to meet dietary needs for a healthy and productive life. The UN's goal is to ensure that everyone has access to sufficient nutritious food worldwide (UN, 2015).

Food insecurity is a major obstacle to the progress and prosperity of individuals, communities, and even nations, often resulting in poverty. According to the World Health Organization's (2022) estimate, hunger will affect 828 million people worldwide by 2021. Unfortunately, the world is moving further away from its goals of eliminating hunger, food insecurity, and malnutrition by 2030, as stated in a 2022 United Nations report. Many people in the world, many of whom are small-scale farmers who rely on agriculture to support themselves and their families, go to bed hungry every night, according to the International Development of the United States of America (2022).

The United Nations (2015) emphasized the importance of improving food access and promoting sustainable agriculture to achieve food security. This requires ensuring equitable access to land, technology, and markets; implementing sustainable food production systems; and adopting resilient agricultural techniques to enhance the productivity and incomes of small-scale farmers. Sustainable farming practices involve the use of a range of methods including agroforestry, biological pest control, composting, crop rotation, erosion prevention, green manure application, intercropping, mulching, and water harvesting, as outlined by Adedokun et al. (2018).

The agricultural industry is facing significant pressure to meet the growing demand for food, industrial raw materials, and biofuels as the world's population continues to expand. However, in certain regions of Africa, the global increase in agricultural production does not meet this demand. Climate change is expected to have a particularly severe impact on Africa owing to its proximity to the equator, as noted by Ojo et al. (2021) and Thinda et al. (2021) and Sarr et al. (2021), Onyeneke (2021) and Ahmed (2022).

Africa is experiencing various physical effects of climate change such as rising sea levels, altered temperatures, and rainfall patterns (Abdulai, 2018). These effects are expected to adversely affect agricultural production, farm income, food security, and economic growth. The impoverished population in sub-Saharan Africa, who rely heavily on agriculture for their livelihood, is likely to be the most affected (Setsoafa et al. 2022).

Sustainable agriculture management could be a potential solution to address the issue of climate change. Improving agricultural output and reversing harmful agroecosystem degradation processes, particularly in smallholder farming systems, could enhance food security and reduce hunger. (Adenle et al. 2019; Zeweld et al. 2020; Ma and Wang 2020; and Bekele et al. 2021)

The central region of Nigeria's Benue State, also known as the "Food Basket of Nigeria", is mostly a low-lying area with an average elevation of 100-300 meters above sea level, as reported by Ujoha et al. (2019). According to Synergos (2021), Benue State is the leading producer of soybeans, mangoes, citrus fruits, roots, and tubers in Nigeria, producing a diverse range of agricultural commodities on a large scale.

Hence, this study examined the role of sustainable agricultural practices in reducing hunger and increasing food security.

1.1 Rationale of the study

Ayuk (2001) suggested that the use of unsustainable agricultural methods in Nigeria has led to poor agricultural production, contributing to food insecurity. Ikpi (1995) argued that Nigerian farmers' inadequate performance could be attributed to their lack of knowledge and application of sustainable agricultural practices. Therefore, promoting sustainable agriculture is not only valuable but also essential, as stated by Wilken (1991). According to Omole (2021), although commercial agriculture is expanding in Nigeria, there are potential long-term risks to the country's agriculture and food security because commercial farmers may not always prioritize the sustainable management of natural resources. This situation presents new prospects for exporters and may sometimes lead to an increase in production. However, in regions where slash-and-burn farming is prevalent, the shift towards sedentary agriculture has caused a reduction in fallow time and a significant decline in soil health and productivity. In addition, the removal of vegetation from steep

slopes for planting has led to an increase in soil erosion. The government's inability to confront individuals who benefit from the destruction of resources exacerbates these problems.

Benue State is acknowledged as Nigeria's primary source of food, but it has been producing well below its potential, according to Synergos (2021). Despite having the ability to provide food for the entire country, Benue's farmers are hindered by inadequate infrastructure, funding, education, technology, legal frameworks, and other resources necessary to maximise their production capacity (Synergos, 2021). Therefore, this study aims to assess the impact of sustainable agricultural practices on reducing hunger and enhancing food security.

1.2 Research Question

The following research questions were answered to accomplish the research objectives:

1. What Sustainable agricultural practices do farmers in Benue state engage in?
2. How does climate change affect farming in Benue State?
3. What strategies do farmers adopt to ensure their food security?

1.3 Outline of the thesis

This chapter presents a case study and brief overview of sustainable agricultural practices, hunger reduction, and food security. The rationale of the study and the research questions were also discussed. This chapter provides an overview of the literature on sustainable agricultural practices, hunger reductions, and food security. The third chapter discusses the sample selection, data collection techniques, and study methodology. In the fourth chapter, the findings from the collected data are analysed. The fifth chapter concludes the project, which offers a few conclusions and helpful recommendations as well as potential considerations for future studies that may be conducted on this topic.

2 Theoretical background

This chapter offers an appraisal of pertinent material and debates from the literature, which are central to this research. This study was conducted in the contexts of sustainable agriculture, climate change, and food security.

2.1 Theoretical aspects of sustainable development

2.1.1 Analytical framework of sustainable intensification

The relationships among climate change, sustainable agricultural practices, and food security are complex and interconnected. A multidimensional approach that considers these factors is required to address food security. The success of sustainable agricultural practices in Africa will play a crucial role in resolving continents' food security challenges. The concept of sustainable intensification was employed to address the challenges of sustainable development in relation to food security. The concept of Sustainable Intensification (SI) was first introduced in the 1990s as a means of increasing yields in vulnerable African settings in the long term (Musumba et al. 2017). At that time, Africa's natural resource degradation caused great concern, and the continent's productivity was mostly low. The foundation of sustainable intensification is the idea that rapidly rising demand, combined with supply side concerns, will increase food prices to a point where hunger and malnutrition would lead to political and economic unrest. The main characters in SI think that the world is struggling to feed an expanding global population and that the problem is worsened by a lack of resources. In this context, the framework offers suggestions on balancing the environmental, economic, and social goals of agriculture. The goal of the SI is to build routes for sustainable food production that vary by location and scale based on the local conditions of the producing area rather than providing a set of food production procedures. This strategy considers various agro-ecological zones, farming systems, farmers' cultural preferences, institutions, legislation, and other elements (Pender et al., 1999).

SI advocates believe that the best way to address food security is to increase output levels per unit input and per unit time while also reducing negative environmental impacts. They recognize that a significant portion of the expected increase in production will come from

existing agricultural land; thus, maintaining productivity is crucial. To achieve these goals, they promoted the use of various tools and techniques. Initially, the SI focused on increasing food production on a given plot of land while minimizing negative environmental impacts and enhancing contributions to natural capital flows and environmental services (Zurek et al., 2015). However, this understanding of SI has since expanded to include non-environmental factors such as social issues, the economy, and human well-being (Loos et al., 2014). These definitions suggest that SI is related to productivity (crop yield, animal production, and production variability), economic viability, profit variability, labour requirements, human nutrition, food sustainability, health, equity/gender, social cohesion, and collective participation.

The techno-ecological approach is based on the belief that technology and human innovation are the best resources to sustain food production. Techno-ecologists argue that by utilising technology and human effort, yields can be increased, while minimizing harm to the environment. They believe that agricultural production techniques can be modified to meet future global food demand. Examples of human adaptation include the use of fertilisers and the intensification of agriculture, which inspired the "Green Revolution" (Boserup, 1965). Techno-ecologists argue that concerns regarding the negative impact of agriculture on the environment are overstated and can be overcome through human actions. They seek to address questions such as which technologies can benefit rural African farmers; which methods are most effective for preventing pests, drought, and flooding; and whether mechanical or conservative procedures are more appropriate. They also considered the need to reduce the environmental impact while implementing policies and practices aimed at increasing food production to feed the world's population.

This framework considers crucial factors that affect food production in Africa, such as human ingenuity, adapting technology to cultural contexts, environmental factors, and the role of the international community. It specifically addresses the challenge that African nations are forced to rely on food imports due to the global economy. This paradigm effectively links the issue of sustainable development with the variables that influence Africa's pursuit of food security.

2.2 Sustainable Agricultural Practice

Sustainable agriculture encompasses various strategies, including agricultural management methods and technological advancements (Krall 2015). It involves the long-term production of high-quality goods and services while considering economic and social structures and preserving renewable and non-renewable resources (Runowski, 1999). Sustainable agriculture aims to achieve long-term production security and meet societal demands without degrading the essential environmental resources. At the micro level, sustainable agriculture relies on environmentally friendly production techniques, provides farmers with adequate income, and benefits society. According to Buckwell et al. (2015), sustainable agriculture involves the effective production of safe, high-quality agricultural products while protecting and improving the natural environment and social and economic conditions of farmers, employees, and local communities and safeguarding the health and welfare of all farmed species. To achieve agricultural sustainability at the local level, it is necessary to increase resource use efficiency or total system self-sufficiency, while reducing environmental degradation and improving the social well-being of farmers (Moraine et al., 2017).

