Perceived Effects of Climate Change and its Variability on Smallholder Farmers Agricultural Production in Southwest, Nigeria

Madumelu Vincent Chidiebere, Johnson Okeowo

Hunan Agricultural University (HUNAU), China

DOI: https://dx.doi.org/10.47772/IJRISS.2025.906000408

Received: 09 June 2025; Accepted: 15 June 2025; Published: 21 July 2025

ABSTRACT

Nigeria is committed to achieving a 20% unconditional and 45% conditional reduction in greenhouse gas (GHG) emissions by 2030, with a strong emphasis on raising awareness and preparing for the impacts of climate change by mobilizing local communities for climate change mitigation efforts. Climate change prediction and its variability have the potential to severely impact the livelihoods of smallholder farmers, leading to food shortages, among other consequences. This study aimed to assess the perceived effects of climate change and its variability on smallholder farmers' agricultural production in Southwest Nigeria. A multi-stage sampling procedure was used to select 240 smallholder farmers from Oyo and Ogun States. A structured interview schedule was used to elicit information from the respondents. Data collected were analyzed using descriptive statistics. Results revealed that 79.2% were aged between 40-70 years, 75.0% were male, 87.5% had formal education, and 54.2% had been smallholder farmers for over 10 years. Major agricultural products included maize, cassava, yam, cocoyam, and vegetables; livestock production included poultry, sheep, goats, pigs, turkeys, and so on. The main adaptation strategies used by smallholder farmers were planting cover crops (100%), mulching (98.3%), mixed farming (95.8%), and relocation to different sites (93.3%). Cover cropping, mixed farming, and mulching were consistently used in the study area. The constraints faced were limited income (Mean = 2.78), water shortage (Mean = 2.77), windstorms (Mean = 2.75), and pests and diseases (Mean = 2.72). The study concluded that climate change negatively affects agricultural production due to the inherent link between climate and the agricultural sector in Nigeria. Therefore, it is recommended that it is essential to enhance awareness and provide educational programs to smallholder farmers through various channels such as cooperative societies, media, and online platforms. Improved understanding of climate change impacts will better equip smallholder farmers to adapt to climate issues.

Keywords: Perception, Smallholder farmer, Strategies, Effect, Climate change

INTRODUCTION

Climate change has the potential to severely affect many countries that are highly dependent on agriculture, leading to food shortages and other consequences. Scientific evidence demonstrates that climate change is a global problem impacting human beings and their socio-economic activities, livelihoods, health, and food security (Amjath-Babu et al., 2016; Clarke et al., 2012). Therefore, people who depend on agricultural production, such as animal husbandry and farming, require a variety of adaptation strategies to mitigate the negative effects of climate change and its variability. Rural agricultural practitioners in Sub-Saharan Africa are expected to be particularly vulnerable to the impacts of climate change, especially due to the combined effects of poverty, inadequate infrastructure and technological development, and a significant reliance on rain-fed agriculture (Lipper et al., 2014; Ericksen et al., 2011; Nelson et al., 2014; Adimassu and Kessler, 2016). Over 95% of agricultural output in Sub-Saharan Africa depends on rainfall (see Simelton et al. (2013), Adebisi-Adelani and Oyesola (2014), and Zake and Hauser (2014)). A sustainable agricultural sector is a key driver of economic development and essential for achieving the Sustainable Development Goals. This is particularly true for a country like Nigeria, which possesses abundant natural and human resources. In Nigeria, the agricultural sector is a mainstay of the economy, contributing 22.35% of the overall GDP in real terms in Q1 2021 (NBS, 2021), and employing 70 percent of the country's labour force (Anderson et al., 2017).

Furthermore, of the four activities that constitute agricultural operations in Nigeria – crop production, livestock, forestry, and fishing – crop production remains the major driver of the sector, accounting for 72% of the overall nominal growth in the sector during the first quarter of 2021. Similarly, based on Nigeria's official definition of smallholders, approximately 95% of Nigerian farmers fall into this category, while corporate and government-supported large-scale farms account for only 5 percent (Sabo et al., 2017).

Climate projections indicate that the African continent is poised to undergo substantial climatic transformations, characterized by pronounced aridity and elevated temperatures in the majority of subtropical regions, alongside marginal increases in precipitation within tropical areas (Abegaz and Wims, 2015; Adebisi-Adelani and Oyesola, 2014; Christensen et al., 2007). Furthermore, climate change models predict that the ramifications of climatic alterations will be exacerbated in various regions throughout Africa (Christensen et al., 2007; Sylla et al., 2016). Nevertheless, the primary challenge associated with these climate change models and scenarios pertinent to Africa especially south-west Nigeria lies in the complexities introduced by uncertainties surrounding potential shifts in precipitation that may accompany ongoing climatic changes. Virtually all models project an aridification of Southern Africa, coupled with considerable uncertainty regarding projections in certain areas, particularly in West Africa, while findings from the Intergovernmental Panel on Climate Change (IPCC, 2014; IPCC, 2013) and supplementary studies (Yamana et al., 2016; Valdivia and Antle, 2015; Dosio and Panitz, 2016) have illuminated ambiguities concerning forthcoming rainfall distributions in the southern Sahara, the Guinea Coast, and the Sahel.

Over the course of time, investigations concerning climate change have primarily concentrated on the evaluation of impacts and adaptation strategies, predicated upon climate change scenarios, while predominantly utilizing quantitative climatological data and models. Nevertheless, a comprehensive understanding of climate change will not be fundamentally confined to the numerical values of climatic parameters; it will equally incorporate variability and the concomitant extreme weather phenomena, as well as the interpretations of these phenomena by local agricultural practitioners who are affected by such changes. Consequently, there exists a necessity for a thorough investigation aimed at scrutinizing farmers' perceptions of extreme weather occurrences, their substantial repercussions on agricultural crop and livestock production, and their adaptive strategies. The dissemination of scientific findings to farmers, coupled with the integration of their insights, will prove invaluable in the implementation and oversight of strategies designed to enhance crop yields not only in Africa but also in other tropical regions. This understanding will empower rural farmers to formulate localized responses to the anticipated ramifications of climate change (Zake and Hauser, 2014; Nyasimi et al., 2013; Savo et al., 2016; Adimassu and Kessler, 2016).

