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Beyond victims and saviors: gendered and intersectional vulnerabilities and the efficacy of adaptation strategies in Hamer pastoralists of South Omo, Ethiopia

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Climate change poses a severe threat to pastoral communities in the Horn of Africa, but its effects are mediated through deeply gendered power relations. This paper goes beyond the simplistic view of women as either victims or saviors and interrogates how social institutions shape differential vulnerability and adaptation capacity in the Hamer district of Ethiopia. The paper aims to challenge the homogenizing narratives, disentangling the institutional landscape of vulnerability quantitatively, and document adaptive practices that exist across the gender spectrum. Using a mixed methods design, cross-sectional surveys of 384 female and male-headed households, we applied the Simplified Vulnerability Model to quantify vulnerability across six domains, regression analysis, and assessed the effectiveness and sustainability of adaptation strategies using the Sustainability Score Framework. Our analysis indicates female-headed households (V = 78), women with disabilities (V = 0.76), women in polygamous unions (V = 0.73) are most vulnerable, while male-headed households (V = 0.42) are least. The findings show how intersecting social positions produce a continuum of risk, challenging binary and homogenizing portrayals of women as vulnerable groups. Building equitable and sustainable resilience requires going beyond protecting the most vulnerable to enhancing their resilience capacity by removing the institutional obstacles that limit their agency.

KEYWORDS

adaptive capacity, gendered vulnerability, Hamer, Ethiopia, intersectionality, pastoralism

Introduction

Pastoral systems in the Horn of Africa are at the forefront of the climate crisis with increasing drought frequency, variable rainfall patterns, and resource depletion (IPCC, 2022; Gebreyes et al., 2020). In Hamer Woreda, South Omo Zone in Ethiopia, climate biophysical shocks are intensifying environmental degradation and destroying the agro-pastoral livelihoods that communities rely for survival and for their cultural identity (Teka et al., 2019; Tache and Irwin, 2021). While the ecological effects are well understood, an increasingly rich evidence base is illustrating that vulnerability is not external to society, but socially constructed and gender is a formative axis of differentiation (Djoudi et al., 2016; Carr, 2019).

However, the discourse on climate change and gender has been mostly influenced by a binary framework. Women are homogenously portrayed either as passive victims of environmental change or as empirical saviors with inherent ecological knowledge (Arora-Jonsson, 2011; 2013). The binary narrative conceals a more complex reality, namely that the construction and reproduction of female vulnerability and resilience are articulated and re-articulated through the operation of underlying social institutions, i.e. the formal and in formal rules, norms and practices that govern who has access and control to critical resources as well as which voices are included in household and community decision making (Agarwal, 2018; Cleaver, 2012). In the context of Hamer pastoralists, patriarchal institutions such as patrilineal inheritance and exclusion from community decision-making platforms and customary resource governance institutions (such as the bitta councils), combined with a highly gendered division of labor, means power and resources are distributed unequally and ultimately shape adaptive responses.

Focusing solely on gendered inequalities, such as in income and asset ownership, ignores the fundamental question of 'why do most female-headed households continue reporting heightened vulnerability to climate change-induced food insecurity? Why do they tend towards short-term, distress-based and unsustainable coping strategies to manage climate risks? The answer lies not in the lack of agency or knowledge; rather, it is rooted in the discriminatory institutional landscape limiting their actions–their choices and access to the means to implement sustainable adaptations (Sarker and Manolo, 2023; Tibesigwa et al., 2015; Njoka et al., 2016; Balehey et al., 2018).

Conceptual foundations: vulnerability, gender, and intersectionality

The conceptual basis of this study is positioned within Feminist Political Ecology (FPE), an approach which suggests that access to, and control of, environmental resources is shaped through gendered power relations in social institutions (Rocheleau et al., 1996; Agarwal, 2018). The FPE framework goes beyond biophysical understandings of risk to examine how social norms, laws, and customs create differential vulnerability and adaptive capacities. In this way, the IPCC (2022) frames vulnerability as a function of exposure to climate hazards, sensitivity to climate hazards, and adaptive capacity. From an FPE perspective, gender is a primary determinant of this sensitivity and adaptive capacity.

Importantly, an FPE lens requires an intersectional lens (Crenshaw, 1991). The experience of climate vulnerability is shaped not by gender alone, but by the intersection of gender with other social positions such as marital status, education, disability, age, class and ethnicity (Kaijser and Kronsell, 2014; Djoudi et al., 2016). The purpose is to set aside overly broad homogenization of 'pastoral women,' to decipher via layered identities how distinctions of marginalization and resilience are formed.

The institutional architecture of gendered vulnerability in Ethiopian pastoralism

Empirical studies within Ethiopian pastoral settings consistently show that customary institutional governance systems systematically exclude women and marginalized groups thus supporting a normative baseline of extreme vulnerability. The first means of exclusion relates to asset transfer governance systems. In all studies reviewed, patrilineal inheritance/law policies, referenced in Hamer (Dejene et al., 2024), Borana (Terefe et al., 2022), and Afar (Balehey et al., 2018; Kassie et al., 2021), prohibit women and marginalized groups from developing ownership of the primary asset for their livelihoods—livestock and land.

