



**FACTORS INFLUENCING AWARENESS AND ADOPTION OF CLIMATE CHANGE
ADAPTATION STRATEGIES AMONG MAIZE FARMERS IN
ADAMAWA AND TARABA STATES, NIGERIA**

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ABSTRACT

The study examined the factors influencing awareness and adoption of climate change adaptation strategies among maize farmers in Adamawa and Taraba States, Nigeria. A multistage sampling technique was used to select 400 farmers and data were collected using structured questionnaires. Descriptive statistics were used to analyze the level of adaptation and constraints, while Logit regression used to assessed factors influence climate-change awareness. The findings indicated that farmers widely adopted strategies such as access to markets and value addition ($\bar{x} = 4.0$), climate-smart agricultural practices ($\bar{x} = 3.8$), crop diversification ($\bar{x} = 3.7$), and water-management techniques ($\bar{x} = 3.6$). However, adoption of innovative technologies ($\bar{x} = 2.9$), sustainable agricultural practices ($\bar{x} = 2.9$), and agroforestry ($\bar{x} = 2.8$) remained low. Results of the Logit model showed that educational level ($P < 0.01$), household size ($P < 0.01$), farm size ($P < 0.05$), land-acquisition method ($P < 0.01$), secondary occupation ($P < 0.01$), and access to extension services ($P < 0.01$) significantly influenced farmers' awareness of climate change among maize farmers in the study area. The major constraints to awareness and adoption climate change were inadequate technical knowledge (82.6%), land-tenure challenges (82.1%), limited market access (79.6%), and sociocultural barriers (79.6%). The study concludes that education level, household size, farm size, land acquisition method and secondary occupation were the factors influencing awareness of climate change effect adaptation strategies among maize farmers in the study area. The study recommends the need by stakeholders to strengthen the extension systems, enhancing farmers' technical capacity, improving land-tenure security, and expanding access to credit and infrastructure to improve climate resilience among maize farmers in the study area.

Keywords: Factors, Awareness, Adoption, Climate Change, Adaptation and Strategies

INTRODUCTION

Farmers around the world are on the front lines of climate change, facing increasingly unpredictable weather patterns, shifts in growing seasons, and more frequent extreme events such as droughts, floods, and storms (Alem *et al.*, 2022). Smallholder farmers have been at the forefront of stimulating rural economies in SSA, especially South Africa. It is estimated that there are 500 million smallholder farmers worldwide, upon which more than 2 billion people depend for their livelihoods, especially in developing countries (Serote *et al.*, 2021; Kamara *et al.*, 2019). Smallholder farmers grow and provide agricultural products for human consumption, and essential sources of human daily required nutrients and income generation to supplement government social grants and remittances (Abegunde *et al.*, 2019). In Sub-Saharan Africa, climate change results in low yield, total crop failure, reduced quality, and increased pest and disease occurrence, making vegetable production unprofitable (Abewoy, 2018). Climate change is a global problem and its impact is made visible especially in the agricultural sector where it has significantly affected production in most developing countries (Elum *et al.*, 2017). Climate change is defined as the change in the atmospheric process of the earth and its cause is mainly attributed to various human activities such as gas flaring related activities, deforestation and other anthropogenic activities which bring about the increase and pollution of greenhouse gases in the atmosphere (Miller and Edwards, 2021; Ajieh and Okoh, 2022). Climate change adaptation strategies describe the adjustments made to bring about moderation in natural or human systems in response to both actual and expected climate change as well as taking advantage of



new/ arising opportunities while Adaptation is regarded as a critical long-term solution in addressing on-going climate change thereby reducing its negative impacts in the future (IPCC, 2001; Elum *et al.*, 2017).

