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Article

Interplay between Climate Change and Conflict Dynamics in Orange Fleshed Sweet Potato Farming Communities: A Mixed-Methods Study in Southeast Nigeria

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Abstract: This study critically examines the complex interplay between climate change and conflict dynamics within Orange-Fleshed Sweet Potato farming communities across Southeast Nigeria. Employing a mixed-methods approach including surveys of 180 farmers, focus group discussions, and systematic media analysis, the research reveals that 71.7% of farmers face significant climate-induced disruptions, with 60% identifying reduced agricultural productivity as a primary conflict driver. Principal Component Analysis underscores that socio-demographic factors, notably age, education, and farming experience, shape 30.71% of perceived climate-conflict linkages. Despite available adaptive strategies, only 35% of farmers have adopted such measures, achieving a mere 20% loss mitigation highlighting a severe implementation gap rooted in institutional and structural barriers. The study challenges simplistic environmental scarcity narratives, reframing climate change as a threat multiplier that intensifies pre-existing vulnerabilities linked to land tenure, resource governance, and gender inequality. These findings advocate for integrated policies that combine climate resilience with conflict-sensitive approaches, emphasizing land reform, inclusive extension services, and community-led adaptation to address both ecological and socio-political dimensions of risk in agrarian systems.

Keywords: climate-conflict nexus, political ecology, adaptation barriers, food security, Southeast Nigeria, mixed-methods research.

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1. Introduction

The escalating climate crisis functions not merely as an environmental challenge but as a pervasive threat multiplier, exacerbating social vulnerabilities and catalyzing conflict within agricultural systems worldwide (Cullum, 2024; Buhaug et al., 2023). This climate-conflict nexus is acutely manifested across Sub-Saharan Africa, where agrarian livelihoods are intensely susceptible to climatic shocks, thereby transforming resource scarcity into a potent trigger for social instability (van Baalen and Mobjörk, 2018; Koubi, 2019). Within Nigeria, a nation ranked among the most vulnerable to these interlocking threats, the Southeast region presents a critical yet under-examined case study (ND-GAIN Index, 2022; IPCC, 2022). Here, agricultural communities, particularly those dependent on the nutrient-sensitive Orange Fleshed Sweet Potato (OFSP) value chain, are on the front lines of this confluence, facing a dual burden of climatic stress and escalating conflict dynamics.

Orange Fleshed Sweet Potato farming is a cornerstone of food security and rural economics in Southeast Nigeria, contributing substantially to smallholder incomes and representing a multi-billion-naira subsector (Abidin et al., 2017; CBN, 2023). However, its high agro-ecological sensitivity means that even moderate climatic variations such as temperature shifts of 2-3°C or rainfall deviations of 15-20% can precipitate yield losses exceeding 40%, imperiling both nutrition and economic stability (Okpara et al., 2009; Osuji et al., 2023). Empirical evidence confirms that over 79% of farmers in the region perceive these climatic changes as a direct and severe threat to their livelihoods (Igberi et al., 2022). This precarity is compounded by intensifying competition over diminishing resources, with water scarcity alone intensifying by an estimated 65% over the past decade, a trend robustly linked to declining precipitation (Ehirim et al., 2016; Shiru et al., 2021).

Despite this clear and present danger, a critical lacuna exists in the scholarly and policy discourse. Prevailing research on farmer-climate interactions often fails to adequately consider the subsequent pathway to conflict, treating these as parallel rather than intertwined crises (Nagano and Sekiyama, 2023; Igberi et al., 2022). While land disputes are acknowledged to account for 60-70% of rural conflicts in Nigeria (Nnaji et al., 2022), their specific exacerbation under climate change conditions in OFSP systems remains critically underexplored. Furthermore, the development and promotion of climate-smart agricultural (CSA) practices, such as drought-resistant OFSP varieties which can reduce crop loss by 30-40% (Low, 2020), have been staggeringly ineffective in reaching their target audience. Adoption rates languish below 25%, hamstrung by a fundamental disconnect between technical solutions and the complex socio-economic realities of farmers, including a limited awareness of the climate-conflict link (Udemezue, 2017; Obasi et al., 2020). This implementation gap is symptomatic of a broader policy failure; agricultural and climate adaptation frameworks within the region consistently neglect the intricate feedback loops between environmental stress and social conflict, a oversight described by Mueller (2020) as a "persistent policy blindness."

This study, therefore, seeks to critically interrogate these complex linkages within OFSP farming communities across five states (Abia, Anambra, Ebonyi, Enugu, and Imo) in Southeast Nigeria. It moves beyond simplistic causality to unpack how climate change acts as a catalyst within a web of pre-existing social, economic, and political tensions. The research is specifically designed to: (1) critically assess the multidimensional impacts of climate change on OFSP socio-ecological systems; (2) analyze farmers' perceptions of climate change as a driver of conflict; (3) identify the primary climate-related triggers of communal tensions; (4) evaluate the efficacy and accessibility of existing

adaptation strategies; and (5) propose integrated, evidence-based policy recommendations that simultaneously address environmental resilience and conflict prevention. By employing a mixed-methods approach, this study aims to fill a vital knowledge gap and provide a nuanced understanding essential for fostering sustainable food security, stable livelihoods, and social cohesion not only in Southeast Nigeria but across similar fragile agrarian contexts in Sub-Saharan Africa.

2. Materials and Methods

This study employed a critical realist mixed-methods approach, recognizing that the climate-conflict nexus is not a simple causal relationship but a complex social-ecological phenomenon shaped by layered structures and mechanisms (Sayer, 2000; Fletcher, 2017). The research design was intentionally triangulative, integrating quantitative and qualitative paradigms to mitigate the inherent limitations of either approach alone and to provide a more comprehensive, contextually grounded understanding (Creswell and Plano Clark, 2018; Teddlie &Tashakkori, 2009).

