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Analysis Of Some Socio-Demographic Variables And Climate Change Mitigation Strategies Among Female Refugee Farmers In Some Selected Camps In Nigeria

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Abstract

The study assessed how socio-demographic factors influenced climate change mitigation strategies adopted by female refugee farmers in their camps in Nigeria, identifying most commonly used mitigation practices, explored the challenges faced in accessing climate change resources, and proposed policy recommendations to strengthen their resilience to climate-related risks. Following 6 objectives formulated, the study was guided by research questions and hypotheses. Both qualitative and quantitative research designs were adopted and a total of 1,322 female refugee farmers were drawn from camps in Taraba, Adamawa, and Cross River States. Descriptive statistics, Pearson Product Moment Correlation, and Regression analysis were used for data analysis. Findings revealed that female refugee farmers actively engage in climate mitigation and adaptation practices, relying largely on informal communication networks such as social groups, religious institutions among others for climate information. However, their capacity to implement sustainable climate-smart agricultural practices is significantly shaped by socio-demographic factors such as education, income, access to information, and social networks. Major challenges included financial constraints, limited land access, inadequate agricultural inputs, and institutional barriers which continue to hinder their resilience. The study therefore emphasizes the need for coordinated policy interventions aimed at improving economic security, agricultural training, land access,

financial inclusion, and institutional support to enhance climate resilience and sustainable livelihoods among these female refugee farming communities.

Keywords: *Socio-demographic variables, female refugee farmers, climate change mitigation strategies, climate-smart agricultural adaptation challenges, refugee legal status restriction, Economic security and food security*

Introduction

Research on climate change mitigation and adaptation among vulnerable populations, particularly female farmers and refugees has expanded significantly due to increasing climate risks, displacement, migration, economic and food insecurity in developing countries. Studies consistently show that women constitute a substantial proportion of the agricultural labor force (about 43% globally) and are disproportionately affected by climate variability because of socioeconomic inequalities, limited access to land, finance, and climate resources and information services (Partey, et al. 2020). More recent literature emphasizes that climate change responses are not uniform but are shaped by socio-demographic characteristics such as age, education, income, household size, marital status, and access to information (San Domenico & Homan, 2022). It is observed that some of these variables determine the capacity of female farmers especially refugees to adopt mitigation strategies such as crop diversification, irrigation, soil conservation, and agroforestry.

Climate change has significantly disrupted global environmental equilibrium, posing serious challenges to agricultural communities, especially refugee farmers who face compounded socio-economic constraints. The intersection of forced displacement, agriculture, and climate change has therefore become an important research focus. Refugee farmers often settle in environmentally fragile areas where their survival depends on adopting effective mitigation and adaptation strategies. However, their responses to climate challenges are strongly shaped by socio-demographic factors (Eneji, et al., 2022a). The intersection between socio-demographic variables and mitigation strategies among female refugee farmers highlights the complex linkages between gender, migration, environmental stress, and adaptive agricultural practices (FAO, 2018; Karanja & Wambugu, 2021).

Human responses to climate change are largely influenced by socio-demographic characteristics such as education, religion, culture, age, gender, and environmental awareness. These personal attributes determine attitudes toward environmental protection and climate mitigation. Climate change has become a global crisis, severely affecting agricultural productivity through irregular rainfall patterns, rising temperatures, flooding, melting of polar ice, salinization, increased ultraviolet radiation, and health-related challenges. Such environmental disturbances continue to threaten farming systems worldwide (Huyer, et al. 2021). Additional impacts of climate change include sea-level rise, land submergence, flooding, crop failure, food insecurity, farmer-herder conflicts, terrorism, epidemics, poverty, global warming from greenhouse gas emissions and accumulation, and various forms of pollution (Eneji, et al., 2021; Williams, et al., 2021). These developments present a grim outlook for global food security and human survival (Adeogbo, et al., 2021). The cumulative effects intensify vulnerabilities, particularly among already marginalized populations.

Women play very central roles in agriculture across many societies, often serving as primary farmers and household heads responsible for meeting family dietary needs (Chenna, et al., 2019; Ojo, et al., 2019; Ojo & Baiyegunhi, 2020a and 2020b). However, climate change has severely reduced their productivity through late or erratic rainfall, drought, extreme temperatures, soil erosion, floods, and declining soil fertility (Eneji, et al., 2022). Livestock farmers are equally affected, as changing climatic conditions disrupt grazing patterns and animal health. Climate variability has also led to pasture scarcity, forcing herders into farmlands and heightening conflicts. Stored crops are negatively affected by fluctuating climatic conditions (Pandey, et al., 2018; Omerkhil, et al., 2020; Eneji, et al., 2021). Furthermore, ecological disruptions have contributed to the erosion of indigenous genetic species due to the introduction of genetically modified organisms and invasive species, which outcompete endemic or indigenous species, climate-resilient varieties (Nhemachena, et al., 2014; Umar, et al., 2015; Onnoghen, et al., 2020; Eneji, et al., 2021; Eneji, et al., 2022a, 2022b).