A comprehensive examination of the scholarly literature pertaining to climate change reveals that a disproportionate emphasis has been placed on the modelling of climate change systems, the evaluation of climate change impacts, the strategies for adaptation, and the assessment of risks; however, there remains a notable deficiency in the exploration of the perceptions and adaptive strategies employed by individuals directly experiencing the ramifications of climate change. In the context of the effects of climate change on smallholder agriculture, it becomes evident that a significant disparity exists between the analytical perspectives of scientists regarding global climate change and the cognizance of rural farmers. Notwithstanding the considerable progress achieved in climate science concerning the comprehension and management of climate change and its repercussions on the agricultural sector at a global scale, the level of awareness and apprehension regarding this issue at the local level, particularly among rural farmers in Africa, remains of paramount importance. Investigations conducted in various regions of the world have demonstrated that farmers develop coping mechanisms in response to climate change predicated upon their individual perceptions of climatic alterations (Abid et al., 2015; Li et al., 2013). Climate change has been identified as a significant factor contributing to the reduction in food production, a phenomenon that has become increasingly evident over the past two to three decades (FAO, 2015). While this issue is recognized as a global concern, it is particularly acute in developing nations, with sub-Saharan Africa ranking among the most severely impacted regions in the tropical domain (FAO, 2015; Essien, 2013). The diversity of food crops cultivated in these areas is profoundly influenced by alterations in climatic conditions. Gray (2021)] indicated that the escalation of regional temperatures attributable to climate change, especially within tropical zones, can induce heat stress across various crop species. A substantial proportion of nations in sub-Saharan Africa are primarily agrarian, with a significant segment of their populace residing in rural settings. These rural populations are heavily reliant on agricultural activities as their primary source of income (Essien, 2013), and their farming methodologies predominantly depend on direct precipitation rather than irrigation systems (Molden et al., 2011).

Although proficient agricultural management strategies possess the capacity to serve as a foundation for efficacious climate change adaptation techniques, it is imperative that indigenous knowledge be integrated with scientific knowledge frameworks to mitigate adverse impacts (Morton, 2017). In instances where agricultural yields diminish due to losses attributable to climate change, as illustrated by alterations in the temporal dynamics of the onset and cessation of rainy (growing) and dry seasons, farmers incur significant costs due to their lack of awareness or preparedness. In the current investigation, the comprehension of rural farmers regarding climate change, its repercussions, and their specific adaptation strategies, constitutes a legitimate basis for science-oriented evaluations aimed at analyzing climatic trends. A substantial proportion of the food consumed in Nigeria is derived from small-scale agricultural practices (i.e., rural farming). These agricultural producers comprise approximately 80 percent of the nation's farming demographic (Essien, 2013; Mgbenka, et al., 2015] and exhibit relatively low levels of agricultural productivity (Okoye and Adamade, (2016). Presently, a significant disparity exists between the overall production of food crops and the burgeoning population of Nigeria, characterized by food production increasing in an arithmetic progression while the population expands in a geometric progression [FAO, 2015; Essien, 2013). This situation suggests that climate change may jeopardize initiatives aimed at addressing both current and prospective food security challenges within this region [FAO, 2015; Osuafor and Nnorom, 2014). An imperative exists to examine the ramifications of climate change on food security in Nigeria through a comprehensive academic lens (World Bank, 2013). Evaluating the repercussions of climate change on food security is crucial for formulating policies that can facilitate interventions and allocate resources directed toward adaptive agricultural methodologies to guarantee stable food production (Burton, et al., 2005; Battisti and Naylor, 2009). In light of this context, the present investigation was initiated to explore the perceived effects of climate change and its variability on agricultural production in southwest, Nigeria. The aims of the research were to:

1. describes socio-economic characteristics of smallholder's farmers in the study area.
2. ascertain the type of agricultural production embarked upon by smallholder farmers towards climate change and its variability in the study area.
3. determine the adaptation strategies and extent of used by smallholder farmers towards climate change in the study area.
4. identify the constraint faced by the smallholder farmers to cope with impacts of climate changes and its variability in the study area.

MATERIALS AND METHODS

Study Area

This research was conducted in the southwestern region of Nigeria, encompassing Lagos, Ekiti, Ogun, Ondo, Osun, and Oyo States, predominantly inhabited by the Yoruba ethnic group. This group represents the most significant ethnic community along the West African coastline and ranks among the largest and most enduring ethnic populations on the African continent. The aggregate population of this region amounts to 27,581,992, with Lagos state accounting for 9,013,534; Oyo 5,591,598; Ondo 3,441,024; Osun 3,423,535; Ogun 3,728,098; and Ekiti with 2,384,212 (National Population Census 2006). The entire southwestern area is situated within the humid tropical zone, bordered by a mangrove swamp forest to the south. The majority of the research area is characterized by freshwater swamp forests and rainforests to the south, transitioning into moist and dry woodland savannah as one moves northward. This region encompasses a land area of approximately 114,271 square kilometers, constituting about 12% of Nigeria's total landmass, positioned between latitudes 4°21' and 9°23' North of the equator and longitudes 2°25' and 6°31' East. The flora is comprised of a combination of coastal vegetation, freshwater swamp forests, lagoonal marshes, and lowland rainforest ecosystems, as well as derived or savanna close canopy woodlands. The climate is predominantly defined by a sub-humid equatorial

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VI June 2025

savannah climate, characterized by a dry season during which precipitation levels fall below 60 mm. The annual rainfall typically ranges from 900 mm to 1500 mm. A bimodal rainfall distribution is observed, with peak precipitation occurring in July and August, influenced by the Inter-tropical discontinuity (ITD). A brief dry season, referred to as the August break, is generally experienced in the month of August. The mean maximum temperature fluctuates between 28°C and 36°C, with February and March identified as the warmest months. The lowest daytime temperatures are typically recorded during the August break. Precipitation is recognized as the most critical climatic factor essential for human sustenance, as well as for the survival of ruminant grazing herds. Periods of reduced rainfall result in a scarcity of both feed and water, necessitating increased grazing distances. The climatic conditions are conducive to the cultivation of a variety of crops, including cassava, maize, sorghum, yams, rice, cocoyams, and beans. Southwestern Nigeria can be classified from two distinct perspectives: the geo-political zone and the agro-ecological zone. The geo-political classification includes Oyo, Ogun, Ondo, Osun, Ekiti, and Lagos States, while the agro-ecological classification encompasses Oyo, Ogun, Lagos, Ondo, Osun, Edo, Delta, and Ekiti States. The current study is analyzed through the lens of the geo-political zones. Agriculture constitutes the foundational element of the overall developmental strategies within the zone, with crop farming serving as the principal occupation for the local populace.