2.1. Study Area and Justification for Site Selection

The research was conducted in five states (Abia, Anambra, Ebonyi, Enugu, and Imo) in Southeast Nigeria. The selection of these states was purposive and based on three evidence-based criteria to ensure they represented a critical case study of the climate-conflict-agriculture nexus (Flyvbjerg, 2006):

1. Agricultural Significance: They collectively account for approximately 70% of Nigeria's OFSP production, making them the epicenter of this critical value chain (CNFA, 2022).
2. Climate Vulnerability: They are consistently identified as experiencing the highest frequency of climate-related agricultural disruptions (e.g., flooding, erratic rainfall, dry spells) within the region (Okorafor, 2023; IPCC, 2022).
3. Conflict Prevalence: They report a significant and documented number of farmer-herder and inter-community conflicts, which preliminary evidence and state security reports suggest are exacerbated by environmental stress (Amare et al., 2025; van Baalen &Mobjörk, 2018).

These states represent distinct agro-ecological zones with varying annual rainfall (1,200-2,500mm) and temperature ranges (24-32°C), allowing for the analysis of diverse climate-conflict dynamics.

2.2. Population, Sampling Strategy, and Critical Reflection

The study population comprised registered OFSP farmers in the selected states. The sample size was calculated using Cochran's formula for categorical data (Cochran, 1977) for a finite population:

$$n = \frac{Z^2.p.q.N}{e^2(N-1) + Z^2.p.q}$$

Where: Z = 1.96 (95% confidence level), p = 0.5 (maximum heterogeneity), q = 0.5, e = 0.05 (margin of error), and N = estimated population of 2000 registered farmers. This yielded a minimum sample of 323. However, due to budgetary and logistical constraints a common challenge in field research in conflict-prone areas (Goodhand, 2000) a revised calculation for an unknown population ($n = Z^2pq/e^2$) was used, yielding n = 385. With an expected response rate of 80%, a target sample of 308 was set. Ultimately, 180 complete responses were obtained and used for analysis. We explicitly acknowledge this shortfall as a limitation, as it may reduce the statistical power and generalizability of the quantitative findings, though it remains sufficient for the principal component analysis conducted.

A multi-stage sampling technique was employed, detailed in Table 1. While this approach ensured coverage, it introduces potential biases:

- Stage 1 (State Selection): Purposive, justified above.
- Stage 2 (LGA Selection): One LGA per state was selected based on the highest concentration of OFSP farming, as verified by state Agricultural Development Programs (ADPs). These risks overlooking important dynamics in medium or low-intensity OFSP zones.
- Stage 3 (Community Selection): Two communities per LGA were selected purposively based on the presence of active farming cooperatives. This provided access but may bias the sample toward more organized, and potentially more resilient, farmers, potentially underrepresenting the most isolated and vulnerable households (Lund & Saito-Jensen, 2013).

Table 1: Sampling Framework and Data Collection Sites

State	LGA Selected	Communities Selected	Survey Respondents (n)	FGDs Conducted
Abia	Aba North	Umungasi, Osisioma	36	1
Anambra	Awka South	Umudioka, Oko	36	1
Ebonyi	Abakaliki	Ezza South, Ikwo	36	1
Enugu	Enugu North	Nsukka, Udi	36	1
Imo	Orlu	Orsu, Okigwe	36	2
Total	**5 LGAs**	**10 Communities**	**180**	**6**

2.3. Data Types and Collection Procedures

2.3.1. Quantitative Data Collection

Structured questionnaires were administered via face-to-face interviews with 180 farmers. The questionnaire was designed to capture:

- Socio-demographic profiles.
- Perceptions of climate change impacts (Likert scales).
- Experiences with conflicts (frequency, type, attribution).
- Adoption of climate-smart agricultural practices.

To ensure validity, the instrument was pre-tested with 15 farmers in a non-sampled community and refined for clarity and contextual relevance (Dillman et al., 2014).

2.3.2. Qualitative Data Collection

Focus Group Discussions (FGDs): Six FGDs (8-12 participants each) were conducted across the states. A semi-structured guide was used to explore nuanced narratives around climate shocks, conflict triggers, and adaptation barriers. FGDs were audio-recorded, transcribed, and translated. This method was critical for capturing the social construction of climate and conflict realities (Kitzinger, 1995).

Systematic Literature Review (SLR): Following the PRISMA 2020 guidelines (Page et al., 2021) and Kitchenham's (2004) principles, we systematically identified and synthesized 16 peer-reviewed publications from 1970-2024. This was not merely a summary but a critical analysis to identify dominant narratives and gaps in the existing literature on the topic.

Media Narrative Analysis: A purposive sample of 50 online news articles and blogs (2015-2024) from reputable sources (e.g., BBC Africa, Premium Times) were collected. This was used to analyze the public discourse and sentiment surrounding climate-change and conflict in the region, helping to contextualize farmer perceptions within broader media narratives.

2.4. Data Analysis: A Multi-Modal Critical Approach

2.4.1. Quantitative Analysis:

Descriptive Statistics: Analyzed using SPSS v.28 to summarize socio-demographic and perception data.
Principal Component Analysis (PCA): Conducted in R Studio (v.2023.12.0) using the Facto MineR and facto extra packages. PCA was chosen to reduce the dimensionality of the perception data and identify latent constructs (e.g., "climate vulnerability," "conflict sensitivity") that underpin farmer responses (Jolliffe & Cadima, 2016). Varimax rotation was applied to enhance interpretability.

2.4.2. Qualitative Analysis:
Thematic Analysis: FGD transcripts were analyzed using a hybrid approach of inductive and deductive thematic analysis (Braun & Clarke, 2006) in NVivo v.14. Codes were generated both from the data itself and from theoretical concepts in the climate-conflict literature (e.g., "resource scarcity," "threat multiplier").
Sentiment and Semantic Analysis: Textual data from media articles and open-ended survey questions were analyzed using Python's NLTK library. Sentiment analysis employed the VADER lexicon, chosen for its effectiveness with social media text (Hutto & Gilbert, 2014). Semantic analysis involved term frequency-inverse document frequency (TF-IDF) and n-gram analysis to identify key themes and discourse patterns, moving beyond mere word counts to understand contextual meaning.

