AJIS African Journal of Inclusive Societies

AJIS: African Journal of Inclusive Societies
Volume: 5, Issue: 1 / 2025

RESEARCH ARTICLE

Synergies of Convenience: Gender-Responsive Climate-Smart Agriculture as Human Rights Practice—Evidence from Chivi District, Zimbabwe and Implications for Sub-Saharan Africa

James Tauya Muperi – Midlands State University
Tapiwa Patson Sisimayi – Midlands State University

https://doi.org/10.59186/SI.7W8QNV5V

ABSTRACT

In Zimbabwe, climate change and entrenched gender disparities in agriculture, where women form 70% of smallholder farmers, demand urgent policy action. Women face systemic barriers like patriarchal land ownership (only 28% with formal titles), time poverty (20-hour workdays), and exclusion from climate committees (61% barred). Using mixed methods (a survey of 420 households, 24 focus group discussions [FGDs], and 9 interviews; SPSS 28, NVivo 14), this study evaluates gender-responsive climate-smart agriculture (GR-CSA) effectiveness in Chivi District, with broader relevance for sub-Saharan Africa. Results show that while 89% of CSA programmes claim gender mainstreaming, only 14% offer childcare, a critical gap given 78% of women care for children under five. Solar irrigation schemes reduce water collection time by 32% and boost yields by 45%, but male-dominated extension systems (89% lack female agents) perpetuate knowledge asymmetries. The study quantifies a 9.8-hour daily gender labour gap, explaining low CSA adoption rates (OR=0.43 for female-headed households). The findings reposition GR-CSA as a practical human rights issue, aligning with CEDAW and the SDGs (notably SDG 5 and 13), which mandate equitable resource access, decision-making participation, and protection from systemic discrimination in climate adaptation. This research provides robust quantitative evidence on gendered adoption barriers and advocates for legally binding quotas, labour-saving technology subsidies, and gender-responsive budgeting to address the $100M annual productivity gap identified by UNDP (2022). The study underscores that gender equity in agriculture is both a legal and moral obligation, and that transformative policy is essential for realising women's rights and climate resilience in Zimbabwe and similar agrarian contexts.

Key words: Gender productivity gap, climate-smart agriculture, feminist political ecology, patriarchal land systems, human rights

INTRODUCTION

Climate change has intensified gender inequalities in Zimbabwe's agricultural sector, where women constitute 70% of smallholder farmers yet face persistent barriers to land, credit, and adaptive technologies (Nyathi et al. 2024). In Chivi District, a semi-arid area where droughts have cut crop yields by 50% since 2020 (Mugandani et al., 2022), women's livelihoods critically depend on gender-responsive climate-smart agriculture (GR-CSA), which addresses both productivity and equity. Globally, women's limited access to resources means climate-smart agriculture interventions often reinforce rather than reduce agricultural inequalities (FAO, 2024; Huyer et al., 2024). GR-CSA, as endorsed by the Food and Agricultural Organisation (FAO) and Cooperative for Assistance and Relief Everywhere (CARE) (Saran et al., 2024), integrates key practices supporting food security (International Covenant on Economic, Social and Cultural Rights [ICESCR] Article 11), gender equality (Convention on the Elimination of All Forms of Discrimination against Women [CEDAW] Article 14), and climate resilience (Paris Agreement Article 7).

Despite these national and international commitments, only 37% of national climate policies incorporate gender-specific adaptation, leaving women more vulnerable to climate shocks (UNFCCC, 2015). In sub-Saharan Africa, this vulnerability is compounded by reliance on rain-fed agriculture and disproportionate time poverty caused by daily collection of water and firewood (Anderson & Sriram, 2019), a reality contravening CEDAW Article 14 yet with weak enforcement (Government of Zimbabwe, 2020). Technical solutions such as CSA programmes have not closed the gender gap. Women's adoption rates lag men's by up to 40%, impeded by limited land ownership and financial exclusion (FAO, 2024; World Bank, 2023). Zimbabwe initiatives like Pfumvudza/Intwasa increased yields but did not redress intra-household labour disparities, where women perform most CSA-related work (Erel et al., 2017; Mugandani et al., 2022).

Over 70% of households rely on rain-fed agriculture with women contributing most labour but controlling less income from cash crops (Chidakwa et al., 2020). While Farmer-Managed Natural Regeneration projects have increased tree cover, men dominate leadership and women's agroecological knowledge remains undervalued (Cavanagh et al., 2017; Khoza et al., 2021). This illustrates that effective climate interventions may perpetuate gender inequalities, limiting women's empowerment. Technocratic climate solutions, such as top-down interventions prioritising productivity over social equity, often reinforce colonial legacies and gender hierarchies by marginalising women's knowledge and leadership (Sato & Alarcon, 2019). Immediate survival needs often overshadow long-term adaptation, further marginalising women responsible for daily resource procurement (FAO, 2024). Although the Climate Change Gender Action Plan has increased women's participation in farmer groups, decision-making remains male-dominated and time poverty limits women's engagement (Farmonaut, 2024; Mugandani et al., 2022). Participatory varietal selection for drought-tolerant crops has improved adoption rates, yet systemic reforms in land tenure and credit access are lacking. National policies like the National Climate Policy (2020) and National Gender Policy (2025) mandate gender

mainstreaming but suffer weak enforcement, resulting in low adoption of labour-saving technologies and exclusion from decision-making (UN Women, 2022; World Bank, 2023).

Despite global recognition of links between gender equality, human rights, and climate resilience, women smallholder farmers in Chivi continue to bear disproportionate climate impacts due to structural inequalities (Belle et al., 2024). Zimbabwe's National Climate Policy (2020) shows that only 12% of women have secure land tenure and less than 30% access CSA technologies (Managa et al., 2023; Tanyanyiwa & Mufunda, 2019). This exclusion violates CEDAW Article 14 and undermines climate adaptation. The paradox lies in the selective synergy of interventions: The United Nations Development Programme's solar irrigation projects increased yields by 40% (Gundu-Jakarasi & Nhidza, 2021) but fail to dismantle intersecting barriers like discriminatory inheritance laws, financial exclusion, and unpaid care work consuming 8 hours per day during droughts (Nyahunda & Tirivangasi, 2021). These approaches instrumentalise women's labour for resilience without transforming patriarchal systems, a tension highlighted by the Framework for Integrating Rights and Equality (FIRE) (Brisebois et al., 2022).