Climate change has been a very big problem to agricultural production all over the world. This is because climate change is negatively affecting agricultural development, food security and human's livelihood condition (Saalu *et al.*, 2020). It is one of the major problems affecting agriculture is (Muroyiwa *et al.*, 2021). Researchers such as Yusuf, 2018; Muroyiwa *et al.*, 2021; Abraham and Fonta, 2018) highlighted the vulnerability of Nigerian farmers to changing climatic conditions, emphasizing the adverse effects on maize production. Erratic rainfall patterns, rising temperatures, and increased frequency of extreme weather events pose serious threats to maize yields and food security in general (Yusuf *et al.*, 2022). The finding of this study will also be of valuable significance to government, researchers, and extension workers by providing them with information on maize vulnerability and adaptation strategies to climate changes in the study area so as to create more awareness and solution to the farmers. Finally, the study will contribute to the existing body of knowledge and serve as reference material for future studies of this nature. This study was therefore carried out to:

- i. describe the level of respondents' climate change adaptative strategies to mitigate effects of climate change
- ii. determine the factors influencing respondents' awareness to climate change effects
- iii. 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 14,099km². 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 21.1⁰C to 26.7⁰C. 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 14.8⁰C and the mean maximum daily temperature recorded is 34.4⁰C (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 km² 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

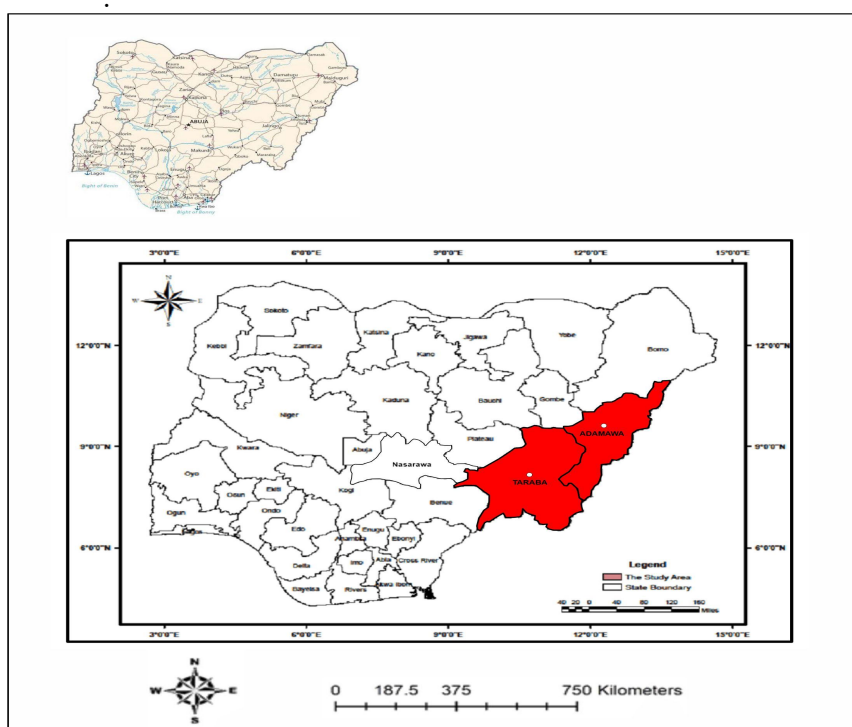


Figure 3: Map of Nigeria Showing the Study Area
Sampling Technique and Sample Size

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%)
Adamawa State			
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
Sub total		2000	200
Taraba State			
Northern	Zing	400	40
	Karim-Lamido	300	30
Central	Gashaka	250	25
	Sardauna	200	20
Southern	Wukari	500	50
	Donga	250	25
Sub total		1900	200
Total		3900	400

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 iii. Inferential statistics such as 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;

β_0 = Intercept

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

Y = Awareness of climate change (1=yes and 0=No)

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_7 = Methods of land acquisition (1=purchase, 2=inheritance, 3=rent, 4=communal, 5=leasehold, 6=government)
 X_8 = Farming experience (years)
 X_9 = Secondary occupation (1=farming, 2=trading, 3=civil servant, 4=agro-forestry, 5=artisan)
 X_{10} = Yield output (bags)
 X_{11} = Access to extension (1=yes, 2=No)