Population of the study

The populations of the study comprises of smallholder farmers (both men and women) in Southwest Nigeria.

Sampling procedure and sample size

Two (Oyo and Ogun) of the six states in southwest Nigeria were purposively selected for the study due to the high number of smallholder farmers and their active participation in agricultural activities. From these two states, there are eight zones of the Agricultural Development Programme in Ogun and Oyo States (OGADEP & OYSADEP). Fifty percent (50%) of the zones were randomly selected, resulting in a total of four zones for the study. The selected zones are (i) Ogun State (OGADEP): Ilaro and Abeokuta zones, and (ii) Oyo State (OYSADEP): Saki and Oyo zones. From each of the selected states, two local government areas were purposively chosen, ensuring they were from different geographical zones. Consequently, four local governments were selected across the two states for a detailed analysis of adaptive strategies. These communities span various agro-climatic zones.

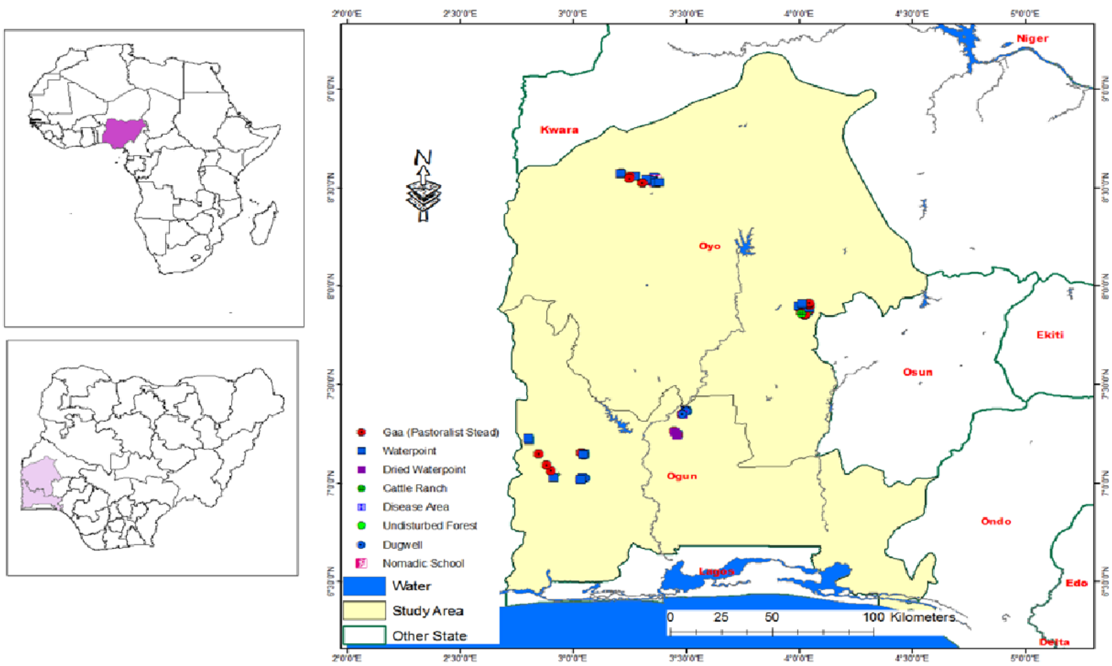

Figure 1: The study area (Ogun and Oyo State).

The communities were selected based on the concentration of smallholder farmers, the size of farmland, involvement in agricultural production, the size of the community, a receptive attitude towards the research, and the years of settlement in the location. Due to the nature of this research and the characteristics of the smallholder farmers, six cells/circles were chosen in each local government from randomly selected communities; the actual respondents were selected based on their availability and willingness to cooperate with the research team. A total sample size of four hundred and eighty (480) was selected for the study.

Data Collection Procedure and Analysis

Primary data for this study were collected using a structured interview guide to obtain relevant information on the categories of respondents; enumerators were recruited and trained in the handling and administration of the interview guide with the smallholder farmers. Secondary data were gathered from literature and previous works on climate change and adaptation strategies. Additional relevant materials were collected from textbooks, journals, magazines, published works, and the internet. Descriptive statistics were employed to analyse the collected data. The descriptive statistical tools used included frequency count, percentage, and mean.

