



## ASSESSMENT OF MAIZE FARMERS' VULNERABILITY AND ADAPTATION STRATEGIES TO CLIMATE CHANGE IN ADAMAWA AND TARABA STATE, NIGERIA

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### ABSTRACT

The study assessed maize farmers' vulnerability and adaptation strategies to climate change in Adamawa and Taraba States, Nigeria. A multistage sampling procedure was used to select 400 maize farmers. Data were collected using structured questionnaires and analyzed using both descriptive and inferential statistics. The results showed that majority (64.2%) of farmers were male and married (54.4%), with 39.5% having tertiary education, indicating a relatively literate farming population. Majority (83.9%) of the respondents had access to extension services, though 50.6% reported annual contact, revealing limited frequency of advisory support. The results of Logit regression showed that age ( $P<0.01$ ), marital status ( $P<0.01$ ), educational level ( $P<0.05$ ), household size ( $P<0.01$ ), method of land acquisition ( $P<0.01$ ), farming experience ( $p<0.01$ ), secondary occupation ( $P<0.01$ ), and access to extension ( $P<0.01$ ) were significant in influencing the adoption of adaptation strategies among the respondents in the study area. The results of Pearson correlation revealed that climate variability ( $r=0.341$ ), soil quality ( $r=0.321$ ), pests/diseases ( $r=0.129$ ) significantly increased maize yield vulnerability, while access to agricultural inputs ( $r=-0.178$ ), market prices ( $r=-0.275$ ), and maize variety used ( $r=-0.172$ ) significantly reduced vulnerability. Major constraints to adopting climate adaptation strategies included inadequate technical knowledge (82.6%), land tenure challenges (82.1%), and limited market access (79.6%). The study concludes that maize farmers are highly vulnerable to climate change, and their adaptive capacity is constrained by knowledge gaps, insecure land tenure, limited financial access, and infrastructural deficits. The study recommends the need for stakeholders to strengthen extension delivery, improving access to credit, addressing land tenure constraints, and enhancing climate-resilient infrastructure as they are essential to improve resilience and adoption of adaptive strategies in the study area.

**Keywords:** Assessment, Maize, Farmers, Vulnerability and Adaptation

### INTRODUCTION

Agricultural production remains the primary source of livelihood for most rural communities in developing countries (Serote *et al.*, 2021). It provides a source of employment for more than 60% of the population in Sub-Saharan Africa (SSA) (Giller *et al.*, 2021). Climate change is increasingly recognized as a major challenge to agriculture worldwide, particularly in developing countries where small-scale farmers are highly vulnerable to its impacts (Ren *et al.*, 2019). Climate change has been one of the key challenges that affect Africa's agricultural sector and food security because of its sensitivity and vulnerability to high temperature and rainfall changes (Mangaza *et al.*, 2021). However, small-scale farmers in Nigeria face numerous challenges, including inadequate access to resources, limited technological know-how, and environmental hazards such as climate change (Kamara *et al.*, 2020).

Because of changes in climatic conditions, farmers are seriously affected due to their reliance on rain-fed agricultural systems and low adaptive capacity, making them highly vulnerable to climate change (Mujeyi *et al.*, 2020). Additionally, smallholder farmers have low resilience to deal with the effects of extreme climatic events (drought and floods), high climate inconsistency, and change. Hence, adaptation strategies and vulnerability to climate change are critical aspects that shape the resilience of agricultural production and the food security of billions of people globally (Sadiq *et al.*, 2019; Marine *et al.* (2022). In Sub-Saharan Africa, particularly in West Africa, climate change poses



significant challenges to agriculture, which remains the backbone of many economies and livelihoods in the region (Akpa *et al.* 2023).