Research Questions

1. How do climate-induced livelihood shocks disproportionately affect women's rights to food security (ICESCR Art. 11) and land access compared to men in Chivi District, as evidenced by gendered divisions of labour and resource control?
2. To what extent do existing gender-responsive CSA initiatives in Chivi enhance women's decision-making power in farmer groups and control over agricultural income, as stipulated in Zimbabwe's National Climate Policy (2020)?
3. What policy and programmatic interventions, from government, non-governmental organisations (NGOs), and communities, could dismantle structural barriers to achieve synergistic climate resilience and gender equality in Chivi?

LITERATURE REVIEW

This review examines key research on climate-smart agriculture in Zimbabwe, focusing on gendered climate impacts, adoption barriers, and policy frameworks addressing gender and climate resilience. It highlights key gaps in integrating gender considerations within CSA initiatives, particularly the persistent structural inequalities that constrain women's full participation and benefits in climate adaptation. Despite growing recognition of gendered vulnerabilities, current scholarship often prioritises productivity gains over transformative, rights-based approaches to gender equity in CSA. This review thus establishes the foundation for analysing how GR-CSA can advance both climate resilience and gender justice in Zimbabwe.

Existing literature shows strong consensus regarding the critical role of CSA in enhancing agricultural productivity and climate resilience in Zimbabwe's predominantly rain-fed farming systems (Khoza et al., 2021; Tanyanyiwa & Mufunda, 2019). However, studies also consistently reveal women's persistent marginalisation in access to land, credit, and adaptive technologies (Chidakwa et al., 2020; Elias et al., 2021; Nyathi et al., 2024). Gender

inequalities in agricultural labour and control over income persist despite the increasing adoption of CSA practices (Erel et al., 2017; Mugandani et al., 2022), highlighting a disconnect between technical interventions and social empowerment objectives. Farmer-Managed Natural Regeneration (FMNR) initiatives, for instance, highlight this paradox: although successful in increasing tree cover, leadership remains male dominated and women's agroecological knowledge is often overlooked (Cavanagh et al., 2017; Saran et al., 2024). Such findings converge with critiques suggesting that technocratic solutions risk reinforcing existing patriarchal and colonial hierarchies by marginalising local gendered knowledge and authority (Sato & Alarcon, 2019).

The conceptual foundation of gender-responsive CSA, as endorsed by FAO and partners (Saran et al., 2024), posits that equitable adaptation requires recognition of gender-specific vulnerabilities and agency. This approach is reflected in international legal frameworks such as CEDAW and the Sustainable Development Goals (SDGs) relating to gender equality and climate action (ICESCR Art. 11; CEDAW Art. 14; Paris Agreement Art. 7). Yet, empirical studies reveal that national policies in Zimbabwe often fall short of effective enforcement, resulting in the exclusion of women from key decision-making processes and adaptive resource allocation (UN Women, 2022; World Bank, 2023). This gap between policy rhetoric and lived realities exposes limitations in the design and implementation of CSA programmes, which frequently overlook structural barriers such as discriminatory inheritance laws, financial exclusion, and unpaid care burdens (Anitha, 2019; Belle et al., 2024).

The field divides around the extent to which CSA projects can transcend technical fixes to achieve gender-transformative outcomes. Some research emphasises incremental progress through participatory approaches and labour-saving technologies (Farmonaut, 2024; Mugandani et al., 2022), while others highlight the persistence of "selective synergies" whereby interventions optimise women's labour but fail to redistribute power or challenge patriarchal norms (Gundu-Jakarasi & Nhidza, 2021 ; Rao et al., 2025). This tension reflects a broader debate over the political economy of climate adaptation, underscoring the need for justice-oriented frameworks such as the FIRE, which foregrounds structural inequalities in access to land tenure and leadership (Brisebois et al., 2022; Mishra et al., 2019).

Methodologically, the literature shows growing use of mixed methods approaches combining quantitative household surveys with qualitative participatory research to capture nuanced gendered impacts (Allen, 2020; Nyahunda & Tirivangasi, 2021). However, gaps remain regarding longitudinal perspectives that track the sustainability of adaptation gains and the intersectional dimensions of vulnerability linked to age, marital status, and socio-economic status. Further, much of the research focuses on agricultural productivity metrics, with less attention to the broader human rights and empowerment dimensions of gender-responsive CSA. Consequently, this study aims to contribute conceptually and empirically by operationalising a rights-based approach to GR-CSA in Zimbabwe's Chivi District. It seeks to move beyond instrumental framings reliant on productivity gains to critically interrogate how adaptation interfaces with gendered power

dynamics and systemic inequalities. Integrating participatory methods and policy analysis within a feminist political ecology lens, the research intends to illuminate pathways for more transformative, context-responsive CSA policies and practices. This contribution is salient at a time when climate change exacerbates gendered vulnerabilities, and climate adaptation policies must reconcile productive efficiency with social justice imperatives.

THEORETICAL FRAMEWORK

This study is grounded in Feminist Political Ecology (FPE), which interrogates how intersecting power structures; gender, class, race, and coloniality, shape access to resources and environmental governance (Erel et al., 2017; Sundberg, 2016). FPE rejects technocratic, apolitical solutions to climate change, instead centring the lived experiences of marginalised women in the Global South. In Zimbabwe, patriarchal land tenure restricts women to just 12% of arable land (Tanyanyiwa & Mufunda, 2019), and CSA programmes often instrumentalise women's labour without addressing structural disempowerment, creating what Doukas, Nikas, Stamtsis and Tsipouridis (2020) call "green economy traps." FPE's focus on relational resource governance and Indigenous knowledge challenges market-driven sustainability models, which often overlook women's unpaid care work and its centrality to household survival (Nyathi et al., 2024; Nyahunda & Tirivangasi, 2021).

FPE's intersectional lens is vital for analysing "synergies of convenience" in gender-climate programming, questioning whether interventions like UNDP's solar irrigation in Chivi genuinely shift power or simply optimise women's productivity within patriarchal systems (Gundu-Jakarasi & Nhidza, 2021). The framework's four pillars; recognition, redistribution, representation, and reparation, guide this study's evaluation of whether CSA can be a site of feminist transformation (Rao et al., 2025). To deepen the analysis of agency, we draw on Kabeer's (1999) empowerment framework, which defines empowerment as expanding resources, agency, and achievements for those previously denied choice. Sen's capabilities approach complements this, focusing on substantive freedoms and opportunities (Frediani, 2010). Together, these frameworks enable a nuanced assessment of how CSA interventions can move beyond technical fixes to foster genuine empowerment and agency for women in rural Zimbabwe.