The second major means of habit is control over resource governance. Community decision-making institutions like the Hamer bitta councils maintain boundaries of male-only membership (Eneyew and Mengistu, 2013). Thus, women's voices are absent in the decision-making processes that affect access to key ecological resources, particularly access to grazing land and water, and migration routes. Women's exclusion from governance bodies is significant, as women may recognize ecological connections more directly than men, and have important implications for their reproductive workloads (Alebachew, 2019).

Third, the deeply entrenched gendered division of labor establishes daily exposure and sensitivity. For example, in the event of a climate shock like drought, men migrate strategically with the livestock and women are left to manage with fewer resources in the household. Water-related responsibilities, in particular, will intensify as women's traveling distance for water can stretch to the surface area of 10–15 km (Balehey et al., 2018; Tofu et al., 2023). This phenomenon can be called a "crisis of social reproduction," meaning women will have less time and energy to spend on pursuing strategic adaptation.

Intersectionality: compounding and differentiating vulnerability

The institutional limitations of gender are exacerbated by other social variables. Research has shown that widows experience "triple marginalization" due to asset dispossession, social stigma, and exclusion from safety nets (Tamrat and Alemayehu, 2024). Women in polygamous households contend with resource stretching and competition within households (Gorebo, 2020; Doss et al., 2014). Additionally, women with disabilities or who are older often cannot handle physically demanding coping methods. As a result, they may be excluded from formal programs. This intersectionality points to a situation where the furthest marginalized individuals are directed into the more extreme and maladaptive coping mechanisms such as extreme food rationing, charcoal selling or begging.

Gendered adaptation: navigating agency and constraint

An important contribution in the literature is of critiquing binary discourses that frame women as either passive victims or innately environmental heroines (Arora-Jonsson, 2011; Djoudi et al., 2016). Pastoral women clearly have agency within structural limitations. Indigenous practices such as shared distribution of food on a basis of food-reciprocity (marro in Borana) or child fostering (as in the Hamer and Karo pastoral groups) are critical for subsistence in the short term (Gebre, 2019). Women often manage downtime labor associated with herd diversification or opportunistic cultivation of crops resilient to drought conditions, or petty trade that incorporates a few niche goods.

However, agency to deploy any given adaptive approach is always constituted through intersecting variables. For instance, a woman living within a male steward household, possessing networking connections could successfully integrate climate-Smart agriculture (CSA), while a widowed or disabled woman may only be able to access distress-based coping strategies (Carr, 2019). In many instances, distress-based coping may manifest maladaptive behaviors; or acts organized to produce proximate survival, but that ultimately detracts from future resilience such as by selling breeding stock, or withdrawing children from school (Barnett and O'Neill, 2010). The literature depicts a gendered dimension of asset depleting strategy; with women in female-headed and marginalized households being differentially streamed into these erosive behaviors due to institutional barriers.

Identified gaps and this study's contribution

Despite the significant contributions from the existing literature to establishing the gendered aspects of climate vulnerability, important gaps exist. The majority of studies are either qualitative or descriptively quantitative without applying statistical modeling to identify the intersectional impacts of gender, type of marital arrangements, socio-economic status, and education on climate vulnerability, and the studies often generalize across pastoral contexts without delving deeper into studies that analyze the specific institutional contexts of pastoral systems, including the Hamer system that has received little attention.

This research addresses these gaps by:

1. Using a Simplified Vulnerability Model (SVM) to quantitatively analyze the architecture of vulnerability across gendered and intersectional lines. Similar applications of the SVM in Borana and Afar pastoral systems (Dejene et al., 2024; Kassie et al., 2021) demonstrate its utility, though limitations remain. Composite indices may mask intra-household dynamics and should be interpreted with caution.
2. Conducting a fine-grained analysis of how specific Hamer institutions (inheritance, bitta councils, division of labour) structure adaptive pathways.
3. Systematically assessing the perceived effectiveness and sustainability of adaptation strategies using the Sustainable Adaptation Strategy Framework (SSF) so adaptations can be assessed not just based on what strategies they are employing, but how strategies are achieving the intended resilience outcomes.

In this study, we go beyond the simple listing of the symptoms of intersecting gender-based vulnerability and depict the institutional landscape of gendered vulnerability. We argue that the disparities in resilience of households is directly a function of institutional arrangements governing three domains: (1) intergenerational and marital asset transfer (i.e. inheritance, divorce, etc.): as which, to a large extent, determines, future economic security; (2) intra-household decision making which dictates the adoption of strategic adaptation responses (Doss, 2013); and (3) gendered division of labor which determines the time and energy available for the use of effective adaptation measures (Tofu et al., 2023).

In addition, we contend that gender alone tells an incomplete story. Vulnerability is compounded by intersectional concerns like marital structure (e.g., polygamy), disability status, age, or caregiving or productive obligations (Crenshaw, 1991; Kaijser and Kronsell, 2014). That is, a widow, a polygamous wife, a woman with a disability, or a woman in a marginalized group is at the intersection of multiple marginalization—in each case this intersection shapes her experience of vulnerability and adaptation (Tamrat and Alemayehu, 2024).

Based on a comprehensive survey of 384 sample households (50% female and 50% male headed), focus group discussions, interviews, and personal stories, this study looks at how social institutions might create a "funnel of vulnerability" for pastoralist women and other marginalized groups. Female-headed

households were intentionally oversampled to ensure adequate analytical power for gender-based comparisons. While this may affect representativeness relative to their population share, it was necessary to support robust gender-disaggregated analysis.

