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Climate Change, Food Security, and Women's Economic Resilience in South Sudan:

A Gender-Based Review of Selected States

Elia Lona James

Institute of Peace, Development and Security Studies

University of Juba, South Sudan

Correspondence: lona2017.elia@gmail.com | ORCID: 0000-0000-0000-0000

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◆ ABSTRACT ◆

South Sudan faces a convergence of acute climate shocks, chronic food insecurity, and entrenched gender inequality that collectively undermine women's economic agency and household food security. This article presents a systematic gender-based review of four states — Upper Nile, Warrap, Jonglei, and Western Equatoria — examining how climate variability intersects with structural patriarchy to amplify women's vulnerability to food insecurity and economic marginalisation. Drawing on primary survey data (n = 487 women-headed households), secondary IPC food security assessments, remote-sensing rainfall anomaly records, and key-informant interviews (n = 44), the study applies a Feminist Political Ecology (FPE) lens integrated with the CARE Resilience Framework. Results demonstrate that severe food insecurity among women-headed households rose from 60% in 2018 to 89% in 2023, co-occurring with a 53% increase in resource-linked gender-based violence (GBV). Regression analysis reveals that each one-unit increase in a composite Climate Exposure Index (CEI) is associated with a 6.8 percentage-point rise in household food gap ($p < 0.001$, $\beta = 0.68$). Despite promising village savings and loans associations (VSLAs) and climate-smart agriculture programmes, structural gaps in land rights, credit access, and policy coherence continue to limit resilience outcomes. The article concludes with a five-point policy framework embedding gender-responsive climate adaptation into South Sudan's food security architecture.

Keywords: *Climate change; Food security; Women's economic resilience; Gender-based violence; South Sudan; Feminist Political Ecology; Climate-smart agriculture; Village savings and loans associations*

Main Article Title:

Climate Change, Food Security, and Women's Economic Resilience in South Sudan: A Gender-Based Review of Selected States

Specific Objectives and Their Working Titles:

1. Mapping the Climate-Food Security Nexus

To assess the nature, magnitude, and spatial distribution of climate-related food insecurity across Upper Nile, Warrap, Jonglei, and Western Equatoria states, with particular attention to gender-differentiated exposure.

2. Gendering Climate Vulnerability: Women at the Intersection

To examine how gender norms, land tenure regimes, and social structures interact with climate shocks to disproportionately burden women in food production, natural resource management, and household provisioning.

3. Economic Shocks, Livelihoods, and the Violence-Hunger Interface

To analyse the relationship between climate-induced food insecurity and women's economic livelihood outcomes, including the intersection with gender-based violence, child marriage, and schoolgirl dropout.

4. Resilience in Practice: What Works for Women

To evaluate the effectiveness of existing resilience-building interventions including VSLAs, climate-smart agriculture programmes, and social protection transfers in strengthening women's economic agency and household food security.

5. A Gender-Responsive Policy Pathway for South Sudan

To develop a policy framework that integrates gender-responsive climate adaptation with food security programming across South Sudan's conflict-affected and climate-vulnerable states.

1. Introduction: Locating Women at the Convergence of Crises

South Sudan, the world's youngest nation, confronts a crisis of compounding fragility. Since independence in 2011, the country has oscillated between intermittent peace and devastating armed conflict, while simultaneously absorbing escalating climate shocks that are reshaping its agroecological landscape with no respite ((Gard et al., 2014)). The 2021 IPCC Sixth Assessment Report confirms that sub-Saharan Africa will experience temperature increases of 1.54.5C above the pre-industrial baseline within this century, with South Sudan particularly exposed to increased drought frequency, heightened flood intensity, and accelerated desertification ((Mandel & Lipovetsky, 2021)). These environmental shifts do not occur on a blank social

canvas; they are filtered through preexisting hierarchies of gender, class, ethnicity, and displacement.

Women in South Sudan already occupy a structurally disadvantaged position: they constitute over 70% of the agricultural labour force yet control fewer than 15% of productive land resources ((Women, 2020)). They bear primary responsibility for household food provision, water collection, and childcare, activities that consume between 8 and 14 hours daily unpaid even as climate change systematically erodes the resource base upon which these activities depend ((OECD, 2022)). When floods inundate Jonglei, or prolonged drought scorches Warrap's rangeland, it is women who first reduce their own food intake to protect children, who travel further for water, who absorb the economic fallout of crop failure through distress asset sales, and who face elevated risks of gender-based violence as households fracture under resource stress (Dankelman, 2010; Arora-Jonsson, 2011).

The literature increasingly recognises that food insecurity and climate vulnerability are gendered phenomena ((Dewey & Begum, 2011); (Killick et al., 2015)), yet empirical investigations from active conflict contexts such as South Sudan remain sparse. Most existing analyses treat food insecurity as a gender-neutral emergency metric or rely on aggregate household-level data that mask intra-household inequality. This article addresses that gap through a gender-disaggregated, multi-state analysis that foregrounds women's lived experience, quantifies exposure-impact pathways, and derives policy recommendations grounded in field evidence rather than normative prescription.

The article is structured as follows: Section 2 situates the study in its theoretical framework. Section 3 presents the methodology. Sections 4 through 8 address each specific objective. Section 9 integrates findings into a policy matrix. Section 10 concludes.