RESULT AND DISCUSSION

Socio-economic characteristics of the smallholder farmers

The result in Table 1 reveals that majority (79.2%) of the respondents were between the ages of 40 and 70 years, with the mean age of 53.5years. This implies that respondents were middle-aged smallholder farmers, energetic to effect of climate change and to perform rigorous agricultural activities on the farm. Most of the respondents (75.0%) were male, this suggest that smallholder farmers are more practiced by males as a result of dominant nature, drudgery and strenuous agronomic practices involved in agricultural activities. The results further show that the majority (83.3%) of the respondents were married, while very few 4.2% were widowed. This means that married people were more involved in farming than single fellow. The results on household size reveal that majority (72.5%) had a household size of 3- 5 persons, while 13.3% had a household size of 6 – 8 persons. The mean household size was 4. This implies that respondents in the study area have a relative low number of people that can help in agricultural production. In terms of educational requirement, majority (87.5%) of the respondents had a form of formal education: primary, secondary or post-secondary education. Almost 13.0% had no formal education. This implies that majority of the respondents were literates, which is in support of Williams (1997) that reported that farmers‟ adoption of improved technology is influenced by their level of education, thus respondents‟ level of education will assist them to seek information on climate variation and be able to adopt available innovation when introduced to them. The farming experience of the respondents shows that, majority of the respondents (87.5%) had been practicing farming for more than 10 years, while few (12.5%) had been practicing farming for a period less than 10 years. The mean years of farming experience was 18.5years. This implies that the respondents have a considerable number of years in farming experience in relation to climate and coping mechanisms as it affects their agricultural production. Also, Table 1 further revealed that most (62.5%) of the respondents had between 1 to 3 hectares of farmland, 8.3% of the arable crop farmers had more than 7 hectares of farmland while 29.2% had between 4 to 6 hectares. The result shows that many of the respondents were small scale farmers and that farm size is a critical factor influencing the output of farmers in the study area. This is in consonance with similar result obtained by Olayide (1990) who categorized small scale farmers as ranging from 0.2 hectares to 9 hectares holding in Nigeria. Thus, the many of the respondents in this study area have farm sizes of less than 9 hectares justifying the respondents as small-scale farmers.

Table 1: Distribution based on socio-economic characteristics of respondents (n = 480)

Variables	Frequency	Percentage	Mean (x)
Sex			
Male	360	75.0	

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VI June 2025

Female	120	25.0	
Age (years)			
≤ 40	40	8.4	
41 – 50	100	20.8	
51 – 60	120	25.0	53.5years
61 - 70	160	33.3	
Above 70	60	12.5	
Marital status			
Single	60	12.5	
Married	400	83.3	
Widowed	20	4.2	
Religion			
Christianity	330	68.8	
Islam	140	29.2	
Traditional	10	2.0	
Household Size (persons)			
< 3	44	9.2	
3 – 5	348	72.5	4persons
6 – 8	64	13.3	
9& above	24	5.0	
Educational status			
No formal education	60	12.5	
Primary education	240	50.0	
Secondary education	140	29.2	
Tertiary education	40	8.3	
Farming experience			
Less than 10	60	12.5	
10 -19	300	62.5	18.5years
20 – 29	56	11.7	
Above 30	64	13.3	
Total land size (hectares)			
1 – 3	300	62.5	2.78
4 – 6	140	29.2	
7 – 9	40	8.3	

Source: Field survey, 2025

Smallholder agricultural production towards climate change and its variability

Crop planted

The findings depicted in Figure 1 were derived from numerous responses provided by the participants within the designated study area. It was noted that a significant proportion (81.3%) of the participants engaged in the cultivation of maize, while 75.0% cultivated cassava. Additionally, 64.6% and 49.6% of the respondents reported planting yam and cocoyam respectively. Furthermore, 49.2% and 42.1% of the participants were involved in the cultivation of tomatoes and permanent crops, such as oil palm, cocoa, and kola, among others. Moreover, 40.4% of the respondents identified themselves as growers of leafy vegetables, while 36.3% were engaged in the farming of fruit vegetables within the study area. The aggregated data indicated that maize and cassava were the predominant crops planted by the majority of the respondents. This observation suggests that maize and cassava are frequently cultivated in the study area, attributable to their resilience in adverse and challenging climatic conditions. A plethora of studies supports similar findings, indicating that climate change currently represents the principal threat to the agricultural sector across all global regions (Mertz et al., 2011; Muller and Shackleton, 2014; Dhanya and Ramachandran, 2015). The existing body of literature has established that both crop production and livestock farming are vulnerable to the impacts of climate change (Aggarwal, 2008) and that such vulnerabilities may lead to an anticipated reduction in the yields of numerous essential crops (Parry, 2007; Sima et al., 2015).

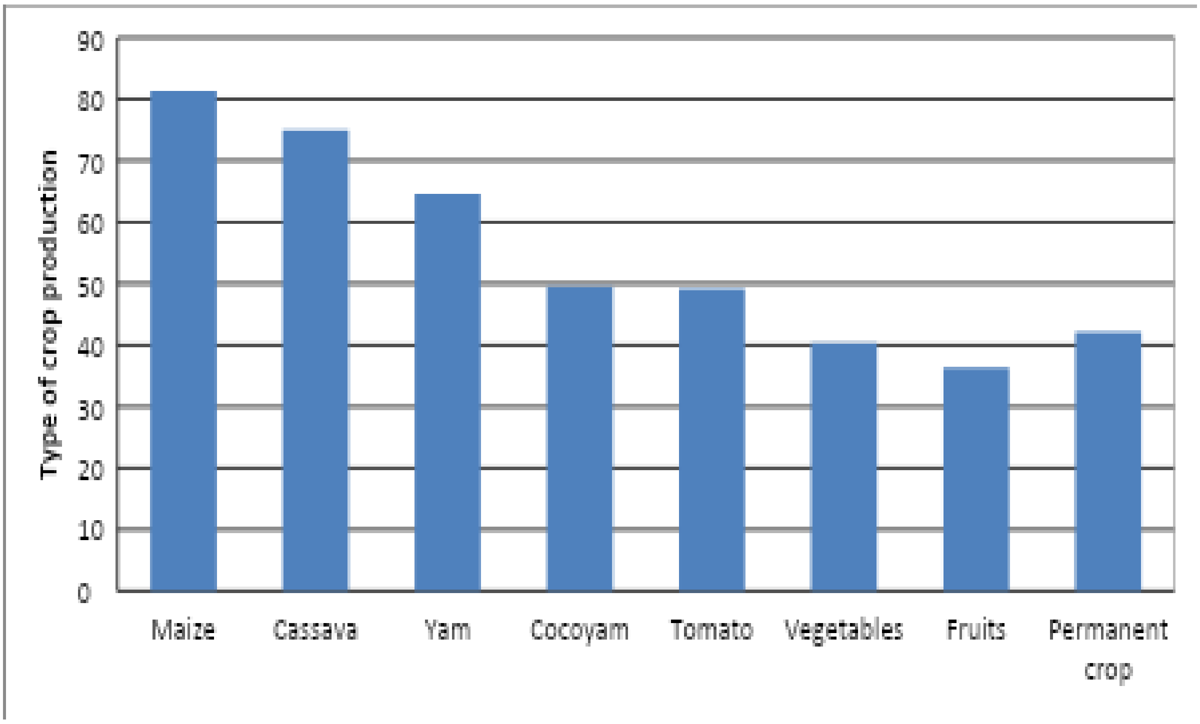

Figure 1: Type of crop produce by the smallholder farmers in the study area.