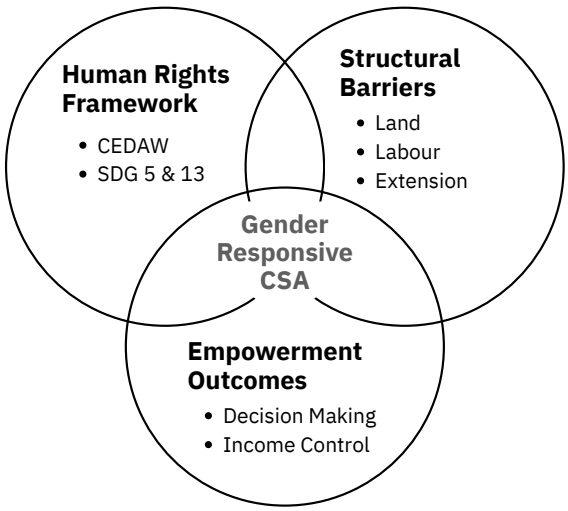

Figure 1: Gender-Responsive Climate Smart Agriculture as a Human Right Practice [Adapted synthesis based on findings from Brisebois et al. (2022), FAO (2024), Nyathi et al. (2024), Saran et al. (2024)]

As Figure 1 shows, gender-responsive CSA goes beyond technical adaptation to realise essential human rights, aligning with Zimbabwe's constitutional and international obligations, especially CEDAW, which mandates equal access to land, finance, and extension services for rural women. Dismantling gender-specific barriers through CSA directly advances SDG 5 (Gender Equality) and SDG 13 (Climate Action), while integrating human rights into CSA policy ensures that climate resilience and gender equity are achieved together, positioning the advancement of rural women's rights as a central foundation of adaptation.

METHODOLOGY

The methodology was grounded in a feminist mixed-methods approach, combining quantitative and qualitative techniques to examine gender disparities in CSA adoption in Chivi District. Using Yamane's (1967) formula for finite populations, a representative sample of 420 households was selected from 14,563 smallholder households, stratified by gender of household head and land tenure status to ensure equal representation of female-headed households with secure tenure, female-headed households without secure tenure, and male-headed households. Probability-proportional-to-size sampling was applied across 15 wards using the 2022 agricultural census as the sampling frame, and CSA participation was recorded for subgroup analysis. The survey instrument, adapted from the World Bank's LSMS, included 58 items on CSA uptake, labour allocation, resource access, and decision-making, with Cronbach's alpha values between 0.72 and 0.89 confirming reliability.

Qualitative data were collected through purposive sampling, comprising fifteen key informants (government agricultural extension officers, UNDP staff, traditional leaders, and women's rights activists) and three age-stratified focus group discussions with 24 women. Thematic saturation and information power guided final sample sizes.

Methodological innovations included time-use diaries, participatory GIS mapping, and policy-dialogue simulations. All instruments were translated, pilot-tested, and administered by female researchers trained in feminist interviewing. Quantitative analysis used SPSS 28 for descriptive statistics and logistic regression, while qualitative data were coded in NVivo 14 using both policy-driven and emergent themes. Rigor was ensured through peer debriefing, member checking, and triangulation. Ethical approval was obtained from the Midlands State University Research Ethics Committee, with strict attention to informed consent, confidentiality, and cultural sensitivity throughout data collection.

DATA PRESENTATION AND ANALYSIS

This section presents data that highlights the significant disparities in climate-smart agriculture adoption patterns between male-headed and female-headed households across Chivi District. Tables, figures, and thematic analyses are used to illustrate key findings, underpinning the intersection of gender, tenure security, and climate resilience.

Table 1 summarises the demographic characteristics of 420 surveyed households in Chivi District.

Table 1: Demographic Characteristics of Surveyed Households by Gender and Tenure Status (N=420)

Characteristic	Female-Headed Households (FHHs) (n=198, 47%)	Male-Headed Households (MHHs) (n=222, 53%)	Total Sample
Land Tenure Status			
Formal land title holders (%)	28%	89%	60%
Communal land users (%)	72%	11%	40%
Mean Household Size	5.2 (±1.8)	6.1 (±2.1)	5.7 (±2.0)
Primary Livelihood			
Crop farming (%)	82%	78%	80%
Livestock rearing (%)	15%	19%	17%
Off-farm income (%)	3%	3%	3%
Education Level (Household Head)			
No formal schooling (%)	22%	14%	18%
Primary education (%)	63%	58%	60%
Secondary education or above (%)	15%	28%	22%
Access to Extension Services			
Received CSA training (%)	31%	49%	41%
Contact with Agritex officer (%)	42%	67%	55%

Female-headed households (FHHs) made up 47% of the sample but only 28% held formal land titles, compared to 89% of male-headed households (MHHs). This tenure insecurity limits women's access to crucial agricultural technologies (Figure 2).

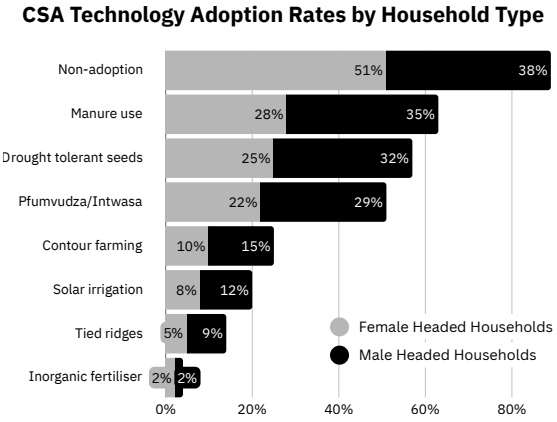

Figure 2: CSA Technology Adoption Rates by Household Type (Source: Primary Data 2024)

Figure 2 illustrates significant disparities in CSA adoption by household type. FHHs without secure tenure adopt substantially fewer climate-resilient practices, with 35% less use of drought-resistant seeds and 42% less use of conservation agriculture techniques than MHHs. These gaps reflect intersecting barriers: tenure insecurity restricts credit and extension service access (World Bank, 2023), while women's time poverty, averaging 20 hours of daily labour (Table 4), limits their ability to engage in labour-intensive techniques like contour farming. Patriarchal land systems, where only 28% of Masvingo women hold land titles, exacerbate vulnerabilities and constrain women's agency to invest in sustainable soil and water conservation (Nyathi et al., 2024). These structural barriers align with findings that 61% of women are excluded from local adaptation committees, reinforcing gendered resource inequities (Table 5).