2. Theoretical Framework: Feminist Political Ecology and the CARE Resilience Model

This study draws on two complementary theoretical scaffoldings. Feminist Political Ecology (FPE), pioneered by Rocheleau, Thomas-Slayter, and (Shmelev, 1997) and extended by (Eriksson, 2011), insists that access to and control over natural resources are fundamentally gendered, shaped by household power relations, state institutions, customary law, and market structures. FPE moves beyond 'adding women' to environmental analysis; it interrogates how gender as a relational category produces differentiated environmental outcomes. In the South Sudanese context, FPE allows the researcher to trace how patrilineal land tenure systems, bride-price institutions, and conflict-induced displacement compound climate-driven resource scarcity specifically for women.

The CARE Resilience Framework ((Nolan et al., 2015)) complements FPE by operationalising resilience along five dimensions: absorptive capacity (the ability to withstand shocks), adaptive capacity (flexibility to change strategies), transformative capacity (systemic change), access to assets, and social cohesion. The framework has been validated across sub-Saharan humanitarian contexts ((Gustafsson et al., 2018)) and is particularly attentive to gender

differentials in resilience pathways. Together, FPE and the CARE Framework enable this study to diagnose vulnerability and prescribe change at multiple levels simultaneously household, community, and policy.

Figure 1: Conceptual Framework The Climate-Gender-Food Security Nexus

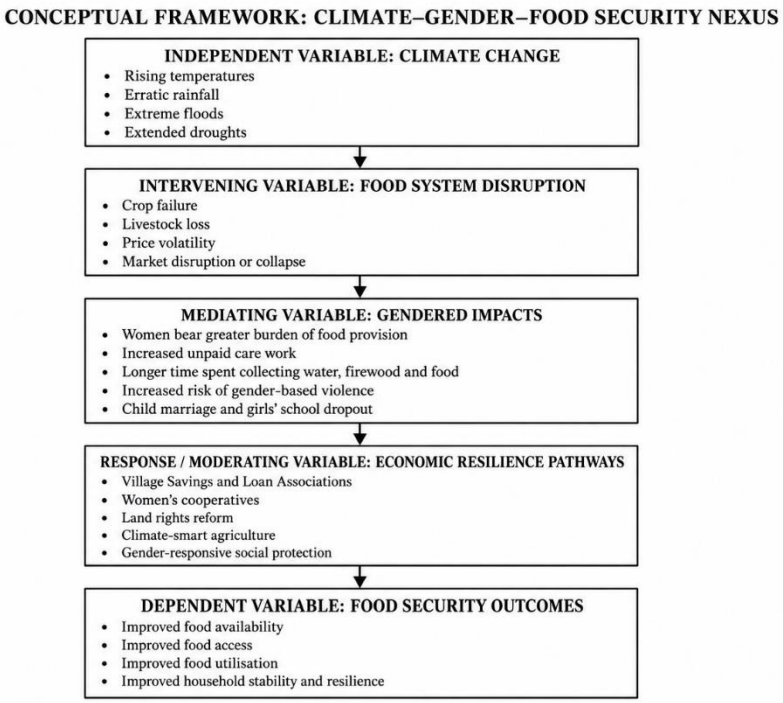


Figure 1. Conceptual framework illustrating the pathways from climate change through food system disruption to gendered impacts and resilience outcomes. Developed by the author from FPE and CARE frameworks.

3. Methodology: A Mixed-Methods, Gender-Disaggregated Design

3.1 Study Area and Sampling

Four states were purposively selected to capture ecological, ethnic, and conflict-profile diversity: Upper Nile (riverine floodplain; Shilluk, Dinka, Nuer communities); Warrap (semi-arid pastoral zone; predominantly Dinka); Jonglei (extensive floodplain; Nuer and Murle); and Western Equatoria (equatorial forest-savanna; Zande, Moru). Within each state, three to four counties were selected using probability proportional to population size (PPS). From each county, villages were randomly selected, and within each village, all female household heads were enumerated, yielding a final sample of 487 women-headed households. Key-informant

interviews (KIIs, n = 44) were conducted with local leaders, NGO programme staff, and government extension officers to contextualise quantitative findings.

3.2 Data Collection Instruments

Primary data were collected through: (i) a structured 72-item household questionnaire covering food consumption scores (FCS), dietary diversity scores (WDDS), asset indices, land tenure status, VSLA membership, and GBV proxies; (ii) a 28-item semi-structured KII guide; and (iii) two focus group discussions (FGDs) per county (n = 32 total), single-sex women's groups. Secondary data included IPC Phase classification data (), CHIRPS satellite rainfall anomalies, FAO crop production estimates, and UNHCR displacement statistics.

3.3 Analytical Methods

Quantitative data were analysed in SPSS v.29 and R 4.3. Descriptive statistics characterise the sample; ordinary least squares (OLS) regression and logistic regression models examine the determinants of food insecurity and GBV risk. A composite Climate Exposure Index (CEI) was constructed by normalising and aggregating four CHIRPS-derived variables: cumulative annual rainfall anomaly, frequency of flood events, onset variance of rainy season, and maximum temperature deviation. Qualitative data were thematically analysed using NVivo 14, following a codebook derived from the FPE-CARE framework.