Livestock reared

The findings delineated in Figure 2 were derived from a multitude of responses obtained from participants within the specified study region. It was discerned that a predominant proportion (91.7%) of the respondents engaged in poultry production, whereas 77.1% of them participated in the rearing of sheep and goats, 64.1% were involved in pig farming, and 66.7% of the respondents practiced turkey production within the study area. Nevertheless, a minor cohort of smallholder farmers engaged in rabbit farming, snail farming, and cattle rearing within the study region. A plethora of scholarly investigations substantiate similar findings, positing that climate change presently represents the paramount threat to the agricultural sector across diverse global regions (Mertz et al., 2011; Muller and Shackleton, 2014; Dhanya and Ramachandran, 2015). The existing body of literature has chronicled that both agricultural crop production and livestock management are vulnerable to the impacts of climate change (Aggarwal, 2008) and that such exposure may lead to a projected reduction in the yields of numerous crucial crops (Parry, 2007; Sima et al., 2015).

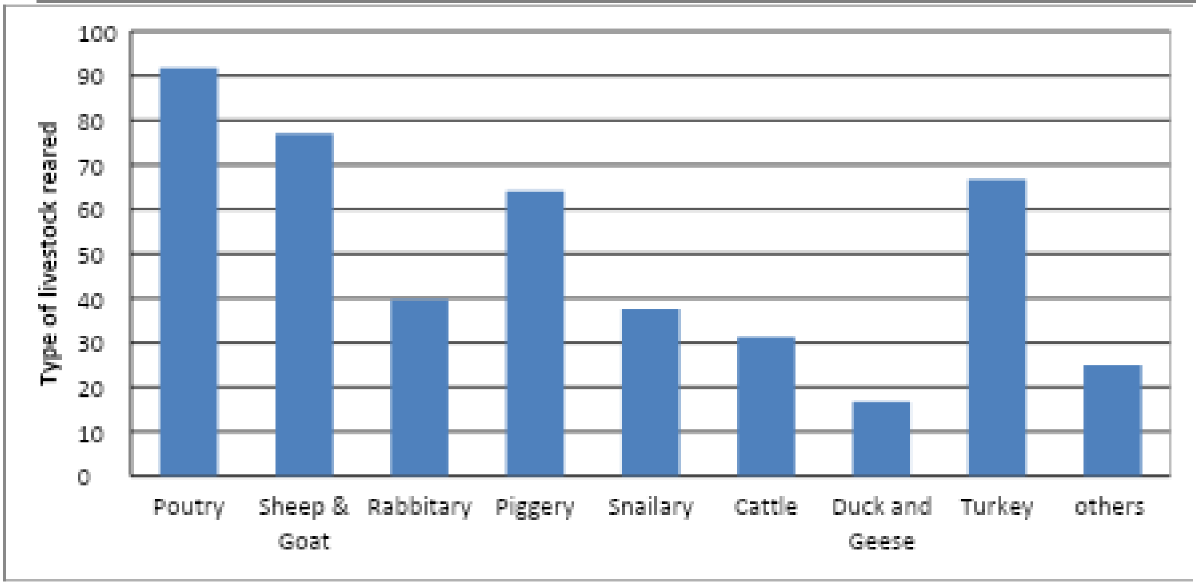

Figure 2: Type of livestock reared by the smallholder farmers in the study area.

Adaptation strategies and extent of used by smallholder farmers in the study area

Adaptation strategies by the smallholder farmers

Based on multiple responses from the respondents, the result in Table 2 shows the various adaptation strategies employed by smallholder farmers to mitigate the impact of climate variation in the study area. All the respondents (100%) indicated that planting cover crops is a measure to mitigate climate change, while most employed the use of mulching (98.3%), mixed farming (95.8%), moving to different sites (93.3%), and crop rotation (91.7%), and applying farmyard manure (83.3%). Other adaptation strategies recorded high percentages of usage, except for changing planting dates (45.8%), bush fallowing (41.7%), and the use of weather forecasts, which is non-cultural (37.5%), that recorded lower levels of usage. This indicates that weather forecast information is not readily accessible and available to arable crop farmers for utilization. An abundance of scholarly investigations in the existing literature has documented that the climate change adaptation strategies employed by agricultural practitioners are contingent upon a multitude of variables (Kuehne, 2014; Simelton et al., 2013; Burnham and Ma, 2015; Bryant et al., 2000).

Table 2: Adaptative strategies use in the study area (n = 240)

Adaptation strategies	Yes	(%)
Planting cover crop	480	100
Mulching	472	98.3
Mixed farming	460	95.8
Movement to different site	448	93.3
Crop rotation	440	91.7
Application of farmyard manure	400	83.3
Increased land cultivated	360	75.0
Decreased land cultivated	352	73.3
Changing in planting period	280	58.3
Planting of tree	260	54.2

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VI June 2025

Minimum tillage	240	50.0
Changes in harvesting date	220	45.8
Bush fallowing	200	41.7
Use of weather forecast	180	37.5