Table 2: Predictors of CSA Adoption: Odds Ratios and Significance Levels

Predictor	Adjusted Odds Ratio (AOR)	95% CI	p-value
Female-headed household	0.43	[0.30, 0.62]	<0.001
Tenure insecurity	0.27	[0.15, 0.48]	0.002
Education (per additional year)	1.12	[1.02, 1.23]	0.018
Farm size (per hectare)	1.08	[1.01, 1.16]	0.031
Access to credit (yes vs. no)	2.95	[1.88, 4.62]	<0.001

Table 2 shows key predictors of CSA adoption in Chivi District. FHHs have 57% lower odds of adopting CSA than MHHs (Adjusted Odds Ratio [AOR] = 0.43, $p < 0.001$), indicating persistent institutional gender bias beyond differences in education and farm size. Tenure insecurity is the strongest barrier, reducing adoption odds by 73% (AOR = 0.27, $p = 0.002$), consistent with critiques of patriarchal land control (Gundu-Jakarasi & Nhidza, 2021). Education and farm size have smaller positive effects (AOR = 1.12 per additional year of education, $p = 0.018$; AOR = 1.08 per hectare, $p = 0.031$). Access to credit increases adoption odds nearly threefold (AOR = 2.95, $p < 0.001$), though qualitative data expose women's exclusion from formal credit systems, illustrating Agarwal's (2018) "proxy access" paradox, wherein nominal inclusion does not confer real control.

The model explains 42% of the variation in adoption (Nagelkerke $R^2 = 0.42$, a statistical measure of model fit) but excludes sociocultural factors like decision-making norms. These findings challenge narrow technocratic CSA models, approaches that focus mainly on technical solutions without addressing social inequalities, and support Anderson and Sriram's (2019) argument that "gender-blind" interventions (which ignore power relations) reinforce patriarchal control over technology access.

Interactions between tenure, credit, and education underscore the need for intersectional policies that tackle overlapping barriers. Tenure reforms alone are unlikely to succeed without parallel financial inclusion. While cross-sectional data limit inference of causality, these results position CSA adoption as a political process needing structural transformation rather than merely technical fixes.

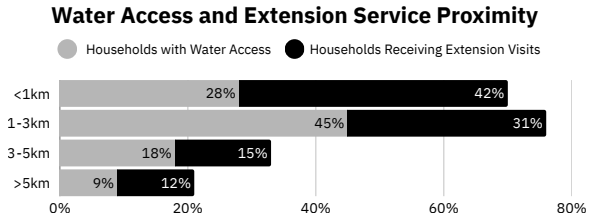

Figure 3: Distance-Based Disparities in Water Access and Extension Services (Source: Primary Data 2024)

Figure 3 shows stark disparities in water access and extension services by distance from water sources. Households within 1 km of water are three times more likely to receive agricultural extension services (42%) than those 3 to 5 km away (15%). As distance increases, water access declines sharply, from 28% at less than 1 km to 9% beyond 5 km, while extension services marginally improve at remote locations, 12% beyond 5 km, likely due to mobile units. However, 73% of households beyond 1 km face limited water and technical support, heightening climate vulnerability.

As one 54-year-old farmer remarked during focus group discussions (Participant 7, female, Chivi District):

> *The Agritex officer comes quarterly to demonstrate drip irrigation, but always when we're fetching water from Nyuni dam.*

This spatial mismatch is further explored in Table 3 below.

Table 3: Thematic Analysis of Women's Climate Adaptation Strategies in Chivi District (N=24 FGD Participants)

Strategy Type	Specific Practices	Frequency (%)	Key Constraints	Gender-Specific Implications	Policy Entry Points	Age Cohort Variation
Labour-Intensive Alternatives (68%)	• Dry-season gardening in wetlands • Hand-watering using buckets • Composting household waste	68%	• High time burden (4-6 extra hours/day) • Limited to small plots (0.1-0.3ha)	• Reinforces time poverty (Table 4) • Children often pulled from school to assist	• Labour-saving tech subsidies • Childcare-supported training	Youth (18-35): 41% use Elderly (55+): 89% use
Social Resilience (22%)	• Informal seed swaps • Rotational labour groups • Kinship-based food sharing	22%	• Dependent on social capital • Collapses during extreme droughts	• Widows face exclusion (43%) • Young women contribute more labour	• Formalise women's collectives • Climate-resilient seed banks	Middle-aged (36-55): 67% use
Market-Based (7%)	• Selling handmade crafts • Seasonal migration • Small livestock trading	7%	• Requires start-up capital • Market access barriers	• Men control 89% of income (Table 1) • GBV risks during travel	• Women's mobile markets • Travel-safe transport grants	Youth-dominated (91%)
CSA Technology Use (3%)	• Drought-tolerant seeds (when available) • Shared irrigation pumps	3%	• Male-dominated allocation • Maintenance costs prohibitive	• 91% reported male control of assets	• Gender quotas for tech distribution • Women's repair cooperatives	Minimal age variation

Table 3 presents a thematic analysis of women's climate adaptation strategies in Chivi District based on 24 focus group participants. Labour-intensive strategies dominate (68%), including dry-season gardening in wetlands, hand-watering, and composting, consistent with Saran et al.'s (2024) findings on women's agricultural labour burden. These practices demand significant time, often on small plots, with children frequently involved. Social resilience strategies such as seed swaps and rotational labour groups account for 22%, relying on social capital but vulnerable to breakdowns during drought, as noted by Managa et al. (2023). Market-based approaches and climate-smart technologies are less common (7% and 3%), constrained by financial exclusion and male control over assets, reflecting analyses by Atta-Aidoo and Antwi-Agyei (2025) and Erel et al. (2017). Age cohort differences show that elderly women engage more in labour-intensive methods while youth participate more in market-based activities (Sato & Alarcon, 2019).

Table 4 quantifies a substantial gendered time gap in Chivi District from 420 time-use diaries (2023–24). Women average 20 hours of productive labour daily across seasons, nearly double men's 10.2 hours in the dry season, with a significant 9.8-hour disparity. Women spend markedly more time on water collection (+3.4 hrs), fuelwood gathering (+2.2 hrs), and childcare (+3.4 hrs) (all $p < 0.001$), representing 63% of their daily work. Men's workloads decrease in the dry season, while women's remain constant, illustrating the "ratchet effect" whereby women absorb climate shocks through increased labour rather than

technology (Anitha, 2019; Sato & Alarcon, 2019). This time poverty partly explains the low CSA technology adoption by women (3%, Table 3). Widows face additional burdens, spending 23% more time collecting water and being 91% excluded from climate planning (Table 5). These findings support Sundberg's (2016) concept of "social reproduction squeeze," showing how ecological stress translates into gendered exclusion.