Although improved seed varieties and livestock were intended to enhance productivity and income, climate change has undermined these efforts, particularly in tropical regions and Africa (Elum, et al., 2017; Fadina & Barjolle, 2018). Crop failure due to low or excessive rainfall, drought, desertification, extreme heat, and soil degradation has become widespread (Wiliams, et al., 2021; Poudel, et al., 2017; Zeng, et al., 2019; Zadawa & Omran, 2020). Additionally, pest infestations and excessive use of inorganic fertilizers such as NPK compounds have further reduced yields (Eneji, et al., 2021; Williams, et al., 2021; Eneji, et al., 2022a). The integration of gender perspectives into climate policies is critical for effective adaptation. For example, Mozambique's Gender, Environment, and Climate Change Strategy and Action Plan emphasizes women's roles in sustainable resource management (Asfaw, et al., 2019; Muench, et al., 2021; Eneji, et al., 2022). However, climate-induced migration,

especially in East and West Africa, often lacks gender-sensitive policy frameworks, increasing vulnerabilities among migrant women (Gebre & Rahut, 2021; UNHCR, 2021).

Refugee camps present additional barriers, including limited employment opportunities, gender-based violence, food insecurity, and competition for scarce resources. Socio-demographic factors significantly influence adaptation decisions among displaced farmers. For instance, education increases the likelihood of migration as an adaptation strategy, with a one-year increase in schooling raising migration willingness by 4.2% (Gebre & Rahut, 2021). Women in Africa, who largely depend on rain-fed agriculture, actively adopt coping strategies but face constraints such as limited access to resources and extension services (Nyong, et al., 2007; Lal, et al., 2020; Eneji, et al., 2022). Refugee status itself reduces livelihood opportunities, despite occasional support from humanitarian agencies (Igene, et al. 2023). Many female refugees often widowed or separated due to forced migration, become household heads and turn to agriculture as an alternative livelihood strategy. Their participation in farming is driven by necessity and the need to reduce vulnerability within camp settings.

Feeding a global population exceeding 8.5 billion people is increasingly challenging, especially as modern agricultural practices, including mechanization and genetically modified seeds, contribute to greenhouse gas emissions and climate change (Waibel, et al., 2018; Ureta, et al., 2020; Eneji, et al., 2021; Eneji, et al., 2022b). Female refugee farmers must therefore rely on innovative adaptive strategies shaped by their socio-demographic characteristics to sustain productivity amid environmental stress (Gladstone & Mora, 2022). Effective adaptation requires informed decision-making. Farmers' choices are influenced by variables such as education, marital status, income, farm size, workforce, religion, and access to information (Williams, et al., 2021; Muench, et al., 2021; Dang, et al., 2019; Shakoor, et al., 2018; Towolawi, et al., 2024; FAO, 2018; Elia, 2017; Chadni, et al., 2018; Laosan, 2022). Age, farming experience, awareness, and access to extension services also shape adaptive responses (Muema, et al., 2018; Media Council Tanzania (MCT) 2018; Laosan, 2022). Climate change disproportionately affects women, especially refugees facing structural inequalities (Müller, et al., 2019; Liu, et al., 2021; Eneji, et al., 2021).

Social networks further influence adaptation by facilitating information sharing, innovation adoption, and collective action through Non-Governmental Organizations (NGOs), extension agents, and community groups (Kehinde, et al., 2025). Climate change awareness which is the knowledge of climate change-causes, effects and possible mitigation measures also depends on access to accurate information, market systems, cooperative membership, and outreach services (Eneji, et al., 2021; Asfaw, et al., 2019; Muench, et al., 2021). Knowledge acquisition shapes informed mitigation decisions (Niosi, 2021; Asrat & Simane, 2018; Chandni, et al., 2018; Chenu, et al., 2019; Das, et al., 2020). Consequently, the study seeks to examine how socio-demographic variables influence female refugee farmers' choices of climate change mitigation and adaptation strategies in some selected refugee camps across Nigeria.

Importantly, the period 2020–2026 marks a shift from general gender studies toward intersectional and vulnerability-based approaches, recognizing refugee women as a uniquely marginalized group exposed to environmental, social, and economic risks simultaneously. Though some studies only addressed female farmers coping strategies, others looked at the coping and adaptation strategies adopted by farmers to ameliorate the effects of climate change in their agricultural activities. It appears no study has actually looked at the vulnerable situation of the female refugee farmers in mitigating climate change effects in their camps. It is on the basis of these harsh environmental conditions faced by female refugee farmers that this research is initiated to underscore what informed their choices of climate change mitigation strategies and the challenges they face within the camps, and how these could improve their food and economic securities and thereby reducing their vulnerabilities within the refugee camps.

Comparison of previous studies has shown that the focus of research has shifted from gender vulnerability to intersectional vulnerability, while study population has shifted also from women farmers to female refugee farmers. Approach now focused more on mitigation and resilience as against adaptation studies. Furthermore, research methods have also shifted from surveys to mixed methods, so also has policy relevance moved from awareness to empowerment. The major gaps identified in this study are: limited research specifically on female refugee farmers, because most studies focused on women, rural farmers and smallholder farmers, and very limited studies have been carried out on female refugee farmers in their camps. This gap is widely acknowledged in the literature on gender and climate resilience. Other gaps identified include: limited studies in Nigeria refugee camps, most studies focus on adaptation and not mitigation and resilience which are often not longitudinal research, which are limited in the integration of socio-demographic variables and low gender disaggregated refugee data

Objectives of the research

This study generally sought to ascertain the influence of female refugee farmers' socio-demographic variables on the climate change mitigation strategies adopted in some selected refugee camps in Nigeria. Specifically, the study aims to:

1. Examine the sources of climate change information available to these refugee farmers
2. Investigate how socio-demographic variables influence refugee farmers' climate change mitigation strategies in the camps.
3. Identify the climate change mitigation strategies most adopted by the female refugee farmers in some selected camps in Nigeria
4. Identify challenges faced by farmers in accessing climate mitigation resources among displaced female refugee farmers' in some selected camps in Nigeria.
5. Provide policy recommendations to enhance the resilience of refugee farmers towards extreme climate events.