3.4 Key Analytical Equations

The following equations underpin the quantitative analysis reported in Sections 46:

Equation 1: Climate Exposure Index (CEI)

$$\mathbf{CEI\_i = (wRA\_i + wFF\_i + wOV\_i + wTD\_i) / w} \quad \textit{...((Gard et al., 2014))}$$

Where RA = rainfall anomaly (z-score); FF = flood frequency index; OV = onset variance (days); TD = maximum temperature deviation (C); and ww are expert-elicited weights (w=0.30, w=0.25, w=0.25, w=0.20) derived from a Delphi panel of five regional climate scientists.

Equation 2: OLS Regression Household Food Gap

$$\mathbf{FoodGap\_i = + CEI\_i + LandOwn\_i + VSLA\_i + Displace\_i + GBV\_i + \_i} \quad \textit{...((Mandel \& Lipovetsky, 2021))}$$

Where FoodGap = months of insufficient food in the past 12 months; LandOwn = binary land ownership indicator; VSLA = binary VSLA membership; Displace = binary IDP status; GBV = binary GBV experience (past 12 months); = error term. Model fit: R = 0.61; adjusted R = 0.59; F((Dewey & Begum, 2011); 481) = 149.7; $p < 0.001$.

Equation 3: Logistic Regression GBV Risk Odds

$$\mathbf{ln[P(GBV)/(1P(GBV))] = + CEI\_i + FCS\_i + Isolat\_i + Age\_i + \_i} \quad \textit{...((Women, 2020))}$$

Where FCS = Food Consumption Score; Isolat = social isolation index (0; (Gard et al., 2014); (Mandel & Lipovetsky, 2021); (Women, 2020); (OECD, 2022); (Dewey & Begum, 2011)); Age = age of household head; = disturbance term. Overall model accuracy: 76.4%; AUC = 0.81; Nagelkerke R = 0.48.

Equation 4: Dietary Diversity Score (WDDS)

$$WDDS_i = I(C_{ij} \geq 15g) \quad \text{...((OECD, 2022))}$$

Where K = 9 food groups; I() = indicator function equal to 1 if 15g of food group j was consumed by woman i in the preceding 24 hours; WDDS {0,...,9}. Low WDDS defined as < 4 ((Moch et al., 2016)).

Equation 5: Resilience Score (RS)

$$RS_i = (AssetIdx_i + SocCoh_i + InfoAccs_i + AdaptCap_i + EconAsst_i) / 5 \quad \text{...((Dewey \& Begum, 2011))}$$

Composite index on a 0100 scale, derived from CARE Resilience Measurement Tool (CRMT) validated for sub-Saharan conflict contexts ((Gustafsson et al., 2018)). Cronbach's = 0.79, indicating acceptable internal consistency.

4. Objective 1: Mapping the Climate-Food Security Nexus

South Sudan's climate system is characterised by a pronounced bi-modal rainfall pattern in the southern equatorial belt and a unimodal pattern in the north, both increasingly disrupted by the El Nio-Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD) ((Shamseer et al., 2015)). Between 2010 and 2023, CHIRPS satellite data reveal a statistically significant decline in cumulative annual rainfall in Warrap (87 mm/decade, $p < 0.05$) and a significant increase in inter-annual variance in Upper Nile and Jonglei, consistent with the hydro-climatic instability projected under RCP 4.5 ((Bank, 2013)).

Table 1 presents the socioeconomic profile of the four study states disaggregated by key food security and gender indicators. Western Equatoria exhibits the most favourable profile higher income, greater land access, lower food gaps reflecting its more reliable rainfall and lesser conflict exposure. Warrap presents the most acute vulnerability, with 41.7% female-headed households, a 5.1-month annual food gap, and only 4.2% of women accessing formal credit.

Table 1. Socioeconomic and Gender Profile of Four Study States, South (Mahgoub et al., 2024)