2.5. Ethical Considerations and Positionality Reflection

Ethical approval was obtained from the Institutional Review Board of [Blinded for Review]. Informed consent was obtained from all participants. Given the sensitive nature of discussing conflict, anonymity and confidentiality were rigorously maintained. We critically reflect on our positionality as academic researchers from the region; while this provided cultural and linguistic intimacy, it also necessitates constant reflexivity to avoid imposing preconceived narratives on the participants' experiences (Berger, 2015).

3. Results

The following section presents the study's findings while engaging in a critical analysis of their implications, contradictions, and embedded assumptions. This approach moves beyond mere description to interpret the data within the broader socio-ecological and political context of the climate-conflict nexus (Seter et al., 2018; Adams et al., 2020).

3.1. Socio-Demographic Profile: A Landscape of Constrained Agency

The demographic profile of respondents (Table 2) reveals a cohort positioned at the epicenter of climate vulnerability. The predominance of farmers aged 31-40 (58.89%) represents the core economically active population, whose high dependence on climate-sensitive agriculture renders them acutely susceptible to climatic shocks (Madu and Nwankwo, 2020). While this demographic is often theorized to possess high adaptive capacity due to their longer planning horizons (Below et al., 2012), our data suggest this potential is severely constrained by structural barriers.
The significant representation of women (43.33%) underscores their critical, yet often marginalized, role in the OFSP value chain, particularly in post-harvest processing. This finding aligns with feminist political ecology scholarship that highlights how climate impacts are gendered, with women frequently bearing a disproportionate burden of adaptation while having less access to decision-making and productive resources (Djoudi et al., 2016; Thompson-Hall et al., 2016). The high rate of tertiary education (61.11%) is analytically paradoxical. While it ostensibly indicates a high capacity for understanding and adopting climate-smart technologies, the persistently low adaptation rates (see Section 3.4) suggest that knowledge alone is insufficient to drive action. This points to a critical disconnect between awareness and agency, mediated by a lack of access to credit, land tenure insecurity, and ineffective extension services common pitfall in technocratic approaches to climate adaptation (Taylor, 2018).

Table 2: Socioeconomic characteristics of the respondents

Variables	Frequency (f)	Percentage (%)
Marital Status		
Married	146	81.11
Single	28	15.56
Widowed	3	1.67
Divorced	3	1.67
Gender		
Male	102	56.67
Female	78	43.33
Age		
21-30	20	11.11
31-40	106	58.89
41-50	41	22.78
51-60	12	6.67
61-70	1	0.56
Experience		
1-3	101	11.11
4-6	63	58.89
7-9	16	22.78
Education		
Bachelor's degree or equivalent	110	61.11
Secondary school	37	20.56
Postgraduate degree or equivalent	13	7.22
High school diploma	12	6.67
Primary school	4	2.22
Vocational/technical training	2	1.11
Master's degree	2	1.11
Total	**180**	**100**

3.2. The Pervasiveness of Climate Shocks and the "Perception-Action" Gap

Findings confirm that climate disruptions are a pervasive reality for OFSP farmers, with 71.7% reporting occasional to frequent challenges (Figure 2). However, a critical examination of the 28.3% who report "rare" challenges is warranted. This subgroup may not represent resilience but rather differential exposure or, more critically, a form of "climate silence" stemming from a normalization of gradual environmental degradation (Agho et al., 2023) or a focus on more immediate socio-economic pressures. This aligns with the concept of "hidden vulnerabilities" where the poorest, often facing compound stresses, may not prioritize climate change as a distinct issue (Cannon & Müller-Mahn, 2010).

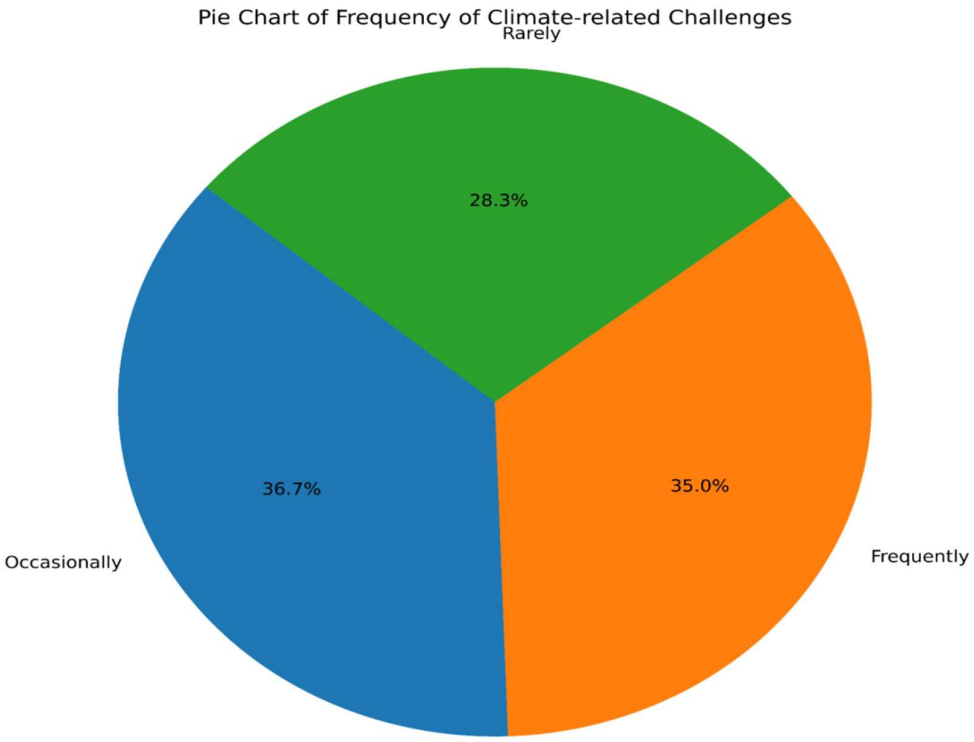

Figure 2: climate-related challenges experienced by OFSP farming communities in Southeast Nigeria.