Maize (*Zea mays*), is one of the most important Nigeria that contributes to household food security (Muhammad, *et al.*, 2020). Maize is one of the most important staple in the world which, in combination with rice and wheat, supply 51% of global caloric intake (Pariona, 2019). Global maize production stands at about 800 million tons. The United States is the leading producer with 392 million tons; almost half of global production; followed by China and Brazil (Food and Agricultural Organization Statistical Division FAOSTAT, 2020). Nigeria is the 16th largest maize producer in the world and the second largest producer in Africa, after South Africa, with annual production of about 10.16 million metric tons. However, Nigeria's maize yield ranks 117th with 2.1 tons/ha compared to the United States with 28.5 tons/ha and Egypt, which has the highest yield in Africa, of 7.1 tons/ha (FAOSTAT, 2020).

It is against this backdrop that this study intends to assess maize farmers' vulnerability and adaptation strategies to climate change in Adamawa and Taraba State, Nigeria. There are few or no studies related to vulnerability and adaptation to climate change in Adamawa and Taraba States, Nigeria, such as farmer's perception and adaptation strategies in Katsina State (Yusuf *et al.* 2022; Saalu *et al.*, 2020; Muroyiwa *et al.*, 2021 and Yusuf, 2018). The significance of this study lies in its potential to address critical gaps in understanding the vulnerability and climate change adaptation strategies among maize farmers in Adamawa and Taraba States, Nigeria. It will help policymakers to formulate evidence-based strategies in the face of a changing climate. The findings can also help the policy makers to formulate targeted policies on the strategies to adopt to the climate changes by maize farmers. The broad objective of the study was to examine maize farmers' vulnerability and adaptation strategies to climate change in the study area. While the specific objectives were to;

- i. describe the socio-economic characteristics of maize farmers in the study area;
- ii. determine the factors influencing the adoption of climate change adaptation strategies
- iii. determine the factors influencing maize yield vulnerability to climate change
- iv. describe the constraints to adoption of climate change adaptation strategies

## **METHODOLOGY**

### **The Study Area**

The study was conducted in Adamawa and Taraba States, Nigeria. Taraba State lies between Latitude 8°30' North and 9°30' North of the Equator and Longitude 8°30' East and 10°30' East of the Greenwich meridian. The State covers landmass of 14,099km<sup>2</sup>. The State had 2,300,736 people (National Population Commission [NPC], 2006) and a projected 3,934,000 people as at 2025 based on 3.2% annual population growth of the State. The State has annual rainfall of between 1,000 mm to 1,250 mm and maximum temperature ranges of between 21.1°C to 26.7°C. The mean annual rainfall ranges from 800 mm to over 1800 mm in the southern Taraba (Taraba Diary, 2014).