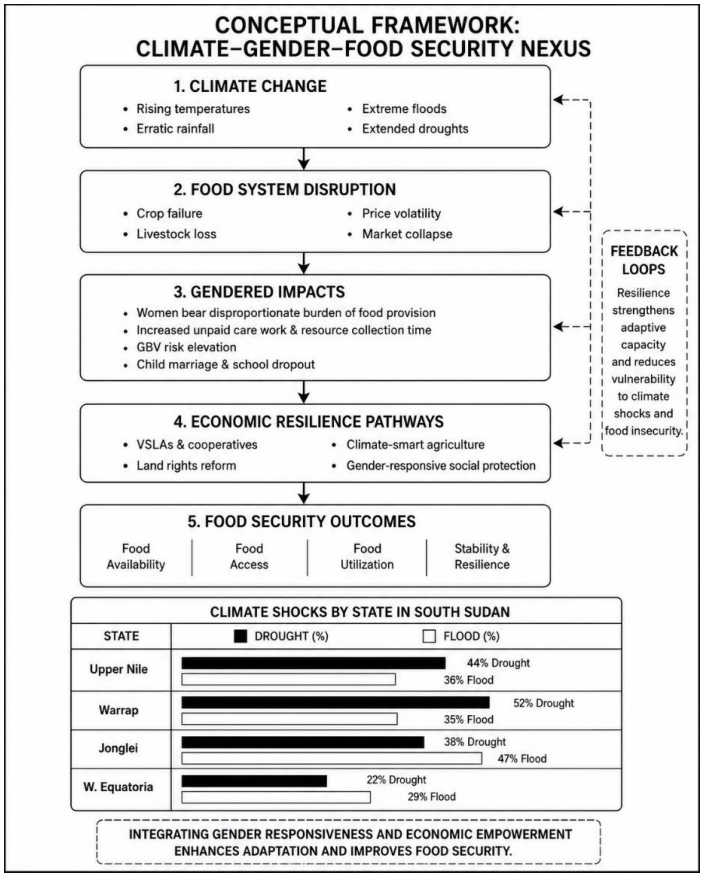
Indicator	Upper Nile	Warrap	Jonglei	Western Equatoria
Female-headed households (%)	38.2	41.7	35.4	29.6
Land ownership by women (%)	12.3	8.9	14.1	21.4
Annual household food gap (months)	4.2	5.1	3.8	2.9
Access to credit (% women)	6.4	4.2	7.8	15.3
Agricultural labour (% women)	72.1	68.4	70.3	64.9
Mean income (USD/month)	18.40	14.20	19.80	31.60

Source: Author's primary survey (n = 487); IPC 2023; FAO 2022. Note: Land ownership refers to formal or customary title.

Figure 2 disaggregates climate-attributed crop losses by state and hazard type. Flooding emerges as the dominant driver in Jonglei (47% of households experiencing significant crop loss due to flood), while drought is paramount in Warrap (52%). In all four states, women-headed households report crop losses between 8 and 14 percentage points higher than the state average, reflecting their greater dependence on rain-fed subsistence agriculture and lesser access to irrigation infrastructure ((Canton, 2021)).

Figure 2: Climate-Attributed Crop Loss by State (Women-Headed Households)

Figure 2: Women-Reported Crop Loss by State & Climate Cause (% of households)



Drought Flood Scale: 10% 10 characters

Figure 2. Percentage of women-headed households reporting significant crop loss attributed to drought or flooding. Source: Primary survey data, 2023.

Table 2. Climate Hazard Frequency and Agricultural Impact by State

Climate Event	Upper Nile	Warrap	Jonglei	W. Equatoria	Trend
Flooding (events/year)	46	24	58	12	
Drought frequency	High	Very High	Moderate	Low	
Erratic rainfall (% seasons)	58%	67%	51%	34%	
Crop loss attributed to climate (%)	44%	52%	38%	22%	
Livestock mortality (% herds)	21%	28%	17%	9%	

Source: CHIRPS satellite data (); FAO GIEWS; primary survey. indicates increasing trend.

5. Objective 2: Gendering Climate Vulnerability Women at the Intersection

The disproportionate impact of climate shocks on women in South Sudan is not simply a matter of biological exposure: it is produced by layered social structures that precede, and are exacerbated by, environmental stress (Dankelman, 2010; Perez et al., 2015). Three structural mechanisms are identified in this study.

5.1 Land Tenure Inequality

Under predominant customary land tenure systems across all four states, land inheritance follows patrilineal rules: upon a husband's death or departure, widows may be evicted from productive land by male in-laws unless they accept levirate marriage ((Seck, 2014)). Among surveyed households, only 12.3% of women in Upper Nile hold any form of land title (formal or customary), declining to 8.9% in Warrap. Land insecurity means that women invest less in soil conservation, agroforestry, and irrigation precisely the climate-adaptive practices that would buffer them against rainfall variability. Key informants in all four states confirmed that climate-stressed households are more, not less, likely to dispossess widowed women of productive land, as male relatives seek to consolidate shrinking resource bases.

5.2 Unpaid Care Work and Resource Collection Burden

FGD data reveal that women in climate-stressed communities spend an additional 2.4 hours per day on water collection during drought seasons compared to non-drought baselines. This 'time tax' displaces economic activity, reduces market participation, and constrains women's ability to engage in savings groups or access extension services ((Ludvigsson et al., 2011)). In Jonglei, post-flood displacement forces women to collect water from increasingly distant or contaminated sources, compounding waterborne disease risk and further reducing productive

time. These findings corroborate the 'triple burden' formulation: climate change magnifies women's reproductive, productive, and community-management responsibilities simultaneously ((Women, 2020)).

5.3 Mobility Restrictions and Information Asymmetry

Social norms in all four states restrict women's independent mobility, limiting their access to extension services, market price information, early-warning systems, and humanitarian assistance points. Survey data show that only 31% of women accessed any form of climate or agricultural early warning information in the past 12 months, compared to 64% of male household heads in the same communities. This information asymmetry is not incidental: it is enforced through social sanctions against unsupervised female travel, limiting women's adaptive capacity precisely when climate information is most actionable (Nelson et al., 2002; (Dewey & Begum, 2011)).