RESULTS AND DISCUSSION

Level of Adoption of Adaptation Strategy among Respondents

The result from Table 2 describes respondents' level of adoption of adaptation strategies. According to the findings farmers practiced different adaptation strategies in order to reduce vulnerability to climate change as well as cope with the climate change effects. Accordingly, almost all adaptative strategies were highly adopted with the exception of three (3). The findings revealed that access to markets/value addition with mean score of (\bar{X} =4.0), promotion of climate-smart agricultural practices (\bar{X} =3.8), crop diversification (\bar{X} =3.7), water management techniques (\bar{X} =3.6), use of climate-resilient crop varieties (\bar{X} =3.6), soil conservation and management (\bar{X} =3.6) were highly adopted as indicated by the mean score values above the threshold value of 3.0. These were followed by adjustment of planting dates (\bar{X} =3.5), livelihood diversification (\bar{X} =3.4), capacity building and education (\bar{X} =3.4), crop and livestock integration (\bar{X} =3.3), and community-based adaptation initiatives (\bar{X} =3.2) were highly adopted strategies for climate change on maize production as indicated by the mean scores above the threshold value of 3.0. This finding implies that respondents were aware of the adverse effects of climate change on maize production hence their ability to adopt climate change adaptation strategies in the study areas.

Table 2: Distribution of Respondents According to their Level of Adoption of Adaptive Strategies

Variables	Mean score	Remark
Access to markets and value addition	4.0	High
Promotion of climate-smart agricultural practices	3.8	High
Crop diversification	3.7	High
Crop diversification	3.7	High
Water management techniques	3.6	High
Use of climate-resilient crop varieties	3.6	High
Soil conservation and management	3.6	High
Adjustment of planting dates	3.5	High
Livelihood diversification	3.4	High
Capacity building and education	3.4	High
Crop and livestock integration	3.3	High
Community-based adaptation initiatives	3.2	High
Early warning systems	3.0	High
Adoption of sustainable agricultural practices	2.9	Low
Adoption of innovative technologies	2.9	Low
Agroforestry and conservation agriculture	2.8	Low

Source: Field Survey, 2025 threshold mean score <3.0=low, ≥ 3.0 =high



However, adoption of innovative technologies ($\bar{X}=2.9$), agroforestry and conservation agriculture ($\bar{X}=2.8$), and adoption of sustainable agricultural practices ($\bar{X}=2.9$) have lower mean scores below the threshold value of 3.0 indicating low adoption of the adaptive strategies in the study area. This finding implies that respondents are actively engaging in a broad range of crucial adaptive strategies. The highest score for access to markets/value addition suggests that economic resilience and market opportunities are drivers for adoption of adaptive strategies. Strategies like crop diversification, water management, adjusting planting dates, and using climate-resilient varieties are fundamental and widely adopted among maize farmers as indicated by Adamu and Yakubu (2021) reported similar patterns where farmers tend to adopt easily implemented, low-cost strategies first. However, the lower adoption of more complex innovative technologies and conservation agriculture mirrors findings by Oyelami *et al.* (2021) and Usman and Aliyu (2021), who identified barriers such as lack of capital, insufficient technical knowledge, and limited access to specific inputs as key impediments to the widespread adoption of more sophisticated and systemic climate-smart practices. Bamigbade *et al.* (2022) discuss adaptive strategies among farmers in Oyo State, underscoring the need to address agricultural practices. Changes in planting dates, crop choices, and irrigation methods can enhance resilience, and sustainable soil management practices are crucial for maintaining agricultural productivity.

Factors Influencing Respondents Awareness on Climate Change Effect on Maize Yield

The results in Table 3 revealed the factors influencing respondents' awareness of climate change effects on maize yield. The results indicated that educational level (1.326) was positive and significant ($P<0.01$) in influencing respondents' awareness of climate change effects on maize yield, suggesting that farmers with more formal education are more likely to be aware of climate change's effects. This is a logical finding, as education enhances the ability to process and comprehend complex information.