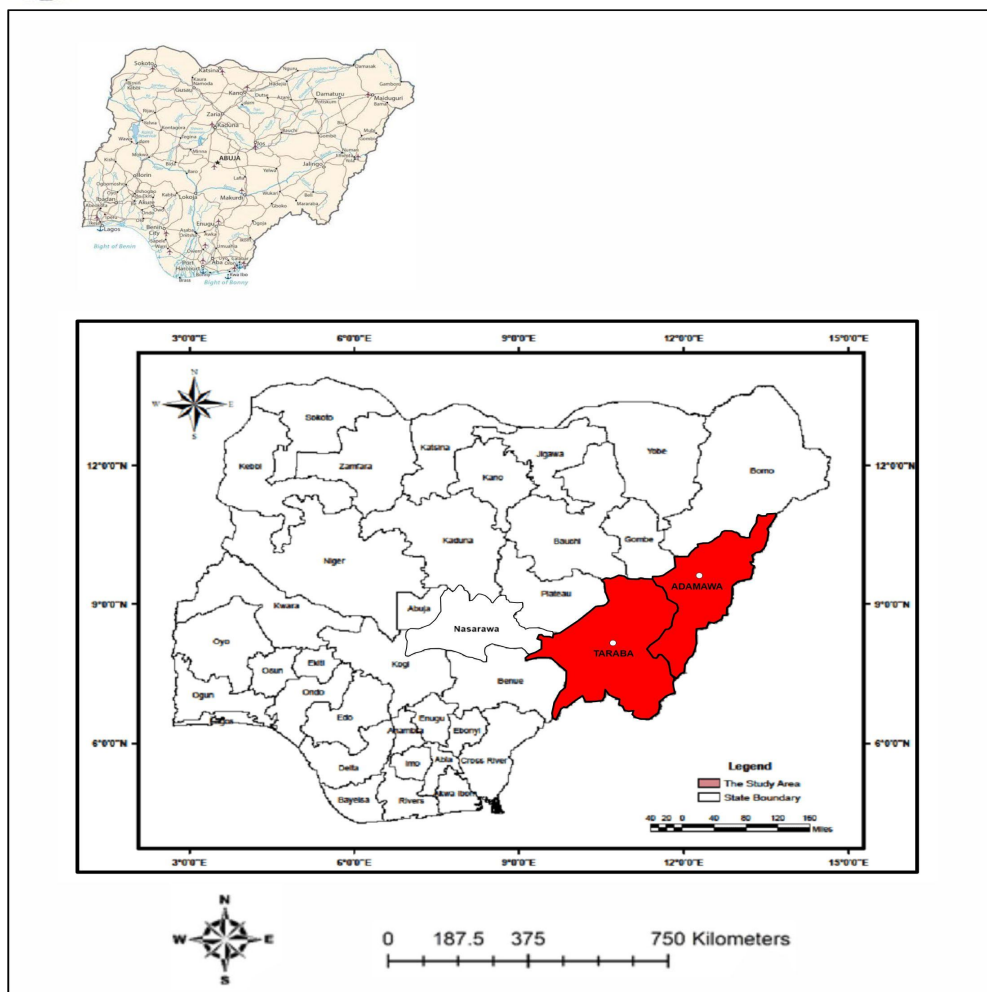
Taraba State shares boundary with Bauchi and Gombe to the North Nasarawa and Plateau State to the North-west, Benue State to the South-west and Republic of Cameroun to the Southeast (Taraba Agricultural Development Programme (TADP, 2019). The State has a tropical climate marked by dry and rainy seasons. The rainy season starts in April and ends in October. The wettest months are August and September. The dry season starts in November and ends in April. The mean minimum daily temperature recorded is 14.8°C and the mean maximum daily temperature recorded is 34.4°C (TADP, 2019). The vegetation of the zone is Guinea Savannah type. The study area is predominantly agrarian with about 80% of its inhabitants depending on subsistence agriculture practices mainly in food and cash crops like rice, cassava, yams, benni seed and maize (TADP, 2019). The vegetation of Taraba State is the Guinea Savannah type with the State being predominantly agrarian and some of the major crop produced are rice, maize, cassava, yam, sorghum and cash crops such as soybeans, oil palm, cocoa, coffee, mangoes, citrus, and banana, dry season production of maize, rice sugarcane and vegetable. Other economic activities include: livestock rearing, fishing, trading and tailoring. Taraba State is predominantly agrarian in nature with about 90% of its



inhabitants depending on subsistence agricultural practices mainly in food crops. The soil type in the study area was predominantly alluvial and sandy light loamy soil with occasional laterite out-grouped here and there. There are rugged hills and mountains with fertile plains and valleys intervening within the northern part of the local government area (Taraba State Government, 2020). The ethnic groups include: Fulani, Mumuyes, Jukuns, Wukums, Chambas, Mambilas, Jenjo and the Tivs among others (Taraba diary, 2018). TADP (2019) revealed that as at 2019, the number of farm families in Taraba State was 230, 000 and is projected 0.5% annual growth to be 1,265,000 as at 2021 (Taraba Diary, 2014).