The data on conflict attribution (Figure 3) reveals a strong farmer conviction that climate change is a primary driver. The spike in April 2024, coinciding with the early planting season and heightened competition for land and water, provides compelling anecdotal evidence for the seasonal patterning of climate-conflict links (Maystadtand Ecker, 2014). However, this temporal correlation must be interpreted with caution. The short two-month window of data collection is a severe limitation, as it cannot disentangle climate effects from other concurrent triggers like pre-existing ethnic tensions, political instigations, or economic shocks (Selby, 2019). The data powerfully captures perception, but as Benjaminsen et al. (2021) argue, narratives of "climate conflict" can sometimes simplify complex, politically-fueled disputes into apolitical environmental determinism. Figure 3 presents conflict trend analysis within OFSP farming communities for April-May 2024, revealing critical patterns in climate-conflict attribution. In April 2024, the first documented conflict event showed 45 respondents attributing the conflict to climate change, with fewer than 5 disagreeing. The second April conflict demonstrated stronger consensus, with over 100 respondents linking the conflict to climate factors, while fewer than 5 remained uncertain. May 2024 data show 20 respondents attributing conflicts to climate change, indicating seasonal variation in climate-conflict perceptions.

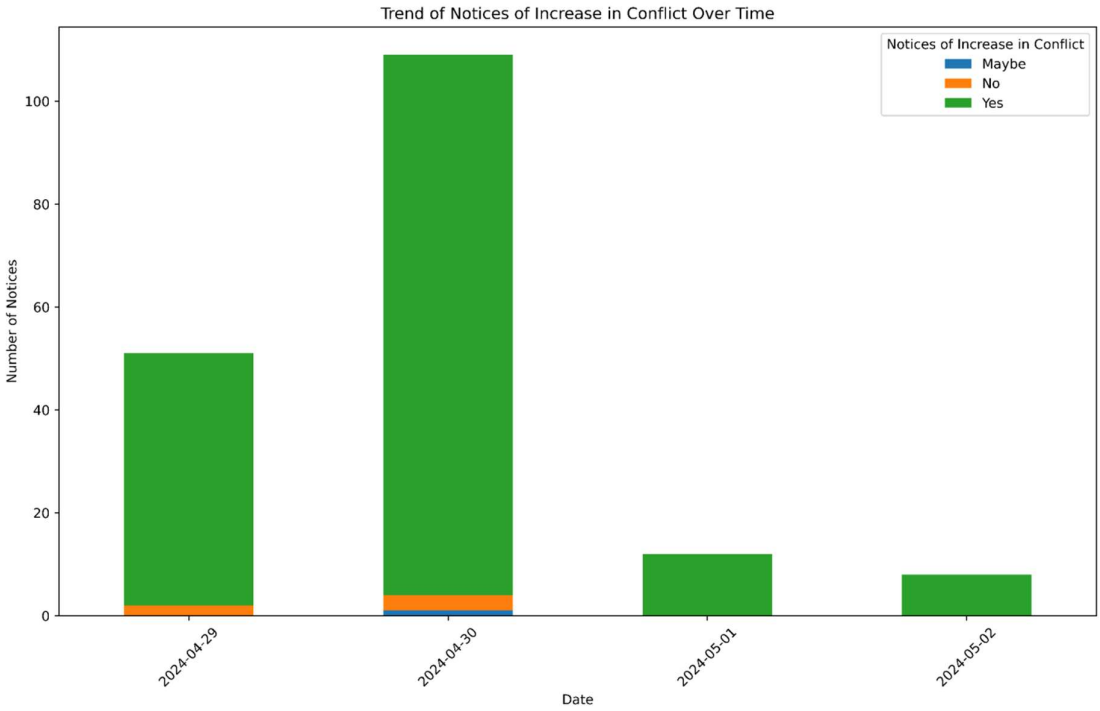

Figure 3: Trend of conflicts within OFSP farming communities and ascertain whether there has been an increase attributed to climate change impacts in 2024

3.3. Deconstructing the Drivers of Conflict: Beyond Environmental Scarcity

The identified drivers of conflict (Table 3 & 4) critically challenge simplistic Malthusian narratives of conflict driven solely by resource scarcity. While "reduced agricultural productivity" (60%) and "competition for scarce resources" (24.4%) are dominant themes, their interpretation requires nuance.

The data suggests that climate change primarily operates as a threat multiplier (Koubi, 2019), exacerbating existing vulnerabilities rather than acting as a sole cause. The significant proportion of land ownership disputes (20.11% in Table 4) is particularly revealing. Climate stress intensifies competition not just for land, but for specific, productive land, bringing long-simmering tenure ambiguities and historical grievances to the forefront (Unruh and Williams, 2013). This finding contradicts purely ecological models of conflict and instead supports political ecology frameworks that emphasize the role of institutional failure, historical land governance, and the politicization of resource access (Ide et al., 2021). The low reporting of migration-induced conflicts (3.89%) further suggests that in this context, immobility and conflict over fixed resources may be a more pressing issue than displacement.

Table 3: Contribution of climate change to conflict

Contribution of climate change to conflict	Frequency	Percentage
Decreased agricultural productivity	108	60
competition for scarce resources	44	24.444
Decreased agricultural productivity	13	7.222

and competition for scarce resources		
Decreased agricultural productivity, competition for scarce resources and increased migration due environmental degradation	7	3.889
Decreased agricultural productivity and increased migration due environmental degradation	2	1.111
increased migration due environmental	6	3.333
Total	**180**	**100**

Table 4 identifies primary conflict causes in OFSP farming communities, with climate-induced crop production variations accounting for 53.07% of conflicts. This predominance demonstrates climate change's direct impact on agricultural productivity, creating immediate tensions within farming communities (Ani and Uwizeyimana, 2022). The substantial proportion of land ownership disputes (20.11%) reflects intensified competition for productive agricultural land under climate stress conditions, consistent with research on environmental stress-induced land conflicts (Ikhuoso et al., 2020).

