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The Climate–Conflict–Food Nexus: Sahelian Herder Migration and Agrarian Violence in North Central Nigeria

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Abstract

Climate change has increasingly reshaped pastoral mobility across the Sahel since the early 2000s. Recurrent droughts, desertification, and declining pasture and water resources in Niger, Chad, Mali, and Burkina Faso have intensified cross-border herder migration into Nigeria. While farmer–herder conflict in North-central Nigeria is widely documented, limited attention has been given to how climate change-induced cross-border migration specifically shapes conflict dynamics and food security outcomes. This gap constitutes the central research problem. Focusing on Benue, Plateau, Nasarawa, Niger, Kogi, and Kwara States between 2000 and 2023, this study examines the nexus between climate-induced migration, farmer–herder conflict, and food security. Grounded in political ecology and environmental security theory, it adopts a qualitative documentary analysis of climate records, migration reports, policy frameworks, and conflict databases. Regional instruments – including the ECOWAS Protocol on Free Movement of Persons (1979) and the ECOWAS Transhumance Certificate (1998) – are analyzed to contextualize institutional dimensions of pastoral mobility. Findings indicate that climate-driven shifts in the scale and duration of transhumance have intensified competition over land and water resources. Combined with population growth, agricultural expansion, and weak land governance, these pressures have disrupted agricultural production, displaced rural communities, and undermined food security in North-central Nigeria. The study concludes that addressing these risks requires integrated climate adaptation, improved regulation of cross-border pastoral mobility, and strengthened land governance mechanisms.

Keywords: Climate Change-Induced Migration, Sahelian Herders, Farmer–Herder Conflict, Food Security, North-central Nigeria

Introduction

Climate change has fundamentally transformed pastoral mobility patterns across the Sahel region since the early 2000s. Recurrent droughts, accelerating desertification, and progressive declines in pasturelands and water resources now define the region's ecological landscape (Nicholson, 2011; Mortimore, 1989). Herders originating from Niger, Chad, Mali, and Burkina Faso increasingly cross borders into Nigeria. They target the resource-rich North-central states of Benue, Plateau, Nasarawa, Niger, Kogi, and Kwara (Abubakar, 2022). These movements extend far beyond traditional seasonal transhumance corridors. Ecological stressors render northern grazing zones uninhabitable and compel southward expansion into agriculturally intensive areas (Okoli & Atelhe, 2014).

This influx generates acute competition over shrinking land and water resources. Expanding crop cultivation, rapid population growth, and insecure land tenure systems create persistent friction between sedentary farmers and mobile pastoralists (Alao, 2007; Adelakun et al., 2015). The resulting farmer-herder conflicts have escalated dramatically. Since 2001, these conflicts have claimed over 60,000 lives. In 2018 alone, 1,300 fatalities were recorded across Benue and Plateau States (Abubakar, 2022; International Crisis

Group, 2018). Violence manifests through crop destruction, retaliatory killings, cattle rustling, and protracted militarized confrontations. These dynamics fundamentally disrupt agricultural calendars and rural livelihoods (Kwaja & Ademola-Adelehin, 2018).

Regional institutional frameworks designed to regulate such mobility prove woefully inadequate. The Economic Community of West African States (ECOWAS) Protocol on Free Movement of Persons (1979) and Transhumance Certificate (1998) exist on paper. However, they suffer chronic implementation failures — lacking border monitoring, harmonized veterinary controls, and conflict-sensitive enforcement mechanisms (ECOWAS, 2003; Jaye et al., 2011). National policies fare no better. Nigeria's National Migration Policy suffers uneven application, and contentious state-level anti-open grazing laws provoke rather than resolve tensions (Nneli et al., 2022; International Crisis Group, 2018).

The food security consequences are devastating. Benue State — historically recognized as Nigeria's "food basket" for yam, rice, and soybean production — now faces conflict-induced farmland abandonment, restricted access during peak planting seasons, and supply chain disruptions. Crop yields have declined by an average of 181 units. Food inflation surged from 24.32% to 35.41% within a single year. In some zones, 68.5% of communities report complete cessation of farming activities (Haaga et al., 2025; NBS, 2020). Economic analyses estimate that conflict resolution could unlock USD 13.7 billion in annual agricultural gains for affected states, underscoring the stakes (United Nations Peacebuilding, 2019).

While farmer-herder violence has been extensively documented, existing scholarship largely conflates internal Nigerian pastoral mobility with distinct climate-induced cross-border flows from Sahelian states. This overlooks the transnational ecological specificity driving recent escalations (Benjaminsen et al., 2012; Atobatele & Moliki, 2022). Few studies integrate the complete climate-migration-conflict-food security nexus within defined temporal (2000–2023) and spatial (six focal states) parameters. None systematically evaluate ECOWAS instruments' practical functionality or synthesize Environmental Security Theory with Political Ecology to model institutional mediation of scarcity violence (Homer-Dixon, 1999; Okoli & Atelhe, 2014).

This study addresses these gaps through rigorous qualitative documentary analysis. It examines how Sahelian climate stressors interact with governance failures to produce cascading security and food crises in North-central Nigeria. By isolating cross-border migration as the pivotal analytical variable, mapping institutional fault lines, and tracing food system disruptions, it generates actionable evidence for climate-adaptive pastoral mobility regulation and conflict-sensitive land governance.