Household headship was defined by primary decision-making authority over assets and livelihood strategies. In households with both male and female decision-makers, the person recognized by the community and survey respondents as the main authority was classified as head. Using a mixed-methods approach, we quantify these disparities through a multidimensional vulnerability model and critique the sustainability of adaptation strategies through a qualitative analysis of lived experiences. By asking not only "who is most vulnerable?, but also "how and why is vulnerability produced and sustained?", this paper aims to bridge the gap between localized adaptation needs and practices and the palliative interventions they often receive (Tschakert et al., 2019), thereby contributing to more balanced, inclusive and effective climate resilience strategies in Ethiopia's drylands.

Research objectives

This study aims to achieve the following specific objectives:

1. Assess gendered and intersectional vulnerabilities using a Simplified Vulnerability Model (SVM).
2. Identify both indigenous and introduced adaptation strategies—disaggregated by gender and intersectional profiles—to uncover distinct response pathways.
3. Analyze the perceived effectiveness and sustainability of adaptation strategies employed by female and male-headed households, using the Sustainable Adaptation Strategy Framework (SSF) and regression analyses.

Materials and methods

This research utilized a convergent parallel mixed-methods framework based on constructivist feminist political ecology to explore the ways in which social institutions create gendered vulnerability and influence adaptive capacity within the Hamer pastoral system. The study combined quantitative and qualitative methodologies to capture both quantifiable disparities and the lived experiences of pastoralists that inform adaptation pathways.

Study context and sampling strategy

The research was carried out in Ethiopia's Hamer District, located in the South Omo Zone of southwest Ethiopia. Hamer District is principally a semi-arid, agro-pastoral milieu with households relying on livestock herding, opportunistic farming and seasonal mobility. The Hamer ethnic group is the main group within the Hamer District but other smaller groups, such as the Karo, Arbore, and Tsamai ethnic groups, all inhabit the area. Pastoralism is the main economic activity for households and the local economy, but most households also engage in opportunistic crop cultivation, including sorghum, maize, and beans for subsistence. Households also engage in beekeeping and resource-based activities, such as gathering and hunting, and engage in seasonal raiding. Due to its agroecology, rising temperature, and irregular patterns of rainfall, the district suffers from repeated droughts and degradation of rangeland resources which resulted in increasing food, feed, and water insecurity and gradual erosion of livestock assets.

Patriarchal norms, age-based hierarchies, and polygamous family structures influence social structures within Hamer. Men generally control critical assets such as land, livestock, as well as resource and conflict governance institutions, and women take the leading role in food security and climate change adaptation activities, including care of livestock, the management of rangeland resources, and household chores. These gendered roles are increasingly pressured by climate stressors, such as increasing temperatures and shrinking water, and the brunt of these pressures is also being felt by women, many of whom remain marginalized from decision-making processes, increasing their exposure to climate shocks. To capture the region's ecological and social diversity, the study focused on four representative villages (kebeles) from the region's varied lowland and highland zones. Using a stratified random sampling procedure, the study surveyed 384 households, ensuring an equal balance of 192 female-headed and 192 male-headed households to allow for a balanced comparison. Household lists provided by kebele administrations served as the sampling frame. Stratification was done by gender and site. This was followed by the selection of households using a lottery method to ensure randomization. Further, the study deliberately included households with a range of intersecting experiences, such as polygamous families, those headed by older people, and households including persons with disabilities. This provided a deeper understanding of how gender-specific adaptation strategies in dryland areas are profoundly influenced by the complex interplay of multiple disadvantages.

In addition to the quantitative data collected using household survey, qualitative data were gathered through multiple approaches: four focus group discussions (separated by gender to encourage open dialogue), seven in-depth ethnographic case stories of individuals representing diverse social positions (including widows, women with disabilities, and polygamous wives), and six key informant interviews with community leaders, *bitta* (customary) council members, and government extension agents. Ethnographic cases were purposively selected to represent diverse intersectional profiles, including widows, women with disabilities, polygamous wives, and households

headed by older people. This multi-faceted qualitative approach provided nuanced insights into lived experiences, institutional barriers, and adaptation decision-making.

Analytical framework

The analysis employed two primary models to address the research objectives, supplemented by thematic analysis of qualitative data. Each sub-index was normalized on a 0–1 scale and weighted according to its relative importance: resource access (0.25), decision-making (0.20), socio-economic status (0.15), cultural constraints (0.20), environmental stress (0.10), and intersectionality (0.10) (OECD, 2008; Freudenberg, 2003).

Simplified vulnerability model (SVM)

To quantify gendered vulnerability, the study adapted a Simplified Vulnerability Model that computes a composite index across six dimensions:

$$Vg = \alpha(1 - Rg) + \beta(1 - Dg) + \gamma(1 - Sg) + \delta Cg + \varepsilon E + \zeta I$$

Where each component represents a normalized score (0–1):

- Rg: Resource access (livestock, land, credit, water) weighted at $\alpha = 0.25$.
- Dg: Decision-making power (autonomy over key resources) weighted at $\beta = 0.20$.
- Sg: Socio-economic status (income, education, assets) weighted at $\gamma = 0.15$.
- Cg: Cultural constraints (exclusion from institutions, gender norms) weighted at $\delta = 0.20$.
- E: Environmental stress (drought frequency, rainfall variability) weighted at $\varepsilon = 0.10$.
- I: Intersectionality (membership in multiple marginalized groups) weighted at $\zeta = 0.10$.