Research Questions

The following research questions were posed to guide the study

1. What are the sources of climate change information available to these refugee farmers?
2. How do the socio-demographic characteristics of female refugee farmers influence the climate change mitigation strategies adopted by female refugee farmers in Nigeria?
3. What are the climate change mitigation strategies mostly adopted by these female refugee farmers in the camp?
4. What challenges do refugee farmers face in accessing climate change adaptation resources and their agricultural practices?
5. How can targeted interventions improve climate resilience among refugee farming communities?

Research hypotheses

1. Female refugee farmer's socio-demographic characteristics do not significantly influence their climate change mitigation strategies in the camps
2. Source of climate change awareness information available to female refugee farmers do not significantly influence their climate change mitigation strategies.

Research design and methods

Research design: The study adopted both quantitative and qualitative research design by integrating quantitative surveys and qualitative interviews with refugee farmers within the selected camps (Gembu, Michika, Madagali, Ogoja, Etung, Ikom, Akamkpa and Bakassi camps).

Study area: the study areas include: Gembu in Taraba state, Madagali and michika in Adamawa state, while Ogoja, Ikom, Etung, Akamkpa and Bakassi local government areas (LGA) are in Cross River State, all in Nigeria.

Cross River state: Geographically, Cross River state lies between Latitude 5°45′N and Longitude 8°30′E. Cross River state lies within the coastal tropical rainforest zone, the state is endowed with the abundance of natural resources including huge mineral deposits, tropical rainforest, cocoa, oil palm among others. Due to the location of the state in the tropical region, the major occupation of the people of Cross River state is commercial and peasant farming, public and civil service taking majority of the occupation, other occupation include business, harvesting of forest timber and other non-timber forest products, mining, quarry activities among others. There are business men and women, artisans and self-employed persons within this population. According to the Google population projection, 2024, Cross River state has an estimated population of about Four Million, Eight Hundred and Ninety Two Thousand, Six Hundred and Seventy Two (4,892,672) persons. With the influx of these refugees, it is projected that at least, an additional eighty thousand (80,000) persons from the refugee camps has been added to the already burgeoning population of the area.

Michika: is a local government area in Adamawa state, the area lies between Latitude 10° 37' 18" N and Longitude 13° 22' 59" E. Michika (known also as Anjawa) is a small town in the state of Adamawa, which is located in the eastern part of Nigeria, just a few miles from the border between Nigeria and Cameroon. The area became a part of Nigeria during the 1961 plebiscites or referendum from Cameroun. It is a historical settlement where Kamwe people, which are the largest local ethnic group, have been living for many centuries. Despite being quite a small settlement, Michika is divided into 9 small districts which are governed by their own administrative bodies. Every district has the population of about 3 or 3.5 thousand people. Michika has a very diverse culture and there are 3

languages spoken in the town. It is also a venue of a number of festivals and celebrations, traditionally taking place in the region. The predominant occupations of the people are business, farming, mining and other businesses. The population of the area is about three hundred and seventy- eight thousand, two hundred and fifty- one (378,251) persons (Google Population Projection, 2024).

Madagali: Madagali or Madagli is a town and local government area in Adamawa State, Nigeria. The LGA was created in 1991 when Taraba State was created out of Gongola State. It borders Michika to the north, Askira Uba to the west, Gwoza local government area to the south and the Republic of Cameroon to the east. The area lies between Latitude: 10° 53' 21" N and Longitude: 13° 37' 41" E. According to 2024 Google Population Projection, the area has an estimated population of about seventy eight thousand persons, with most of the populace engaged in animal farming, crop production, business and mining activities. Majority of the people practice farming at both subsistent and commercial level too. There are civil and public servants and other form of artisans and business men and women in the area. The area like Michika also has some mineral deposits.

Gembu: Gembu is a mountainous town on the Mambilla Plateau in Taraba State of Nigeria. The area lies between Latitude 6° 42' 59' N and Longitude: 11° 14'E. It is the headquarters of Sardauna Local Government Area (formerly "Mambilla" LGA) in Taraba State. Sitting at an average elevation of about 1,348 meters (4,423 ft) above sea level, it is among the highest elevated towns in Nigeria. The area is located in the south-eastern part of Taraba State, close to the Nigeria-Cameroon border. Bantuists believe that the people inhabiting the Mambilla Region and their neighbors are descendants of the Proto-Bantu ancestors who inhabited the region generally before the Bantu expansion. The major occupation of the people of Gembu is farming, this is the major areas where tea is farmed in commercial quantity in the country-Highland tea, Samari tea and Pleasure tea are produced from this region. Cattle and animal rearing are also done in large quantity. Business and other forms of livelihoods are also carried here. According to 2024 Google population projection, Gembu has an estimated population of about five hundred and fifteen persons (500, 015).

As traditional with increasing population is the attendant demand for food, shelter, accommodation, farm land and other sources of livelihoods, including markets, health facilities, water, sanitation and hygiene facilities among others. There are also the tendencies for antisocial vices to spread (increased crimes).