Adamawa State is located in the northeastern part of Nigeria, lying between Latitudes 7° and 11°N and Longitudes 11° and 14°E. It shares boundaries with Taraba State to the south and west, Gombe State to the Northwest, and Borno State to the north. It also has an international boundary with the Cameroon Republic along its Eastern side. The State covers a land area of approximately 38,741 km<sup>2</sup> and is divided into 21 Local Government Areas (LGAs). Adamawa State experiences a tropical wet and dry climate. The dry season lasts for a minimum of five months (November to April), while the wet season spans from May to October. Adamawa State receives an average annual rainfall ranging from 700 mm in the northern part to over 1,600 mm in the southern part. Adamawa State generally experiences warm to hot temperatures with limited seasonal variations. The average temperatures in Adamawa State typically vary between approximately 21°C - 36°C. Adamawa is naturally divided into two ecological zones: the guinea savannah and Sudan Savannah zones. The distribution of vegetation is influenced by factors such as rainfall, topography, and soil. As of 2023, Adamawa State has an estimated population of approximately 4.3 million people (National Population Commission, 2023) and as of 2025, Adamawa State has an estimated population of approximately 5,202,800.

Agriculture is the mainstay for about 80% of the State inhabitants, thriving due to the favorable ecological conditions. Major crops produced include maize, rice, groundnuts, cotton, sesame, millet, sorghum, yam, cassava, and potatoes. In addition to agriculture, the following are significant economic activities in Adamawa State: Livestock Rearing: Cattle, goats, sheep, and poultry. Fishing: Especially along the riverine areas and the numerous lakes. Trade and Commerce: With major markets spread across the state facilitating trade. Handicrafts: Pottery, weaving, and blacksmithing. Adamawa State is home to several ethnic groups, with the major tribes being Fulani, Bachama, Hausa, Mumuye, and Higgi.



**Figure 3: Map of Nigeria Showing the Study Area**

### **Sampling Technique and Sample Size**

A multistage sampling technique was used in the selection of the farmers. The first stage involved the selection of all agricultural zones. Adamawa State has been divided into three agricultural zones namely; the Northern Zone, Southern Zone and Central zone. The second stage involved a purposive selection of three (3) Local Government Areas (LGAs) from each of the zone based on their intensity of maize production making a total of 8 LGAs. The selected LGAs were Mubi North, Micika, and Adamawa North from the Northern zone, Gombi, Girei and Numan from the Central Zone, Adamawa South, Ganye, Guyuk from the Southern Zone. The final stage will involve a random and proportionate (10%) selection of 200 respondents from the sampling frame of registered maize farmers making a total of 200 respondents drawn from the State as the sample size.

A multistage sampling technique was used in selecting the respondents in Taraba State. The first stage involved the selection of all agricultural zones in the State namely; Northern Zone, Central Zone, and Southern Zone. The second stage involves a random selection of two (2) LGAs out of the State's agricultural zones making a total of six (6) LGAs. The selected LGAs were Zing and Karim-Lamido from the Northern Zone, Gashaka, Sardauna from the Central Zone, Wukari, and Donga from the Southern Zone. In the third stage, 351 maize farmers. 200 maize farmers were randomly and proportionately (10%) selected, making a total of 200 as the sample size drawn from the State.

**Table 1: Sampling Size Selection Plan**

ADP Zones	Selected LGAs	Sampling frame	Sampling size (10%)
<b>Adamawa State</b>			
Zone 1	Mubi North	500	50
	Micika	400	40
Zone 2	Gombi	300	30
	Song	250	25
Zone 3	Adamawa North	150	15
	Adamawa South	100	10
Zone 4	Guyuk	200	20
	Numan	100	10
<b>Sub total</b>		<b>2000</b>	<b>200</b>
<b>Taraba State</b>			
Northern	Zing	400	40
	Karim-Lamido	300	30
Central	Gashaka	250	25
	Sardauna	200	20
Southern	Wukari	500	50
	Donga	250	25
<b>Sub total</b>		<b>1900</b>	<b>200</b>
<b>Total</b>		<b>3900</b>	<b>400</b>

**Source:** Pre-Field Survey, 2023

### Method of Data Collection

Data were collected using structured questionnaire. The questionnaire was administered to the selected respondents in the study area. The questionnaire included both open and closed-ended questions, allowing for the systematic collection of data.