Field survey, 2025

Extent of utilisation by the smallholder farmers

Table 3 shows that the majority (75.0%) of smallholder farmers consistently use cover crops with a mean value of 2.75 as the most utilized practice in the study area. A significant portion (60.0%) of smallholder farmers also consistently practice mixed farming, with a mean value of 2.57 in terms of utilization in the study area. Furthermore, most (58.3%) smallholder farmers consistently use mulching, with a mean value of 2.56, ranking it third in terms of utilization in the study area. Overall, the data on the extent of use of adaptive strategies indicates that most smallholder farmers moderately utilize adaptive strategies in their farming activities in the study area. It has been elucidated in a majority of these investigations that smallholder farmers exhibit a heightened propensity to react to contemporary climate fluctuations (Morton, 2007, Morton, 2017); however, the efficacy of their adaptive strategies for managing climatic alterations is contingent upon their socio-cultural and economic attributes. Kuehne (2014) has observed a comparable phenomenon amongst agricultural practitioners in the South Australian Riverland, wherein these farmers employed various adaptation strategies to mitigate the impacts of extreme meteorological events attributable to climate change. Simelton et al. (2013) had previously asserted that given farmers possess a comprehension of the evolving climate, climate change scientists and policymakers must be more attuned to the perspectives of farmers to enhance the adaptation strategies they employ, thereby facilitating the formulation and execution of more effective adaptation policies.

Table 3: Extent of utilization of adaptation strategies (n = 240)

Extent of utilization	**A (%)**	**O (%)**	**N (%)**	**Mean**
Planting cover crop	360(75.0)	120(25.0)	-	2.75
Mulching	280(58.3)	192(40.0)	8(1.7)	2.56
Mixed farming	292(60.8)	168(35.0)	20(4.2)	2.57
Movement to different site	260(54.2)	188(39.2)	32(6.6)	2.50
Crop rotation	272(56.7)	168(35.0)	20(8.3)	2.48
Application of farmyard manure	260(54.2)	140(29.2)	80(16.6)	2.37
Increased land cultivated	240(50.0)	120(25.0)	120(25.0)	2.25
Decreased land cultivated	220(45.8)	132(27.5)	128(26.7)	2.19
Changing in planting period	160(33.3)	120(25.0)	200(41.7)	1.92
Planting of tree	80(16.6)	180(37.5)	220(45.8)	1.71
Minimum tillage	180(37.5)	60(12.5)	240(50.0)	1.88
Changes in harvesting date	160(33.3)	60(12.5)	260(54.2)	1.79
Bush fallowing	160(33.3)	40(8.3)	280(58.3)	1.75
Use of weather forecast	120(25.0)	60(12.5)	300(62.5)	1.62

Source: Field survey, 2025

Constraint faced by the smallholder farmers to cope with impacts of climate changes and its variability in the study area.

Table 3 presents the results showing the various climate-related constraints faced by smallholder farmers in their agricultural production within the study area. A majority (86.7%) of the respondents indicated that limited income, with a mean value of 2.78, is a significant constraint hindering smallholder farmers in adapting to climate change in the study area. Additionally, 85.0% of the respondents revealed that a shortage of water, with a mean value of 2.77, also affects smallholder farmers' ability to cope with climate change. Furthermore, 85.0% and 80.8% of the respondents identified wind storms and pests and diseases, respectively, with mean values of 2.75 and 2.72, as other major constraints impacting smallholder farmers. Most respondents (79.2%) noted occurrences of erosion, while 75.0% cited instability in the planting calendar, 72.5% mentioned high irrigation costs, and 69.2% pointed to inadequate knowledge on coping or building resilience as constraints faced by smallholder farmers. Half (50.0%) of the respondents indicated that a reduction in soil fertility was a minor issue related to climate change. Additionally, more than half of the respondents (52.5% and 50.8%) reported that lack of access to weather forecast technology and low yields were major constraints confronting them in relation to climate change. Benhin (2006) reports that a lack of access to credit or savings and insufficient information about climate change are among the major challenges faced by farmers in adapting to climate change in Africa. Deressa (2008) noted that many of the problems or constraints encountered by farmers in adapting to climate change are linked to poverty. The high rate of poverty among smallholder farmers in the state significantly impacts the achievement of sustainable development goals in Ogun State and the nation as a whole.

Table 3: Constraint to adaptation strategies. (n = 240)

Constraints	Major (%)	Minor (%)	Not a constraint(%)	Mean
Instability of planting calendar	360 (75.0)	52 (10.8)	68 (14.2)	2.60
Reduction in soil fertility	212 (44.2)	240 (50.0)	28 (5.8)	2.38
Lack of access to weather forecast technology	252 (52.5)	152(31.7)	76 (15.8)	2.37
Stunted growth	236 (49.2)	100 (20.8)	144 (30.0)	2.19
Shortage of water	396 (82.5)	56 (11.7)	28 (5.8)	2.77
Erosion occurrence	380(79.2)	30 (5.8)	72 (15.0)	2.64
Wind storm	408 (85.0)	24 (5.0)	48 (10.0)	2.75
Pest and diseases attack	388 (80.8)	48 (10.0)	44 (9.2)	2.72
Low yield	244 (50.8)	160 (33.3)	76 (15.8)	2.35
Poor access to information sources	232 (48.3)	108 (22.5)	140 (29.2)	2.19
High cost of irrigation	348 (72.5)	48 (10.0)	84 (17.5)	2.55
Inadequate knowledge on how to cope or build resilience	332 (69.2)	92(19.2)	56 (11.7)	2.58
Limited income	416 (86.7)	24 (5.0)	40 (8.3)	2.78

Source: Field survey, 2025

CONCLUSION AND RECOMMENDATION

There is no doubt that, under a business-as-usual scenario, the impacts of climate change will continue unabated in the near future. The study sites are primarily inhabited by smallholder households living below the poverty line. The majority of farming systems rely on rainfall. Consequently, climate change negatively affects agricultural production due to the inherent link between climate and the agricultural sector in Nigeria. Primarily, the study confirmed the presence of climate variability/change in the study area. Furthermore, the study gathered smallholder farmers' perceptions of recent climate variability/change. Smallholder farmers' perceptions of climate change, effective climate change adaptation methods, and local knowledge were used in conjunction with scientific knowledge systems. Farmers' perceptions of climate change impacts on both crops and livestock were examined, and climate change adaptation strategies and their extent of use were assessed. The results indicated that both crop and livestock farmers have observed changes in climate. Most farmers observed changes in weather patterns and an increase in the frequency of extreme events, which they reported as having impacts on both crops and livestock. They perceived changes in the timing of the start and end of the rains during the growing seasons and noticed that some crop yields have decreased in recent years. To effective address climate change and its variability, it is essential to enhance awareness and provide educational programme to smallholder farmers through various channels such as co-operatives society, media and online platforms. Improved understanding of climate change impacts will better equip smallholder farmers to adapt to climate issues. Furthermore, greater organisational support and promoting farmers-to-farmers knowledge exchange can foster and bolster their climate-related knowledge and influence their perception..