The FAO (2012) defines sustainable agriculture as the management and preservation of natural resources, as well as the direction of technological and institutional changes, to guarantee the fulfilment of human needs for both present and future generations. This approach ensures sustainability on multiple levels. Sustainable agriculture is an agricultural system that is customized to a particular location, allowing crop and animal production to remain relatively constant despite typical weather variations, and preventing gradual declines.

Pieiro et al. (2021) stated that sustainable agricultural practices enable the more efficient use of natural resources, reduce the environmental impact of agriculture, and enhance the ability to adapt to climate change and variability. These practices include precision farming, integrated pest management (IPM), sustainable agroforestry techniques, crop rotation, increased crop diversity, use of cover crops, no-till systems, and reduced-till systems. Sustainable agriculture ensures long-term employment, adequate income, fair and equal work, and excellent opportunities and living conditions for all individuals in the agricultural

value chain. It also guarantees that the essential nutritional needs of present and future generations are met in terms of both quality and quantity (Wörner and Krall, 2012).

2.2.1 Brief Trajectory of Agricultural Policies in Nigeria

Nigeria's economy was primarily based on agriculture until the early 1970s; however, since then, oil has become the dominant sector, with agriculture playing a secondary role. However, several measures have been implemented to maximise the potential of Nigerian agriculture to feed the population, owing to the risks associated with relying solely on crude oil revenue to support the economy. These measures included Operation Feed the Nation (OFN), Green Revolution, the National Food Acceleration Production Programme (NAFPP), and the Directorate of Food, Road, and Rural Infrastructure (DFRRI). The Obasanjo administration launched the National Cassava Initiative in 2004-2005 as an agricultural program, and President Yar Adua's 7-point agenda emphasized food security. President Goodluck's agricultural transformation program. Despite these initiatives, Nigeria was unable to meet its internal food needs and exports to support economic growth.

Thus, a new agricultural promotion policy (2016–2020) was created. The policy objectives were as follows:

(i) achieve food security.,

(ii) boost production and productivity,

(iii) create jobs and income; and

(iv) Increase exports and decrease food imports, freeing up resources for vital infrastructure development and social service delivery. The program aims to revolutionize agriculture in Nigeria to ensure food security, sustainable development, and climate change adaptation. The primary objective is to reduce a country's dependence on food imports by increasing domestic food production. The policy also seeks to commercialize agriculture by providing technologies, financial services, input supply chains, and market links that directly engage poor rural farmers. Rural economic growth is crucial to successful job creation, economic diversity, improved security, and sustainable economic growth. This strategy also focuses on improving environmental and agricultural sustainability and reducing the impact of climate change. It aims to increase agricultural output, marketing,

and other agricultural operations, while promoting the sustainable use of natural resources such as land, soil, water, and ecosystems. The program also prioritizes nutrition-sensitive agriculture, particularly for vulnerable populations such as children under the age of five, nursing mothers, and people with disabilities and chronic illnesses, to address issues of stunting, wasting, underweight, and other forms of hunger and malnutrition. Overall, this strategy is comprehensive and commendable for promoting sustainable agriculture.

2.2.2 Definition of Climate Change

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as a shift in climate caused either directly or indirectly by human activity that alters the composition of the global atmosphere. This change occurred in addition to the natural variability of the climate observed over similar time periods.

Human activities, such as burning fossil fuels and changing land use, have led to atmospheric emission of greenhouse gases, particularly carbon dioxide, which is the primary contributor to recent climate change. Prior to industrialization, the atmospheric carbon dioxide concentration was 277 ppm. The increase in greenhouse gases due to human activity intensifies the natural greenhouse effect by trapping outgoing infrared radiation within Earth's atmosphere, resulting in anthropogenic global warming. This rise in temperature has led to more frequent, intense, and prolonged extreme weather events, which have increasingly negative impacts on society, as noted by IPCC (2013).

2.2.3 Food Security

The concept of food security is a highly debated topic on the global policy agenda of the 21st century. Some scholars have described this as simple. The term food security was first introduced at the 1974 World Food Conference following the food crisis of 1972-1975. Scholars have proposed numerous definitions of food security, each offering a different perspective on how to study or understand food security. Some scholars have focused on individuals and households, whereas others have emphasised daily caloric intake or nutritional measures. There are also studies that analyse food security at the national level by examining a nation's ability to achieve and maintain self-sufficiency in food production.

The concept of food security pertains to the availability of sufficient food and food production to meet the increasing demand and balance output supply (Idrisa et al., 2008). Ladele and Ayoola (quoted by Adegbola et al. in 2011) suggest that food security is a result of the level of food production, meaning that high levels of food production equate to food security. Food security exists when everyone has physical and financial access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life (World Food Summit 1996). This concept of food security comprises four components: availability, accessibility (both physically and financially), usage (how it is consumed and assimilated by the body), and stability of these three components (FAO, 2015). Food insecurity, which can be temporary or chronic, arises from the absence of one or more of these components of food security (NAP, 2020). For instance, if food is available but not accessible to a particular population owing to price or distance, the population experiences food insecurity. Poverty, limited access to healthy foods, and lack of social support exacerbate food insecurity, making it challenging for people to access the food they need, leading to a cycle of food insecurity.

Dimension of food Security

Availability: Availability of food refers to sufficient food in sufficient quantity for consumption. Food accessibility, on the other hand, pertains to the physical presence of food, and includes the quantity, quality, and variety of food accessible to people (Burke and Lobell, 2010). Food availability is a key component of food production, distribution, and exchange (Ericksen 2008).

Stability: Stability in the context of food security refers to the assurance of the regular availability of resources necessary to access and consume food.

Access (ability of persons to receive food frequently through own production or purchase) The concept of food accessibility considers an individual's ability to regularly acquire food either through personal production or purchase. This dimension encompasses the quantity, quality, and variety of food necessary for a healthy and active lifestyle. The key components of food accessibility include price, availability, and personal preferences (FAO 2017; Ingram 2011; FAO 2017).

Utilization (quality and safety of food, nutrition elements and ability of the body to absorb necessary amounts of nutrients) Food utilization refers to the capacity of an individual to effectively consume and benefit from food. This includes considerations of food quality, safety, nutritional value, and the body's ability to absorb necessary nutrients. Factors such as food safety, nutritional content, and social significance are known to significantly impact an individual's food consumption (Gregory, Ingram, and Brklacich, 2005; FAO, 2017).

2.3 Sustainable Agricultural practice and food security

Setsoafa, Ma, and Renwick (2022) have reported that in Ghana, sustainable agricultural practices (SAPs) have been utilized to address challenges related to food security and climate change. The study found that farmers' decisions to use SAPs were influenced by various factors such as social demographics, plot-level characteristics, extension services, and location. The implementation of all three SAPs was more beneficial in terms of farm income and food security than that of only one or two SAPs. Similarly, Huan et al. (2022) used a nationally representative farm-level survey dataset of 1357 farm households from 132 villages in China to evaluate the impact of socialised services on the adoption of SAPs. The study found that the use of socialised services significantly increased the adoption of SAPs. The authors concluded that socialised agricultural services could play a crucial role in encouraging smallholders to adopt sustainable agricultural technologies, thereby facilitating the transition from traditional to sustainable agriculture.

Abdalla et al. (2021) conducted a study in Sub-Saharan Africa to investigate the relationship between farm earnings and food security (also known as self-sufficiency in food production or SSF) among rural households. This study examined various sustainable agricultural practices (SAPs) such as zero tillage, intercropping, residue incorporation, and animal manure. The authors used the Multinomial Endogenous Treatment Effect (METE) technique and found that the joint adoption of SAPs resulted in increased farm revenue and food security compared to the adoption of a single practice. The study also revealed that households adopting at least three SAPs had significantly higher farm incomes and food security than those adopting fewer SAPs.

Similarly, Olagunju, Oyetunde-Usman, and Ogunpaimo (2021) investigated the factors influencing the adoption of different SAPs and the intensity of their use using cross-

sectional data from the 2015 Nigeria General Household Survey. The study considered SAPs such as improved seeds, artificial fertiliser, mixed-cropping practices, and organic manure. The findings showed that factors such as the age of the household head, gender, education, household size, availability of extension services, and household wealth status had a significant impact on farmers' adoption of various SAPs and the intensity of their use.

Nagy and Al Jaafreh (2020) conducted a study in Hungary to examine the relationship between sustainable agriculture indicators and food security determinants over the long-term using descriptive analysis. This study found that several sustainable agricultural indices, such as greenhouse gas emissions, fertiliser use, organic farming, and agricultural areas, have an impact on food security.

Similarly, Ndor, Obadiah, and Nasir (2020) investigated the impact of sustainable agriculture practices on Nigeria's food security and economic growth. This study revealed that sustainable agricultural development can enhance food security and economic growth.