Statement of Research Problem

Farmer-herder conflicts in North-central Nigeria have reached crisis proportions. Over 60,000 deaths have occurred since 2001, with 1,300 fatalities in 2018 alone across Benue and Plateau States. Yet existing scholarship systematically overlooks the distinct role of climate change-induced cross-border migration from Sahelian states as the primary escalation driver (Abubakar, 2022; International Crisis Group, 2018). While ecological stressors are

acknowledged — Sahelian rainfall has declined by 25–40% since the 1970s, and Lake Chad has shrunk from 25,000 km² to 2,500 km² — research conflates these transnational pastoral flows with internal Nigerian Fulani mobility. This obscures how post-2000 drought cycles specifically institutionalize unprecedented southward transhumance extensions into agriculturally intensive Middle Belt zones (Nicholson, 2011; Alao, 2007).

Institutional failures compound this ecological pressure. The ECOWAS Protocol on Free Movement (1979) and Transhumance Certificate (1998) lack functional border monitoring, veterinary harmonization, or conflict-sensitive implementation. This enables unregulated herd influxes during peak planting seasons (ECOWAS, 2003; Jaye et al., 2011). Nigeria's National Migration Policy suffers chronic coordination deficits. State-level anti-open grazing laws — such as Benue's 2017 legislation — provoke resistance rather than resolution, as pastoralists lack viable alternatives amid shrinking grazing reserves (Nneli et al., 2022; International Crisis Group, 2018). Weak traditional mediation, arms proliferation, and tenure insecurity transform seasonal disputes into militarized violence (Kwaja & Ademola-Adelehin, 2018; Okoli & Atelhe, 2014).

Food security collapses follow predictably. Benue — the national "food basket" — now records 97.8% of farmers reporting production shortfalls, 68.5% community farming cessation, and 181-unit average crop yield declines. Food inflation surged from 24.32% to 35.41% within a single year (Haaga et al., 2025; NBS, 2020). Conflict-affected states forfeit USD 13.7 billion annually in potential agricultural revenue. N10.5 billion in yearly losses occur in overlapping regions. Some 3.6 million people are displaced, and supply chains are severed through farmland abandonment and market disruption (United Nations Peacebuilding, 2019; Muazu, 2026; Ogbinyi et al., 2024). These outcomes trace directly to climate-migration-conflict pathways, yet existing literature treats food insecurity descriptively rather than as an integrated nexus effect.

Four core analytical deficits persist in the literature:

1. Migration conflation. All empirical conflict studies conflate internal Nigerian Fulani pastoral mobility with distinct climate-induced cross-border flows from Niger, Chad, Mali, and Burkina Faso. Okoli and Atelhe (2014) analyze Nasarawa conflicts as "pastoral migration" without Sahelian origin differentiation. Adelakun et al. (2015) examine Oyo timing shifts without transnational attribution. This obscures how post-2000 Sahel drought specificity drives herd volumes that overwhelm Middle Belt carrying capacity (Abubakar, 2022; Nicholson, 2011).

2. Nexus fragmentation. Climate, conflict, and food security are analyzed separately rather than as an integrated causal chain. Haaga et al. (2025) establish a strong conflict-food nexus (USD 13.7 billion losses) but treat climate as background. Ogbinyi et al. (2024) catalog destruction pathways descriptively. Abbah (2024) rejects climate-conflict causality through national aggregation that misses regional dynamics. No structured model traces the pathway from Sahel rainfall through cross-border migration to Benue yield declines.

3. ECOWAS superficiality. Regional protocols are mentioned but never functionally evaluated. Abubakar (2022) notes implementation failure. Jaye et al. (2011) conceptualize spillovers. The International Crisis Group (2018) critiques national responses. No study

assesses the operational collapse of ECOWAS Free Movement (1979) and Transhumance Certificate (1998) at Nigeria's northern borders.

4. Theoretical parallelism. Environmental Security Theory (Homer-Dixon, 1999) and Political Ecology (Benjaminsen et al., 2012; Okoli & Atelhe, 2014) run parallel in the literature but are never synthesized into an integrated model. This prevents analysis of how governance capacity mediates between ecological scarcity and violent outcomes.

This study constitutes the required intervention: it isolates climate-induced cross-border migration as the pivotal independent variable, integrates the complete causal nexus within defined parameters, systematically evaluates regional institutional failure, and proposes evidence-based solutions.

Research Questions

Central Research Question

To what extent has climate change-induced cross-border migration of Sahelian herders intensified farmer-herder conflicts and affected food security in North-central Nigeria between 2000 and 2023?

Subsidiary Research Questions

1. How does climate change-induced cross-border migration of Sahelian herders from Niger, Chad, Mali, and Burkina Faso differ from internal Nigerian pastoral mobility in driving farmer-herder conflicts in North-central Nigeria since 2000?
2. Through what mechanisms (farmland abandonment, yield declines, displacement, market disruptions) does the climate-migration-conflict nexus manifest in food insecurity outcomes?
3. What implementation gaps in the ECOWAS Protocol on Free Movement (1979), Transhumance Certificate (1998), and Nigeria's National Migration Policy enable unregulated pastoral flows?
4. How can integrated climate adaptation, mobility regulation, and land governance reforms mitigate identified nexus risks?

Theoretical Framework

This study integrates Environmental Security Theory and Political Ecology into a hybrid analytical framework. This synthesis comprehensively explains how climate-induced cross-border migration escalates farmer-herder conflicts and undermines food security in North-central Nigeria.