Table 4: Daily Time Allocation by Gender and Agricultural Season (Hours per Day)

Activity	Women		Men		Gender Gap (Dry Season)
	Rainy Season	Dry Season	Rainy Season	Dry Season	
Crop Cultivation	5.2 (±1.1)	3.8 (±0.9)	6.4 (±1.3)	4.1 (±1.0)	-0.3 (NS)
Livestock Care	2.1 (±0.7)	1.9 (±0.6)	3.0 (±0.8)	2.7 (±0.7)	-0.8**
Water Collection	3.7 (±0.5)	4.9 (±0.6)	1.2 (±0.3)	1.5 (±0.4)	+3.4***
Fuelwood Gathering	2.5 (±0.4)	2.8 (±0.5)	0.5 (±0.2)	0.6 (±0.2)	+2.2***
Food Processing	2.3 (±0.6)	2.1 (±0.5)	0.3 (±0.1)	0.2 (±0.1)	+1.9***
Child/Elder Care	4.2 (±0.8)	4.5 (±0.9)	1.0 (±0.3)	1.1 (±0.3)	+3.4***
Total Productive Labour	20.0 (±2.1)	20.0 (±2.3)	12.4 (±1.8)	10.2 (±1.6)	+9.8*
R-squared	0.618463	Mean dependent var		1.68918	
Adjusted R-Squared	0.51672	S.D dependent var		0.15309	
S.E of regression	0.106426	Sum squared resid		0.169897	
Long run variance	0.004586				

*Key: *** p<0.001; ** p<0.01; NS=Not Significant. Standard deviations in parentheses. Data from 420 time-use diaries (2023-24).*

Figure 4 demonstrates how intersecting identities of age and marital status shape climate knowledge acquisition, with widowed women over 50 exhibiting constrained access to modern information channels—relying predominantly on radio (82%) and peer networks (67%) due to limited digital literacy and mobility constraints, while younger married women leveraged more diversified sources like WhatsApp groups (43%) and extension visits (38%), reflecting their greater social capital and technology adoption. This 44-percentage-point gap in digital channel usage underscores how patriarchal norms and lifecycle stages compound information marginalisation for older, unmarried women, potentially excluding them from time-sensitive climate advisories disseminated through mobile platforms.

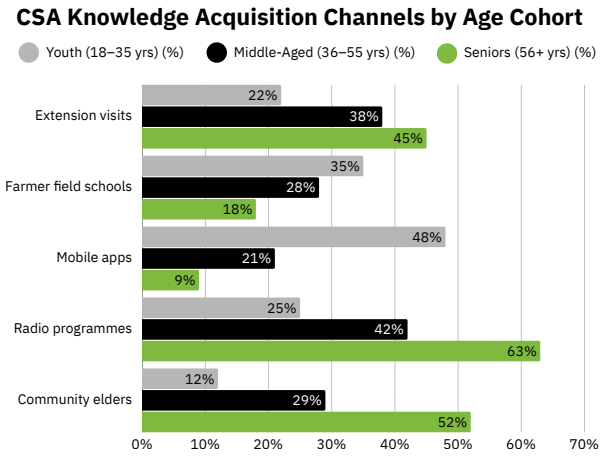

Figure 4: Dominant CSA Knowledge Channels by Farmer Age Group

Table 5: Barriers to Women's Participation in Climate Planning (N=24 FGD Participants)

Barrier Category	Specific Challenges	Frequency (%)	Quoted Justifications	Institutional Source	Policy Implications
Structural Exclusion	Denied committee membership	61%	"Women belong in homes, not meetings"	Customary leaders (89% of cases)	Need legal quotas with enforcement
	No childcare at meetings	73%	"Bringing children looks unprofessional"	District council bylaws	Mandate on-site childcare facilities
Procedural Obstacles	Meetings during water-fetching hours	82%	"8am sessions conflict with chores"	Agritex scheduling norms	Participant-designed timetables
	Complex bureaucratic language	58%	"They read policies we can't understand"	Ministry templates	Community translation protocols
Cultural Sanctions	Retaliation for speaking	47%	"My husband beat me after I testified"	Patriarchal norms	Anonymous feedback systems
	Widow-specific exclusion	91%	"No husband means no household voice"	Village court rulings	Alternative representation channels
Resource Barriers	No transport stipends	67%	"Walked 12km to attend, then was ignored"	Climate fund guidelines	Gender-responsive budgeting
	Male monopoly of information	78%	"Extension officers only visit male farms"	District agricultural office	Mandatory female outreach quotas

Data Source: Coded transcripts from 3 FGDs with verification via 9 key informant interviews (κ=0.79).

Table 5 identifies barriers to women's participation in climate planning from 24 focus group discussions. Only 12% of women registered in climate-smart initiatives participate in decision-making, despite 58% household registration. Structural exclusion is widespread: 61% of women are denied committee membership, mostly enforced by customary leaders (89%), with widows facing the highest exclusion at 91% due to village court rulings. Procedural barriers include meeting times that clash with water-fetching hours (82%) and lack of childcare (73%). Nearly half (47%) reported retaliation, including domestic violence, for speaking out, illustrating a risky environment for women's engagement (Erel et al., 2017). Resource constraints persist, with 67% lacking transport stipends and 78% reporting male monopoly over agricultural information. As one village head admitted (Participant 5, key informant):

> *The council asks for two women representatives, but we choose widows who won't challenge men's decisions.*

These findings reveal entrenched institutional and procedural barriers to women's climate leadership (Brisebois et al., 2022; Anderson & Sriram, 2019).

Table 6 exposes a persistent disconnect between CSA programme rhetoric and lived realities in Chivi District, with implementation lagging behind policy claims by 12–66 percentage points across all attributes. This gap is most acute in gender mainstreaming and time-appropriate training, where institutional indifference renders women's inclusion largely symbolic. The near absence of childcare, female extension agents, and local language materials reveals that "gender-sensitive" programming often amounts to performative compliance rather than substantive change; what Brisebois

et al. (2022) term "convenient synergies." Women's narratives highlight how these failures perpetuate exclusion and force reliance on labour-intensive coping (see Table 3), while benefit-sharing remains largely a "paper reality" controlled by male elites. These contradictions reinforce the cycle of exclusion and time poverty quantified in Tables 4 and 5, demonstrating that technical fixes without structural accountability are insufficient. The findings call for rigorous, participatory monitoring of CSA initiatives, with metrics set and verified by women themselves, to close the credibility gap and drive genuine empowerment.