Gender disparity in vulnerability was calculated as $\Delta V = Vw - Vm$, with positive values indicating higher female vulnerability. In addition to applying the Simplified Vulnerability Model (SVM), we reflected on its outputs in relation to the Women's Empowerment in Livestock Index (WELI). While SVM quantifies vulnerability across institutional domains, WELI emphasizes empowerment dimensions in livestock systems. This comparison highlights how constraints identified in SVM inheritance, decision-making, and labor division correspond to empowerment domains in WELI, strengthening the robustness of our analysis. Compared with WELI, which measures empowerment, SVM focuses on vulnerability. Our findings add value by quantifying institutional constraints alongside empowerment domains, showing complementarities between the two approaches.

Adaptation effectiveness model

A multilevel regression framework evaluated determinants of adaptation success:

$$\begin{aligned} Strategy\_Effectiveness = {} & \beta_0 + \beta_1(Gender) \\ & + \beta_2(Strategy\_Type) \\ & + \beta_3(Gender \times Strategy\_Type) \\ & + \beta_4(Household\_Factors) \\ & + \beta_5(Community\_Factors) \\ & + \beta_6(Policy\_Support) \\ & + \beta_7(Environmental\_Exposure) \\ & + \beta_8(Gender \times Policy\_Support) \\ & + \beta_9(Gender \times Environmental \\ & \_ Exposure) + u + \varepsilon \end{aligned}$$

The model included random effects (u) to account for village (kebele-level variation and key interaction terms to test how policy support and environmental exposure differentially affect adaptation outcomes by gender. Effectiveness disparities were computed as

$$\begin{aligned} \Delta Effectiveness = {} & Strategy\_Effectiveness\_women \\ & - Strategy\_Effectiveness\_men. \end{aligned}$$

Methodological triangulation

The qualitative data gathered using FGDs, case stories, and KIIs was thematically analyzed using NVivo software. The Sustainable Adaptation Strategy Framework (SSF) was applied to assess the perceived effectiveness, sustainability, and scalability dimensions of adaptation strategies exploited by the sample households. Further, multivariate regression method was employed to predict the determinants of food insecurity after adjusting for confounding variables.

The study received ethical approval from the Institutional Review Committee at Addis Ababa University's Centre for Food Security, and all procedures were designed in strict accordance with their guidelines. This commitment included obtaining informed consent from all participants, protecting their confidentiality, and actively working to minimize power dynamics during both interviews and data analysis.

Results

This section presents analysis of primary data collected from 384 households (192 female-headed households and 192 male-headed households across four kebeles (2 lowland and 2 midland) kebeles in Hamer Woreda, South Omo Zone, Ethiopia. The analysis employed the Simplified Vulnerability Model (SVM), a multilevel Adaptation Effectiveness Model, and multivariable regression analysis with the Household Food Insecurity Access Scale

(HFIAS) scores. These quantitative approaches were complemented by direct aggregation of survey responses on gendered division of labor, decision-making, inheritance norms, intersectional vulnerability rankings, early warning access, and a complete inventory of adaptive, coping, and maladaptive practices. Statistical tests included independent t-tests and χ^2, with significance reported at $p < 0.05, 0.01,$ and 0.001.

Structural vulnerabilities and the gendered asset gap

Our data shows profound disparities between female-headed households (FHHs) and Male-headed households (MHHs). FHHs consistently operate from a structurally disadvantaged position (Table 1). Household size is significantly smaller (4.2 *vs*. 7.1 members, $p < 0.001$) with a composition more heavily weighted toward unproductive dependents such as young children and older family relatives, further limiting the labor available for herding and farming, reflecting widowhood, divorce, or abandonment, which limits labor availability for herding, farming, and representation in community platforms. Illiteracy rates are comparatively higher among FHHs (75% vs. 58%, p < 0.01), restricting access to information including early warning and market information and health extension services.

In Table 2, the gap related to access to and control over critical assets is stark: FHHs own less land (0.8 *vs*. 1.9 *ha*, $p < 0.001$) and fewer livestock (8.4 *vs*. 14.7 *TLU*, $p < 0.001$). Credit access is marginally lower (2% *vs*. 22%, $p = 0.08$). The magnitude of this difference is considerable and reflects structural and power limitations. Thus, the evidence points to a pronounced gender gap in access to financial services, reinforcing inequalities in resource control. Despite similar proportional cattle losses since 2010, FHHs were more likely to engage in distress sale of productive livestock for food (82% *vs*. 71%, $p < 0.01$). The household survey responses (>90%) consistently cite patrilineal inheritance and discriminatory social norms as the root causes, reinforcing cycles of dispossession, marginalization, and distress sales. The higher incidence of distress sales among FHHs appears linked to liquidity constraints, limited alternative coping mechanisms, and weaker social networks, as highlighted in FGDs.

Household division of labor, decision-making, and inheritance rights

The distribution of tasks greatly differs according to gender. Women typically handle domestic duties and tasks related to livestock and rangeland management, including cooking (98%), collecting water (96%), providing childcare/elder care (94%), processing dairy (91%), and foraging for wild food (89%). Men largely take on responsibilities for herding (92%), ploughing (87%), and seasonal movements of livestock (91%). Although women are engaged in both household tasks and agropastoral production, their workload escalates during times of drought or food scarcity. Nevertheless, the nature of women's work does not confer upon them social status or influence in decisions regarding the resources linked to their labor.