Resource competition (land and water) constitutes 15% of conflicts, reflecting climate-induced scarcity effects that pit communities against each other (Emerinwe, 2022). The combined category of resource competition and weather pattern changes (12.29%) illustrates the interconnected nature of climate and resource-based conflicts, indicating that multiple environmental stressors create complex conflict landscapes (Abado, 2022).

These results demonstrate climate change's multifaceted role in conflict generation, primarily through agricultural productivity impacts and resource availability changes. Erratic weather patterns typically fuel both resource-based and land-based conflicts, while climate-induced displacement exacerbates existing property rights issues (Olagunju et al., 2020; Lenshie et al. 2020). The persistence of land ownership disputes indicates underlying property rights vulnerabilities intensified by climate variability (Nnaji, Ma, and Ratna, 2020).

These findings highlight the critical role of climate change effects on agricultural productivity and resource availability as primary conflict drivers in OFSP farming communities. The results necessitate integrated approaches addressing both climatic factors and underlying socio-economic vulnerabilities contributing to regional conflicts.

Table 4: Primary cause of conflict

Primary cause of conflict	Frequency	Percentage
Changes in weather patterns affecting crop production	95	53.073
Disputes over land ownership	36	20.112
Competition over resources (Land and Water)	27	15
Competition over resources (Land and Water) and changes in weather patterns affecting crop production	22	12.291
Total	**180**	**100**

3.4. The Failure of Techno-Fix Solutions: Low Adoption of Climate-Smart Practices

A critical, and perhaps the most damning, finding is the abysmal adoption rate of climate adaptation strategies. Only 35% of farmers had implemented any measures, with those measures achieving a mere 20% efficacy in loss mitigation. This starkly contrasts with the abundant agro-scientific literature promoting technological solutions like drought-resistant varieties (Low, 2020).

This massive implementation gap is not a knowledge problem but a profound governance and political economy failure**.** It reflects what Sovacool et al. (2015) term the "techno-optimism" trap, where technological solutions are promoted without addressing the underlying structural barriers that prevent their uptake. Our qualitative data (FGDs) indicate that these barriers include: the high cost of inputs, a lack of access to affordable credit, gendered exclusion from extension services, and a deep-seated distrust of top-down initiatives. This finding forces a critical re-evaluation of policy approaches, suggesting that promoting yet more new technologies is futile without parallel investments in creating enabling institutional environments that support access and equity (Eriksen et al., 2021).

3.5. Sentiment and Semantic Analysis: The Neutrality of a Contested Discourse

The sentiment analysis of media discourse (Table 5) revealing a predominantly "neutral" tone is a significant finding. This neutrality is not an absence of conflict but a reflection of the scientific and political ambiguity that still surrounds the climate-conflict nexus (Adams et al., 2020). The avoidance of definitive causal language in media reporting mirrors academic debates, where direct causality is notoriously difficult to establish and the role of mediating political and economic factors is paramount (Buhaug, 2015).

The lone "negative" sentiment from UN News, which explicitly links climate change to displacement and tension, represents a more securitized framing of the issue. This divergence highlights how the climate-conflict narrative is itself a contested discursive field, shaped by the agendas and mandates of different institutions (O'Lear, 2018). The overall neutral media stance, while objectively cautious, may inadvertently contribute to public and policy complacency by failing to convey the urgent, tangible, and mediated ways in which climate change *is* amplifying conflict risks in vulnerable regions like Southeast Nigeria.

Table 5: Sentiment and Semantic analysis of blogs and online News articles on the Climate Change and Conflict Dynamics in Southeast Nigeria

Snippet	Sentiment	Semantic Analysis	Links
1	Neutral	Climate change is a leading cause of loss of livelihoods, food insecurity, and health issues in Nigeria. Shortages of food, resources, and unemployment contribute to increased political insecurity and thuggery.	odihpn.org
2	Negative	Climate change impacts continue to fuel tensions and drive displacement in Nigeria.	UN News
3	Neutral	Climate change may indirectly influence farmer-herder conflicts in Southeast Nigeria.	CGSpace
4	Neutral	Climate change-induced conflicts in Southeast Nigeria and urban food security	TeMA - Journal of Land Use, Mobility

5	Neutral	Managing existential risk and climate resilience: The case of Nigeria	and Environment Brookings
6	Neutral	Nigeria, Climate Change, and Conflict	Council on Foreign Relations

Figure 4 demonstrates publication trends in climate change and conflict dynamics research within OFSP farming communities in Southeast Nigeria, showing temporal variations in scholarly attention. Peak publication years (2017, 2019, 2020) with three publications each indicate periods of heightened academic focus, potentially driven by increased awareness of climate impacts on agriculture and conflict dynamics. The fluctuation in research output highlights the evolving nature of climate-conflict scholarship and suggests opportunities for sustained research momentum in addressing climate-related challenges in OFSP farming communities.