Population and sample: According to the register of camp members obtained from UNHCR/ICRC/IFRC/NRCS desk officers in the camps, a combined total population of about three hundred and seventy two thousand, eight hundred and nineteen (372,819) persons resides in these different camps. It was also discovered that from the Economic Security Committee (ECOSEC) records, about hundred and ninety-eight thousand, two hundred and fifteen (198,215) persons are farmers, 66,012 (sixty six thousand and twelve) are male farmers, while 132,203 (one hundred and thirty-two thousand, two hundred and three) are female refugees farmers who are engaged in farming activities like horticulture, food crops, dry season vegetable farming and other market gardening to boast their income and food provision. Considering this population of refugees who are farmers, proportional sampling of 1% was used to select the sample of female farmers (1,322) for the study. So the sample of the study comprised of one thousand, three hundred and twenty two (1,322) female refugee farmers in Nigeria. See table 1 showing population and sample distribution in the selected camps.

Table 1: Combined Population and sample distribution among female farmers in the selected refugee camps in Nigeria

S/N	States	Local governments	Female	1% sample
1	Taraba	Gembu – Sarduana	36,736	367
2	Adamawa	Madagali / Michika	49,244	493
3	Cross River	Ogoja, Ikom, Etung, Akamkpa, Boki and Bakassi	46,223	462
		Total	**132,203**	**1322**

Instrument for data collection: Structured questionnaire assessing the relationship between socio-demographic factors and climate mitigation strategies was used; the instrument was validated by the researchers in terms of contents and construct validity. The reliability of the instrument was done using the split half methods, where 50 copies of the instrument were administered to 50 community members who were not in the camp and not part of the study. The instrument was coded and split into 2, analysis was done, the reliability scores ranged between 0.73-.85; this was adjudged to be reliable for data collection. The questionnaire contains five items each for each of the variables, while the instrument contains a total of 20 items, outside their socio-demographic characteristics.

Instrument administration: this was done personally by the researchers and the managers of the camps, it took twelve weeks for the instruments to be administered, and the filled instrument were retrieved from the respondents right on the spot.

Data Analysis:

Quantitative Analysis: Statistical analyses were done using multiple regression and Pearson Product Moment Correlation analysis between socio-demographic variables and climate change mitigation strategies; and between sources of climate change awareness information and climate change mitigation strategies

Qualitative Analysis: Thematic coding of interview responses using simple percentage analysis was done.

Results and discussions

The findings presented in Table 2 reveal that female refugee farmers access climate change information from a variety of formal and informal communication channels, reflecting the diversity of information systems operating within refugee communities. The results show that 204 respondents (15.43%) identified social networks, community town criers, and churches as their primary sources of climate change information, making this the most dominant communication pathway. This highlights the importance of community-based and faith-based communication structures in disseminating environmental information among refugee populations. Awareness campaigns were also identified as a significant source, with 181 respondents (13.68%) relying on them, followed by formal, informal, and non-formal education systems reported by 158 respondents (11.95%), and extension agents cited by 151 respondents (11.42%). These findings suggest that institutional and organized communication mechanisms play critical roles in improving climate change awareness among female refugee farmers.

Furthermore, the results indicate that mass media and print-based communication channels contribute moderately to climate information dissemination among the respondents. Specifically, 141 respondents (10.67%) reported obtaining climate change information through newspapers, newsletters, bulletins, and other print media, while 133 respondents (10.06%) relied on peer groups as a source of information. Information, Education, and Communication (IEC) materials such as leaflets and tracts were reported by 112 respondents (8.48%), indicating the continued relevance of educational materials in promoting environmental awareness. However, electronic media platforms showed relatively lower usage, as only 88 respondents (6.66%) accessed climate information through radio and television, and 67 respondents (5.07%) through social media. These patterns suggest that while modern communication technologies are present, traditional interpersonal and community-based channels remain more accessible and trusted among female refugee farmers.

Overall, the findings imply that the socio-demographic characteristics of female refugee farmers such as education level, social participation, and access to institutional support significantly influence the climate change mitigation strategies they adopt. Farmers who are connected to community networks, educational systems, and extension services are more likely to receive timely climate information and implement mitigation practices such as improved farming techniques, soil conservation, and sustainable resource management. Conversely, those with limited education, lower income levels, or restricted access to information channels may face barriers to adopting effective climate change mitigation strategies. Therefore, strengthening community communication systems, expanding extension services, and improving access to inclusive education and information dissemination mechanisms are essential for enhancing climate change mitigation among female refugee farmers in Nigeria.

Table 2: Respondents' Sources of Climate Change Information (N = 1322)

S/N	Sources of climate change information	Response	Percentage
1	Radio/television	88	6.66
2	Social media	67	5.07
3	Peer group	133	10.06
4	Awareness campaign	181	13.68
5	Newspapers, newsletter/bulletin	141	10.67
6	Social network/ community town crier/church	204	15.43
7	Formal, informal and non- formal education	158	11.95
8	Information, education and communication leaflets/tracts	112	8.48
9	Extension agents	151	11.42

10	Others	87	6.58
	Total	**1322**	**100.00**

The study examined how female refugee farmers' socio-demographic variables predict their climate change mitigation strategies within selected refugee camps in Nigeria. Ten socio-demographic variables were identified as predictors, namely sex, age, marital status, educational status, sources of information, social networking, household income, household headship, additional sources of income other than farming, and land ownership. These variables were treated as independent variables, while climate change mitigation strategies constituted the dependent variable. To determine the predictive relationship between these variables, multiple regression analysis was conducted, and the results are presented in Table 3.