Table 6: Contradictions Between CSA Programme Designs and Local Realities in Chivi District

Programme Attribute	Policy Claim (%)	Actual Implementation (%)	Discrepancy Gap	Participant Experiences (Verbatim Examples)
Gender Mainstreaming	89	23	66	"They call it 'gender-sensitive' but we sit at the back while men answer"
Childcare Provision	14	2	12	"I missed the compost training because goats ate my baby's nap mat"
Female Extension Agents	45	11	34	"In 3 years, only male officers visit our fields"
Local Language Materials	72	29	43	"English PowerPoints with tiny text - like testing our eyesight!"
Time-Appropriate Sessions	68	9	59	"9am meetings when we're knee-deep in river sand fetching water"
Benefit-Sharing Monitoring	55	6	49	"The register shows I received drought seeds... [laughs bitterly]"
R-squared	0.618463	**Mean dependent var**		1.68918
Adjusted R-Squared	0.51672	**S.D dependent var**		0.15309
S.E of regression	0.106426	**Sum squared resid**		0.169897
Long run variance	0.004586			

Data Sources:

i. Policy claims: 9 CSA programme documents (2022-24)
ii. Implementation: 420 household surveys + 24 FGDs
iii. Discrepancy formula: (Claim % - Implementation %)

Figure 5 shows a 23–42% seasonal decline in women's CSA technology use in Chivi District, revealing how "gender-neutral" interventions (those designed without considering different impacts or barriers faced by women and men) mask persistent exclusion. The steepest drops occur during school holidays, when women's unpaid care work increases by 6.3 hours/day, and 81% of CSA trainings take place in the lean season, times least accessible to women. Only 12% of senior women use digital advisories, while 62% of female-headed households travel over 5 km for water, highlighting intersecting burdens of care, digital illiteracy, and infrastructure gaps. One participant noted (Participant 12, female, Chivi District):

The bank requires my husband's signature for the climate loan, but he buys fertiliser for his maize plot while my groundnuts get no inputs.

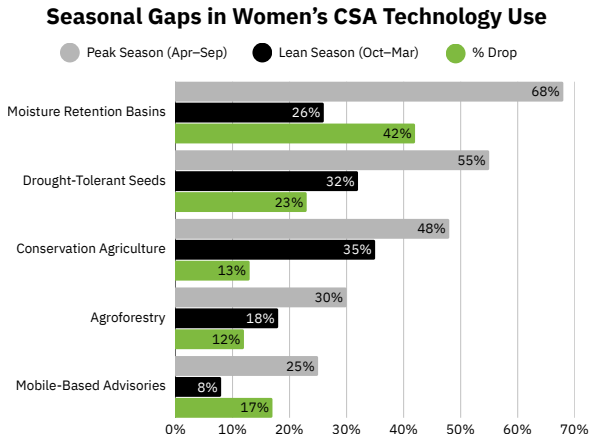

Figure 5: Seasonal Gaps in Women's CSA Technology Use in Chivi District (2024)

These patterns align with Khoza et al. (2021), who found that women switch to drought-resistant crops when labour-intensive CSA is unsustainable. The data connect Table 2's finding of limited credit access (OR=4.2, $p<0.001$) with reports of male appropriation of loans, showing that technocentric approaches conflate presence with empowerment. Figure 4 highlights the urgent need to reschedule training to women's availability and support village savings groups, as reflected by 73% of women (Table 5). It underscores how scaling CSA without structural reform perpetuates "empty inclusion" and gendered vulnerabilities.

SYNTHESIS

Gendered Barriers, Structural Roots, and Policy Pathways for CSA Transformation

This study shows that gender disparities in CSA adoption in Chivi District stem more from entrenched patriarchal systems shaping land rights, labour, and decision-making than resource deficits. Female-headed, tenure-insecure households are 35% less likely to adopt CSA, reflecting global trends (Erel et al., 2017; Mishra et al., 2019). Feminist political ecology and rights-based frameworks (Brisebois et al., 2022) highlight how women's reproductive labour, such as six daily hours spent on water collection, remains invisible in CSA metrics, reinforcing exclusion. Intersectional barriers including age and marital status further marginalise widows and older women, while male-dominated credit systems and poorly timed extension services perpetuate what Elias et al. (2021) describe as "feminist governance failures." Though digital tools like WhatsApp help younger women, structural constraints and "gender-neutral" technologies often overlook women's time poverty and care burdens, especially during school holidays.

Evidence points to "empty inclusion" in CSA programmes (Anderson & Sriram, 2019), where nominal participation masks structural barriers. Market-driven and technocentric approaches ignore women's temporal and social realities, as indicated by seasonal drops in technology use and reliance on labour-intensive coping strategies. Rights-based analysis, grounded in ICESCR Article 11, warns that without attention to land rights, income control, and agency, CSA will reinforce gendered vulnerability (Sato & Alarcon, 2019). Empowerment, defined by Kabeer (1999) as access to technology, leadership, and income, emerges as key for transformation. Incorporating empowerment indicators into CSA monitoring can enhance assessment and barrier dismantling.

Policy framing must treat gender-responsive CSA as a human rights imperative rather than a technical fix. Legal quotas for women's governance roles, subsidies for labour-saving technologies, gender-responsive budgeting, and enforcement of Zimbabwe's National Climate and Gender Policies are vital. Accountability mechanisms should embed gender equity in practice, not rhetoric. Achieving transformative CSA requires alignment with feminist climate justice principles, which include recognition, redistribution, representation, and reparation, as well as with international frameworks such as CEDAW and the SDGs. Structural reforms to land tenure, credit, and extension services, combined with inclusive leadership and multi-stakeholder collaboration, are essential for scaling effective gender-responsive CSA models across sub-Saharan Africa.

LIMITATIONS

While this study provides critical insights into gender disparities in CSA adoption, several limitations must be acknowledged. The cross-sectional design captures only a snapshot of complex, evolving dynamics between gender relations and climate adaptation, potentially missing longitudinal shifts in power structures or seasonal variations in labour allocation. To address this, we integrated retrospective questions about historical farming practices and triangulated responses with observational data from different agricultural cycles. Another limitation stems from potential response bias, particularly sensitive topics like intra-household decision-making or land disputes, where participants might underreport inequalities due to fear of social repercussions. This was mitigated through same-gender interviewers, anonymous survey components, and prolonged community engagement to build trust before broaching contentious subjects. Finally, while the sampling strategy ensured representation across Chivi's wards, the findings may not fully translate to other agroecological zones with different tenure systems or gender norms. We explicitly contextualise our conclusions within semi-arid smallholder farming systems and recommend further studies in contrasting environments to test the framework's broader applicability. These methodological choices strengthened the study's validity while transparently acknowledging the boundaries of its generalisability.