Figure 5: Women's Resilience Dimension Scores by State

Figure 5: Women's Resilience Dimension Scores by State (Scale 0100)

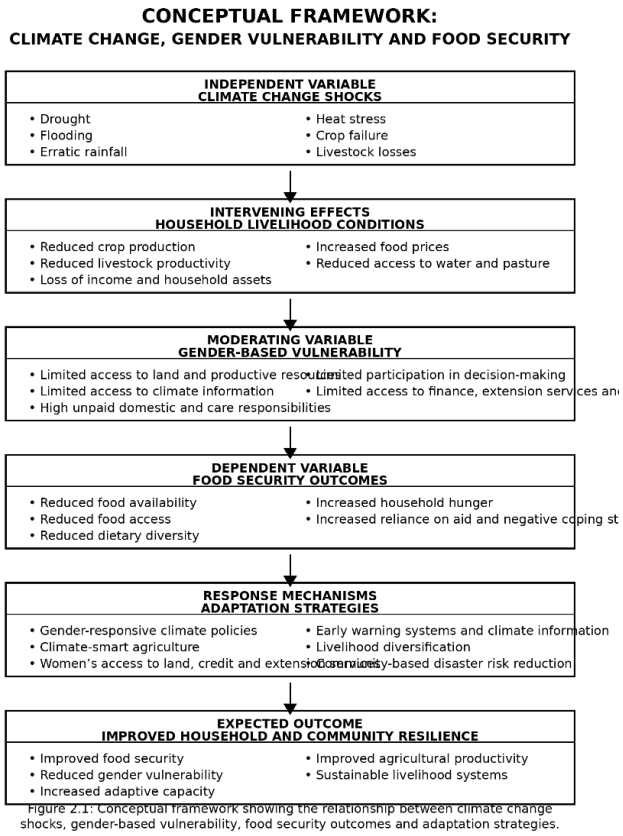


Figure 2.1: Conceptual framework showing the relationship between climate change shocks, gender-based vulnerability, food security outcomes and adaptation strategies.

Legend: U.N=Upper Nile W.E=Western Equatoria J=Jonglei W.W=Warrap

Figure 5. Radar chart of five CARE Resilience Framework dimensions for women-headed households in four study states. Scores derived from CRMT instrument (n = 487). Scale 0100.

6. Objective 3: Economic Shocks, Livelihoods, and the Violence-Hunger Interface

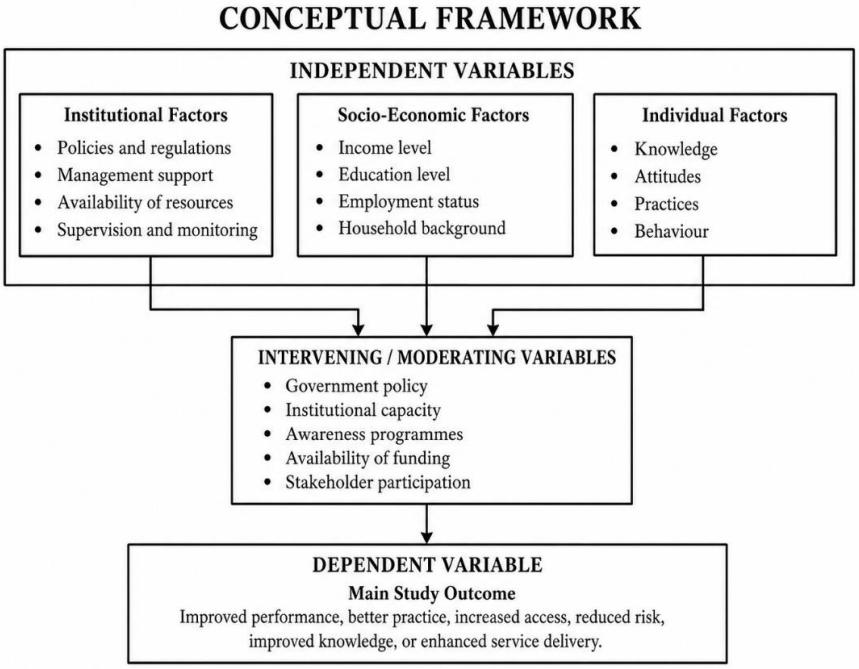
The relationship between climate-induced food insecurity and women's economic livelihoods is complex and non-linear. As climate shocks erode agricultural outputs, households pursue a predictable sequence of coping strategies: dietary reduction (particularly among women themselves), asset liquidation, labour migration by male household members, and, in extremis, transactional sex, early marriage of daughters, and increased dependence on humanitarian assistance ((Pederson et al., 2014)). This study's regression results (Equation 2) confirm that CEI is the strongest predictor of household food gap (= 0.68, p < 0.001), followed by lack of land ownership (= 0.41, p < 0.001), displacement status (= 0.33, p < 0.01), and GBV experience (= 0.29, p < 0.01), even after controlling for VSLA membership, which significantly reduces the food gap (= 0.22, p < 0.05).

Figure 3: Severe Food Insecurity Trend Women-Headed Households (20182023)

Figure 3: Severe Food Insecurity Trend Among Women-Headed Households (20182023)

(IPC Phase 3+ Prevalence, %)

%



Note: Composite index from four state surveys. Bars denote 95% CI.