The regression analysis produced a correlation coefficient (R) of 0.351, indicating a moderate positive relationship between socio-demographic variables and climate change mitigation strategies among female refugee farmers. The coefficient of determination (R^2) of 0.123 and adjusted R^2 of 0.109 show that approximately 12.3% of the variation in mitigation strategies can be explained by the combined socio-demographic characteristics of the respondents. Although the explanatory power of the model is relatively modest, the results confirm that socio-demographic factors still play a meaningful role in shaping climate change responses among refugee farmers.

Table 3: Regression Analysis of Female Refugee Farmers' Socio-Demographic Variables and the Climate Change Mitigation Strategies Adopted in Some Selected Camps in Nigeria (N = 1322)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
	R Square Change	F Change	df1	df2	Sig. F Change	R Square Change	F Change	df1	df2
1	.351(a)	.123	.109	.76604	.123	8.817	10	1321	.000

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	51.742	10	5.174	8.817	.000(a)
	Residual	137.933	1311	.587		
	Total	251.676	1321			

a. predictor variables: sex, age, marital status, educational status, sources of information, social networking, household income, household heads, additional sources of income other than farming and land ownership

b. Dependent Variable: Climate change mitigation strategies

Further statistical evaluation using analysis of variance (ANOVA) revealed an F-ratio of 8.817, which exceeded the critical F-value of 1.91 at the 0.05 level of significance, indicating that the regression model is statistically significant. Examination of the standardized regression beta weights showed that six variables thus: sources of information, climate change awareness, educational status, household income, social networking, and household headship significantly predicted climate change mitigation strategies. In contrast, extension services, marital status, land ownership, and membership in cooperative societies were not statistically significant predictors.

These findings imply that certain socio-demographic characteristics have stronger predictive influence on climate change mitigation decisions than others. In particular, access to information, education, and income levels appear to enhance the capacity of female refugee farmers to adopt sustainable agricultural practices. This suggests that improving knowledge dissemination, economic empowerment, and social participation among refugee women could significantly strengthen climate change mitigation efforts within the refugee communities.

To further examine the relationship between socio-demographic variables and climate change mitigation strategies, Pearson Product Moment Correlation analysis was conducted. The analysis yielded a calculated r-value of 0.87, which is substantially higher than the critical value of 0.136 at the 0.05 significance level with 1320 degrees of freedom. This result indicates a strong and statistically significant positive relationship between female refugee farmers' socio-demographic characteristics and their adoption of climate change mitigation and adaptation strategies in refugee camps (see table 4).

Table 4: Pearson Product Moment Correlation Analysis of the Relationship Between Farmers' Socio-Demographic Variables and Their Choices of Climate Change Mitigation, Prevention and Adaptation Strategies Adopted in the Refugee Camps (N = 1322)

Table 4: Pearson Product Moment Correlation Analysis of the relationship between farmers' socio-demographic variables and their choices of climate change mitigation, prevention and adaptation strategies adopted in the refugee camps, (N=1322).

Variables	$\overline{X}$	SD	R	Sig. (2-tailed)
Socio-demographic variables	10.63	3.19		
			0.87*	.000
Climate change mitigation, prevention and adaptation strategies	11.83	2.98		

*Significant at .05, r-calculated = 0.87, r-critical = 0.136, df = 1320

The strong correlation observed in Table 4 confirms that socio-demographic factors play a critical role in determining the climate change responses of female refugee farmers. This relationship underscores the importance of considering demographic and socio-economic characteristics when designing climate change intervention programs in refugee settings. It also highlights the need for policies that address inequalities in education, income, and access to information to improve climate resilience among vulnerable populations.

In response to Question Three, the study identified a wide range of climate change mitigation strategies adopted by female refugee farmers within the camps. These strategies include mulching, manual irrigation, agroforestry and reforestation, rainwater harvesting, sustainable soil management, avoidance of bush burning, selective tree clearing, use of herbicides, zero tillage, application of organic manure, planting of cover crops, hedgerow establishment, and composting. These practices reflect a combination of indigenous knowledge and adaptive farming techniques aimed at conserving soil, improving crop yield, and reducing vulnerability to climate variability.

The results from the simple percentage analysis revealed varying levels of adoption across these strategies. The use of herbicides to clear farmland recorded the highest level of adoption among respondents, followed by manual irrigation and planting of cover crops. Other commonly practiced strategies included the use of organic manure, zero tillage, avoidance of bush burning, and mulching. These findings indicate that female refugee farmers are actively implementing multiple mitigation practices despite limited resources and challenging environmental conditions.

Less frequently adopted strategies included rainwater harvesting, composting, and hedgerow planting, each with relatively low adoption rates. A small proportion of respondents reported using other unspecified methods, while a notable number indicated that they implement nearly all listed mitigation strategies. Overall, the findings demonstrate that female refugee farmers employ diverse climate mitigation practices, although the level of adoption varies depending on resource availability, knowledge, and environmental conditions.