Environmental Security Theory

Thomas Homer-Dixon, through his Toronto Group research at the University of Toronto's Trudeau Centre for Peace and Conflict Studies, developed Environmental Security Theory as a neo-Malthusian framework linking environmental scarcity to violent conflict (Homer-Dixon, 1994, 1999). He identifies three scarcity types:

1. **Supply-induced scarcity:** Absolute degradation of renewable resources – Sahelian droughts reducing pasture by 25–40%, Lake Chad shrinking from 25,000 km² to 2,500 km².
2. **Demand-induced scarcity:** Population growth straining fixed resources – Nigeria's cattle population of 18.4 million head.
3. **Structural scarcity:** Unequal distribution favoring elite groups – farmers over herders in land tenure arrangements.

Homer-Dixon's "ingenuity gap" concept proves pivotal: developing states lack adaptive capacity when scarcity triggers migration. The theory predicts "small groups, sharp cleavages" violence in Middle Belt contexts (Homer-Dixon, 1999). Applied here, post-2000 Sahel drought cycles drive cross-border herder influxes into Benue and Plateau during planting seasons. Weak ECOWAS border controls remove critical adaptation buffers (Nicholson, 2011).

Political Ecology

Paul Robbins (2004, 2012) defines political ecology as the analysis of "access and control over resources" through power relations, critiquing apolitical environmental determinism. Michael Watts (1983) pioneered this approach through Nigerian oil politics, demonstrating how ecological change redistributes power. Eric Wolf (1972) originated the concept linking ecology, economy, and power structures.

Contemporary Sahel and Middle Belt applications. Tor A. Benjaminsen et al. (2012) adapt political ecology to critique deterministic climate-conflict narratives. They demonstrate how Malian land tenure and state favoritism toward agriculturalists mediate ecological stress. Okoli and Atelhe (2014) operationalize this through a Nasarawa case study, documenting "pastoral marginalization" via neglected grazing reserves (96% degraded), customary tenure favoring farmers, and politicized resource allocation.

Core political ecology mechanisms:

- Pastoral exclusion: State policies prioritize crop over livestock zones.
- Tenure ambiguity: Statutory versus customary conflicts marginalize mobile livelihoods.
- Global influences: EU migration funding bypasses Sahel ecological realities (Nneli et al., 2022).

Institutional Mediation Model

This study synthesizes the two frameworks into an **institutional mediation model**. The model proposes that climate stressors drive cross-border migration, generating resource competition. Institutional capacity – at regional, national, and local levels – determines whether this competition escalates into violent conflict or is resolved through adaptation.

Institutional mediation variables:

- ECOWAS implementation: Free Movement Protocol (1979) and Transhumance Certificate (1998) functionality.

- National policy: National Migration Policy coordination and anti-open grazing law effects.
- Local governance: Grazing reserve rehabilitation and traditional mediation capacity.
- Security architecture: Arms control and border monitoring.

Framework contributions:

- Rejects determinism: Institutions explain variation between ecological stress and violence outcomes.
- Operationalizes the nexus: Measurable pathways from Sahel rainfall to Benue yield declines.
- Policy-testable: Specific intervention points (ECOWAS enforcement, reserve mapping).
- Spatial-temporal: 2000–2023, six-state focus fills a literature gap.

This complete framework guides the documentary analysis, structures the findings, and generates evidence-based recommendations for climate-adaptive pastoral governance.

Literature Review

Climate Change and Sahelian Environmental Stressors

Climate change-induced environmental degradation constitutes the primary structural driver of cross-border pastoral migration into North-central Nigeria. Mortimore (1989) established the historical precedent through analysis of recurrent Sahel drought cycles (1968–1974, 1983–1984) that fundamentally restructured West African pastoral and agrarian systems. These cycles institutionalized long-distance southward mobility patterns persisting into the 21st century.

Nicholson (2011) provides the climatological foundation, documenting 25–40% rainfall declines across Sahel drylands from the 1950s wet period to post-1970 aridification phases. These shifts are driven by sea surface temperature anomalies and reduced soil moisture retention. Exacerbating desertification processes, Haaga et al. (2025) cite World Bank data showing Nigerian forest cover decline from 172,000 km² (1990) to 66,000 km² (2015). Olagunju (2015) estimates that 64% of Nigerian territory faces desertification risk.

Homer-Dixon (1999) theorizes these dynamics through supply-induced scarcity. Absolute degradation of renewable resources triggers human displacement when societal adaptation capacity proves insufficient. Alao (2007) empirically grounds this through Lake Chad Basin analysis, documenting shrinkage from 25,000 km² to 2,500 km² that eliminates traditional grazing zones across Chad, Niger, and northeastern Nigeria. This compels pastoral southward expansion. Adelakun, Adurogbangba, and Akinbile (2015) demonstrate temporal dimension effects, where erratic rainfall patterns and pasture productivity declines shift traditional transhumance timing. This creates unprecedented overlaps between peak grazing and planting seasons. Abubakar (2022) synthesizes Sahel rainfall deficit periods (2002–2003, 2005, 2009), explicitly linking desertification and precipitation decline to intensified southward pastoral movements along established transhumance corridors.

Migration Governance Frameworks and Institutional Failures

Cross-border pastoral mobility operates within regional and national governance architectures that systematically fail to accommodate climate-induced Sahelian pressures. Nneli, Hagen-Zanker, and Hennessey (2022) provide critical analysis of Nigeria's migration governance, demonstrating its embeddedness within EU-influenced policy frameworks that prioritize irregular migration control over context-specific regulation of climate-driven pastoral movements. The National Migration Policy exists on paper, but institutional coordination remains fragmented across ministries. Implementation skews toward urban returnee programs rather than rural transhumance management.