Table 3: Factors Influencing Respondents Awareness on Climate Change Effect on Maize Yield

Variables	B	S.E.	Wald	df	Sig.
Sex	-.835	.435	3.681	1	.055
Age	.053	.038	1.963	1	.161
Marital status	-.199	.258	.595	1	.440
Educational level	1.326	.257	26.606	1	.000***
Household size	-.119	.040	8.829	1	.003***
Farm size	1.317	.604	4.759	1	.029**
Methods of land acquisition	1.128	.240	22.023	1	.000***
Farming experience	-.014	.036	.159	1	.690
Secondary occupation	-.760	.150	25.587	1	.000***
Yield output	-.010	.008	1.646	1	.199
Access to extension	2.002	.471	18.076	1	.000***
Constant	-6.690	1.778	14.153	1	.000***

Source: Field Survey, 2025 ***, **Significant at 1% and 5%

The finding also showed that access to extension services (2.002) was positive and significant ($P<0.01$). This highlights the vital role of agricultural support systems in disseminating crucial information. Methods of land acquisition (1.128) was also positive and significant ($P<0.01$) in influencing awareness, which may be linked to a more secure or formal land tenure system that encourages long-term planning and investment in knowledge. The findings further show that Farm size (1.317) was positive and significant ($P<0.05$) which implies that increase in farm size could lead to increase level of awareness on climate change effect among respondents. On the other hand, household size (-0.119) is a significant ($P<0.01$) and negative factor influencing respondents' awareness of climate change effects on maize yield, implying that larger households may have less time for or access to information on climate change, possibly due to a greater focus on subsistence or daily labor. The result also shows that secondary occupation (-0.760) is a significant ($P<0.01$) and negative factor, possibly because it diverts time and attention away from agricultural issues. However,



sex, age, marital status, farming experience and yield output of maize farmers were not significant indicating little or no influence on respondents' level of awareness on climate change effect in the study area. Oyekale and Odusanya (2020) and Adepoju and Olaoye (2021) corroborate the finding that educational attainment and access to extension services are key drivers of farmers' awareness and adoption of climate-smart agricultural practices. The significant positive influence of farm size on awareness also aligns with Akinnagbe (2021) who suggest that larger-scale farmers may have more resources and motivation to seek out climate-related information.

Constraints to Adoption of Adaptive Strategies

The result from Table 4 reveals the constraints to respondents' awareness of climate change effect on maize production in the study area. 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 1st, 2nd, 3rd and 4th, respectively. 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 5th and 6th, respectively.

Table 4: 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 st
Challenges related to land tenure or ownership	326	82.1	2 nd
Limited access to markets for selling agricultural produce	316	79.6	3 rd
Social or cultural barriers to adopting new agricultural practices	316	79.6	3 rd
Conflict or insecurity affecting agricultural activities	299	75.3	5 th
Lack of access to financial resources for implementing adaptation measures	297	74.8	6 th
Insufficient infrastructure (e.g., irrigation systems, roads) to support adaptation efforts	297	74.8	6 th

Source: Field Survey, 2025

This finding implies that lack of technical knowledge/skills highlights a critical need for targeted and practical training programs that build specific competencies for climate adaptation. Land tenure challenges are fundamental structural issues that affect farmers' willingness to invest long-term in land-improving adaptive measures. Adamu and Yakubu (2021) extensively discussed inadequate technical knowledge, insecure land tenure, and poor market access as primary hindrances to technology adoption among maize farmers. Mohammed and Umar (2020) and Usman and Aliyu (2021) consistently highlighted the devastating impact of insecurity on agricultural activities and the limited access to financial resources and infrastructure as persistent barriers in the Northeast.

CONCLUSION AND RECOMMENDATION

The study concludes that education level, household size, farm size, land acquisition method, secondary occupation and access to extension contact were the factors influencing awareness of climate change effects adaptation strategies among maize farmers in the study area. Despite the high level of adoption of adaptive strategies, the adoption of the strategies were constrained lack of technical knowledge and skills, coupled with fundamental structural issues related to land tenure and limited access to markets. Based on the findings, the following recommendations were made;

- Extension agents should be trained to provide targeted, practical, and location-specific training on climate-resilient farming techniques.



- ii. Cooperatives should initiate and implement accessible micro-credit schemes and grants specifically for smallholder farmers
- iii. Community stakeholders should implement policies that clarify and secure land tenure for farmers
- iv. Farmers should embrace peace and settle their differences amicably to ensure peace and security in agricultural areas.

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