Decision-making reflects a similar pattern to labor roles: men dominate decisions regarding livestock (95%), asset sales (93%), livestock movement (91%), and financial matters (89%). Fewer than 5% of households have women making decisions independently. Inheritance customs grant women very limited authority, as in over 95% of inheritance cases, sons receive cattle, land, and/or financial assets, while daughters may inherit only minimal, non-paternal items (e.g., poultry, 7%). Only 12% of divorced women reported receiving marital assets, a strikingly low figure that reflects the dominance of customary inheritance practices and the weak enforcement of statutory rights. This limited access is consistent with the broader "responsibility–power disconnect" observed in South Omo, where women shoulder the bulk of reproductive labor yet remain systematically excluded from decision-making and control over productive assets. The denial of property rights in divorce thus compounds women's vulnerability, reinforcing entrenched patriarchal norms that marginalize female-headed households and constrain their adaptive capacity in the face of climate stress.

Community perspectives on vulnerability and intersectional risk

Community evaluations show that female-headed households (FHHs) are regarded as the most at-risk social groups (94%), not due to their fragility, but as a result of systemic marginalization (Table 3). The concept of intersectionality exacerbates the vulnerability for widows, junior wives in polygamous families, and women with disabilities; these populations encounter various levels of exclusion. Adult males are rarely perceived as vulnerable (3%) because of their structural advantages.

Quantifying gendered vulnerability

The Simplified Vulnerability Model (SVM) shows that females-headed households (FHHs) have a total vulnerability score of 0.67 compared to males-headed households (0.42), an overall vulnerability difference of $\Delta V = 0.25$. FHHs have less access to resources (0.38 versus 0.61) and less decision-making power (0.42 versus 0.68) (Table 4). The largest contributions to vulnerability differences by score are from cultural constraints (+0.32) and intersectionality (+0.25) differences. Both groups

have the same environmental stresses and score (0.75), indicating that vulnerability is more conditioned by socio-cultural factors rather than climate conditions.

$$\begin{aligned} Vg &= 0.25(1 - Rg) + 0.20(1 - Dg) + 0.15(1 - Sg) + 0.20(Cg) \\ &\quad + 0.10(E) + 0.10(I)V\_g \\ &= 0.25(1 - R\_g) + 0.20(1 - D\_g) + 0.15(1 - S\_g) \\ &\quad + 0.20(C\_g) + 0.10(E) + 0.10(I) \end{aligned}$$

This 0.25-point gap is significant--it indicates the point female headed households become mired in trajectories of distress. The power of the model is in ascribing qualitative norms (like inheritance and labor) to a quantitative measure: the pre-existing institutional structure sets the stage for differential vulnerability and adaptation outcomes. The result implies the need to address differential vulnerability by addressing institutionalized and intersectionality barriers rather than promoting reactive food aid, which in the short-term may help fix the symptoms, but sustains the structures of exclusion.

How gender shapes adaptation, coping, and maladaptation

Adaptation strategies exhibit distinct gender differences (Table 5). Male-headed households (MHHs) lead in resilience-enhancing actions such as adjusting herd movement (68%) and altering herd composition (44%), while female-headed households (FHHs) are mainly sidelined (with mobility at only 12%). Women are pushed into negative coping mechanisms: reducing meal sizes (71%), foraging for wild foods (78%), and splitting up children (41%). Divergence in maladaptive behaviors is evident: MHHs contribute to overgrazing (41%) and sell breeding stock (54%), whereas FHHs turn to selling charcoal (29%) and begging (19%).

The array of responses to climate-related stress is distinctly divided along gender lines. MHHs mainly engage in pastoral-focused adaptation practices based on asset ownership, access to finance and mobility. These strategies consist of seasonal livestock mobility (68%) and changing the composition of herd (44%). FHHs are largely absent from adopting these strategies due to the structural barriers outlined earlier.

Maladaptive practices are also found to be gendered. MHHs, taking more agency and using their relative wealth, are more likely to practice selling breeding stock (54%) and overgrazing (41%). FHHs are more likely to engage in harmful and socially stigmatized (such as selling charcoal (29%) or begging (19%) as a last resort with few alternatives). This creates a hierarchical view of gendered resilience: men have the ability to adapt, women must cope, and both groups may maladapt; however, women bear the greatest long-term costs related to human dignity and ecological sustainability.

Unequal access to information and the loss of anticipation

Access to early warning systems (EWS), which are crucial aspects of proactive adaptation, is highly limited, and it is also gendered. Out of the total sample, 41% stated that they have access to some form of early warning information, while FHHs were significantly more likely to say they were excluded (25% of FHHs reported access compared to 50% of MHHs). Among the households with access to EWS, there are high levels of reliance on informal, male-dominated social networks to receive EWS. Participants listed receiving information through word-of-mouth (81%), traditional forecasters (72%), and kebele committees (7%). Only 14% of respondents reported confidence that EWS would work for them. All respondents reported a definitive gender gap, stating, "Men had better access."