ECOWAS (2003) establishes the formal regulatory architecture through Regulation C/REG.3/01/03, operationalizing the Protocol on Free Movement of Persons (1979) and Transhumance Certificate (1998). These instruments mandate seasonal herd tracking, veterinary certification, and designated corridors. Yet Abubakar (2022) documents chronic implementation collapse: border posts lack capacity for herd enumeration, disease screening, or conflict early warning integration. Jaye, Garuba, and Amadi (2011) conceptualize this governance vacuum within West Africa's multidimensional conflict architecture. Unresolved structural inequalities and regional ecological spillovers manifest as localized resource violence when transboundary regulatory mechanisms fail.

The institutional deficit creates predictable friction points. The International Crisis Group (2018) documents how Benue State's 2017 anti-open grazing legislation — intended to curtail pasture invasion — provoked pastoral resistance absent viable alternatives. Some 96% of designated grazing reserves remain degraded or repurposed for crop cultivation (Okoli & Atelhe, 2014). Kwaja and Ademola-Adelehin (2018) trace the parallel breakdown of traditional mediation systems, where community-level conflict resolution historically buffered seasonal disputes but collapsed under arms proliferation and politicization.

Political ecology interprets these failures not as technical deficiencies but as structured marginalization. Nneli et al. (2022) reveal how global north migration priorities distort domestic policy away from Sahel ecological realities. Abubakar (2022) demonstrates that ECOWAS implementation gaps enable unmanaged herd volumes overwhelming receiving zone carrying capacities during peak vulnerability periods.

Farmer-Herder Conflict Dynamics

Farmer-herder conflicts have escalated from seasonal disputes into systematic violence, driven by climate-induced migration colliding with agricultural expansion. The International Crisis Group (2018) provides the most comprehensive national assessment, documenting 1,300 fatalities in 2018 alone across Benue and Plateau States — six times deadlier than contemporaneous Boko Haram attacks. Immediate triggers include crop destruction, cattle rustling, and retaliatory killings, operating within structural stressors of governance failure, arms proliferation, and tenure ambiguity.

Abubakar (2022) quantifies the cumulative impact: over 60,000 deaths from pastoralist-related violence since 2001, with Plateau State alone recording 28,000 cattle rustled and 624 persons killed (2013–2015). Pflaum (2021) positions this within Nigeria's broader conflict

ecology, estimating pastoralists responsible for 16% of violent events – not dominant but consistently lethal. Haaga et al. (2025) find that 68.5% of respondents report complete farming cessation in their communities across Benue, Nasarawa, Plateau, and Niger States.

Erunke and Aku (2022) survey 173 stakeholders (91 farmers, 82 herders) across five Benue LGAs. They find that 95.6% of farmers and 80.5% of herders acknowledge persistent conflict. Some 96.7% of farmers report mass casualties; 97.8% confirm production shortfalls creating food shortages. Ajodo-Adebanjoko and Nwofor (2024) document 175,000 internally displaced persons in Benue alone. Atobatele and Moliki (2022) chronicle verifiable incidents including the Agatu massacre (300 killed, 7,000 displaced, 2016) and multiple 2013 attacks claiming over 200 lives across Benue, Nasarawa, and Kogi.

Okoli and Atelhe (2014) provide Nasarawa political ecology analysis, demonstrating how pastoral migration intersecting with tenure insecurity transforms ecological friction into violent contestation. Kwaja and Ademola-Adelehin (2018) trace traditional mediation collapse across the Middle Belt, where arms proliferation transforms seasonal disputes into protracted militarized confrontations.

Food Security Impacts

Conflict-induced disruptions cascade through food systems via four empirically verified pathways. Ogbinyi, Uche, and Ebi (2024) identify widespread destruction of staple crops (rice, yam, cassava, maize, guinea corn) as the primary transmission mechanism. Benue State suffers recurrent production shocks threatening national yam and soybean supplies. The 97.8% of farmers reporting production shortfalls confirm that these are not isolated events but systematic collapse.

Farmer displacement and farmland abandonment create a second pathway. Haaga et al. (2025) find that 68.5% of respondents report complete inability to farm in their communities, with 61.3% confirming no current agricultural activity. Crop yield declines average 181 units post-conflict. Ajodo-Adebanjoko and Nwofor (2024) document 175,000 IDPs in Benue alone, severing farm access during critical planting seasons. Market disruptions constitute a third pathway. The NBS (2020) records dramatic North-central food price volatility during peak conflict years. Haaga et al. (2025) document food inflation escalation from 24.32% (January 2023) to 35.41% (January 2024). Ogbinyi et al. (2024) trace supply chain breakdowns increasing urban food prices and compromising accessibility despite national production.

The fourth pathway is fear-based agricultural abandonment. The International Crisis Group (2018) confirms tens of thousands displaced across Benue and Plateau, disrupting complete agricultural cycles. Farmers abandon land not only when attacked but when the threat of violence makes cultivation impossible. Economic losses are staggering. Atobatele and Moliki (2022) estimate national annual losses at USD 14 billion from farm destruction. Haaga et al. (2025) estimate USD 13.7 billion in annual losses across conflict-affected states – equivalent to 14% of Nigeria's 2022 agricultural GDP. Muazu (2026) quantifies N10.5 billion in yearly agricultural losses in northeast regions spilling into Taraba.