Umeh and Igwe (2019) conducted a study with 160 respondents to investigate the factors influencing the adoption of sustainable agricultural practices (SAPs) among farmers in Nigeria's Ohaukwu Local Government Area. This study found that the socioeconomic characteristics of rural farmers significantly influenced their SAP adoption. The implementation of SAPs has been hindered by institutional, political, and socioeconomic barriers.

Similarly, Adedokun et al. (2018) focused on 70 farmers in the Ikorodu neighbourhood of Lagos, Nigeria, to examine their adoption of sustainable practices. The study used a t-test and probit regression and found that the majority of farmers used more than five of the nine sustainable practices, whereas 48.33% of farmers relied on inorganic fertilisers. The study also revealed that there was no significant difference in the output of farmers who used more than five sustainable arable farming practices compared to those who used fewer than five.

2.3.1 Climate Change and Farming Activities

Numerous studies have examined the relationships between farming practices, food security, and climate change. In a recent study, Ani et al. (2022) examined the changing impact of climate change on the food and human security sectors in Nigeria using a combination of quantitative and qualitative data. This study's findings were based on a comprehensive analysis of primary and secondary data sources, including qualitative data collected across Nigeria between January and November 2018 and 2019. The researchers conducted semi-structured Key Informant Interviews (KIIs) with 48 participants representing the six geopolitical zones of the selected research areas. This study revealed that climate change has a significant impact on food security.

Akzar and Amandaria (2021) analysed the socioeconomic and agricultural market implications of climate change in the agricultural sector. Their study revealed that potential negative impacts on agricultural inputs could lead to changes in agricultural output and food costs. The authors suggested that investing in adequate infrastructure and utilizing research and innovation could help mitigate the effects of climate change and support sustainable economic growth, social development, and environmental protection.

Batool (2022) contributed to the understanding of the impact of climate change on food security in Pakistan by examining climate variations. This study utilised an ARDL approach to analyse historical data from 1991 to 2020 using wheat production as a proxy for food security in Pakistan. This study found that rising minimum and maximum temperatures and unpredictable rainfall patterns caused by global warming are the primary climatic factors affecting Pakistan's food security by reducing wheat production. This study also suggests that expanding the area under wheat cultivation could help Pakistan achieve greater food security by increasing wheat production.

In 2021, Htoo conducted a study evaluated the impact of climate change on Myanmar's agricultural output from 2009 to 2019. This study focused on determining the best fit of a multiple regression model and found that temperature fluctuations had a negative effect on grain crop production in Myanmar.

Chandio et al. (2019) investigated the impacts of climate change on agricultural productivity in China between 1982 and 2014. The study utilised both long-run and short-run analyses, including the Johansen cointegration test and the ARDL limits testing

technique, to evaluate the relationship between the variables under investigation. The study found that, while temperature and rainfall had a negative long-term impact on agricultural production, CO2 emissions had significant short- and long-term effects on agricultural output.

Rehman et al. (2019) studied the relationship between CO2 emissions and agricultural productivity in Pakistan to examine the short- and long-term impact of climate change factors on agricultural output in China. This study found that enhancing seed dispersal and total food grains was negatively associated with CO2 emissions.

Durodola (2019) conducted a study focused on Nigeria and found that extreme events such as droughts and floods have a significant impact on agricultural production and food security. Schnitter and Berry (2019) also revealed that climate-related changes in the food system could negatively affect human health by reducing food security.

Xu et al. (2019) measured the effects of climate change and human interventions on agricultural production and food security. This study analysed the impact of population, sown area, fertiliser use intensity, and climate change on agricultural production and food security from 1990 to 2015. This study utilised data on factors such as cropland, fertiliser use, precipitation, mean temperature, population size, and the total production of wheat, rice, beans, maize, and tubers. Food security was measured by per capita food availability and the econometric relationship between the dependent and independent variables was examined using the OLS model.

The study found that more than one-fourth of the counties in the Yangtze River Basin have been exposed to a high risk of food insecurity, with between 19.4% and 27.4% of counties experiencing severe or moderate food insufficiency since 1990. Solaymani (2017) employed a stochastic technique to investigate the impact of changes in rainfall and temperature on food security in Malaysia, specifically, food supply and access difficulties. This study analysed the short- and long-term effects of these changes on food security. The study found that due to a decrease in the supply of agricultural products, pressure from commodity inflation, and a decrease in household income, rainfall–temperature variability had a negative impact on food availability and access in both time periods.

The study concludes that climate variability shocks have detrimental effects on consumption and welfare across all household types, particularly in rural areas. The decrease in food availability and access caused by these shocks can lead to reduced consumption and welfare, which can have long-term negative effects on food security.

Rahim and Puay (2017) examined the relationship between economic expansion and climate change in Malaysia from 1983 to 2013. The study utilised unit root tests, including the Dickey-Fuller GLS (DF-GLS) and ADF, the Johansen cointegration method (JCA), and the vector error correction model to evaluate the variable (ECM). The study variables were gross domestic product (GDP), precipitation, temperature, and arable land. The findings indicate that the research variables have a long-run co-integration connection. The relationship between GDP, temperature, and arable land is a one-way causal.

Agbola and Fayiga (2016) conducted a study in Nigeria and found that extreme climatic events such as flooding, excessive heat, and drought degraded the soil, resulting in low crop yields. This decline in agricultural yield may cause farmers to modify their way of life, particularly in rural areas. Qureshi et al. (2013) also reported that climate change had a negative impact on agricultural exports in Australia, raising concerns about the safety of the world's food supply.

2.4 Hypothesis Development

The development of hypotheses based on a literature review was the goal of this study.

2.4.1 Sustainability Agricultural Practice and Food Security

The majority of the existing literature supports the notion that sustainable agricultural practices increase food security (Setsoafa et al.,,2022; Huan et al., 2022; Nagy and Al Jaafreh, 2020). Based on this, the research follows the majority and the Sustainable Intensification analytical framework as it hypothesizes that

H_1: Sustainability Agricultural Practice enhance Food Security,

2.4.2 Climate Change and Farming Activities

Most of the existing literature supports the notion that Climate Change adversely affects Farming Activities such as Akzar and Amandaria (2021), Htoo (2021), and Bocchiola et al. (2019). Hence, we propose the following hypotheses:

H_2: Climate Change adversely affect Farming Activities

3 Methods

3.1 Study Area

Benue State, which is also known as the Food Basket of the Nigeria, due to its impact in agricultural production, is one of the 36 states of the country. Having a land area of approximately 33,955 km^2, and a population of about 4,253,641. The state was established in 1976 by splitting the former Benue-Plateau state. Benue State is in the north-central geopolitical region of Nigeria, with Makurdi as its capital. The state is divided into twenty-three local government areas, including Ado, Agatu, Apa, Buruku, Gboko, Guma, Gwer-East, Gwer-West, Katsina-Ala, Konshisha, Kwande, Logo, Makurdi, Obi, Ogbadibo, Ohimini, Oju, Okpokwu, Otukpo, Tarka, Ukum, Ushongo, and Vandeikya. Most of the population works as farmers, whereas those living near rivers primarily fish. Benue State shares its southern and eastern borders with Cameroon**.**

3.2 Research design

This chapter presents the research methodology applied to data collection and analysis. It covers the research design, sample and sampling procedures, data sources, data-gathering tools, and data analysis and presentation techniques.

This study employed a descriptive methodology to investigate the effects of sustainable agricultural practices on food security and the influence of climate change on farming activities in Benue. The study utilized Standardized questionnaires were used for data collection, analysis, and interpretation. While standardized questionnaires gather data, they may limit the output to basic numerical summaries rather than to detailed narratives and comprehensive analyses of human perception.

3.2.1 Sources of data

Both primary and secondary data sources were used in this study. A systematic questionnaire was used to gather primary data. Secondary data included information from pertinent books, journals, news articles, newspaper articles, and the Internet.

3.2.2 Data Collection Instruments.

Primary data were collected using an online Google Forms survey. According to Saunders et al. (2016), sampling can generate statistical findings that accurately represent the entire population without necessitating the collection of data from every individual.

During the questionnaire distribution process, a representative from the Benue state aided in reaching out to a wide range of individuals, including university students, teachers, parents, and people of various ages and educational backgrounds, who were primarily engaged in farming. Data were collected between 15/03/23 March 30/03/23. A total of 49 responses were obtained from various regions in the state of Benue. The questionnaire did not have any open-ended questions and instead used a 3-point Likert scale (Yes, No, and Maybe) to limit the amount of high-quality data that the researcher could gather from the participants. As a result, a significant amount of data was collected. The questionnaire can be found in the appendix.

3.2.3 Data presentation and analysis

The techniques for data analysis were decided upon when the target population, sample size, research methodology, and data collection were determined. Descriptive statistics were used to analyse the demographics and research issues. Descriptive statistics, such as frequency, percentage, and diagram, were used to analyse the data. To answer the research questions and hypotheses.

4 Results and Interpretations

The fourth chapter focuses on the results obtained from the various analyses. The analyses were conducted according to the three research questions of this study. The first section of this chapter highlights the characteristics of the participants, and the second section provides critical accounts of the main results and discussion.