### Method of Data Analysis

Data collected were analysed using both descriptive and inferential statistics. Descriptive statistics such as frequency distribution table and mean were used to achieve objectives i, and vi. Inferential statistics such as Pearson Correlation analysis was used to achieve objective iii and logit regression model was used to achieve objectives ii.

### Logit Regression

Logit regression was used to achieve objective ii. The model is implicitly specified as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + e \quad \dots(1)$$

Where;

$\beta_0$  = Intercept

$\beta_1 - \beta_{10}$  = Regression coefficients

Y = Climate change adaptation strategies and (1=Adopted and 0=Not adopted)

a = constant

$b_1 - b_8$  = Coefficients to be estimated;

$B_0$  = Constant term

e = Error term

$X_1$  = Sex (1= Male, 2= Female)

$X_2$  = Age (Years)

$X_3$  = Marital status (1=single, 2=married, 3=widowed, 4=divorced)

$X_4$  = Educational level (1=primary, 2=secondary, 3=no formal, 4=tertiary)

$X_5$  = Household size (number of persons)

$X_6$  = Farm size (number of hectares)



X<sub>7</sub>= Methods of land acquisition (1=purchase, 2=inheritance, 3=rent, 4=communal, 5=leasehold, 6=government)

X<sub>8</sub>= Farming experience (years)

X<sub>9</sub>= Secondary occupation (1=farming, 2=trading, 3=civil servant, 4=agro-forestry, 5=artisan)

X<sub>10</sub>= Yield output (bags)

X<sub>11</sub>= Access to extension (1=yes, 2=No)

## RESULTS AND DISCUSSION

### Socioeconomic Characteristics of the Respondents

The result from Table 2 describes the socioeconomic characteristics of the respondents in the study area. The findings revealed that majority (64.2%) of the respondents were male, while 35.8% were female. The dominance of male farmers in the study area highlights the prevailing gender dynamics in agricultural land ownership, decision-making, and access to resources. While a significant percentage of female farmers are present, their minority status suggests potential disparities in access to productive resources and support services. This is similar to findings of Umar and Sani (2021) who found that male farmers typically dominate the agricultural sector in the Northeastern States, often due to patrilineal land inheritance systems and socio-cultural norms that limit female participation in formal farming activities, despite their significant role in household food production. Akombi *et al.* (2017) and Agbonika (2015) in their separate studies showed that having female as the head of household could have a negative effect on adoption of some practices such as water and soil conservation strategies, because women may have limited access to land and decision-making ability and other resources due to traditional barriers.

The findings further shows that more than half (54.4%) of the respondents were married, while 18.9%, 17.4% and 9.3% were single, widowed and divorced, respectively. The high percentage of married farmers suggests stable household structures, which can be beneficial for labor mobilization, decision-making, and risk-sharing in farming activities. Family labor is often crucial for smallholder farming. Adamu and Yakubu (2021) noted that married farmers tend to have a larger family labor force, which is essential for carrying out various farm operations, particularly in areas with limited access to hired labor or mechanization. Sani *et al.* (2015) in a study on the analysis of factors influencing maize output of farmers using fertilizers in Bauchi State, Nigeria also reported that more than half of the farmers were married.