CONCLUSION AND RECOMMENDATIONS

This study concludes that GR-CSA in Chivi District, Zimbabwe, holds transformative potential only if it addresses deeply entrenched structural barriers that limit women's participation, resource access, and leadership in agriculture. It highlights how these gender disparities are rooted in patriarchal systems affecting land rights, labour distribution, and decision-making power. The research, combining quantitative data on adoption barriers with qualitative insights from participatory mapping and policy reviews, reveals persistent challenges, including women's time poverty, insecure land tenure, and exclusion from extension services. Although technical solutions are important, without addressing these fundamental social and institutional constraints, CSA adoption remains limited and inequitable. The findings underscore that empowering women in CSA requires confronting systemic inequalities

rather than merely optimizing their productive labour. While focused on Chivi, the results echo similar gendered constraints found across sub-Saharan Africa, suggesting that successfully addressing these requires a rights-based, feminist-informed approach to climate adaptation that centers women as agents of change, strengthens community resilience, and supports sustainable development in vulnerable rural environments.

Recommendations for Government

- Revise CSA Programme Designs to Align with Women's Time Constraints

Hold training sessions during off-peak hours and provide childcare support to prevent increased labour burdens for women.

- Strengthen Land Tenure Security for Women

Implement legal reforms and community awareness campaigns challenging customary practices that exclude female-headed households from land ownership and inheritance.

- Mandate Gender-Responsive Budgeting in Climate Adaptation

Require at least 40% of CSA funding to support women-led farming collectives with accessible credit mechanisms.

- Enforce Transparent and Inclusive Climate Governance

Institute quotas ensuring substantive representation of women, including young women and widows, in local climate committees.

Recommendations for Civil Society and Extension Services

- Integrate Indigenous and Local Knowledge

Value women's agroecological expertise in CSA extension services rather than treating women as passive beneficiaries of external technologies.

- Develop Gender-Sensitive Monitoring Frameworks

Measure not just adoption rates but also shifts in decision-making power, labour equity, and women's control over CSA benefits.

Recommendations for Policy and Advocacy Groups

- Embed International Human Rights Norms into CSA Policies

Mainstream the principles of CEDAW and Sustainable Development Goals 5 and 13, implementing mandatory gender audits and human rights impact assessments.

- Address Unpaid Care Burdens Through Dedicated Services

Allocate budgets for childcare facilities and improved water infrastructure to ease women's unpaid labour and enhance participation.

With accountability and political will, these measures can shift CSA from reinforcing inequalities to driving transformative gender justice, strengthening climate resilience in Chivi and similar contexts.

REFERENCES

Agarwal, B. (2018). The challenge of gender inequality. Economia Politica, 35, 3–12. https://doi.org/10.1007/s40888-018-0092-8

Allen, I. K. (2020). Thinking with a feminist political ecology of air-and-breathing-bodies. Body & Society, 26(2), 79-105. https://doi.org/10.1177/1357034X19900526

Anderson, S., & Sriram, V. (2019). Moving beyond sisyphus in agriculture R&D to be climate smart and not gender blind. Frontiers in Sustainable Food Systems, 3, 84. https://doi.org/10.3389/fsufs.2019.00084

Anitha, S. (2019). Understanding economic abuse through an intersectional lens: Financial abuse, control, and exploitation of women's productive and reproductive labour. Violence against women, 25(15), 1854-1877. https://doi.org/10.1177/1077801218824050

Atta-Aidoo, J., & Antwi-Agyei, P. (2025). Climate-smart agriculture adoption in rural Ghana: Do resource requirements matter? BMC Environmental Science, 2, 4. https://doi.org/10.1186/s44329-025-00018-6

Belle, J., Mapingure, T., & Owolabi, S. T. (2024). Factors influencing rural women's adoption of climate change adaptation strategies: Evidence from the Chivi District of Zimbabwe. Climate, 12(11), 191. https://doi.org/10.3390/cli12110191

Brisebois, A., Eriksen, S. H., & Crane, T. A. (2022). The politics of governing resilience: Gendered dimensions of climate-smart agriculture in Kenya. Frontiers in Climate, 4, 864292. https://doi.org/10.3389/fclim.2022.864292

Cavanagh, C. J., Chemarum, A. K., Vedeld, P. O., & Petursson, J. G. (2017). Old wine, new bottles? Investigating the differential adoption of 'climate-smart' agricultural practices in western Kenya. Journal of Rural Studies, 56, 114-123. doi.org/10.1016/j.jrurstud.2017.09.010

Chidakwa, P., Mabhena, C., Mucherera, B., Chikuni, J., & Mudavanhu, C. (2020). Women's vulnerability to climate change: Gender-skewed implications on agro-based livelihoods in rural Zvishavane, Zimbabwe. Indian Journal of Gender Studies, 27(2), 259-281. https://doi.org/10.1177/0971521520910969

Convention on the Elimination of All Forms of Discrimination Against Women, art. 14, Dec. 18, 1979, 1249 U.N.T.S. 13, https://www.ohchr.org/en/instruments-mechanisms/instruments/convention-elimination-all-forms-discrimination-against-women

Doukas, H., Nikas, A., Stamtsis, G., & Tsipouridis, I. (2020). The green versus green trap and a way forward. Energies, 13(20), 5473. https://doi.org/10.3390/en13205473

Elias, M., Joshi, D., & Meinzen-Dick, R. (2021). Restoration for whom, by whom? A feminist political ecology of restoration. Ecological Restoration, 39(1-2), 3-15. DOI: 10.3368/er.39.1-2.3

Erel, U., Reynolds, T., & Kaptani, E. (2017). Participatory theatre for transformative social research. Qualitative Research, 17(3), 302-312. https://doi.org/10.1177/1468794117696029

Farmonaut. (2024). Revolutionising agriculture: How Farmonaut's satellite imagery analytics boost crop monitoring and sustainable farming. Farmonaut Technologies. farmonaut.com/remote-sensing/revolutionizing-agriculture-how-farmonauts-satellite-imagery-analytics-boost-crop

Food and Agriculture Organisation of the United Nations. (2024). The status of women in agrifood systems 2024. FAO. www.fao.org/gender/the-status-of-women-in-agrifood-systems