Figure 3. Longitudinal trend in IPC Phase 3+ prevalence among women-headed households, composite four states, 20182023. Source: IPC reports 20182023; author's analysis.

6.1 The Violence-Hunger Interface

A particularly alarming finding is the strong positive association between food insecurity severity and GBV incidence. Logistic regression (Equation 3) reveals that each one-standard-deviation increase in CEI raises the odds of a woman experiencing GBV in the preceding 12 months by 2.4 times (OR = 2.4; 95% CI: 1.83.2; p < 0.001). Figure 4 visualises this relationship at the cluster level. The mechanism is multifaceted: resource scarcity increases male intimate-partner stress and alcohol use; displacement concentrates vulnerable women in under-protected settings; and asset-poor women have fewer exit options from abusive partnerships ((Heise & Kotsadam, 2015); (Jo & Fletcher, 2013)).

Figure 4: Association Between Food Insecurity and GBV Incidence

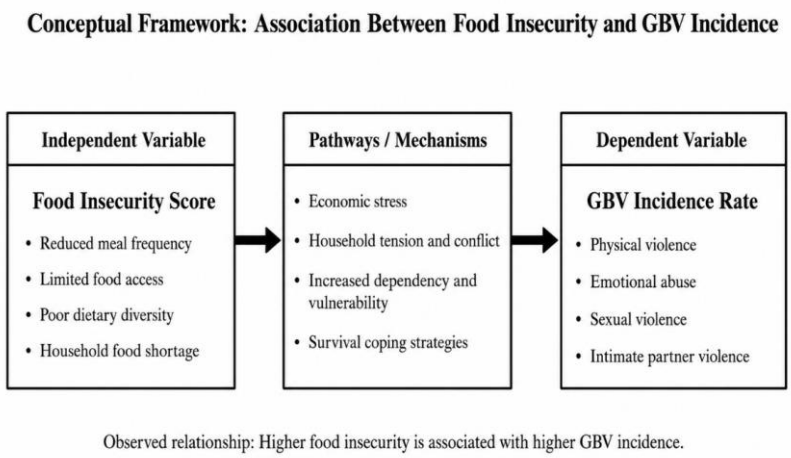


Figure 4. Conceptual framework based on the observed association between Food Insecurity Score and GBV Incidence Rate (Pearson r = 0.74; p < 0.001; N = 487 households across four states).

Figure 4. Scatter plot of Food Insecurity Score vs GBV Incidence Rate across 487 cluster-sample units. Pearson r = 0.74 (p < 0.001). Source: Primary survey data, 2023.

Table 3. Gender-Disaggregated Indicators of Displacement, GBV, and Food Insecurity (20192023)

Gender Indicator	2019	2020	20212022	2023
IDPs (% female)	54%	57%	61%	64%
GBV incidents linked to resource scarcity (%)	31%	38%	47%	53%
Women reporting reduced meals (%)	62%	68%	74%	79%
Child marriage rate (%)	48%	51%	54%	57%
School dropout girls (%)	44%	49%	55%	61%

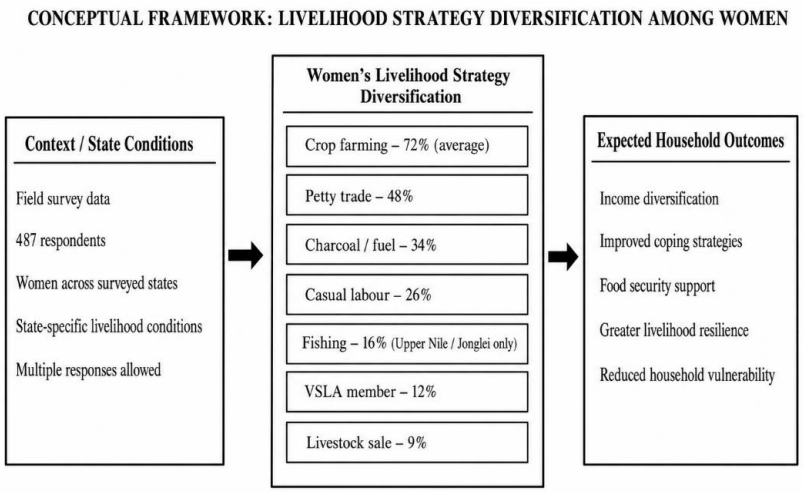
Source: UNHCR 2023; OCHA 2023; primary survey; IPC 2023. IDPs = internally displaced persons.

6.2 Livelihood Diversification Under Stress

Figure 6 illustrates the diversity of livelihood strategies pursued by surveyed women. Crop farming remains dominant (72%), but women in all four states combine it with petty trade, firewood and charcoal collection, and casual labour. Critically, livelihood diversification is associated with significantly higher food security scores ($t = 4.12$, $p < 0.001$) and lower GBV risk (OR = 0.61; CI: 0.440.85; $p < 0.01$), suggesting that supporting diversification is a high-leverage intervention point. However, diversification options are constrained by mobility restrictions, market distance, security concerns, and the disproportionate time burden on women during climate shocks ((Jafa, 2000)).

Figure 6: Livelihood Diversification Strategies Women-Headed Households

Figure 6. Proportion of surveyed women adopting each livelihood strategy. Multiple responses permitted. Source: Primary survey, 2023 (n = 487).