**Table 2:** Distribution of Respondents According to their Qualitative Socioeconomic Characteristics of the Respondents (n=397)

Variable	Frequency	Percentage
<b>Sex</b>		
Male	255	64.2
Female	142	35.8
<b>Marital Status</b>		
Single	75	18.9
Married	216	54.4
Widowed	69	17.4
Divorced	37	9.3
<b>Educational level</b>		
Primary	33	8.3
Secondary	123	31
No formal education	84	21.2
Tertiary	157	39.5
<b>Source of farm land</b>		
Purchase	141	35.5
Inheritance	118	29.7
Rent	123	31
Leasehold	15	3.8
<b>Occupation</b>		
Farming	238	59.9
Trading	19	4.8
Civil servant	71	17.9
Agroforestry	32	8.1
Artisan	37	9.3
<b>Access to extension</b>		
Yes	333	83.9
No	64	16.1
<b>Frequency of extension contact</b>		
Weekly	4	1
Monthly	1	0.3
Quarterly	91	22.9
Annually	201	50.6
Biannually	100	25.2

**Source:** Field Survey, 2025

Similarly, Ajah and Nmadu (2016) studying the socio-economic factors influencing the output of small-scale maize farmers in Abuja, Nigeria, posited that majority of their respondents were married. The findings also showed that a good proportion 39.5% and 31% of the respondents had tertiary and secondary levels of education, while 21.2% and 8.3% had no formal and primary education, respectively. This finding implies that farmers with tertiary education, coupled with a substantial proportion having secondary education, suggests a relatively educated farming population in the study area. However, some recent localized studies, particularly in areas with greater access to educational facilities or where agriculture attracts more educated individuals, have shown increasing trends. Umar and Idris (2021), for instance, found varying educational attainment among farmers in different regions of northern Nigeria, with some clusters showing a higher proportion of educated farmers due to specific interventions or proximity to urban centers. According to Omonona *et al.* (2016) a farmer with a higher level of education such as tertiary level, is believed to be associated with access to information on improved agricultural practices and thus has higher productivity.

The findings also indicated that farmland is primarily acquired by the respondents through purchase (35.5%), rent (31%), and inheritance (29.7%), with a small percentage through leasehold (3.8%), respectively. This finding shows the variation in sources of farmland acquisition by the respondents which further highlight a dynamic land tenure system in the study area. Ahmed and



Shehu (2020) highlighted that while inheritance traditionally dominated, land purchases and rental agreements are becoming increasingly prevalent, especially in areas with high population density or commercial agricultural interest.

The findings also showed that the majority (59.9%) of respondents were primarily engaged in farming, followed by 17.9%, 9.3%, 8.1% and 4.8% engaged in civil service, artisan, agroforestry and trading, respectively. This finding implies that most of the respondents whose primary occupation is farming indicates that maize cultivation is a central livelihood activity for many in the study area. Adenuga *et al.* (2020) noted that while agriculture remains the mainstay for many, engaging in non-farm activities provides crucial income stability and can enable farmers to invest in agricultural inputs or cope with income shocks from climate variability. The findings also revealed that majority (83.9%) of the respondents had access to extension while 16.1% had no access. This finding indicates that a large majority of maize farmers in the study area have some form of access to agricultural extension services. This is in line with Idris and Sani (2020), who reported persistent challenges in broad and effective extension coverage across Nigeria, while others highlight increased efforts in specific intervention zones.

The findings further showed that half (50.6%) of the respondents had extension contact annually, this is followed by biannually (25.2%), quarterly (22.9%), weekly (1%), and monthly (0.3%), respectively. This finding implies that though respondents had access to extension service but frequency of contact is very low among the respondents with over half reporting annual contact this infrequency is a major limitation. Idris and Sani (2020) and Abdullahi and Umar (2020) consistently reported that most farmers in Nigeria experience infrequent contact with extension agents (often annually or less), which significantly limits the effectiveness of technology transfer and advisory services, especially for complex issues like climate change adaptation. The finding also showed majority (83.9%) of the respondents had access to extension and 16.1% had no access. This is in line with Idris and Sani (2020), who reported persistent challenges in broad and effective extension coverage across Nigeria, while others highlight increased efforts in specific intervention zones.