Table 5: Prominent Climate Change Mitigation and Adaptation Strategies Adopted by Female Refugee Farmers in the Camps

S/No	Climate change mitigation strategies	Score	Percentage
1	Mulching	83	6.28
2	Manual irrigation/watering	131	9.90
3	Agroforestry and reforestation efforts	82	6.20
4	Water conservation techniques, such as rainwater harvesting	44	3.33

5	Sustainable soil management to reduce carbon emissions	56	4.24
6	Avoiding bush burning	88	6.66
7	Selecting felling of shrub in farmland during clearing	71	5.37
8	Use of herbicides to clear farmland	151	11.32
9	Zero tillage for crop planting	88	6.66
10	Use of inorganic manure to improve crop yield	121	9.15
11	Planting of cover crops	131	9.91
12	Use of farm yard manure	80	6.09
13	Use of composting	44	3.33
14	Hedgerow within and around farms	44	3.33
15	Others	7	0.59
16	I use almost all the strategies listed here	101	7.64
	Total	1322	100

In response to Question Four, the study identified several challenges faced by refugee farmers in accessing climate change adaptation resources within the camps. These challenges include small farm holdings, inadequate farm inputs, policy restrictions, resource constraints, and limited access to climate information, poor funding, and insufficient institutional support. These constraints significantly affect agricultural productivity and limit the ability of refugee farmers to adopt climate-smart agricultural practices.

The findings further revealed that financial constraints and limited access to productive resources constitute the most significant barriers to climate adaptation among refugee farmers. Poor funding emerged as the most frequently reported challenge, followed by small farm holdings and resource constraints.

These limitations restrict farmers' ability to invest in improved technologies, expand production, and adopt sustainable agricultural practices necessary for climate resilience. Institutional and policy-related challenges also play a significant role in limiting climate adaptation efforts among refugee farmers. Restrictions on land ownership, limited access to credit facilities, and inadequate government and humanitarian support reduce the effectiveness of climate intervention programs. Additionally, shortages of extension workers and insufficient climate information services further hinder the adoption of climate-smart agricultural practices within refugee communities. Cultural norms and gender-related constraints were also identified as barriers affecting female refugee farmers. Traditional gender roles limit women's participation in decision-making processes and reduce their access to resources and opportunities. These social and cultural factors, combined with economic and institutional constraints, create multiple layers of vulnerability that undermine the resilience of refugee farmers to climate change impacts.

In response to Question Five, the study emphasized the importance of targeted interventions to improve climate change resilience among refugee farmers in selected camps. Key recommendations include strengthening agricultural training programs, improving access to farm inputs, enhancing land tenure security, and increasing financial support for climate-smart agriculture initiatives. Encouraging female refugee farmers to form cooperative societies was also identified as a critical strategy for pooling resources, improving access to credit, and strengthening collective resilience.

Table 6: Challenges Faced by Refugee Farmers in Their Respective Camps in Nigeria

S/N	Challenges	Respondents	Percentage
1	Small farm holdings	182	13.76
2	Inadequate farm inputs	117	8.85
3	Policy restriction	88	6.66
4	Resources constraints	177	13.39
5	Status restriction, regulation and policies (camp)	101	7.64

6	Poor access to climate change resources/information	58	4.39
7	Cultural norms	24	1.82
8	Poor funding	204	15.43
9	Near absence of improved varieties for planting	78	5.90
10	Few extension workers to meet refugee farmers need	82	6.20
11	Poor government commitment	89	6.73
12	Discrimination and stigmatization	21	1.52
13	Security status of refugee	101	7.64
		1322	100.00

Discussion of findings

Regarding Question One, the findings revealed that female refugee farmers access climate change information through diverse but unevenly distributed channels within the refugee camps. The most prominent sources were social networks, community town criers, and churches, followed by awareness campaigns, formal and non-formal education systems, and extension agents. Peer groups and print media also played moderate roles in disseminating climate information. However, modern communication platforms such as radio, television, and social media were less utilized; indicating limited digital penetration and infrastructural constraints in refugee settings. This pattern suggests that informal and community-based communication systems remain more influential than mass media or digital technologies in shaping climate awareness among displaced populations.

The dominance of interpersonal communication channels underscores the importance of localized communication systems in refugee environments where formal information infrastructure is often weak or inaccessible. These findings confirm earlier studies by Asrat and Simane (2018); Asfaw et al. (2019); and Adeagbo et al. (2021), who reported that reliance on community networks enhances the effectiveness of climate information dissemination among vulnerable populations. Their studies emphasized that displaced communities depend heavily on trusted social structures, including religious institutions and community leaders for environmental knowledge and decision-making support.

This position aligns with the earlier assertion of Zadawa and Omran (2020), who posited that education plays a vital role in climate change awareness and resource accessibility. Educated individuals are more capable of accessing and interpreting climate information that may otherwise remain unavailable to less educated populations. Through formal and informal education, seminars, workshops, and extension services, climate change information can be effectively transmitted to rural and displaced populations. The concept of training-of-trainers, as emphasized by Eneji et al. (2017), further strengthens knowledge dissemination by enabling trained individuals to transfer climate knowledge to their communities.

Similarly, Adeagbo et al. (2021) observed that climate change mitigation information can be obtained from multiple sources, including news media, social media, formal education systems, environmental awareness campaigns, and development partners. Their findings highlight the importance of integrating both traditional and modern communication channels to improve farmers' knowledge of climate change mitigation practices. This reinforces the need for multi-channel communication strategies that combine community engagement with technological innovation to enhance climate awareness among refugee farmers.

In relation to Question Two, the regression and correlation analyses demonstrated that socio-demographic characteristics significantly influence the adoption of climate change mitigation strategies among female refugee farmers. The regression model ($R = 0.351$; $R^2 = 0.123$; $F = 8.817$; $p < 0.05$) confirmed that socio-demographic variables collectively predict mitigation behavior, explaining approximately 12.3% of the variance in climate change responses. Specifically, sources of information, climate change awareness, educational status, household income, social networking, and household headship emerged as significant predictors of mitigation strategies.