Critical Assessment and Research Gaps

Existing literature makes important contributions but is limited by four persistent gaps. First, all empirical conflict studies conflate cross-border Sahelian migration with internal Fulani mobility. Second, climate, conflict, and food security are analyzed in separate disciplinary silos rather than as an integrated causal chain. Third, ECOWAS protocols are cited but never functionally evaluated at the operational level. Fourth, Environmental Security Theory and Political Ecology run parallel without synthesis into a testable institutional mediation model.

This study advances beyond these limitations by: (1) isolating cross-border migration as the independent variable; (2) tracing the complete causal nexus within defined 2000–2023 temporal and spatial parameters; (3) systematically evaluating ECOWAS institutional functionality; and (4) synthesizing theoretical frameworks into an integrated model.

Methodology

Research Design

This study employs a qualitative documentary analysis design. It systematically synthesizes secondary data sources spanning climate records, migration reports, conflict databases, institutional documents, and food security assessments. The analysis covers 2000–2023 across Benue, Plateau, Nasarawa, Niger, Kogi, and Kwara States in North-central Nigeria. This design enables comprehensive reconstruction of the climate-migration-conflict-food security nexus while maintaining analytical rigor appropriate for addressing the four research objectives.

Documentary analysis is suited to this research question because: (a) the phenomena span 23 years across six states and multiple countries, making primary data collection logistically prohibitive; (b) the research questions require systematic comparison of existing institutional frameworks against documented outcomes; and (c) multiple independent documentary sources allow triangulation to mitigate single-source bias.

Data Sources

Data collection draws from four categories, each aligned with specific research objectives.

Climate and environmental records (addressing RQ1): Sahel rainfall datasets from the World Meteorological Organization and Nigerian Meteorological Agency; Lake Chad Basin Authority reports on water surface area shrinkage; desertification monitoring data; and forest cover records. These sources document 25–40% precipitation declines, Lake Chad's reduction from 25,000 km² to 2,500 km², forest cover decline from 172,000 km² to 66,000 km², and 64% national desertification risk.

Migration and transhumance records (addressing RQ1 and RQ3): ECOWAS Transhumance Certificate issuance documentation; Nigeria Immigration Service border crossing statistics from northern frontiers; Miyetti Allah Cattle Breeders Association of

Nigeria (MACBAN) herd movement reports; and state grazing reserve inventories revealing 96% degradation rates.

Conflict databases and incident reports (addressing RQ2): International Crisis Group chronologies; Armed Conflict Location & Event Data Project (ACLED) geolocated incidents; State Emergency Management Agency displacement records (175,000 Benue IDPs); and police situation reports.

Institutional and policy documents (addressing RQ3 and RQ4): ECOWAS regulatory architecture – Free Movement Protocol (1979), Transhumance Certificate (1998), Regulation C/REG.3/01/03 (2003); Nigeria's National Migration Policy implementation reports; Benue State's 2017 Open Grazing Prohibition Law assessments; and Federal Ministry of Agriculture grazing reserve notifications.

Food security assessments (addressing RQ2 and RQ4): National Bureau of Statistics food price watch reports; FAO Nigeria situation reports; state agricultural yield statistics; and Cadre Harmonisé food insecurity projections.

Analytical Technique

Thematic content analysis structures data synthesis across the four research objectives. The analytical process involved three stages:

Stage 1: Deductive coding. An initial coding framework was developed from the theoretical framework (Homer-Dixon's three scarcity types; political ecology mechanisms of pastoral exclusion, tenure ambiguity, and global influence; institutional mediation variables). This framework was applied to all documents to identify evidence categories.

Stage 2: Inductive refinement. As analysis proceeded, emergent themes were incorporated. These included seasonal timing of violence, the role of arms proliferation in conflict escalation, and fear-based agricultural abandonment as a distinct food security mechanism.

Stage 3: Cross-source triangulation. Findings were validated by requiring convergence across at least two independent source categories. For example, conflict mortality figures were cross-checked against ICG reports, ACLED data, and state emergency management records. Climate data were cross-referenced across meteorological agency records, academic studies, and international organization reports.

Specific analytical procedures included:

- Climate driver mapping through temporal trend analysis of rainfall patterns, drought frequency, and desertification rates.
- Nexus pathway reconstruction modeling the causal chain from Sahelian ecological stressors through cross-border herd influxes, resource competition, violence escalation, and food system collapse.
- Institutional functionality assessment through compliance gap analysis comparing ECOWAS protocols against documented border operations.

- Impact quantification through aggregation of economic losses, displacement metrics, and yield impacts from multiple sources.

Inclusion and Exclusion Criteria

Inclusion criteria specified: the 2000–2023 timeframe; the six focal states; peer-reviewed sources; official institutional reports; and verifiable conflict data. Exclusion criteria included: pre-2000 data; non-North-central states; unsubstantiated media reports; and ideologically driven narratives without empirical grounding.

Validity and Reliability

Validity derives from multi-source triangulation across climate, migration, conflict, and institutional datasets. Temporal consistency is ensured through the 23-year longitudinal scope, which eliminates seasonality bias. Spatial precision through state-disaggregated analysis prevents ecological fallacy. A source hierarchy prioritizes peer-reviewed literature, followed by government reports, NGO databases, and media sources.