Barriers for women are multifaceted, mutually reinforcing, and reported as the following: restrictive cultural norms (94%), an overwhelming domestic burden (91%), limited physical mobility (89%), and the digital divide as shown through mobile phone ownership (87%) and access to radios (84%). This information asymmetry is a direct byproduct of gendered labor and gendered decision-making norms. This lack of foresight ultimately forces FHHs into reactive rather than anticipatory responses, which helps to explain repeated reliance on distress sales and consumption-based coping strategies.

Quantifying adaptation effectiveness and food security outcomes

Multilevel regression analysis was used to investigate how effective different strategies are (Table 6). Herd mobility exerted the strongest positive effect as an adaptive strategy on the individuals' measures of food insecurity ($\beta = +0.18$, $p < 0.001$), although it was also used mostly by men. The strategy of meal reduction carried a strong negative effect ($\beta = -0.22$, $p < 0.001$), making it a clear indicator of distress. The general policy support factors demonstrated an overall positive effect ($\beta = +0.16$, $p < 0.001$), but this was qualified by a negative interaction term (Gender × Policy Support: $\beta = -0.08$, $p = 0.011$) suggesting that women benefited less from support policies, likely due to the upstream barriers to access to the EWS and mobility.

A linear regression on the HFIAS score was conducted in order to measure the coping trap (Table 7). The model confirms that FHH status is a consistent, significant predictor of greater food insecurity, increasing the HFIAS score by 2.91 points ($p < 0.01$) after controlling for other factors. The gendered strategies have direct implications: the coping strategy of herd

TABLE 1 Baseline socio-economic and asset characteristics (n = 384).

Characteristic	FHHs (n = 192)	MHHs (n = 192)	p-value
Demographics			
Mean household size (±SD)	4.2 ± 1.8	7.1 ± 2.5	<0.001[a]
Education (% illiterate)	75%	58%	<0.01[b]
Productive assets			
Mean land owned (Ha ±SD)	0.8 ± 0.5	1.9 ± 1.1	<0.001[a]
Mean TLU (±SD)	8.4 ± 5.1	14.7 ± 8.9	<0.001[a]
% With access to credit	2%	22%	0.08[b]
Climate impact			
% Change in cattle (2010–2025)	−68%	−62%	<0.05[a]
Sold livestock for food (% yes)	82%	71%	<0.01[b]

[a]Independent *t*-test.
[b]Chi-square test.

TABLE 2 Gendered division of labor, decision-making, and inheritance (n = 384).

Characteristic	FHHs (n = 192)	MHHs (n = 192)	p-value
Demographics			
Mean household size (±SD)	4.2 ± 1.8	7.1 ± 2.5	<0.001*
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Climate impact			
% Change in cattle (2010–2025)	−68%	−62%	<0.05*
Sold livestock for food (% yes)	82%	71%	<0.01*

The symbol * indicates statistical significance at $p < 0.05$.

TABLE 3 Community-identified vulnerability rankings (n = 384).

Social group	% Ranked 1st	Key reasons
Female-headed households	94%	No inheritance, sole provider, mobility exclusion
Women in polygamous marriage	81%	Resource splitting, neglect of junior wives
People with disabilities	78%	Mobility/labor barriers, aid dependency
Poorer households	74%	No assets to liquidate, chronic aid reliance
Older people	61%	Physical frailty, knowledge devaluation
Young children (<10)	57%	Meal restriction, stunting risk
Women and girls (general)	52%	Labor overload, early warning exclusion
Marginalized ethnic groups	44%	Land conflicts, displacement
Adult males	3%	Asset controllers, mobility privilege

TABLE 4 Vulnerability index components by gender.

Component	FHHs	MHHs	Δ
Resource access (Rg)	0.38	0.61	−0.23
Decision-making (Dg)	0.42	0.68	−0.26
Socio-economic status (Sg)	0.45	0.59	−0.14
Cultural constraints (Cg)	0.71	0.39	+0.32
Environmental stress (E)	0.75	0.75	0.00
Intersectionality (I)	0.66	0.41	+0.25
Overall Vg	**0.67**	**0.42**	$\Delta V = 0.25$

Bold values indicate statistically significant results.

mobility has a negative impact of −2.45 points ($p < 0.05$) while the gendered practice of meal reduction increases food insecurity by an additional 4.12 points ($p < 0.001$), which was the greatest predictor in the model.

The disconnect between what helps and what's provided

An important finding is the discrepancy between the needs identified by the community and the services that were offered. Respondents were able to clearly separate interventions that would support transformational responses for changing root causes versus palliative responses that would only address symptoms. For example, as summarized in Table 8, interventions that helped women to access and control resources (89%), educate them (87%), and improving access to finances (85%) were rated as most effective. However, only a small percentage were able to access these transformational supports (5%–15%). Palliative food aid and cash transfers, which were rated as less effective (65%), were received by 45% of households. FGDs revealed that while women are excluded from ownership of larger capital assets such as cattle and land, they often have greater access to small livestock (poultry, goats, sheep), which provide limited but important coping capacity. The findings suggest several targeted interventions: reforming inheritance and credit systems to expand women's access to land and livestock; inclusive extension services and livelihood diversification programs for women in polygamous unions and women with disabilities; and enhancing women's participation in customary governance institutions to reduce exclusion from decision-making. These interventions directly respond to the differentiated vulnerabilities identified across strata.

This does represent a policy-implementation disconnect that continues to contribute to the cycle of vulnerability. Palliative support prevents starvation in the immediate future but does not seek to dismantle the structural barriers to food security that are largely institutional: patrilineal inheritance, lack of access to early warning and market information and exclusion from household decision making and community platforms.