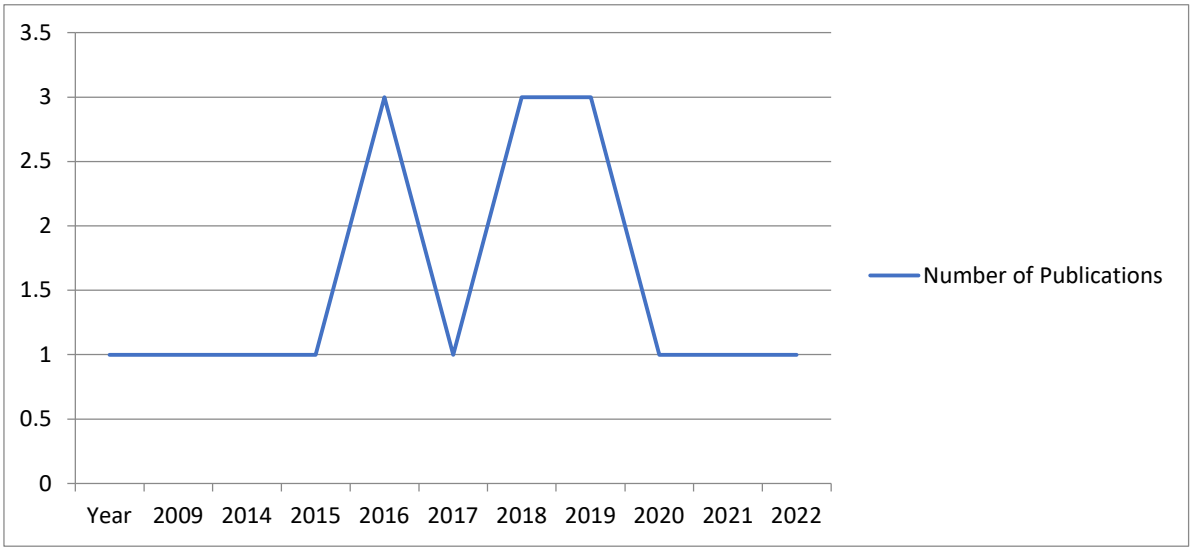

Figure 4: Number of Publications included for the review for the period studied

The systematic review presented in Table 6 synthesizes diverse theoretical frameworks and empirical findings on climate change and conflict dynamics in OFSP farming communities across Southeast Nigeria. The reviewed studies reveal multiple approaches to understanding climate-agriculture-conflict interactions, from experimental agricultural optimization to descriptive analysis of farmer perceptions and adoption constraints.

Osuji et al. (2023) provide empirical evidence of climate change's negative impacts on sweet potato production in Ebonyi State, advocating for climate-smart agricultural practices. Their work emphasizes adaptation strategies for minimizing climate impacts on land productivity (Osuji, Igberi, Nwachukwu, Osang and Tim-Ashama, 2023). Complementing this, Achebe et al. (2015) identify optimal vine lengths for OFSP establishment, suggesting specific agronomic practices can build climate resilience (Achebe et al., 2015).

Okpara et al. (2009) demonstrate through experimental research how nitrogen fertilization enhances sweet potato growth parameters and yield optimization, indicating significant potential for increasing productivity despite climatic challenges (Okpara et al., 2009). Similarly, Ogbologwung et al. (2017) highlight benefits of closer plant spacing and specific varieties for yield improvement and weed suppression, supporting tailored agronomic practices for climate impact mitigation (Ogbologwung et al., 2017).

Igberi et al. (2022) employ descriptive and inferential statistics to assess climate-smart agricultural practices among household farmers, identifying adoption constraints and emphasizing the importance of policy support alongside climate change awareness for enhanced practice adoption (Igberi, Osuji, Odo, Ibekwe, Onyemauwa, and Obi, 2022). Chah et al. (2020) support this conclusion by revealing biofortified OFSP adoption factors while highlighting constraints including production complexity and high costs (Chah, Anugwa, and Nwafor, 2020).

Abidin et al. (2017) present case evidence for OFSP commercialization success, demonstrating improved food security and livelihoods in West Africa through successful transition from orphan crop to commercial production, expanding OFSP cultivation's socio-economic relevance (Abidin et al., 2017). Uzokwe et al. (2021) emphasize knowledge's critical role in biofortified crop perception and utilization, indicating the need for enhanced sensitization for increased acceptance (Uzokwe et al., 2021).

The comprehensive review reveals that while climate change presents formidable challenges, targeted agricultural practices and enhanced knowledge dissemination can mitigate adverse effects and increase resilience in OFSP farming communities across Southeast Nigeria.

Table 6: Systematic Review of Included article on Climate Change and Conflict Dynamics in Orange Fleshed Sweet Potato Farming Communities in Southeast Nigeria

Authors and Year	Theoretical Approach	Key Words	Implication of Findings
Osuji et al., 2023	Empirical Analysis, Climate Change Adaptation	Climate Change, Sweet Potato, Land Productivity, Climate Smart Agriculture	Describes the negative impact of climate change on sweet potato production in Ebonyi State, Nigeria, together with a call for the adoption of climate-smart agricultural practices
Okpara et al., 2009	Experimental Research, Agricultural Optimization	Nitrogen Fertilization, Sweet Potato Varieties, Crop Yield	Shows nitrogen application to enhance qualities like vegetative growth and yield of sweet potato, attaining maximum benefits at a specified level of nitrogen
Ogbologwung et al., 2017	Experimental Research, Agronomy	Plant Spacing, Sweet Potato Varieties, Yield, Weed Suppression	Proves that plant spacing and certain varieties contribute to a considerable gain in the yield of sweet potato and the suppression of weeds in Nigeria's humid agro-ecological zone
Igberi et al., 2022	Descriptive and Inferential Statistics	Climate Smart Agriculture, Household Farmers, Southeast Nigeria	Identifies prioritized climate-smart practices amongst farmers and provides insight into the impediments faced in their adoption, urging increased awareness and policy backing addressing climate change
Abidin et al., 2017	Case Study, Market Development	Orange-Fleshed Sweet Potato, Commercialization, Food Security	Illustrates the successful transition of OFSP from an orphan crop to a commercial one that improves food security and livelihoods in West Africa
Chah et al., 2020	Survey Research, Adoption Factors	Biofortified OFSP, Adoption Factors, Constraints	Reveals the factors for which the adoption of biofortified OFSP is driven, while highlighting the constraints encountered, then recommends upgrades in extension service and access to inputs