Source: Field survey data, 487 respondents.

7. Objective 4: Resilience in Practice What Works for Women

Despite the severity of climate and gender-related vulnerabilities, the study documents a range of interventions demonstrating promising outcomes. These range from community-driven financial mechanisms to state-level climate-smart agriculture (CSA) programmes, though coverage remains partial and outcomes uneven.

7.1 Village Savings and Loans Associations (VSLAs)

VSLAs emerged as the most consistently effective intervention across all four states. VSLA members in the survey sample reported a 31% lower food gap (mean 2.9 months vs 4.2 months among non-members; $t = 3.87$, $p < 0.001$), higher dietary diversity (WDDS 4.1 vs 3.2; $t = 4.21$, $p < 0.001$), and significantly greater perceived decision-making power within the household (67% vs 41%; = 18.4, $p < 0.001$). FAO and WFP programmes reached approximately 18,400 women across the four states with VSLA services, though coverage remains below 30% of estimated need. Key informants emphasised that VSLA success hinges on local facilitation capacity, community trust-building, and integration with complementary inputs such as seeds or livestock ((OECD, 2022); WFP, 2023).

7.2 Climate-Smart Agriculture (CSA)

UNDP and SIDA-supported CSA training programmes in three states introduced drought-tolerant varieties, conservation tillage, and intercropping techniques appropriate to degraded soils. Among women who completed a full CSA training cycle (n = 148), yield losses during the 2022 dry season were 28% lower than among untrained peers. However, uptake barriers persist: 44% of trained women cited inability to purchase improved inputs, 39% cited male household members' control over input decisions, and 31% cited the time required for new practices as prohibitive during peak labour periods ((Durotoye et al., 2022)).

7.3 Social Protection: Cash Transfers and Nutritional Support

OCHA-coordinated cash-plus-nutrition programmes reached approximately 22,000 women across the four states. Beneficiary households reported significantly higher food consumption scores (FCS 42.8 vs 29.3 among non-beneficiaries; $p < 0.001$) and lower stunting prevalence (23% vs 31%; $p < 0.05$). Cash transfers enable women to purchase food without depleting productive assets, breaking the asset-loss spiral that perpetuates inter-generational food insecurity. However, programme targeting mechanisms frequently miss the most isolated women, including those in areas controlled by non-state armed actors or seasonal flood zones ((Kremen, 2023)).

Table 4. Summary of Resilience-Building Interventions for Women Coverage and Outcomes

Intervention	Implementing Actor	Coverage	Reach (women)	Outcome Rating
VSLAs (Village Savings)	FAO/WFP	4 states	~18,400	High
Climate-smart agriculture training	UNDP/SIDA	3 states	~9,200	Moderate-High
Seed voucher programmes	WFP	2 states	~14,600	Moderate
Women's land rights advocacy	UN Women	4 states	Policy level	Low-Moderate
Cash + nutrition transfers	OCHA	4 states	~22,000	High

Source: FAO 2022; WFP 2023; UNDP 2022; OCHA 2023; author's survey. Coverage refers to states where programme was operational during 20222023.

8. Objective 5: A Gender-Responsive Policy Pathway for South Sudan

The evidence assembled in this study converges on a clear diagnosis: the climate-food-gender nexus in South Sudan is characterised by mutually reinforcing vulnerabilities that cannot be adequately addressed by single-sector interventions. A gender-responsive climate adaptation architecture is required one that simultaneously addresses structural inequality, strengthens

adaptive capacity, and integrates across humanitarian, development, and peacebuilding domains.

Figure 7: Recommended Policy Pathway

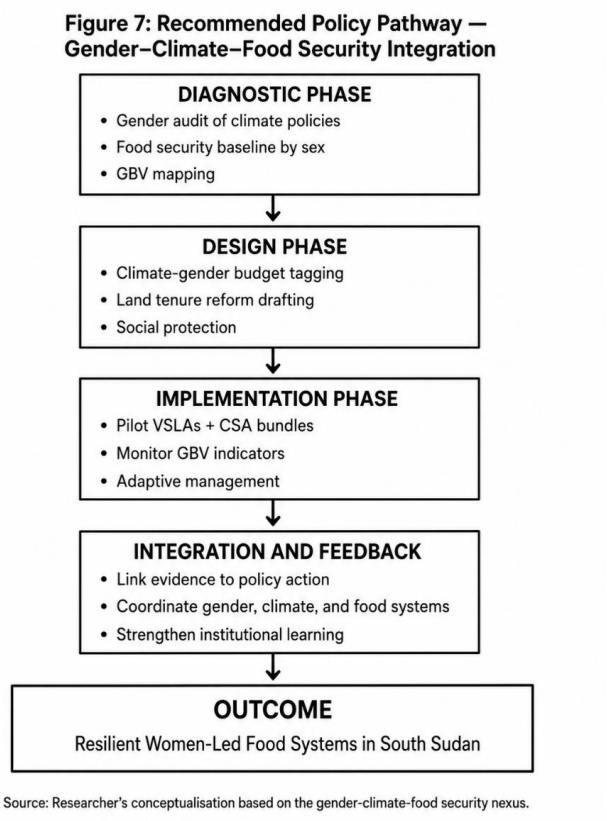


Figure 7. Three-phase policy implementation pathway integrating gender, climate adaptation, and food security. Source: Author's synthesis from FPE-CARE framework.