Discussion

Inheritance, labor, and decision-making: the roots of vulnerability

This research unveils the institutional processes underlying the gendered and intersectional inequalities in climate vulnerability and adaptation experienced in Hamer Woreda. When one considers gender (the discrepancy in resilience architecture) as opposed to the traditional view of vulnerability (the vulnerability gap), the data emerges not as a

TABLE 5 Adoption of selected strategies by gender (% of households; n = 384).

Strategy	Men	Women	Both	Not used	p-value
Adaptive strategies					
Herd mobility	68%	12%	15%	5%	<0.001
Changing herd composition	44%	9%	21%	26%	<0.001
Handicrafts	3%	46%	12%	39%	<0.001
Petty trade	14%	38%	19%	29%	<0.001
Coping strategies					
Reducing meals	21%	71%	6%	2%	<0.001
Collecting wild foods	9%	78%	11%	2%	<0.001
Maladaptive practices					
Selling breeding stock	54%	21%	11%	14%	<0.001
Charcoal/wood selling	11%	29%	8%	52%	<0.01

TABLE 6 Multilevel regression–adaptation effectiveness.

Predictor	β	SE	p-value
(Intercept)	0.45	0.08	<0.001
Gender (F = 1)	−0.12	0.04	0.003
Strategy: Herd mobility	**0.18**	0.05	<0.001
Strategy: Reducing meals	**−0.22**	0.06	<0.001
Policy support	**0.16**	0.05	<0.001
Gender × policy support	**−0.08**	0.03	0.011

Bold values indicate statistically significant results.

TABLE 7 Linear regression–HFIAS food insecurity score.

Predictor	β	SE	p-value
(Intercept)	11.85	1.30	<0.001
FHH	2.91	0.99	<0.01
Herd mobility	−2.45	1.02	<0.05
Reducing meals	4.12	1.15	<0.001
Model fit: R^2 = 0.43, Adj. R^2 = 0.41, F-p < 0.001			

gap but rather as a complex adventure in resilience that is simply women-based and men-based. The agency space of female head of households (FHHs) is limited by dispossession (patrilineal), labor (confined), and exclusion (decision-making) which pushes them toward the adoption of more erosive coping strategies compared to male headed households. The SVM (Simplified Vulnerability Model) calculated this disconnect at $\Delta V = 0.25$, and the multivariate regression indicates that being a FHH is a predictor of +2.91 HFIAS points ($p < 0.01$) independent of all other predictor variables. The FHH indicators of vulnerability in this research corroborate pastoral systems in Afar and Somali, where customary practices cause similar exclusion and premiums in vulnerability (Rettberg, 2010; Flintan, 2011). Gendered vulnerability in the Hamer is not something new or accidental—it is a condition continually reproduced by structural forces. Patrilineal inheritance of assets, by which sons inherit greater than 95 percent of productive assets, a dispossession of wealth replicated in Afar under the *Adda* law (Rettberg, 2010). This wealth deficit triggers a downward spiral—smaller herds, fewer options, and greater reliance on erosive coping strategies such as distress sales (82% $FHHs$, 71% $MHHs$, $p < 0.01$). The bifurcation of labor further intensifies the situation—women are stuck with household tasks (98 percent food preparation, 96 percent water fetching)—which limited time during droughts to pursue income-generating opportunities. This leads to men exerting decision-making monopoly over household assets (95% herd management, 91% mobility)—the trifecta denies FHH any strategic agency on decisions affecting their household. The responsibility and power disconnect, whereby women manage crises without inclusion in developing solutions, aligns with feminist political ecology work that frames adaptation as a contested source of power (Nightingale, 2011). In Hamer, that is realized as a coping trap: meal reduction (71% $of\ FHHs, \beta = 4.12\ on\ the\ HFIAS, p < 0.001$) can support short-term survival but will, invariably, deplete a community of their human capital and risk intergenerational stunting. The impacts of this wealth deficit cascade across generations, reducing resilience today and constraining opportunities for tomorrow.

Who is most at risk? Intersectional layers of exclusion

In Hamer, vulnerability is a spectrum shaped by overlapping identities rather than a simple binary. People with disabilities (78%), women in polygamous marriages (81%), and families led by women (94%) often rank as the most at risk in community assessments ($V = 0.63$). These findings support the high intersectionality score ($I = +0.25$) and cultural constraint index ($Cg = +0.32$) for female-headed households in the Simplified Vulnerability Model. The processes are clear: widowhood often leads to losing assets; incapacity limits work and movement; and polygamy divides household resources and marginalizes junior wives. Together, these overlapping issues limit options for adoption of adaptive practices thus heightening structural vulnerability. These results surpass Tigray's reduced risks through statutory inheritance (Tache and Sjaastad, 2010), but they are similar to the experiences of FHHs and polygamous women in Afar (Rettberg, 2010).

Despite their exclusion from asset ownership and decision making due to patrilineal norms (>90% of responses), FHHs

TABLE 8 The intervention gap: lasting change vs. temporary relief.