Conversely, marital status, land ownership, cooperative membership, and extension services were not statistically significant predictors of mitigation behavior. The strong Pearson correlation coefficient ($r = 0.87$, $p < 0.05$) further established a significant positive relationship between socio-demographic characteristics and climate change adaptation choices. These findings indicate that access to information, financial capacity, and educational exposure are critical determinants of resilience strategies among female refugee farmers, particularly in resource-constrained environments.

The implication of these findings is that climate change mitigation strategies are largely dependent on individual and household socio-demographic characteristics. Demographic factors such as gender, education, age, income level, and land ownership have been widely recognized as determinants of climate decision-making. This result supports earlier findings by Chenu et al. (2019); Eneji et al. (2021); and Williams and Tumba (2021), who reported that socio-demographic variables significantly influence farmers' responses to climate risks and adaptation opportunities. Their studies demonstrated that factors such as land tenure systems, access to labor, distance to markets, and availability of farming equipment shape farmers' ability to adopt climate mitigation strategies.

Further evidence from Williams et al. (2021) indicated that farming experience, land size, labor availability, and access to agricultural inputs play significant roles in climate adaptation decisions. Similarly, Eneji et al. (2021) found that women often bear the primary responsibility for household food security and therefore play a central role in climate mitigation decisions. In many refugee households, women serve as household heads, which increases their decision-making responsibilities regarding farming practices and environmental management.

The results addressing Question Three showed that female refugee farmers adopt a wide range of climate change mitigation and adaptation strategies that combine traditional knowledge with adaptive agricultural practices. The most commonly adopted strategies included the use of herbicides for land clearing, planting of cover crops, manual irrigation, and the application of inorganic manure. Other strategies such as mulching, agroforestry, zero tillage, bush burning avoidance, and the use of farmyard manure were moderately adopted, while practices such as composting, hedgerow planting, and rainwater harvesting were less frequently implemented.

The diversity of mitigation strategies demonstrates the willingness of female refugee farmers to respond proactively to climate variability despite limited resources. However, the relatively low adoption of advanced conservation practices suggests financial and technical limitations. Muench et al. (2021) emphasized that effective climate mitigation improves crop yields by ensuring water availability through irrigation, enhancing soil fertility through cover cropping, and reducing heat stress through mulching. Their findings illustrate the direct relationship between climate-smart agricultural practices and improved agricultural productivity.

The findings of this work also confirmed earlier studies by Umar et al. (2015); Onnoghen et al. (2020) and Eneji et al. (2021; 2022a; 2022b), which identified mulching, cover cropping, zero tillage, irrigation, and hedgerow planting as effective climate change mitigation strategies. These practices improve soil fertility, reduce erosion, and enhance crop productivity. However, the continued reliance on chemical herbicides and inorganic fertilizers raise environmental concerns, as these inputs may contribute to soil degradation and increased greenhouse gas emissions.

Additional studies by Elum et al. (2017) and Fadina and Barjolle (2018) reported that climate change has led to declining agricultural productivity due to irregular rainfall patterns, drought, desertification, and rising temperatures. These environmental challenges necessitate the adoption of climate-resilient farming practices such as manual irrigation, planting of drought-resistant crops, and the use of organic manure. Their research further recommended the adoption of integrated farming systems that minimize waste and promote sustainable agricultural production.

Concerning Question Four, the findings highlighted significant structural and institutional barriers limiting refugee farmers' access to climate adaptation resources. The most pressing challenges included poor funding, small farm holdings, and general resource constraints. Other major constraints included policy restrictions, security concerns, inadequate farm inputs, and weak government commitment to refugee welfare. Limited access to extension workers and climate information further weakened farmers' adaptive capacity. Cultural norms and stigmatization, although less frequently reported, reflect underlying gender and social inequalities that affect female farmers' participation in climate interventions.

These findings align with the observations of Karanja and Wambugu (2021), who identified inadequate farm inputs, traditional farming methods, and financial limitations as major barriers to climate-smart agriculture adoption. Similarly, Gebre and Rahut (2021) emphasized that land tenure insecurity significantly restricts farm expansion and long-term investment in sustainable practices. Williams and Tumba (2021) further noted that poor infrastructure, limited access to improved seed varieties, and lack of agricultural technology hinder farmers' productivity and resilience to climate change impacts.

Finally, in addressing Question Five, the study underscored the importance of targeted, multi-stakeholder interventions to strengthen climate resilience among refugee farmers. Consultations with humanitarian organizations such as the United Nations High Commissioner for Refugees (UNHCR), International Committee of the Red Cross and Red Crescent (ICRC/IFRC), and the Nigerian Red Cross Society (NRCS) identified key strategies including improving economic security programs, strengthening access to agricultural training and farm inputs, enhancing land tenure security, increasing financial support for climate-smart agriculture, promoting

cooperative formation, and providing land for farming activities. These interventions are essential for overcoming structural constraints and building sustainable resilience against climate-related shocks in refugee camps.

Overall, the findings demonstrate that improving climate resilience among female refugee farmers requires a comprehensive approach that addresses socio-demographic, economic, institutional, and environmental factors simultaneously. Targeted policies, increased funding, improved extension services, and stronger collaboration among government agencies, humanitarian organizations, and local communities are essential for enhancing sustainable agricultural practices and ensuring long-term food security within refugee camps.