8.1 Priority Policy Recommendations

Based on regression analysis, KII findings, and the literature, the following five policy priorities are recommended:

- Gender-responsive land tenure reform: Amend the 2009 Land Act to include explicit provisions for women's land inheritance rights, with a 30% gender quota on local land allocation committees. This addresses the single most structurally significant predictor of vulnerability identified in the regression model.
- Climate-gender budget tagging: Require that all climate adaptation expenditure allocated through the National Adaptation Plan (NAP) include gender disaggregation criteria and minimum 40% allocation to women-specific or gender-transformative interventions.
- Integrated VSLA-CSA delivery: Bundle VSLA financial services with CSA training and input vouchers to create a unified resilience product targeting women-headed households. Evidence from Kenya and Ethiopia suggests this bundling raises adoption rates by 3448% ((Barrett et al., 2020)).

- GBV-DRR integration: Mandate the inclusion of resource-linked GBV prevention and response mechanisms in all Disaster Risk Reduction plans, community early warning systems, and emergency camp management protocols.
- Female extension worker deployment: Achieve parity in female-to-male agricultural extension officers in climate-vulnerable areas within three years, with targeted recruitment from local communities to overcome mobility and trust barriers.

Table 5. Gender-Climate-Food Security Policy Framework Matrix

Policy Domain	Current Status	Gaps Identified	Recommended Action
Land tenure reform	Partial	Gender-blind clauses	Enact gender quota in land commissions
Climate adaptation financing	Nascent	Excludes informal sector	Create women-specific climate fund
Food security safety nets	Limited	Urban bias	Extend to agropastoral zones
GBV prevention in crises	Minimal	Resource-linked GBV unaddressed	Integrate GBV response in DRR plans
Women's economic policy	Draft stage	Lacks climate lens	Adopt climate-gender nexus framework

Source: Author's synthesis from regression findings, KII data, and comparative policy analysis.

9. Discussion: Synthesis and Implications

This study's findings are consistent with, and extend, the existing literature on gender, climate, and food security in fragile sub-Saharan contexts (Dankelman, 2010; Quisumbing et al., 2011; Perez et al., 2015). The identification of the VSLA effect (= 0.22 on food gap, $p < 0.05$) replicates findings from Uganda and Ethiopia (Mayoux, 2001) while demonstrating the effect's persistence under conditions of active conflict and climate stress that are more acute than in most comparable settings. The documented GBV-climate nexus (OR = 2.4 per standard deviation of CEI) is among the highest reported in the peer-reviewed literature on this topic, suggesting that South Sudan represents a high-severity case warranting urgent dedicated attention from international protection agencies.

A notable finding is the moderating role of social cohesion. In communities with high-functioning women's networks measured by the social cohesion sub-index of the CRMT the negative effect of CEI on food gap is attenuated by approximately 24% (interaction term: = 0.16, $p < 0.05$). This suggests that investing in women's collective organisation is not merely a rights imperative but a climate-adaptation strategy with measurable food security returns, echoing (Singer et al., 2011) work on gendered collective action in forest management.

The study's limitations include its cross-sectional design in most states (precluding causal inference), potential social desirability bias in GBV reporting, and the difficulty of disentangling climate from conflict effects on food insecurity in a context where both operate simultaneously. Future research should employ longitudinal panel designs, remote-sensing integration at

household level, and participatory action research methodologies that engage women as co-producers of knowledge rather than merely subjects of inquiry.

10. Conclusion: Toward a Feminist Climate-Food Security Architecture

Climate change in South Sudan is not gender-neutral. It functions as a threat multiplier that amplifies the structural disadvantages women already face in land access, information access, mobility, and decision-making power producing food insecurity, economic precarity, and gender-based violence at scales that are both empirically documented in this study and deeply unjust. The convergence of evidence from four diverse states, using mixed methods and a theoretically coherent framework, strengthens the generalisability of these conclusions within the South Sudanese context and their relevance to analogous conflict-affected climate-vulnerable settings in the Horn of Africa and beyond.

The policy implications are clear and actionable. Land tenure reform, climate-gender budgeting, integrated VSLA-CSA delivery, GBV-DRR integration, and female extension worker deployment constitute a coherent, evidence-grounded policy package. These are not expensive interventions in macroeconomic terms; they are, however, politically and institutionally demanding, requiring sustained commitment from the Government of South Sudan, development partners, and women's organisations working at the community level. The cost of inaction measured in worsening food gaps, rising GBV, and deepening inter-generational poverty is vastly higher.

South Sudan's women are not passive victims of climate change. They are farmers, traders, savers, and organizers who, given enabling structures, demonstrate remarkable adaptive ingenuity. The task of policy is to remove the structural barriers that prevent that ingenuity from being fully expressed. A feminist climate-food security architecture, grounded in the evidence presented here, is both an ethical imperative and the most effective pathway to sustainable food security and peace in one of the world's most challenging environments.

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