4.1 Demographic Analysis

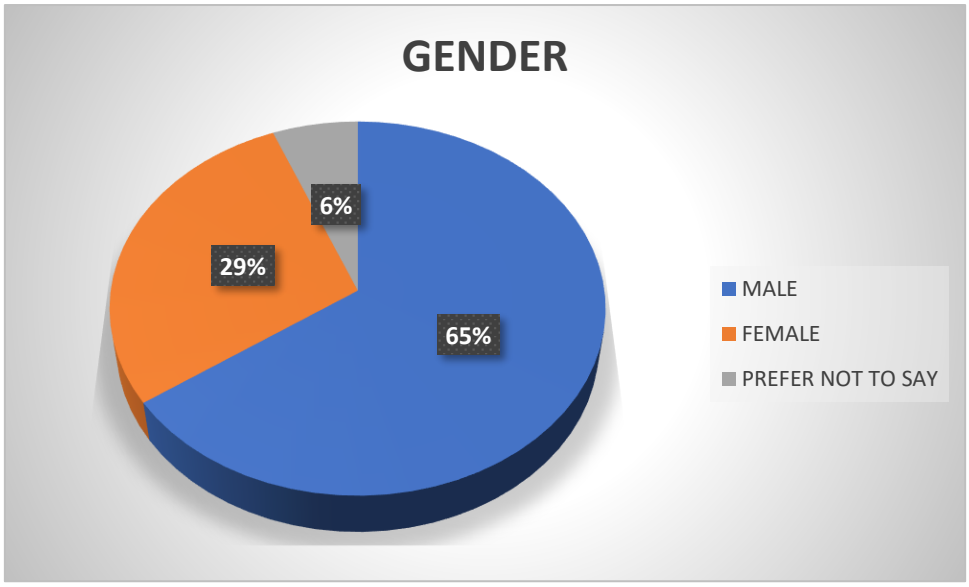

Figure 1*: Gender of respondents*

The data revealed that 65% of the respondents were male, 29% were female, and 6% chose not to disclose their gender (Figure 1). This suggests that a larger proportion of respondents were male, indicating that the majority of farmers in Benue were men.

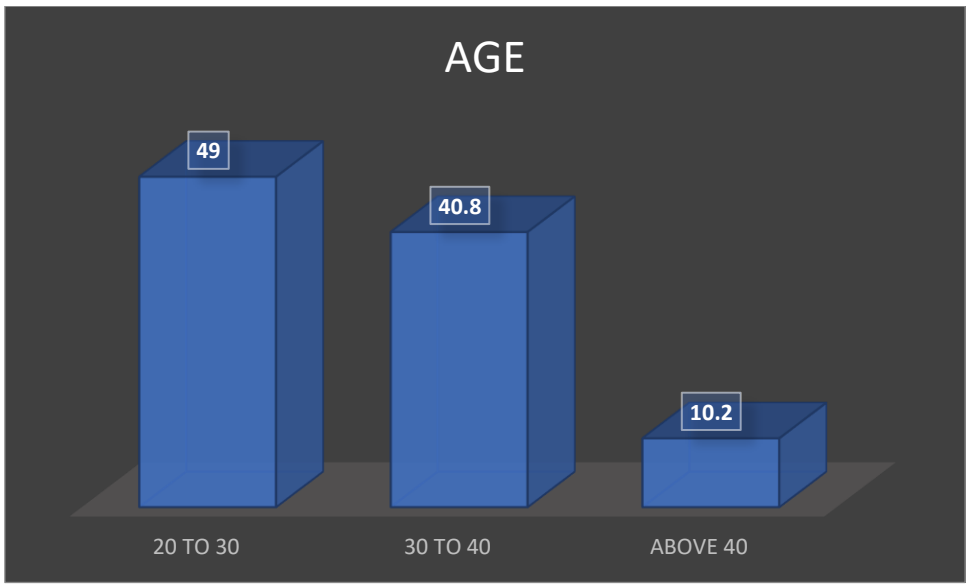

Figure 2: *Age of the Respondents*

According to the results, 49% of the respondents were 20–30 years old, 40.8% were 30–40 years old, and 10.2% were over 40 years old (Figure 2).

Figure 2 reveals that a higher proportion of the survey respondents fell within the age range of 20 to 30 years, while fewer farmers in the higher age bracket participated in the survey. This trend can be explained by the fact that the survey was distributed by a university student who was also within that age group and who had greater access to people in the same age range. This finding also suggests that the younger generation is more interested in and willing to engage in farming practices.

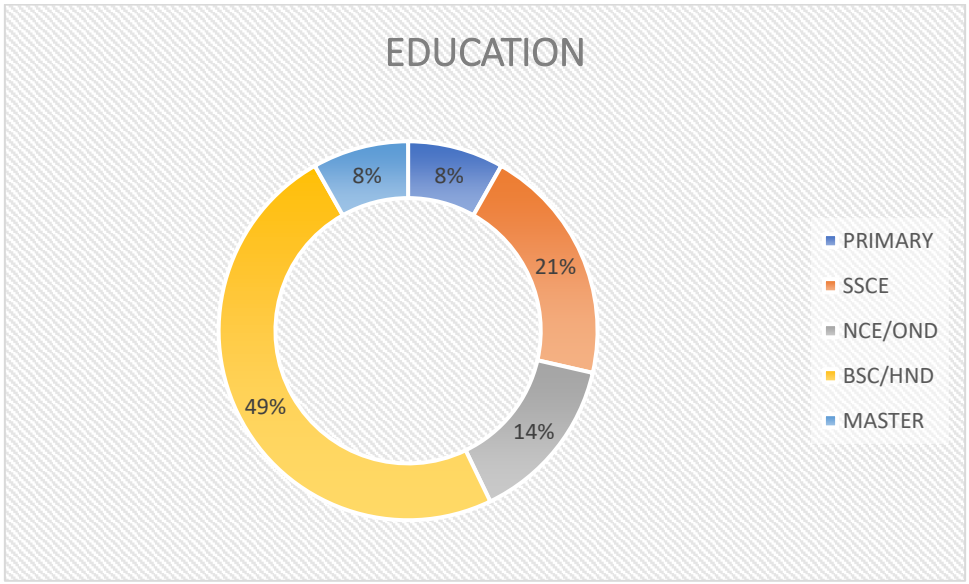

Figure 3: *Education of the Respondents*

The survey results indicated that 8% of the respondents had a primary education alone, 21% had SSCE, 14% had NCE/OND, 49% had a bachelor 's or higher diploma degree (BSC/HND), and 8% had master's degrees (Figure 3). This shows that the respondents with BSC/HND were the largest group. A larger number of people are graduates and students who are interested in agriculture, which indicates that the majority of youth in the region specialise in farming despite their qualifications in agriculture or other fields of study.

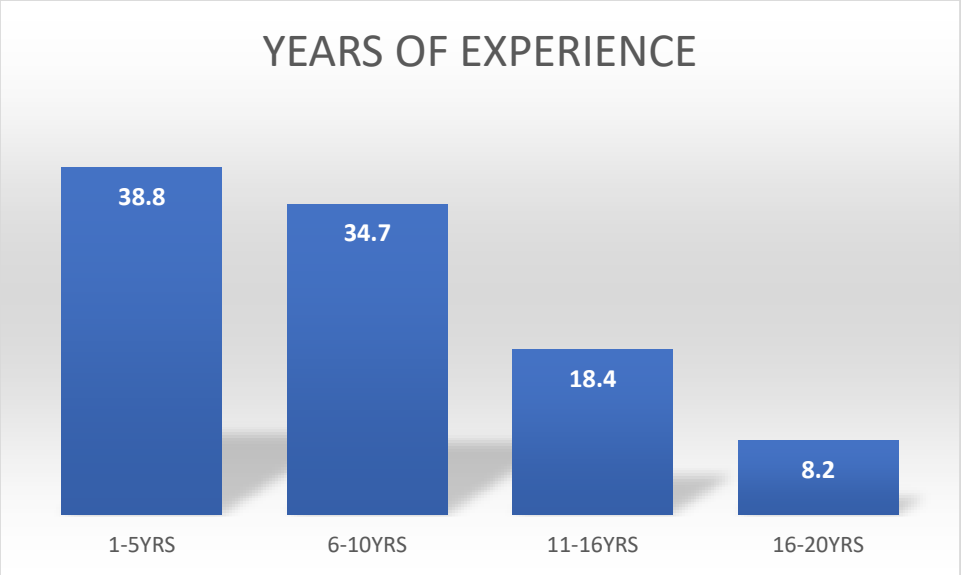

Figure 4: *years of experience*

According to the data, 38.8% of the respondents had 1–5 years of farming experience, 34.7% had 6–10 years of experience, 18.4% had 11–16 years of experience, and 8.2% had 16–20 years of experience (Figure 4). The figures indicate that the largest group of respondents (38.8 %) had one to five years of farming experience, which aligns with the largest age group in figure 2. This suggests that most of the responses were from graduates and students.