REFERENCES

1. Abegaz, D.M. and Wims, P. (2015). Extension agents' awareness of climate change in Ethiopia. J. Agric. Educ. Ext., 21, pp. 479-495.
2. Abid, M. Scheffran, J. Schneider, U.A. Ashfaq, M. (2015). Farmers' perceptions of and adaptation strategies to climate change and their determinants: the case of Punjab province, Pakistan. Earth Syst. Dyn., 6, p. 225.
3. Adebisi-Adelani, O. Oyesola, O. (2014). Farmers' perceptions of the effect of climate change on tomato production in Nigeria. Int. J. Veg. Sci., 20, pp. 366-373.
4. Adimassu, Z. and Kessler, A. (2016). Factors affecting farmers' coping and adaptation strategies to perceived trends of declining rainfall and crop productivity in the central Rift valley of Ethiopia. Environ. Syst. Res., 5. p. 1.
5. Aggarwal, P. (2008). Global climate change and Indian agriculture: impacts, adaptation and mitigation. Indian J. Agric. Sci., 78, p. 911.
6. Amjath-Babu, T.S. Krupnik, T.J. Aravindakshan, S. Arshad, M. and Kaechele, H. (2016). Climate change and indicators of probable shifts in the consumption portfolios of dryland farmers in Sub-Saharan Africa: Implications for policy, Ecological Indicators, Vol 67, Pg 830-838, (https://www.sciencedirect.com/science/article/pii/S1470160X16301340)
7. Battisti, D.S., and Naylor R.L. (2009). Historical Warnings of Future Food Insecurity with Unprecedented Seasonal Heat. Science. 323:240–244. doi: 10.1126/science.1164363.
8. Benhin, J. K. (2006). Climate change and South African agriculture: Impacts and adaptation options (Vol. 21). CEEPA discussion paper.
9. Bryant, C. R., Smit, B., Brklacich, M., Johnston, T. R., Smithers, J., Chjotti, Q., and Singh, B. (2000). Adaptation in Canadian agriculture to climatic variability and change. Climatic Change, 45(1), 181–201. doi.org/10. 1023/A:1005653320241
10. Burnham, M. and Ma, Z (2015). Linking smallholder farmer climate change adaptation decisions to development. Clim. Dev., pp. 1-23.
11. Burton I., Lim B., Spanger-Siegfried E., Malone E.L., and Huq S. (2005). Adaptation Policy Frameworks for Climate Change: Developing Strategies, Policies, and Measures. Cambridge University Press; Cambridge, UK: New York, NY, USA.
12. Christensen, J., Hewitson, B., Busuioc, A., Chen, A., Gao, X., Held, I., Jones, R., Kolli, R., Kwon, W., Laprise, R., (2007). Regional Climate projections [Book Section] Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change book edts Solomon S., D, M. Manning, Z. Chen, M. Marquis, KB Averyt, M. Tignor and ML Miller.-Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.
13. Clarke, C., Shackleton, S., and Powell, M. (2012). Climate change perceptions, drought responses and views on carbon farming amongst commercial livestock and game farmers in the semiarid Great Fish

River Valley, Eastern Cape province, South Africa. African Journal of Range & Forage Science, 29(1), 13–23. https://doi.org/10.2989/10220119.2012.687041