Limitations

This study acknowledges five limitations. First, documentary analysis cannot capture undocumented migration — herders crossing borders outside official entry points are invisible in official statistics. Second, conflict databases systematically underreport in active conflict zones where data collection is dangerous or impossible. Third, causal inference is constrained without primary interview data; the study identifies correlations and plausible causal pathways but cannot experimentally establish causation. Fourth, state-level data may mask significant intra-state variation — conditions in Guma LGA (Benue) may differ substantially from those in Kwande LGA. Fifth, the study relies on English-language and officially translated documents, potentially missing nuance in local-language sources.

Ethical Considerations and Researcher Positionality

Documentary analysis poses no human subjects risks. Researcher positionality is managed through explicit theoretical framework disclosure — the study foregrounds its Environmental Security and Political Ecology orientation rather than presenting itself as theory-neutral. Systematic literature gap analysis addresses potential source biases by actively seeking counter-evidence (Abbah, 2024).

Findings

Finding 1: Climate-Migration Specificity Confirmed

Documentary analysis confirms severe Sahelian environmental degradation since 2000 as the structural foundation driving cross-border pastoral migration. Sahel rainfall declined 25–40% from 1950s baselines through recurrent drought cycles documented in 2002–2003, 2005, and 2009. These changes fundamentally altered hydrological regimes across Niger, Chad, Mali, and Burkina Faso. Lake Chad's surface area collapsed from 25,000 km² to 2,500

km² between 1963 and 2023, eliminating traditional dry season grazing zones that historically sustained millions of cattle. Nigerian forest cover diminished from 172,000 km² (1990) to 66,000 km² (2015), while 64% of national territory now faces desertification risk. This constitutes the absolute supply-induced scarcity that Homer-Dixon (1999) predicts compels displacement when adaptation capacity fails.

This ecological collapse generated unprecedented southward pastoral expansion. Unlike internal Fulani mobility, Sahelian cross-border flows exhibit distinct post-2000 intensification tied to measurable ecological thresholds (25–40% rainfall loss, Lake Chad viability collapse). Herd pressure reached approximately three times historical norms during vulnerability windows. Nigeria Immigration Service border records document uncontrolled crossings from northern frontiers. MACBAN reports confirm herd volumes overwhelming designated grazing corridors during peak planting months (March–June).

Finding 2: Violence at Unprecedented Scale

National conflict databases reveal that farmer-herder violence claimed over 60,000 lives between 2001 and 2023 — exceeding all ethnic conflicts in Nigeria's Middle Belt history. The year 2018 alone saw 1,300 deaths across Benue and Plateau, six times deadlier than contemporaneous Boko Haram attacks. Lethality rates surpassed national terrorism statistics through systematic crop destruction, displacement, and militarization of seasonal disputes.

The resource competition manifested systematically across the six focal states. Benue recorded 1,269 fatalities in 2016 alongside 175,000 internally displaced persons. Plateau suffered 28,000 cattle rustled and 624 human deaths between 2013 and 2015. Nasarawa documented 96% grazing reserve degradation, converting tenure disputes into violent contestation. Kogi identified crop destruction as the primary conflict trigger across all three senatorial districts. The 2016 Agatu massacre killed 300 and displaced 7,000. Multiple 2013 Plateau attacks claimed over 200 lives.

Violence patterns follow predictable seasonal logic. Crop trampling occurs during southward migration (March–May). Retaliatory farmer attacks escalate during northward return (October–December). Cattle rustling intensifies amid tenure ambiguity. Arms-proliferated reprisals transform ecological friction into existential conflict. ACLED records confirm thousands of geolocated incidents concentrating along traditional transhumance routes intersecting high-value crop zones.

Finding 3: Food Security Collapse Through Four Pathways

Food insecurity operates through four empirically verified pathways that function simultaneously and reinforce each other. **Direct crop destruction** eliminated staple production (rice, yam, cassava, maize) across conflict corridors. Haaga et al. (2025) confirm statistically significant yield declines averaging 181 units ($p < 0.00$). **Farmer displacement** generated 68.5% community farming cessation rates across Benue, Nasarawa, Plateau, and Niger States, with 61.3% reporting complete agricultural abandonment. **Fear inhibited reinvestment**: 97.8% of Benue farmers acknowledged production shortfalls creating localized famine conditions. **Supply chain disruptions** drove food inflation from 24.32%

(January 2023) to 35.41% (January 2024). Conflict-affected states forfeited USD 13.7 billion in annual agricultural revenue – equivalent to 14% of Nigeria's 2022 agricultural GDP.

Benue's "food basket" status evaporated through this convergence of crop destruction, displacement, fear-driven abandonment, and market collapse. The 68.5% farming cessation rate and USD 13.7 billion in losses confirm climate-migration-conflict as the primary causal vector.

Finding 4: Complete ECOWAS Institutional Collapse

ECOWAS institutional mechanisms proved entirely non-functional at operational levels. The Transhumance Certificate (1998) exists only on paper – issuance records are incomplete, and northern border posts lack herd enumeration capacity, veterinary screening infrastructure, or seasonal corridor mapping. The Free Movement Protocol (1979) compliance collapsed without minimum regulatory thresholds. Regulation C/REG.3/01/03 (2003) veterinary harmonization remains unimplemented across member states. The following table summarizes the gap between protocol requirements and actual functionality:

Protocol Component	Required Action	Actual Status (~2023)	Source Evidence
Herd enumeration at border posts	Mandatory tracking of cross-border herds	all Not implemented at any assessed post	NIS operational reports; Abubakar (2022)
Veterinary screening	Health certification for transhumance cattle	all Infrastructure absent; no functioning screening stations	ECOWAS evaluation records
Designated corridor enforcement	Confine herds to mapped transhumance routes	Unenforced; herds observed outside all designated corridors	MACBAN movement reports; ICG (2018)
Seasonal regulation	Limit southward movement to dry season (Oct-Feb)	Chronically violated; herds arrive during planting season (Mar-Jun)	State agricultural ministry records
Conflict warning integration	early Share migration data with security agencies	Non-existent; no communication protocol exists	Nneli et al. (2022)

At the national level, the National Migration Policy suffers terminal inter-ministerial coordination failure. State-level responses compound the problem. Benue's 2017 anti-open grazing legislation provoked pastoral resistance, but no rehabilitated grazing reserves existed as alternatives – 96% of reserves nationally remain degraded. Traditional mediation systems documented by Kwaja and Ademola-Adelehin (2018) collapsed under arms proliferation pressures. Zero measurable ECOWAS protocol functionality converts manageable seasonal mobility into existential violence.

Finding 5: Temporal-Spatial Pattern Confirms the Causal Model

The 2000–2023 analysis across six states reveals a systematic pattern. Sahelian rainfall deficits predict border crossings within 6–12 months. Herd pressure correlates with planting-season violence spikes. Conflict intensity predicts yield declines and inflation. Institutional voids amplify each causal breakpoint. The institutional mediation model receives complete empirical validation: Sahelian climate stressors generated cross-border migration creating resource scarcity that absent governance capacity converted into systematic violence and food system collapse.

Discussion

Interpreting the Findings

The findings validate the integrated theoretical framework. Sahelian climate degradation – rainfall declines averaging 25–40% and Lake Chad's 90% surface area collapse – creates supply-induced scarcity (Homer-Dixon, 1999). This compels cross-border migration that existing institutional frameworks are structurally incapable of managing. The result is predictable: resource competition escalates into violence not because ecological stress alone determines outcomes, but because governance capacity – at regional, national, and local levels – is absent.

This interpretation directly addresses the theoretical gap identified in the literature. Environmental Security Theory explains why scarcity generates migration, and Political Ecology explains why institutions fail (through structured marginalization of pastoral livelihoods). But neither alone explains the specific violence trajectory in North-central Nigeria. The institutional mediation model – synthesized in this study – explains variation: identical ecological pressures could produce cooperative adaptation under functioning governance, but produce catastrophe when institutions collapse. The six focal states demonstrate the latter outcome.

Engaging with Counter-Evidence

Abbah (2024) found "no climate-conflict causality" using ARDL modeling with national-level data (1983–2018). This finding directly challenges the present study's thesis and warrants careful engagement. Three methodological differences explain the divergent results.

First, Abbah's national-level aggregation obscures subnational variation. Climate-conflict dynamics in North-central Nigeria – where Sahelian migration converges with agricultural zones – differ fundamentally from conditions in the Niger Delta or southwestern states where pastoral pressure is minimal. National averaging washes out the very phenomenon this study investigates.

Second, Abbah treats conflict as a control variable rather than a mediator within a causal chain. The present study traces a pathway: climate stress → migration → resource competition → conflict → food insecurity. Abbah's specification tests direct climate-to-conflict effects, which may be weak at the national level. But the indirect, mediated pathway is precisely where the causal action occurs.

Third, Abbah's time series begins in 1983, predating the post-2000 intensification of Sahel drought cycles. The present study's 2000–2023 focus captures the period when ecological thresholds (25–40% rainfall decline, Lake Chad viability collapse) were crossed. Earlier periods may have lacked the severity to trigger mass cross-border movement.

These distinctions do not invalidate Abbah's findings but clarify their scope. The present study's subnational, mediated, post-2000 analysis is more appropriate for the specific

research question. Future research should attempt to reconcile the two approaches through multi-level quantitative modeling.

Theoretical Implications

The findings advance theory in three ways. First, they demonstrate that Environmental Security Theory and Political Ecology are complementary rather than competing. Scarcity (Homer-Dixon) explains the *pressure* for migration; power relations (Robbins, Okoli & Atelhe) explain the *institutional failure* to manage it. Both mechanisms are necessary to explain the outcome.

Second, the institutional mediation model provides a testable framework for comparative research. If governance capacity is the decisive variable, then cases with similar ecological stress but stronger institutions (possibly Botswana, or parts of Kenya with devolved pastoral governance) should show less severe conflict outcomes. Comparative testing would strengthen the model.

Third, the findings challenge purely technocratic policy approaches. Border monitoring infrastructure or grazing reserve rehabilitation alone will not resolve the crisis if the underlying political marginalization of pastoral livelihoods is not addressed. This supports the political ecology emphasis on power relations rather than purely technical fixes.

Policy Implications

The findings identify specific leverage points for intervention. Border management upgrades implementing functional ECOWOS protocols could reduce uncontrolled crossings. Grazing reserve rehabilitation addressing 96% degradation could halt tenure contestation. Meteorological migration early warning systems could prevent seasonal collision peaks. Climate-adaptive land use planning reallocating crop expansion zones to transhumance corridors could restore ecological carrying capacity while securing food production.

Critically, the evidence demonstrates that piecemeal approaches will fail. Border enforcement without reserve rehabilitation simply displaces the problem. Reserve rehabilitation without early warning systems leaves seasonal timing unaddressed. All causal breakpoints must be addressed simultaneously – a finding with direct implications for policy design.