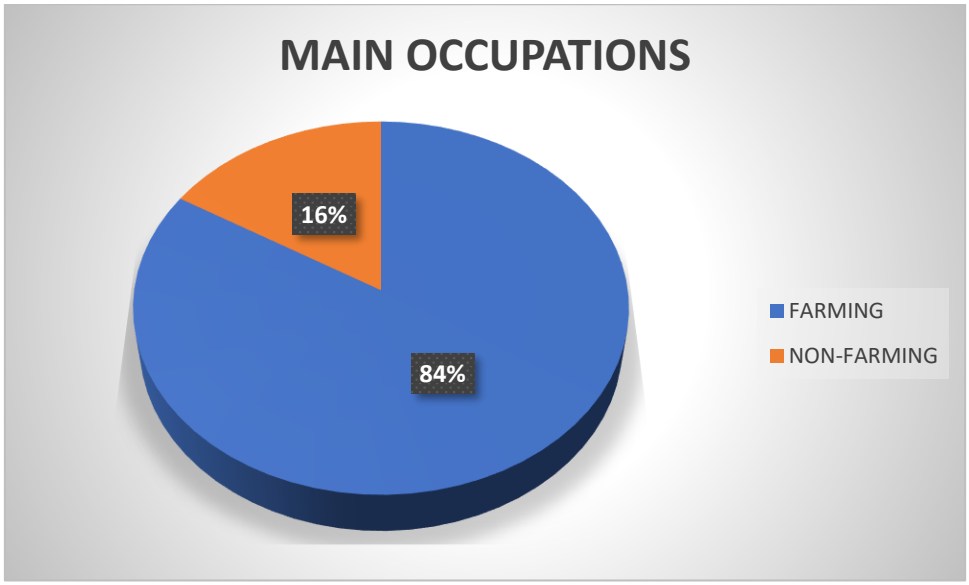

Figure 5: *Main Occupation of the Respondents*

Figure 5 shows that 84% of the respondents were farming as a major occupation, while 16% were engaged in secondary work. This shows that a higher percentage of the respondents were farmers.

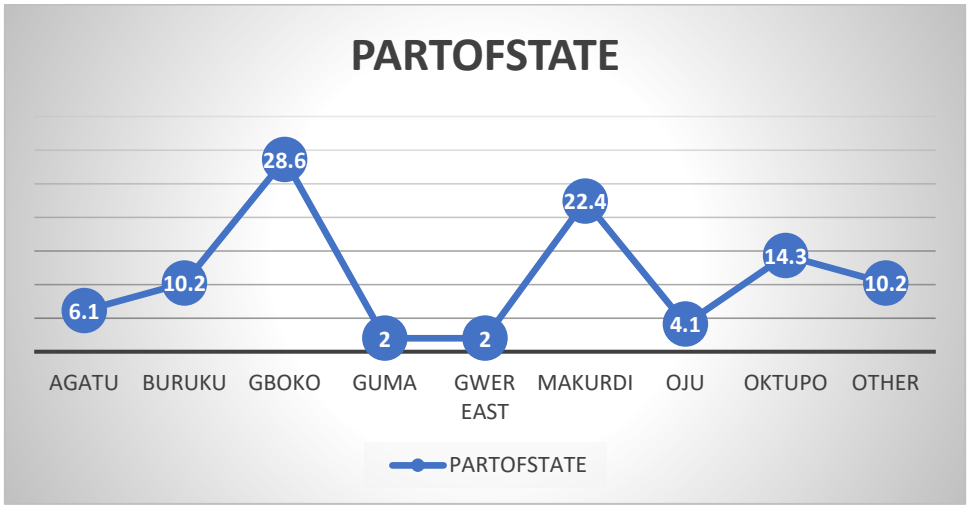

Figure 6: *Part of the state*

Figure 6 shows that 6.1% of the respondents were from the Agatu part of Benue, 10% from Buruku, 28.6% from Gboko, 2% from Guma, 2% from Gwer East, 22.4% from Makurdi, 4.1% from Oju, 14.3% from Oktupo, and 10.2% from other parts of the state. This implies that gboko had the highest percentage (28.6 %). These are represented by the red dots in Figure 7.

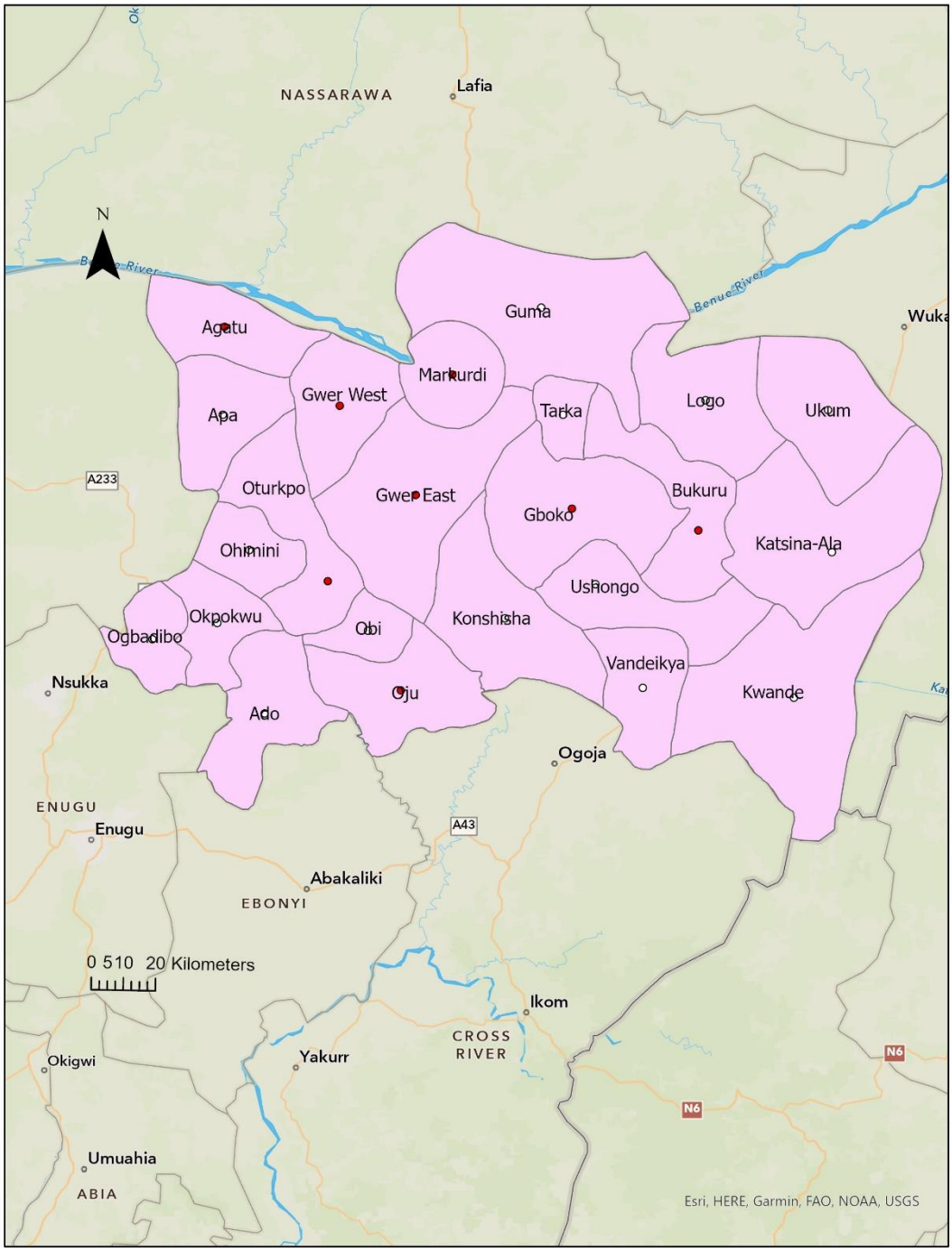

Figure 7: *Map of Benue* State. The red dots indicate the cities where the questions were answered.

4.2 Presentations of Major Findings

This section details the results of data analysis. The major findings of the analysis are presented in accordance with the research questions that this study sought to answer. The findings are also interpreted in the context of factors that determine sustainable agricultural practices, how these factors influence food production, and how climate change has affected farming activities in Benue.

4.2.1 Sustainable Agriculture Practices in Benue

Research Question 1 sought to investigate the sustainable agricultural practices that farmers in Benue engage in. Data collected from 49 participants to answer RQ1 were analysed using descriptive statistics. Seven items in the survey were tailored to elicit responses from participants to answer RQ1. The results are presented in Table 1 using the frequency distribution of each response and their percentages.

As shown in Table 1 and Figure 8, more than half the participants indicated that they had adopted sustainable agricultural practices in their farming activities. However, intercropping, improved seeds, and crop rotation are the three most common sustainable agricultural practices among farmers in Benue. For instance, 39 out of the 49 participants mentioned that they adopted intercropping in their farming activities. Based on these results, it can be concluded that intercropping is a sustainable agricultural practice that farmers adopt in their farming activities.