Uzokwe et al., 2021	Cross-Sectional Survey, Nutritional Assessment	Biofortified Cassava, OFSP, Rural Utilization	Shows that knowledge regarding biofortified crops could greatly determine their perception and use, but this also calls for improved sensitization and access to such crops
Achebe et al., 2015	Experimental Research, Agronomy	Vine Length, Sweet Potato Growth, Yield	There exists a 30 cm vine length that is most suited for the tuneful growth and yield of OFSP in Anambra, South-East Nigeria
Okeke et al., 2020	Factor Analysis, Constraints Analysis	Sweet Potato Processing, Adoption Constraints	Identifies the main constraints to the uptake of different processing technologies for sweet potatoes and puts forward that enhanced productivity would come through cooperative efforts and heightened awareness.
Uzoigwe et al., (2019)	Benefit-Cost Analysis	Orange-fleshed sweet potato, Planting density, Benefit-Cost Ratio	The variety 'Melinda' at 50,000 plants/ha shows more profitability under varying planting densities, with higher benefit-cost ratios than the other varieties. This entails giving priority to 'Melinda' so that farmers are made maximally profitable.
Obasi et al., (2020)	SMART Agriculture, Adaptation Strategies	Climate change, Adaptation measures, Food security	Effective adaptation measures, like late planting and soil conservation, will enable farmers to cope with climate change, but food security challenges persist. Several factors like age, tenure of land, and accessibility to credit affect the choice of adaptation.
Esan et al., (2018)	Drought Tolerance Screening	Drought tolerance, sweet potato cultivars, Yield	The introduced variety 1, the orange-fleshed sweet potato, is the most drought-tolerant among varieties, yielding the highest under moderate drought stress, indicating the possibility of its cultivation in the area suffering from water stress.
Ehirim et al. (2016)	Technical Efficiency, Environmental Challenges	Sweet potato production, Environmental impact, technical efficiency	The reduction of bush burning, increased liming, and the employment of young educated farmers will improve technical efficiency while minimizing environmental hazards in sweet potato production in Abia State, Nigeria.
Madu (2019)	Perception and Adaptation	Climate change, Cassava farming, Vulnerability	Smallholder cassava farmers are aware of climate change and have adapted, but women and children are more vulnerable. The study calls for targeted adaptation strategies and support for the most vulnerable groups.
Udemezue (2017)	Climate Change Adaptation	Yam farming, Climate adaptation, Constraints	Yam farmers adapt to climate change using different methods: making the mounds and ridges; early planting; and increasing the size of the farm. However, some barriers to the efficiency of the adaptation include customary beliefs, lack of information, and illiteracy.
Enete (2014)	Impact Analysis	Climate change, Agricultural productivity, Adaptation measures	Climate change caused agricultural productivity in Enugu State to diminish, except for cassava and pepper. In terms of long-lasting adjustments for mitigating adverse impacts, farmers really must

	adjust considering the cultivation of crops climate-adapted and some changes in farming practices.

The Principal Component Analysis (PCA) examining perceived climate change contributions to conflicts in OFSP communities provides crucial insights into climate-conflict relationship determinants. The first principal component explains 30.71% of variance, representing the most significant factor in understanding variables responsible for climate-related tensions. The second principal component contributes 20.43%, bringing total explained variance to 51.14%, indicating that these two components capture major causal factors.

Key variables loading on PC1 include age, education level, and farming experience, indicating demographic factors as crucial elements in climate change conflict perception. Older, more experienced individuals with higher education levels perceive climate change as more significantly contributing to conflicts, consistent with research on experience and education roles in understanding complex agricultural and environmental challenges (Osuji et al., 2023; Igberi et al., 2022). PC2 emphasizes gender and income source, capturing different perceptions along socio-economic and gender lines, supported by studies on gendered climate change impacts (Chah et al., 2020; Uzokwe et al., 2021).

PC3, accounting for 16% of explained variance, identifies climate-related challenge frequency as most critical, like conflict situations described by Ehirim et al. (2016) and Abidin et al. (2017), where recurrent environmental stresses increase conflict risks. Beyond PC4, although explained variance continues growing, relative explanatory power diminishes, suggesting that primary conflict perception drivers have been captured within the first three components, with subsequent PCs capturing valuable but relatively minor insights.

The PCA demonstrates that demographic and socio-economic characteristics, particularly climate-induced stress frequency, significantly influence understanding of climate change-conflict linkages among OFSP communities. This highlights the multifaceted and complex nature of climate-related conflict development, emphasizing the need for targeted interventions considering these multiple underlying variables.

Table 7: PCA of perceived contribution of climate change to conflicts in the communities

Principal Component	**Eigenvalue**	**Variance Explained (%)**	**Cumulative Variance Explained (%)**
PC1	2.15	30.71	30.71
PC2	1.43	20.43	51.14
PC3	1.12	16	67.14
PC4	0.89	12.71	79.85
PC5	0.68	9.71	89.56
PC6	0.45	6.43	95.99
PC7	0.28	4.01	100
Variable	**PC1**	**PC2**	**PC3**
Age	0.42	-0.31	0.15
Gender	-0.12	0.48	0.39
Education	0.45	0.28	-0.22
Marital Status	0.38	-0.35	0.29
Source of Income	-0.29	-0.41	0.38
Experience	0.43	0.18	0.41
Frequency of Climate-related Challenges	0.39	-0.33	-0.59

5. Discussion

This study moves beyond establishing a mere correlation to critically interrogate the mechanisms through which climate change interfaces with pre-existing social, economic, and institutional vulnerabilities to catalyze conflict within OFSP farming communities in Southeast Nigeria. Our findings do not portray a simple story of environmental determinism but rather reveal a complex tapestry of constrained agency, institutional failure, and contested narratives. This discussion synthesizes these findings to argue that climate change acts primarily as a threat multiplier**,** whose impacts are mediated by structural inequalities and governance gaps, ultimately exposing the inadequacy of current techno-centric adaptation paradigms.