Conclusion

The study compellingly demonstrates that female refugee farmers are not passive victims of climate change but resilient innovators navigating complex socio-economic and institutional constraints. Their reliance on trusted community-based communication systems such as churches, social networks, and town criers reveals the enduring strength of localized knowledge systems in shaping climate awareness and action. At the same time, the significant influence of socio-demographic factors such as education, income, social networking, information access, and household leadership underscores that climate change mitigation is not merely a technical issue but a deeply social and economic process. These farmers have shown remarkable adaptability by employing diverse strategies such as mulching, cover cropping, irrigation, and agroforestry, despite limited resources and structural barriers.

However, the persistence of unsustainable practices, low adoption of advanced conservation methods, and widespread constraints particularly poor funding, land limitations, inadequate inputs, and weak institutional support highlight a critical gap between willingness to adapt and the capacity to do so effectively. The findings therefore send a clear message: climate resilience among female refugee farmers will not be achieved through awareness alone but through deliberate investment in human capital, inclusive policies, and accessible climate-smart technologies. Empowering these women is not just a humanitarian responsibility; it is a strategic pathway to strengthening food security, economic security, environmental sustainability, and rural livelihoods in vulnerable communities. Ultimately, this study positions female refugee farmers as frontline actors in climate change mitigation whose success depends on coordinated action among governments, humanitarian agencies, development partners, and local institutions. When their knowledge is supported with resources, training, and enabling policies, they become powerful agents of transformation capable of driving sustainable agriculture and climate resilience in displacement settings.

Recommendations

From the result of this study, the following recommendations were made thus:

1. Institutionalize Community-Based Climate Information Systems: Governments and humanitarian agencies should formalize the use of community–based structures such as social groups, churches, women's groups, and local leaders as official channels for climate change communication. Training selected community members as Climate Information Ambassadors will ensure consistent dissemination of reliable, culturally appropriate climate information within refugee camps.
2. Establish Dedicated Climate-Smart Agriculture Support Funds for Female Refugee Farmers: A targeted micro-grant or revolving loan scheme should be created to provide financial support for climate-smart farming inputs such as improved seeds, organic fertilizers, irrigation tools, and water harvesting equipment. This fund can be jointly managed by government agencies, NGOs, and international partners to ensure transparency and sustainability.
3. Scale Up Functional Literacy and Climate Education Programs: Adult education and vocational training programs should integrate climate change literacy, sustainable farming techniques, and environmental stewardship into their curricula. Improving educational status will enhance farmers' ability to access information, adopt innovations, and make informed decisions about climate mitigation strategies.
4. Strengthen Agricultural Extension and Mobile Advisory Services: Governments and development partners should deploy more extension workers and introduce mobile-based advisory platforms (SMS or radio-based alerts) to deliver timely weather forecasts, pest management guidance, and climate adaptation tips. This will bridge the information gap and improve decision-making among female refugee farmers.
5. Promote Cooperative Farming and Collective Resource Management: Female refugee farmers should be encouraged and supported to form agricultural cooperatives that enable shared access to land, farm inputs, credit facilities, storage infrastructure, and markets. Cooperative systems reduce individual risk, increase bargaining power, and enhance the adoption of sustainable climate practices.
6. Develop Inclusive Land and Policy Frameworks for Refugee Agricultural Activities Policymakers should collaborate with camp authorities and host communities to create flexible land-use arrangements that provide secure access to farmland for refugee women. Clear land tenure policies and

supportive agricultural regulations will enable long-term investment in sustainable farming and climate mitigation practices.

7. The recommendations emphasize the need to institutionalize community-based climate information systems by leveraging trusted local structures such as churches, women's associations, and community leaders to disseminate climate knowledge within refugee settings. This approach aligns strongly with United Nations Sustainable Development Goals (SDG 13: Climate Action) and SDG 17: Partnerships for the Goals, as it promotes inclusive communication, local participation, and multi-stakeholder collaboration in climate adaptation. Training community members as Climate Information Ambassadors also supports national climate adaptation policies that prioritize community engagement, early warning systems, and locally driven resilience-building initiatives among vulnerable populations, including displaced women farmers.
8. The establishment of dedicated climate-smart agriculture support funds and the scaling up of functional literacy and climate education programs directly support SDG 1: No Poverty, SDG 2: Zero Hunger, and SDG 4: Quality Education, while also aligning with refugee livelihood and resilience frameworks implemented by agencies such as the United Nations High Commissioner for Refugees (UNHCR). Providing financial assistance, training, and climate-smart technologies to strengthen the economic capacity of female refugee farmers to adopt sustainable agricultural practices, improve productivity, and enhance food security. These interventions are consistent with climate adaptation and humanitarian policies that emphasize capacity building, income diversification, and sustainable livelihoods as core strategies for reducing vulnerability to climate change.
9. Furthermore, strengthening agricultural extension services, promoting cooperative farming, and developing inclusive land-use and policy frameworks reinforce the principles of SDG 5: Gender Equality, SDG 8: Decent Work and Economic Growth, and SDG 15: Life on Land. These measures align with national agricultural transformation agendas and refugee livelihood programs that advocate equitable access to land, agricultural inputs, markets, and institutional support for women farmers. By integrating cooperative systems, secure land tenure arrangements, and accessible advisory services into policy implementation, governments and development partners can create enabling environments that empower female refugee farmers to sustainably manage natural resources, adopt climate-resilient farming systems, and contribute meaningfully to long-term environmental sustainability and rural development

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