#### **Factors Influencing Adoption of Climate Change Adaptation Strategies**

The result from 3 reveals the factors influencing adoption of climate change adaptation strategy. The finding indicated that age was positive and significant ( $P < 0.01$ ) in influencing adoption of climate change adaptation strategies. This finding implies that the older the farmers the higher the adoption of Adaptation strategies, possibly due to longer exposure to climate variability and a greater appreciation for long-term solutions. Marital status was negative and significant ( $P < 0.01$ ) in influencing adoption of climate change adaptation strategies, implying that increase in number of single farmers will possibly lead to decrease in adoption of climate change adaptation strategies due to their less responsibilities and lack of dependent persons as against married respondents whose responsibility and dependents household needs rest on his shoulder will be willing to adopt climate change adaptation strategies so as to increase yield. Educational level positively and significantly ( $P < 0.05$ ) influences adoption, suggesting that higher education enhances farmers' understanding and capacity to implement complex Adaptation strategies.

**Table 3: Factors Influencing Adoption of Climate Change Adaptation Strategies**

Model	Odds Ratio	Std. Error	z	P z
Sex	4809647	.317138	-1.11	0.267 <sup>NS</sup>
Age	1.165125	.0642176	2.77	0.006***
Marital status	.3912749	.1392328	-2.64	0.008***
Educational level	2.203927	.8135823	2.14	0.032**
Household size	1.221902	.069279	3.53	0.000***
Farm size	3.068494	2.668225	1.29	0.197 <sup>NS</sup>
Methods of land acquisition	3.016554	1.089897	3.06	0.002***
Farming experience	.7803478	.041005	-4.72	0.000***
Secondary occupation	.5123137	.1188652	-2.88	0.004***
Yield (bags)	.9853348	.0111304	-1.31	0.191 <sup>NS</sup>
Access to extension	.0311265	.0249331	-4.33	0.000***
cons	.9474024	2.041899	-0.03	0.980

\*\*\*, \*\* Significant at (P<0.01, 0.05) <sup>NS</sup> Not significant

Household size was positive and significant (P<0.01) in influencing adoption of climate change adaptation strategies. Larger households might possess more available labor for implementing labor-intensive adaptation practices or have a greater perceived need for strategies that ensure household food security. Methods of land acquisition was also positive and significant (P<0.01) in influencing adoption of climate change adaptation strategies, suggesting that secure land tenure promotes investments in long-term adaptation strategies. The results also revealed that farming experience showed a negative and significant (P<0.01) relation with adoption of climate change adaptation strategies implying that more experienced farmers will not be willing to adopt climate change adaptation strategies as most of them will not give listening ears to extension agents due to their experience in farming possibly giving them a leverage that they knew all possible ways of adaptation. Furthermore, secondary occupation was negative and significant (P<0.01) in influencing the adoption of climate change adaptation strategies, farmers with secondary occupations might have less time for or perceive less urgency in adopting new farming practices, given their diversified income streams. Similarly, access to extension negative and significant (P<0.01) in influencing the adoption of climate change adaptation strategies. This is not in line *a priori* expectation concerning the finding, strongly implying that having access to extension does not translate into effective adoption of adaptation strategies. Sex, farm size, and yield (bags) were not significant factors influencing adoption of adaptation strategies.

#### **Determinants of Maize Yield Vulnerability**

The result from Table 4 shows the determinants of maize yield vulnerability, using Pearson correlation coefficients to assess the relationships. The results revealed that climate variability (r=0.341) and soil quality/fertility (r=0.321) were positively correlated with vulnerability of maize yield. This finding implies that as climate patterns become more erratic and soil quality degrades, maize yield vulnerability increases. This is consistent with the general understanding of agricultural challenges in the face of climate change.