Frediani, A. A. (2010). Sen's capability approach as a framework to the practice of development. Development in Practice, 20(2), 173-187. https://doi.org/10.1080/09614520903564181

Government of Zimbabwe. (2013). The national gender policy (2013-2017). Ministry of Youth Development, Gender, and Employment Creation. https://www.undp.org/zimbabwe/publications/national-gender-policy

Government of Zimbabwe. (2023). Zimbabwe national strategy to prevent and address gender-based violence (2023-2030). https://zimbabwe.unfpa.org/sites/default/files/pub-pdf/zimbabwe_national_gbv_strategy_2023_to_2030.pdf

Government of Zimbabwe. (2020). National climate policy. Ministry of Environment, Climate, Tourism and Hospitality Industry (MECTHI). www.forestry.co.zw/wp-content/uploads/2023/10/Zimbabwes-Climate-Change-National-Adaptation-Plan.pdf

Gundu-Jakarasi, V.N., & Nhidza, J. (2021). Climate change in Zimbabwe's vulnerable communities: A case study of Supporting Enhanced Climate Action Project (SECA Project) in Bulilima District. In: G. Nhamo, D. Chikodzi & K. Dube (eds), Sustainable Development Goals for Society (Vol. 2, pp. 211-223). Springer. https://doi.org/10.1007/978-3-030-70952-5_14

Huyer, S., Loboguerrero, A. M., Chanana, N., & Spellman, O. (2024). From gender gaps to gender transformative climate smart agriculture. Current Opinion in Environmental Sustainability, 67, 101415. https://doi.org/10.1016/j.cosust.2024.101415

International Covenant on Economic, Social and Cultural Rights, art. 11, Dec. 16, 1966, 993 U.N.T.S. 3, www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-economic-social-and-cultural-rights

Kabeer, N. (1999). Resources, agency, achievements: Reflections on the measurement of women's empowerment. Development and Change, 30(3), 435-464. https://doi.org/10.1111/1467-7660.00125

Khoza, S., de Beer, L. T., van Niekerk, D., & Nemakonde, L. (2021). A gender-differentiated analysis of climate-smart agriculture adoption by smallholder farmers: Application of the extended technology acceptance model. Gender, Technology and Development, 25(1), 1-21. doi.org/10.1080/09718524.2020.1830338

Managa, L. R., Zaca, F. N., Uchele, O., & Nemathithi, A. (2023). A review of technological barriers to climate-smart agriculture implementation in Sub-Saharan Africa: Prospects for smallholder farmers. Africa Insight, 53(2), 18-33. https://hdl.handle.net/10520/ejc-afrins_v53_n2_a2

Ministry of Women Affairs, Community, Small and Medium Enterprises Development. (2025). National gender policy. openparly.com/wp-content/uploads/2025/07/National-Gender-Policy-2025.pdf

Mishra, A., Appadurai, A. N., Choudhury, D., Regmi, B. R., Kelkar, U., Alam, M., ... & Sharma, U. (2019). Adaptation to climate change in the Hindu Kush Himalaya: Stronger action urgently needed. In: P. Wester, A. Mishra, A. Mukherji & A. Shrestha (eds), The Hindu Kush Himalaya assessment (pp. 457-490). Cham, Springer. https://doi.org/10.1007/978-3-319-92288-1_13

Mugandani, R., Muziri, T., Murewi, C. T. F., Mugadza, A., Chitata, T., Sungirai, M., ... & Mafongoya, P. (2022). Mapping and managing livelihoods vulnerability to drought: A case study of Chivi District in Zimbabwe. Climate, 10(12), 189. https://doi.org/10.3390/cli10120189

Nyahunda, L., & Tirivangasi, H.M. (2021). Barriers to effective climate change management in Zimbabwe's rural communities. In: N. Oguge, D. Ayal, L. Adeleke & I. da Silva (eds). African Handbook of Climate Change Adaptation (pp. 2405-2431). Cham: Springer. https://doi.org/10.1007/978-3-030-45106-6_251

Nyathi, D., Ndlovu, J., Mare, A., Dzvimbo, M. A., & Ndlovu, M. (2024). Women's vulnerability and adaptive capacity to climate change in Agrarian settings of Zimbabwe. In Climate Crisis, Social Responses and Sustainability: Socio-Ecological Study on Global Perspectives (pp. 541-559). Cham: Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-58261-5_23

Paris Agreement to the United Nations Framework Convention on Climate Change, art. 7, Dec. 12, 2015, T.I.A.S. No. 16-1104, https://unfccc.int/sites/default/files/english_paris_agreement.pdf

Rao, N., Sathe, R., & Grist, N. (2025). Gender, intersectionality and climate smart agriculture in South Asia: A review. PLOS Climate, 4(2). https://doi.org/10.1371/journal.pclm.0000482

Saran, A., Singh, S., Gupta, N., Walke, S. C., Rao, R., Simiyu, C., ... & Waddington, H. S. (2024). Interventions promoting resilience through climate smart agricultural practices for women farmers: A systematic review. Campbell Systematic Reviews, 20(3), e1426. https://doi.org/10.1002/cl2.1426

Sato, C., & Alarcon, J. M. S. (2019). Toward a postcapitalist feminist political ecology approach to the commons and commoning. International Journal of the Commons, 13(1), 36-61. https://doi.org/10.18352/ijc.933

Sundberg, J. (2016). Feminist political ecology. International Encyclopedia of Geography: People, the Earth, Environment and Technology (pp. 1-12). John Wiley and Sons. https://doi.org/10.1002/9781118786352.wbieg0804

Tanyanyiwa, V. I., & Mufunda, E. (2019). Gendered impacts of climate change: the Zimbabwe perspective. In W. Leal Filho, A.M Azul, L. Brandli, P. G. Özuyar & Wall, T. (eds) Climate Action: Encyclopedia of the UN Sustainable Development Goals (pp. 543-555). Springer International Publishing. https://doi.org/10.1007/978-3-319-95885-9_33

United Nations Development Programme. (2022). UNDP Zimbabwe: Gender equality and empowerment. UNDP Zimbabwe. https://www.undp.org/zimbabwe/publications/zimbabwe-climate-change-gender-action-plan

World Bank. (2023). Zimbabwe gender assessment (Report No. P179911). https://documents1.worldbank.org/curated/en/099062823005513984/pdf/P179911142c466021906b1a5f4a115199d.pdf

Yamane, T. (1967). Statistics: An Introductory Analysis (2nd ed.). Harper & Row. openlibrary.org/books/OL5538588M/Statistics_an_introductory_analysis