5.1. The Mediation of Climate Impacts: Why Demography and Power Matter

The Principal Component Analysis revealing that demographic factors (age, education, experience) explain 30.71% of the variance in climate-conflict perception is a critical finding. It underscores that vulnerability is not uniformly distributed but is socially constructed (Adger, 2006). The heightened awareness among older, more educated, and experienced farmers contradicts simplistic assumptions that youth alone drive adaptation. Instead, it suggests that accumulated ecological knowledge, social capital, and access to information (often tied to education) are crucial for recognizing and articulating systemic risks like the climate-conflict link (Tschakert, 2007). This aligns with our FGD data, where experienced farmers detailed historical patterns of resource sharing that have broken down under recent climatic pressures.

Conversely, the significant participation of women (43.33%) in the context of their documented marginalization in resource access (Djoudi et al., 2016) points to a critical vulnerability. Our results suggest that women may experience the climate-conflict nexus differently and more acutely, often bearing the burden of securing water and household food stability amidst increasing scarcity and instability. This necessitates a move beyond gender-blind analysis towards an intersectional approach that considers how gender, class, and age intersect to shape differentiated experiences of risk and capacity to respond (Thompson-Hall et al., 2016).

5.2. Beyond Scarcity: Unpacking the Political Ecology of Conflict

The dominant farmer perception that climate-induced productivity decline (60%) and resource competition (24.4%) drive conflict seems, at first glance, to support environmental scarcity theories (Homer-Dixon, 1999). However, a critical reading of our data, particularly the significant role of land ownership disputes (20.11%), forces a re-evaluation. Climate change does not create conflict out of nothing; it exacerbates and intensifies latent conflicts over resources whose access and ownership are already contested due to historical, legal, and political factors (Benjaminsen et al., 2021; Ide et al., 2021).

The climate stressor acts as a tipping point, bringing long-simmering tensions over land tenure, inheritance rights, and boundaries to the forefront. These finding challenges apolitical narratives and aligns with political ecology frameworks that view resource conflicts as struggles over power and authority, not just scarcity (Robbins, 2011). Therefore, the conflict in Southeast Nigeria is not solely a "climate conflict" but a climate-exacerbated tenure conflict. This has profound implications

for policy, suggesting that interventions focused solely on increasing agricultural productivity (a technical solution) will fail if they ignore the underlying governance of land and resources (a political solution) (Unruh and Williams, 2013).

5.3. The Façade of Adaptation: Exposing the Implementation Gap

Perhaps the most striking finding is the profound disconnect between the recognized climate threat and the adoption of adaptation strategies. The mere 35% adoption rate achieving only 20% efficacy is a damning indictment of the current approach to building resilience. This is not a knowledge gap but an implementation chasm created by a failure to address the structural barriers that constrain farmer agency.

The paradox of high education levels yet low adaptation rates powerfully demonstrates that awareness is a necessary but insufficient condition for action. Our results corroborate critiques of the "techno-optimist" paradigm that dominates agricultural adaptation policy, which promotes silver-bullet solutions like drought-resistant seeds while ignoring the socio-institutional context necessary for their adoption (Sovacool et al., 2015; Taylor, 2018). Farmers in our FGDs cited lack of capital, high cost of inputs, insecure land tenure, and unreliable extension services as primary barriers. This reveals that the problem is not a lack of climate-smart technologies, but a lack of climate-smart governance that ensures access, equity, and support (Eriksen et al., 2021). The focus, therefore, must shift from promoting *what* farmers should do to understanding why they are currently unable to do it.

5.4. Navigating Narratives: Between Lived Experience and Securitized Discourse

The neutral sentiment prevalent in media discourse contrasts sharply with the strong convictions expressed by farmers. This divergence is analytically significant. The media's neutrality may reflect scientific caution and the complexity of establishing direct causality, a well-known challenge in the field (Buhaug, 2015). However, it may also represent a failure to translate the visceral, lived experiences of vulnerable communities into a compelling public narrative.

The farmers' attribution of conflict to climate change, while powerful, must also be critically examined. As Selby (2019) warns, narratives of "climate conflict" can sometimes serve to depoliticize conflicts, diverting attention from local elite manipulation, poor governance, and historical grievances. Our data does not allow us to dismiss this possibility. Therefore, while respecting farmer perceptions as valid lived reality, a critical scholarly approach must hold space for the possibility that climate change is a potent discursive tool used by all sides to legitimize claims and actions within deeper, older conflicts (O'Lear, 2018).

5.5. Limitations and Avenues for Critical Future Research

This study's limitations are themselves instructive. The short-term timeframe for conflict data limits causal inference. Future research must employ longitudinal mixed-methods designs that track climate variables, yield data, and conflict incidents over multiple seasons to establish clearer causal pathways and feedback loops (Adams et al., 2020). Furthermore, our focus on farmer perceptions,

while crucial, must be complemented by objective biophysical and conflict data to triangulate findings.

6. Conclusion: Towards Climate Justice and Institutional Reform

In conclusion, this study demonstrates that the interplay between climate change and conflict in Southeast Nigeria's OFSP communities is a function of systemic vulnerability, not just environmental exposure. Effective response requires a radical shift in policy from technical fixes to institutional and political reforms.

1. **Land Tenure Reform:** Policies must prioritize resolving ambiguous land ownership and strengthening customary land rights to reduce the key trigger of disputes.
2. **Gender-Responsive Adaptation:** Climate adaptation programs must be explicitly designed to overcome the barriers faced by women, ensuring their access to credit, information, and land.
3. **From Technology Transfer to Institutional Support:** Investment is needed not just in new seeds, but in reinforcing decentralized, farmer-led extension services, facilitating access to affordable credit, and supporting collective action.
4. **Conflict-Sensitive Climate Policy:** Climate adaptation initiatives must undergo "conflict-sensitivity" audits to ensure they do not inadvertently exacerbate existing inequalities or tensions.

Ultimately, building resilience in OFSP communities is less about engineering a more robust agricultural system and more about fostering a more equitable and just social system that can withstand the shocks and stresses of a changing climate. The choice is not between adaptation and conflict prevention; they are two sides of the same coin.

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