Table 1: Participants' responses to sustainable agricultural practices

What are the sustainable agricultural practices do farmers in Benue engage in?

Questions	Yes		No		Maybe	
	Frequency	%	Frequency	%	Frequency	%
1. Do you practice intercropping?	39	79.6	7	14.3	3	6.1
2. Do you use organic fertilisers/manure on your farm?	35	71.4	5	10.2	9	18.4

3. Do you keep trees in your farm area?	30	61.2	10	20.4	9	18.4
4. Do you embrace the use of improved seed?	41	83.7	6	12.2	2	4.1
5. Does your farming employ fewer chemical fertilisers?	35	71.4	5	10.2	9	18.4
6. Do you constantly apply biological pest control measures?	36	73.5	3	6.1	10	20.4
7. Do you engage in crop rotation?	45	91.8	4	8.2	-	-

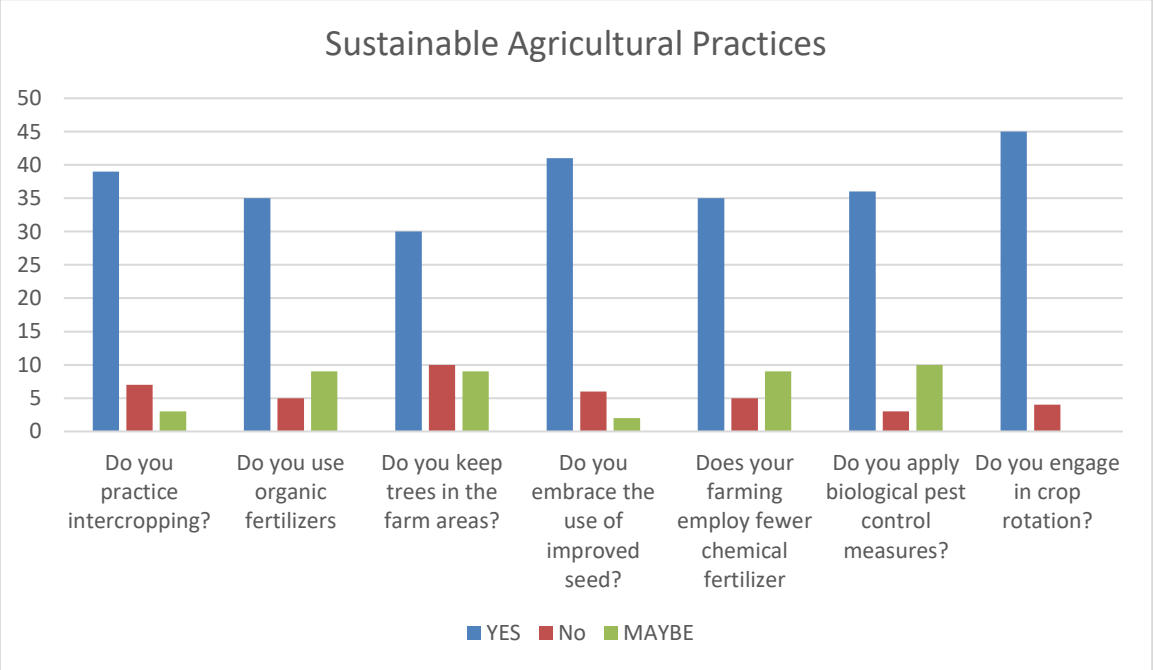

Figure 8: *Sustainable agricultural methods practiced by respondents.*

2. How does climate change affect farming in Benue State?

Table 2: Participants' Knowledge about Climate Change

Questions	Yes	No	Maybe

	Frequency	%	Frequency	%	Frequency	%
1. Have you experienced extremely high temperatures more frequently in recent years?	43	87.8	6	12.2	-	-
2. Have you experienced extremely low temperatures more frequently in recent years?	36	73.5	13	26.5	-	-
3. Have your farm activities been affected by low rainfall more often in recent years?	43	87.8	6	12.2	-	0
4. Have your farm activities been affected more often by rainstorm/heavy rain in recent years?	31	63.3	11	22.4	7	14.3
5. Have you experienced pest/disease outbreaks more frequently in the recent years?	31	63.3	18	36.7	-	-

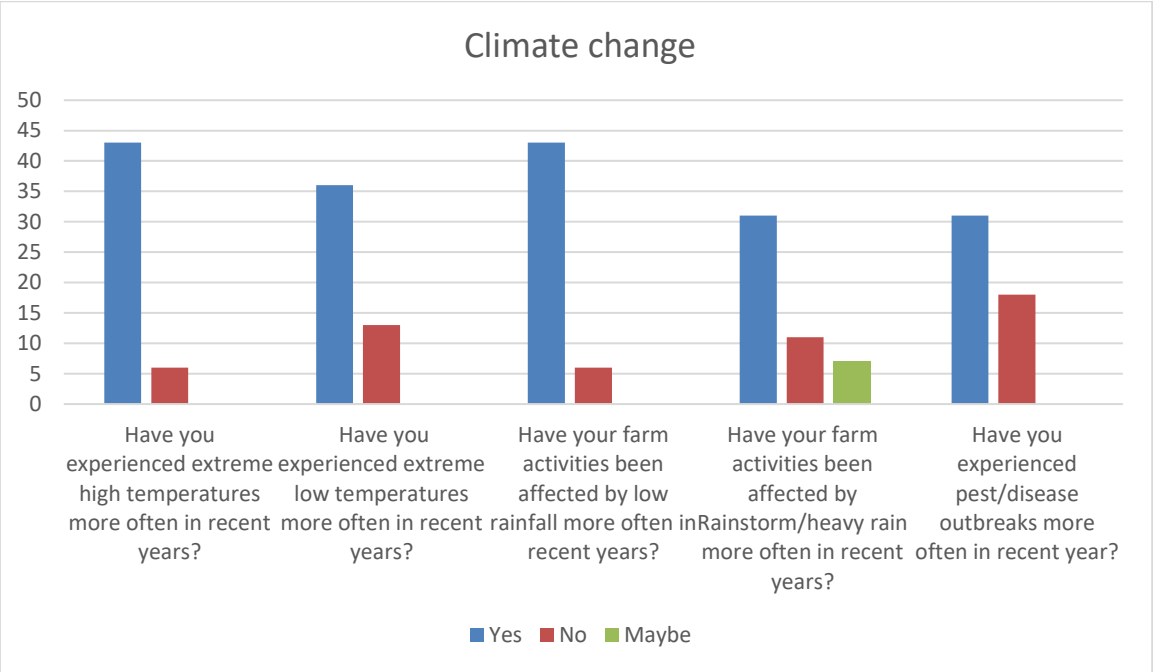

Figure 9: *Impact of climate change experienced by respondents.*

The primary objective of Research Question 2 was to investigate the influence of climate change on farming practices in Benue Province. To achieve this goal, a survey was conducted with 49 participants and the data collected was analyzed using descriptive statistics. The survey comprised five questions specifically designed to gather information on the impact of climate change on participants' farm produce. The results of the survey are presented in Table 2 and Figure 9, which provide a comprehensive overview of the frequency distribution and percentage of each response. This table offers valuable insights into participants' perceptions of the effects of climate change on their farming practices in Benue State.

Based on survey responses, a significant proportion of farmers reported experiencing the effects of climate change, including high rainfall, low rainfall, low temperature, high temperature, and pest and disease outbreaks. These findings suggest that farmers in Benue State have been greatly affected by climate change, which could potentially lead to reduced yield and productivity. Therefore, it can be concluded that climate change is a significant challenge for farmers in the region, and appropriate measures need to be taken to mitigate its effects and ensure sustainable agricultural practices.