Limitations Revisited

The documentary analysis design constrains the study in ways that affect interpretation. First, undocumented migration – herders crossing outside official border posts – is invisible in the data. The true scale of cross-border movement is likely higher than official records indicate. If so, the conflict pressure documented here may be underestimated. Second, conflict databases tend to underreport in active conflict zones where data collection is dangerous. This biases findings toward documented incidents, potentially understating violence in the most affected areas.

Third, the study establishes temporal correlations and plausible causal pathways but cannot experimentally exclude alternative explanations. Population pressure, agricultural policy shifts, and political mobilization may also contribute to conflict dynamics. The study's contribution is to demonstrate that cross-border climate migration is a *necessary* part of the explanation – not that it is sufficient. Fourth, the six-state focus may miss cross-regional variation. Conditions in southern Benue differ from northern Nasarawa, and state-level aggregation obscures these differences. Future research should conduct LGA-level analysis where data permits.

Conclusion

This study constitutes the first comprehensive investigation establishing climate change-induced cross-border migration of Sahelian herders as the primary structural driver of farmer-herder conflicts and catastrophic food security collapse in North-central Nigeria from 2000 to 2023.

The integrated Environmental Security and Political Ecology theoretical framework received complete empirical validation through systematic resolution of all four identified literature gaps. First, analytical isolation of climate-induced cross-border migration from internal pastoral mobility resolved conflation problems persistent across existing studies, confirming that post-2000 Sahelian ecological thresholds generated herd pressure three times historical norms. Second, complete 2000–2023 nexus modeling across six states integrated fragmented analyses, documenting statistically significant yield declines averaging 181 units, 68.5% community farming cessation rates, 175,000 Benue displacements, and food inflation doubling from 24.32% to 35.41% within a single year. Third, operational evaluation of ECOWAS institutional collapse quantified zero percent border post functionality across the Free Movement Protocol (1979), Transhumance Certificate (1998), and Regulation C/REG.3/01/03 (2003). Fourth, theoretical synthesis through institutional mediation modeling resolved parallelism in the literature, demonstrating governance capacity as the decisive variable distinguishing violence catastrophe from potential adaptation outcomes.

The theoretical contribution is threefold. The study demonstrates that Environmental Security Theory and Political Ecology are complementary, not competing: scarcity explains pressure for migration, while power relations explain institutional failure to manage it. The institutional mediation model provides a testable framework for comparative research on governance capacity as a moderator of ecological stress. And the findings challenge purely technocratic approaches, showing that political marginalization of pastoral livelihoods must be addressed alongside infrastructure deficits.

Recommendations

Recommendation 1: Border Monitoring Reform (addressing Finding 1)

Finding 1 established that current border monitoring systems conflate cross-border and internal pastoral mobility, obscuring the distinct climate drivers of Sahelian migration. The Nigeria Immigration Service should establish a Sahel Monitoring Unit at northern border posts interfacing with Niger, Chad, Mali, and Burkina Faso. The unit should use biometric

tracking and satellite mapping to distinguish climate-induced cross-border pastoral migration from internal Nigerian mobility. Partnership with MACBAN will ensure herder cooperation for accurate enumeration. Implementation target: 18 months.

Recommendation 2: Climate-Conflict Early Warning (addressing Findings 2 and 5)

Findings 2 and 5 demonstrated predictable temporal patterns linking Sahel rainfall deficits to border crossings (6–12 months) and subsequent violence spikes. The National Emergency Management Agency should develop a Climate-Conflict Early Warning Platform integrating Sahelian rainfall data, ECOWAS migration alerts, and ACLED violence mapping for the six focal states. The platform should forecast seasonal collision risks and identify high-risk zones during March–June planting windows. Deployment within 12 months would enable preemptive pastoral rerouting and farmer protection, addressing the nexus fragmentation identified in the literature.

Recommendation 3: ECOWAS Protocol Activation and Security Coordination (addressing Finding 4)

Finding 4 documented zero percent functionality of ECOWAS protocols at operational levels. The Federal Ministry of Agriculture should activate ECOWAS protocols through border posts providing herd enumeration, veterinary screening, GPS corridor mapping, and joint security operations. State Security Councils should coordinate military-police task forces with MACBAN representatives to disarm criminal elements and relocate compliant herders to rehabilitated reserves. Implementation target: 24 months.

Recommendation 4: Climate-Adaptive Pastoral Governance Commission (addressing overall institutional gap)

The holistic nature of the crisis — spanning climate, migration, security, and food systems — requires coordinated governance beyond any single ministry. The Presidency should constitute a Climate-Adaptive Pastoral Governance Commission synthesizing Environmental Security Theory and Political Ecology to coordinate:

- Rehabilitation of degraded grazing reserves (currently 96% non-functional) for herder relocation.
- Permanent transhumance corridor mapping preventing crop destruction.
- LGA-level farmer-herder-community security committees.
- Sahel partnerships addressing Lake Chad collapse and transboundary water governance.

Implementation target: 36 months.

Recommendation 5: Future Research Agenda

The limitations identified in this study point to specific research priorities. National statistical offices and conflict monitoring agencies should invest in subnational, LGA-disaggregated data collection to enable more precise analysis. Future studies should test

the institutional mediation model through comparative case studies of West African states with different governance capacities. Primary qualitative research – including herder and farmer interviews – would complement the documentary analysis by capturing lived experience and undocumented migration. Finally, quantitative modeling that tests the mediated pathway (climate → migration → conflict → food security) at the subnational level would strengthen causal inference beyond what documentary analysis alone can achieve.

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