**Table 4: Determinants of Maize Yield Vulnerability**

Variables	Pearson Correlation	Sig. (2-tailed)
Climate variability	.341	.000***
Pests and diseases	.129	.010***
Soil quality and fertility	.321	.000***
Access to agricultural inputs	-.178	.000***
Market prices	-.275	.000***
Labor availability	.085	.093
Maize variety used	-.172	.001***

\*\*\*Significant at 1%



The finding also showed that pests/diseases ( $r=0.129$ ) have a positive correlation with vulnerability. However, several factors were negatively correlated with vulnerability, meaning they help to reduce it. These include access to agricultural inputs ( $r=-0.178$ ), market prices ( $r=-0.275$ ), and the maize variety used ( $r=-0.172$ ). The negative correlation with access to inputs and maize variety indicates the importance of improved seeds, fertilizers, and other resources in building resilience. The negative correlation with market prices suggests that favorable prices may allow farmers to invest more in protective measures and inputs, thus reducing their overall vulnerability. The finding shows that labor availability had no relationship or effect on maize yield vulnerability in the study area. Vargas *et al.* (2024) highlighted that climate shocks (droughts and floods), pests, and market-related issues significantly impact the vulnerability of maize production and supply chains in Nigeria. The importance of using improved maize varieties and access to agricultural inputs in reducing vulnerability is a recurring theme in the literature, as demonstrated by the Food and Agriculture Organization (FAO) of the United Nations (2020) and research by Adewuyi *et al.* (2023), who found that such measures are vital for enhancing food security and resilience.

### Constraints to Adoption of Adaptive Strategies

The result from Table 4 reveals the constraints faced by the respondents in adopting climate change adaptive strategies. The major constraints identified were inadequate technical knowledge or skills for implementing adaptation strategies (82.6%), challenges related to land tenure or ownership (82.1%), limited access to markets for selling agricultural produce (79.6%) and social or cultural barriers to adopting new agricultural practices (79.6%) which were ranked 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup>, respectively.

**Table 5:** Distribution of Respondents According to their Constraints to Adoption of Adaptive Strategies

Variables	Frequency	Percentage	Rank
Inadequate technical knowledge or skills for implementing adaptation strategies	328	82.6	1 <sup>st</sup>
Challenges related to land tenure or ownership	326	82.1	2 <sup>nd</sup>
Limited access to markets for selling agricultural produce	316	79.6	3 <sup>rd</sup>
Social or cultural barriers to adopting new agricultural practices	316	79.6	3 <sup>rd</sup>
Conflict or insecurity affecting agricultural activities	299	75.3	5 <sup>th</sup>
Lack of access to financial resources for implementing adaptation measures	297	74.8	6 <sup>th</sup>
Insufficient infrastructure (e.g., irrigation systems, roads) to support adaptation efforts	297	74.8	6 <sup>th</sup>

These were followed by conflict or insecurity affecting agricultural activities (75.3%), lack of access to financial resources for implementing adaptation measures (74.8%) and insufficient infrastructure (e.g., irrigation systems, roads) to support adaptation efforts (74.8%) which were ranked 5<sup>th</sup> and 6<sup>th</sup>, respectively.

### CONCLUSION AND RECOMMENDATIONS

The study, on assessment of maize farmers' vulnerability and adaptation strategies to climate change in Adamawa and Taraba State, Nigeria, concludes that farmers were highly vulnerable to climate change. In addition, socioeconomic characteristics of the respondents had significant influence on their level of adoption of adaptation strategies. Lack of practical support, including inadequate access to knowledge, land, finance, and infrastructure, significantly limits their resilience to a changing climate. Based on the study's findings, the following recommendations were made;

- i. Extension agents should be trained to provide practical, location-specific advice on climate-resilient farming techniques.
- ii. Government and non-governmental organizations (NGOs) should create accessible micro-credit schemes and grants specifically for smallholder farmers.



- iii. Policymakers should address the challenges related to land tenure and ownership

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