Table 3: Participants' Responses to Food Security

(What strategies do farmers in Benue adopt to ensure food security)

Questions	Yes		No		Maybe	
	Frequency	%	Frequency	%	Frequency	%
1 Has your farm increased the size of production or livestock in the last 5 years?	36	73.5	13	26.5	-	-
2.Do you plan to increase farm production or livestock in the near future?	42	85.7	4	8.2	3	6.1
3. Do you practice integrated farming (livestock and crops) on your farms?	33	67.3	15	30.6	1	2.0
4.Do you think there are advantages of small-scale farming?	43	87.8	3	6.1	3	6.1
5.Does your farm produce high-quality output?	43	87.8	3	6.1	3	6.1
6.Are your products available for sale in the market?	44	89.8	5	10.2	-	-
7.Are your farms safe for human consumption?	44	89.8	5	10.2	-	-

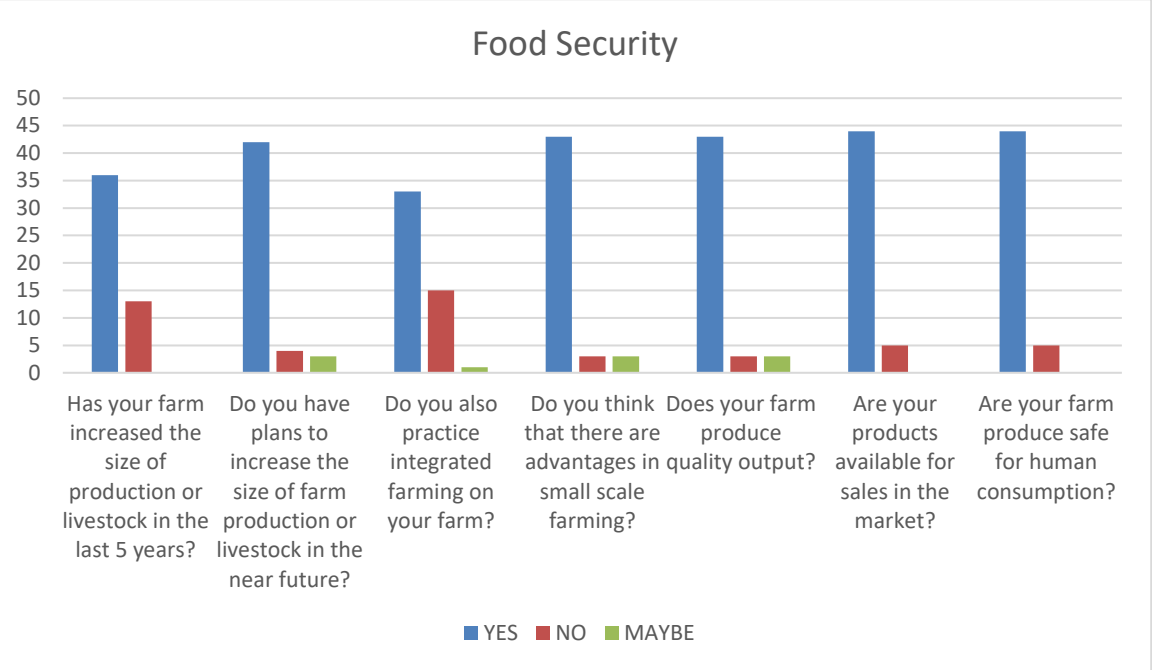

Figure 10: Strategies adopted by respondents to achieve food security.

The objective of Research Question 3 was to investigate the strategies adopted by farmers in Benue State to ensure food security. A total of 49 participants responded to the survey, which consisted of seven questions designed to gather information on the strategies employed by farmers. Almost all respondents answered affirmatively to all the survey questions, indicating that they have adopted various strategies, such as making their products available for sale, producing high-quality crops, ensuring the safety of farm produce, implementing integrated farming practices, increasing farm productivity, and being aware of the benefits of small-scale farming practices. These findings suggest that farmers in Benue State take proactive measures to ensure food security and improve their livelihood.

TABLE 4: Challenge Facing Farming and Food Security

		Frequency	Percent
Which of the following is the major threat to food security?	ALL OF THE ABOVE	37	75.5
	CLIMATE CHANGE	4	8.2
	FARMER-HERDER CLASH	2	4.1
	INSECURITY	3	6.1
	LAND TENURE SYSTEM	2	4.1
	LOW CREDIT ACCESS TO LOAN	1	2.0
	Total	49	100.0

Table 4 reveals that 2% of the respondents agreed that low credit access to loans was the major constraint to farming and food security in the Benue state. 4.1% stated that the land tenure system is a major threat, and 6.1% are of the opinion that insecurity is a major issue. 4.1% are of the opinion that farmer herder clash is the major threat, 8.2% said that climate change is the major problem, and 75.5% stated that all the above-mentioned issues are the major problem affecting farming activities and food security in the Benue state. In other words, farmers in the state face a number of challenges and addressing them requires a comprehensive approach.

5 Discussions

The results showed that farmers in the state practice sustainable agriculture through crop rotation, intercropping, and tree planting, which preserve soil nutritive value and improve food security. This conformed to UN Sustainable Development Goal 2 (SDG 2), with the goal of ensuring food security and ending all forms of hunger by 2030.

The responses highlighted farmers' effective use of natural resources by planting trees to increase soil fertility, reduce erosion, and promote biodiversity. It is necessary to reduce the use of chemical fertilisers because of their environmental impact. These practices agree with Pieiro et al. (2021) in that sustainable agricultural techniques allow for more effective use of natural resources, reduce the environmental impact of agriculture, and improve the capacity for adaptation to climate change and climate variability. Encouraging tree planting and using improved seeds can promote sustainable agriculture and improve yields, while reducing environmental issues. Overuse of chemical fertilisers can lead to soil degradation, nutrient depletion, reduced crop yields, and harm to food security. Chemical fertiliser production and application contributes to greenhouse gas emissions and water contamination, harms aquatic ecosystems, and reduces biodiversity. Organic fertilisers are safe, eco-friendly, and can promote healthy plant growth without harming the environment. The regular use of organic fertilisers supports a sustainable future. This finding is consistent with sustainable intensification analytical framework theory, which advocates the use of various tools to improve production. Techno-ecologists believe that by utilising technology and human effort, yields can be increased, while minimising harm to the environment.

Research has revealed that climate change is one of the most significant factors affecting food security, according to people's responses. Changes in temperature and rainfall and the effects of pests and diseases have had a negative impact on farming activities in Benue State, Nigeria; therefore, urgent action needs to be put in place.

To improve food security, most farmers are said to have practiced food security by indicating that they practiced most of the strategies to improve crop security by trying to improve farm size and produce quality. This shows that the idea of food security is evident in Benue State, which always has enough food and food products available to satisfy rising consumption demand and balance output demand and supply, which supports Idrisa et al. 's (2008) submission on food security. However, from the critical challenges faced by farmers, it will be difficult to achieve the four dimensions of food security: availability, stability, access, and utilization which FAO, 2017 also reported.

6 Conclusion

This study found that climate change has a significant negative influence on farming activities in Benue State, posing a major threat to agricultural production and livelihoods in the region. This negative impact can be attributed to factors such as erratic rainfall patterns, flooding, drought, pests, and diseases. These impacts can have serious consequences for food security and livelihoods, especially for small-scale farmers who rely on agriculture for income. Reduced crop yield, increased crop failure, and reduced access to food can result in food insecurity and hunger.

Based on their responses, many farmers have claimed to have adopted sustainable agricultural practices, resulting in improved crop productivity. However, a higher percentage of farmers use both organic and chemical fertilisers, which can be inappropriate for the environment and cause severe harm.

The results indicate that most farmers have plans to increase their farm size and practice small-scale farming, with a focus on producing quality output. These strategies are expected to improve food security and enhance access to food.

6.1 Recommendation

To address the negative impact of climate change on farming activities in Benue State, there is a need for concerted efforts from all stakeholders to develop and implement climate change adaptation strategies. These strategies could include further development of climate-smart agriculture techniques, such as the use of drought-tolerant crop varieties and increased adoption of sustainable agricultural practices, as well as the development and implementation of policies that support small-scale farmers and other vulnerable groups to build their resilience to the impacts of climate change. This could include providing them access to climate information, early warning systems, and weather-based index insurance to protect their crops from climate-related risks. Overall, the findings suggest that climate change is a significant challenge for farming activities in Benue State, and urgent action is needed to address this challenge and protect the livelihoods of small-scale farmers while ensuring food security and reducing hunger in the region.

It is important to provide more education to farmers to improve their sustainable agricultural practices and to ensure food security in the state. Farmers should also consider adopting organic fertilizers instead of chemical fertilizers to reduce their environmental impact.

7 Critical Review

The process of collecting information for the survey presented some challenges, particularly in terms of distributing the survey questions to the target population. It was difficult to reach the intended audience size, which resulted in a limited number of respondents. The survey questions were answered by only a small number of people in eight out of 23 towns as shown in figure 7, as information from other towns could not be obtained. Furthermore, distributing the survey to farmers who were illiterate or lacked internet access proved to be a challenge. Consequently, only 49 respondents participated in the survey. The data collection period lasted for two weeks but extending it to a few more days may have resulted in a higher response rate. To ensure unbiased results, I believe that conducting interviews would be a more appropriate method for further studies because the lack of complete access to people can lead to biased outcomes.

8 Reference

Abdulai, A. & Huffman, W. (2014). The adoption and impact of soil and water conservation technology: an endogenous switching regression application. *Land Economics,* 90, 26–43.

Adedokun, A. S., Ogunyemi, O. I., & Lawal, A. (2018). Sustainable agricultural practices and arable farmers' productivity in Lagos State, Nigeria. *Journal of Sustainable Development in Africa,* 20(2), 103-112.

Ahmed, M. H. (2022). Impact of improved seed and inorganic fertilizer on maize yield and welfare: Evidence from Eastern Ethiopia. *Journal of Agricultural and Food Research,* 7, 100266. https://doi.org/10.1016/j.jafr.2021.100266

Adenle, A. A., Wedig, K., & Azadi, H. (2019). Sustainable Agriculture and Food Security in Africa: The Role of Innovative Technologies and International Organizations. *Technology in Society*, 58, 101143.