14. Deressa T, Hassen R, Alemu T, Yesuf M, and Ringler C (2008) Analyzing the determinants of farmers' choice of adaptation measures and perceptions of climate change in the Nile Basin of Ethiopia. International Food Policy Research Institute (IFPRI) Discussion Paper No. 00798. IFPRI. Development, Washington, DC. Laxenburg, Austria
15. Dhanya, P. and Ramachandran, A. (2015). Farmers' perceptions of climate change and the proposed agriculture adaptation strategies in a semi arid region of south India. J. Integr. Environ. Sci.
16. Dosio, A. and Panitz, H.J. (2016). Climate change projections for CORDEX-Africa with COSMO-CLM regional climate model and differences with the driving global climate models. Clim. Dyn., 46, pp. 1599-1625.
17. Ericksen P., Thornton P., Notenbaert A., Cramer L., Jones P., and Herrero M., (2011). Mapping Hotspots of Climate Change and Food Insecurity in the Global Tropics. Copenhagen, Denmark: CGIAR Research Program on Climate Change. Agriculture and Food Security (CCAFS).
18. Essien, E.B. (2013). Food Insecurity and Agricultural Development in Sub-Saharan Africa: Threats and Opportunities. Int. J. Dev. Stud. 25:91–115.
19. FAO. (2015). Climate Change and Food Security: Risks and Responses. Food And Agriculture Organization Of The United Nations; Rome, Italy.
20. Gray, E. (2021). NASA at Your Table: Climate Change and Its Environmental Impacts on Crop Growth. NASA's Earth Science News Team; Washington, DC, USA.
21. Kuehne, G. (2014). How do farmers' climate change beliefs affect adaptation to climate change? Soc. Nat. Resour., 27, pp. 492-506.
22. Li, C., Tang, Y., Luo, H., Di, B., and Zhang, L. (2013). Local farmers' perceptions of climate change and local adaptive strategies: A case study from the Middle Yarlung Zangbo River Valley, Tibet, China. Environmental Management, 52(4), 894–906.
23. Lipper, L. Thornton, P. Campbell, B.M. Baedeker, T. Braimoh,A. Bwalya,M. Caron, P. Cattaneo, A. Garrity, D. and Henry, K. (2014). Climate-smart agriculture for food security. Nat. Clim. Change, 4, pp. 1068-1072.
24. Mertz, O. Mbow, C. Reenberg, A. Genesio, L. Lambin, E.F. D'Haen, S. Zorom, M. Rasmussen, K. Diall o, D. Barbier, B. (2011). Adaptation strategies and climate vulnerability in the Sudano-Sahelian region of West Africa. Atmos. Sci. Lett., 12 (2011), pp. 104-108.
25. Mgbenka R.N., Mbah E.N., and Ezeano C.I. (2015). A Review of Small Holder Farming in Nigeria: Need for Transformation. AERJ. 2015;5:19–26. doi: 10.5829/idosi.aerj.2015.5.2.1134.
26. Molden D., Vithanage M., de Fraiture C., Faures J.M., Gordon L., Molle F., and Peden D. (2011). Treatise on Water Science. Elsevier; Amsterdam, The Netherlands. Water Availability and Its Use in Agriculture; pp. 707–732.
27. Morton, J. (2017). Climate change and African agriculture: unlocking the potential of research and advisory services. F. Nunan (Ed.), In Making Climate Compatible Development Happen, Wiley (in press).
28. Morton, J.F. (2007). The impact of climate change on smallholder and subsistence agriculture. Proc. Natl. Acad. Sci. USA, 104, pp. 19680-19685
29. Muller, C. Shackleton, S.E (2015). Perceptions of climate change and barriers to adaptation amongst commonage and commercial livestock farmers in the semi-arid eastern Cape Karoo. Afr. J. Range Forage Sci., 31, pp. 1-12.
30. Nelson, G.C. Mensbrugghe, D. Ahammad, H. Blanc, E. Calvin, K. Hasegawa, T. Havlik, P. Heyhoe, E. Kyle, P. Lotze-Campen, H. (2014). Agriculture and climate change in global scenarios: why don't the models agree. Agric. Econ., 45, pp. 85-101.
31. Nyasimi, M., Radeny, M., and Kinyangi, J., (2013). Climate Change Adaptation and Mitigation Initiatives for Agriculture in East Africa..
32. Okoye B.C., and Adamade C. (2016). Agriculture in Nigeria: Country Report for FAO-Nigeria; Technical Report Presented during the Technical Training on Cassava Production and Processing Technologies provided under the Framework of the FAO China South-South Cooperation (SSC) Programme. pp. 1–27. Available online:

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VI June 2025

https://www.researchgate.net/publication/351272788_Agriculture_in_Nigeria_Country_Report_for_FAO-Nigeria.

33. Olayide, S. O. (1990). Characteristics Problems and Significance of Farmers. In Olayide S.O, Eweka, J.A and Bello Osagie, V.E (eds). Nigeria small farmers‟ problems and prospects in integrated rural development.
34. Osuafor A.M., and Nnorom N.R. (2014). Impact of Climate Change on Food Security in Nigeria. Int. J. Sci. Technol. 3:208–219.
35. Parry, M.L., (2007). Climate Change 2007-impacts, Adaptation and Vulnerability: Working Group II Contribution to the Fourth Assessment Report of the IPCC, Cambridge University Press.
36. Savo, V. Lepofsky, D. Benner, J. Kohfeld, K. Bailey, J. Lertzman, K. (2016). Observations of climate change among subsistence-oriented communities around the world. Nat. Clim. Change, 6, pp. 462-473.
37. Sima, M. Popovici, E.A. Bălteanu, D. Micu, D.M. Kucsicsa, G. Dragotă, C. Grigorescu, I. (2015). A farmer-based analysis of climate change adaptation options of agriculture in the Bărăgan Plain, Romania. Earth Perspect., 2, pp. 1-21
38. Simelton, E. Quinn, C.H. Batisani, N. Dougill, A.J. Dyer, J.C. Fraser, E.D. Mkwambisi, D. Sallu, S. Stringer, L.C. (2013). Is rainfall really changing? Farmers' perceptions, meteorological data, and policy implications. Clim. Dev., 5, pp. 123-138.
39. Sylla, M.B. Elguindi, N. Giorgi, F. Wisser, D. (2016). Projected robust shift of climate zones over West Africa in response to anthropogenic climate change for the late 21st century. Clim. Change, 134, pp. 241-253.
40. Valdivia R.O., and Antle J.M., (2015). New methods to assess climate change impacts, vulnerability and adaptation of agricultural production systems: the experience of AgMIP regional integrated assessments in Sub-Saharan Africa and South Asia. In: Proceedings of the ASABE 1st Climate Change Symposium: Adaptation and Mitigation Conference. American Society of Agricultural and Biological Engineers, pp. 1–3.
41. Williams, S. K. T. (1997). Agricultural extension and food security in Nigeria. Proceedings of 3rd annual national conference of AESON, March. 6, OAU. Ile Ife.
42. World Bank (2013). Turn Down the Heat: Climate Extremes, Regional Impacts, and the Case for Resilience. Volume 2 The World Bank; Washington, DC, USA: 2013.
43. Yamana, T.K. Bomblies, A. Eltahir, E.A (2016). Climate change unlikely to increase malaria burden in West Africa. Nat. Clim. Change.
44. Zake, J. and Hauser, M. (2014). Farmers' perceptions of implementation of climate variability disaster preparedness strategies in Central Uganda. Environ. Hazards, 13 (2014), pp. 248-266.
45. National Bureau of Statistics. (2021). Nigerian Gross Domestic Product Report (Q1 2021), Central Business District Abuja.
46. Anderson, J., Marita, C., Musiime, D., and Thiam, M (2017). National Survey and Segmentation of Smallholder Households in Nigeria. Understanding Their Demand for Financial, Agricultural, and Digital Solutions. CGAP Working Paper.
47. Sabo, B.B., Isah, S.D., Chamo, A.M., and Rabiu, M.A (2017). Role of Smallholder Farmers in Nigeria's Food Security Scholarly Journal of Agricultural Science 7(1), pp. 1-5