Agula, C., Akudugu, M. A., Dittoh, S., Mabe, F. N. (2018). Promoting sustainable agriculture in Africa through ecosystem-based farm management practices: Evidence from Ghana. *Agriculture and Food Security,* 7, 5.

Biam, C. K., & Tavershima, T. (2020). Food security status of rural farming households in Benue State, Nigeria. *African Journal of Food, Agriculture, Nutrition and Development, 20*(2), 15677-15694. doi: 10.18697/ajfand.90.17980

Ikpi, A. E. (1995). Policy relevance of research on sustainable development in Nigeria's agriculture. In A. E. Ikpi & J. K. Olayemi (Eds.) Sustainable Agriculture and Economic Development in Nigeria (pp. 5-19). *Winrock International Institute for Agricultural Development.*

Ma, W., & Wang, X. (2020). Internet use, sustainable agricultural practices, and rural income: Evidence from China. *Australian Journal of Agricultural and Resource Economics,* 64, 1087–1112. https://doi.org/10.1111/1467-8489.12390

Mgbada, J. U., Ohajianya, D. O., Nzeh, E. C. (2016). Sustainable agricultural practices and their determinants in Southeast Nigeria. *Journal of Advanced Agricultural Technologies, 3(*3), 204-215.

Ojo, T. O., Ogundeji, A. A., & Belle, J. A. (2021). Climate change perception and impact of on-farm demonstration on the intensity of adoption of adaptation strategies among smallholder farmers in South Africa. *Technological Forecasting and Social Change,* 172, 121031. https://doi.org/10.1016/j.techfore.2021.121031

Omole, D.A. (2021, June 11). Nigeria's agricultural sector is growing, but is sustainability forgotten in the rush to commercialize? Medium. https://medium.com/enabling-sustainability/nigerias-agricultural-sector-is-growing-but-is-sustainability-being-forgotten-in-the-rush-to-16e1b493e942

Onyeneke, R. U. (2021). Does climate change adaptation lead to increased productivity of rice production? Lessons from Ebonyi State, Nigeria. *Renewable Agriculture and Food Systems,* 36, 54–68. https://doi.org/10.1017/S1742170519000486

Oyetunde Usman Z., Oluseyi Olagunju K. & Rafiat Ogunpaimo O. (2021). Determinants of adoption of multiple sustainable agricultural practices among smallholder farmers in Nigeria. *International Soil and Water Conservation Research, 9*(2), 241-248. https://doi.org/10.1016/j.iswcr.2020.10.007

Rahman, K., & Zhang, D. (2018). Effects of Fertilizer Broadcasting on the Excessive Use of Inorganic Fertilizers and Environmental Sustainability. Sustainability, 10(3), 759. https://doi.org/10.3390/su10030759

Sarr, M., Bezabih Ayele, M., Kimani, M. E., & Ruhinduka, R. (2021). Who benefits from climate-friendly agriculture? Marginal returns to a rainfed system of rice intensification in Tanzania. World Development, 138, 105160. https://doi.org/10.1016/j.worlddev.2020.105160

Setsoafa, E. D., Ma, W., & Renwick, A. (2022). Effects of sustainable agricultural practices on farm income and food security in northern Ghana. *Agricultural and Food Economics,* 10, 9. https://doi.org/10.1186/s40100-022-002

Synergos. (2020). Nigeria: Launch of the First Agriculture Plan for Benue State. Synergos 2019-2020 impact report. Retrieved from https://www.synergos.org/about/2019-2020/first-agriculture-plan-benue-state-nigeria

Thinda, K. T., Ogundeji, A. A., Belle, J. A., & Ojo, T. O. (2021). Determinants of relevant constraints inhibiting farmers' adoption of climate change adaptation strategies in South Africa. *Journal of Asian and African Studies,* 56, 610–627. https://doi.org/10.1177/0021909620934836

Ujoha, F., Igbawuaband, T., & Ogidi Paul, M. (2019). Suitability mapping for rice cultivation in Benue State, Nigeria, using satellite data. Geo-spatial Information Science, 22(4), 332-344. https://doi.org/10.1080/10095020.2019.1637075

Umeh, G. N. & Igwe, G. V. C. (2019). Adoption of sustainable agricultural practices among farmers in the Ohaukwu Local Government Area of Ebonyi State, Nigeria. *Agricultural Extension Journal, 3*(4), 224-232.

United States Agency for International Development (USAID). (2022). Agriculture and Food Security. Retrieved from https://www.usaid.gov/agriculture-and-food-security

Wilken, G. C. (1991). Sustainable agriculture is a solution, but what is the problem? Occasional Paper No. 14. United States Agency for International Development.

World Health Organisation. (2022, July 6). UN Report: Global hunger numbers have risen to 828 million by 2021. Retrieved from https://www.who.int/news/item/06-07-2022-un-report--global-hunger-numbers-rose-to-as-many-as-828-million-in-2021

Yuk, E. T. (2001). Social, economic, and policy dimensions of soil organic matter management in sub-Saharan Africa: Challenges and opportunities. Nutrient Cycling in Agroecosystems, 61, 183-195. https://doi.org/10.1023/A:1013357909674

Zeweld, W., Van Huylenbroeck, G., Tesfay, G., Gebremedhin, B., & Tsegay, Y. (2020). Sustainable agricultural practices, environmental risk mitigation, and livelihood improvements: empirical evidence from Northern Ethiopia. *Land Use Policy, 95,* 103799. https://doi.org/10.1016/j.landusepol.2019.01.002.

9 Appendices

Table 1: Demographic of the Respondents

Variables	Frequency	Percentage
GENDER		
MALE	32	65.3
FEMALE	14	28.6
PREFER NOT TO SAY	3	6.1
Total	**49**	**100**
AGE		
20 TO 30	24	49.0
30 TO 40	20	40.8
ABOVE 40	5	10.2
Total	49	100.0
EDUCATION		
PRIMARY	4	8.2
SSCE	10	20.4
NCE/OND	7	14.3
BSC/HND	24	49.0
MASTER	4	8.2
Total	49	100.0
YEARS OF EXPERIENCE		
1-5YRS	19	38.8

6-10YRS	17	34.7
11-16YRS	9	18.4
16-20YRS	4	8.2
Total	49	100.0
MAIN OCCUPTIONS		
FARMING	41	83.7
NON-FARMING	8	16.3
Total	49	100.0
PARTOFSTATE		
AGATU	3	6.1
BURUKU	5	10.1
GBOKO	14	28.6
GUMA	1	2.0
GWER EAST	1	2.0
MAKURDI	11	22.4
OJU	2	4.1
OKTUPO	7	14.3
OTHER	5	10.2
Total	49	100.0

QUESTIONAIRE FOR RESPONDENTS

The objective of this survey was to gather reliable information to assess the role of sustainable agricultural practices in reducing hunger and improving food security.

1.Gender
Male

Female

prefer not to say.

2.Age
Below 20

20 to 30

30 to 40

40 to 50

3.Education level
Primary

SSCE

NCE/OND

BSC/HND

Masters

4.Years of Experience in Farming Required to answer
1-5yrs

6-10yrs

11-15yrs

16-20yrs

5.Main Occupation
Farming

Non-Farming

6.In which city are you farming in Benue state? Required to answer. Single line text.
Enter your answer.

7.SECTION B: Sustainable Agriculture, Food Security and Climate Change
Do you engage in crop rotation?
Yes

No

8.Do you practice intercropping?
Yes

No

Maybe

9.Do you use organic fertilisers/manure on your farm?
Yes

No

Maybe

10.Do you keep trees in your farm area?
Yes

No

Maybe

11.Do you embrace the use of improved seed?
Yes

No

Maybe

12.Does your farming employ fewer chemical fertilisers?
Yes

No

Maybe

13.Do you constantly apply biological pest control measures?
Yes

No

Maybe

14.Required climate change to answer.
Have you experienced extremely high temperatures more frequently in recent years?
Yes

No

15.Have you experienced extremely low temperatures more frequently in recent years?
Yes

No

16.Have your farm activities been affected by low rainfall more often in recent years?
Yes

No

17.Have your farm activities been affected more often by rainstorm/heavy rain in recent years?

Yes

No

Maybe

18.Have you experienced pest/disease outbreaks more frequently in the recent years?
Yes

No.

Food security and farming activities

19 Has your farm increased the size of production or livestock in the last five years?
Yes

No

20.Do you plan to increase farm production or livestock in the near future?

Yes

No

Maybe

21. Do you practice integrated farming (livestock and crops) on your farms?
Yes

No

Maybe

22.Do you think there are advantages of small-scale farming?
Yes

No

Maybe

23.Does your farm produce high-quality output?
Yes

No

Maybe

24.Are your products available for sale in the market?
Yes

No

25.Are your farms safe for human consumption?
Yes

No

26.Which of the following are the major threats to farming and food security?
Land tenure system

farmers-herders clash

Insecurity

low credit-access to loan

Climate change

All of the above