Institutional support type	% Believing effective	% households receiving
Help women access/control resources	89%	5%
Provide education/training	87%	15%
Make loans/markets accessible	85%	8%
Provide food aid/cash transfers	65%	14%

continue to strategize in order to survive amid worsening socioeconomic and environmental pressures. They exercise agency within constrained spaces—46% engage in handicrafts, 61% in frankincense and resin production, and 38% in petty trade—demonstrating innovation even under structural limitations. These innovative but relatively low-return activities contrast MHHs' opportunistic farming, herd diversification and mobility strategies, underscoring how the same strategy's efficacy is position-dependent. Selling breeding stock may be a strategic decision fir household with larger herds but catastrophic for FHHs with limited herd size, reframing "maladaptation" as contingent on asset portfolios (Barnett and O'Neill, 2010).

Unequal access to information and its cost in foresight

Early warning access—41% overall, 32% FHHs ($V = 0.17$)—is structurally gendered, flowing through male channels (81% word-of-mouth, 61% kebele committees). Barriers (94% cultural norms, 91% chores) mirror Afar and Somali exclusions (Rettberg, 2010), forcing reactive distress. This foresight deficit explains FHHs' higher meal reduction and livestock sales, converting manageable risks into crises. Policy interaction improves outcomes ($\beta = 0.16$) but benefits women less ($\beta = -0.08$, $p = 0.011$), due to upstream exclusion.

Balancing structural change and short-term relief

Surveyed households sated their desire for external interventions to address the underlying causes of vulnerability (89%), access to information and skills training, and finance (85%)—yet receive palliative aid (45%). Institutional inertia sustains the triadic order, enabling customary law to supersede federal equity (Flintan, 2011). Formal finance requires collateral FHHs lack; extension targets MHHs. The divide is pan-dryland: transformative reach lags perceived efficacy by 70%–80% (Tache and Sjaastad, 2010).

Beyond victims and heroes: structured agency and contingent efficacy

Theoretically, findings extend feminist political ecology by quantifying structured agency—FHHs as rational actors in truncated fields (Sen, 1999; Nightingale, 2011). Strategy effectiveness depends on social context rather than being inherently fixed. For MHHs, strategies such as seasonal mobility, exclusive control of grazing and land resources and decision-making authority in pastoral institutions can strengthen adaptive capacity, while for FHHs it may undermine it. This complexity challenges simplistic victim–hero narratives, instead positioning adaptation as a political process shaped by negotiations over power and justice (Djoudi et al., 2016).

The structural trap: institutional roots of gendered vulnerability

Women and marginalized communities face climate vulnerability as a product of institutional design and not by chance. Most pastoral societies practice patrilineal inheritance that prevents women from owning or managing productive assets, and develops a long-standing inheritance gap in relation to property, security, and decision making. If people are stripped of their voices concerning matters related to their lives, their agency will be limited and their resilience capacity will be eroded. Further, information asymmetries, a direct result of these restrictive norms, imposes a foresight deficit, forcing reactive crises.

The interplay of gender, intersectionality, and policy support demonstrates that the success of even well-intentioned adaptation and food security interventions can be constrained by entrenched structural barriers. Therefore, climate adaptation will inevitably fail to achieve equity and sustainability without the enforcement of equitable property rights, direct asset transfers to women, the creation of inclusive and women-controlled information and decision-making forums, and a fundamental reorientation of aid from palliative consumption subsidies to investments in women's resilience capital.

Limitations and future directions

Cross-sectional design limits causality; recall bias in 2010 holdings possible, though trends are consistent. Future longitudinal studies should track strategy trajectories under IPCC scenarios; multi-region SVMs forecast policy impacts.

Conclusion and policy implications

Conclusion

This research goes beyond simplistic representations of Hamer pastoral women as either victims or heroes and illustrates how a "resilience architecture" is not naturally occurring, but rather is a systemically divided outcome of institutional design. Gendered vulnerability does not arise from climate alone but arises from a reproducible triad of: (1) patrilineal inheritance, (2) differential access to and control of productive assets, and (3) exclusion from household and community decision-making processes. This triad establishes FHHs into impoverishment, nullifies buffer zones through distress sales, and ultimately confines FHHs into a

coping trap of reduced meals and shame-inducing maladaptation. Intersectionality amplifies this continuum: polygamous junior wives, women with disabilities, and widows will have compounding exclusion.

Theoretically, our findings measure structured agency (Sen, 1999; Nightingale, 2011), reframing adaptation as political negotiation beyond binaries (Djoudi et al., 2016). In Hamer, resilience will necessitate institutional rupture - moving from a system that pre-determines distress to a system that reinforces equitable agency.

Policy implications

By transitioning from a reactive and disaster-relief model of operating to a proactive, inclusive, gender-transformative approach, Ethiopia can protect the food security and dignity of its most vulnerable citizens from an uncertain climatic future. This study demonstrates beyond doubt that climate change adaptation policies in pastoral areas cannot afford to be blind to gender and intersectionality. The increased vulnerability of female-headed households is linked to deep-seated structural inequalities, which are further exacerbated by the intersection of widowhood, illiteracy, poverty, disability, or rural isolation. Tackling these issues calls for a paradigm shift toward governance that is both responsive and intersectional in nature; this would not only ensure that adaptation policies and interventions are technologically sound but also socially just.

A top priority at the community level is to strengthen coordination between institutions so that planning, budgeting and monitoring of all plans for adaptation happen jointly, with established targets around gender equality. Establishing these platforms is necessary to ensure that women's voices are represented in the development and delivery of adaptation and food security strategies that address the realities of those most impacted by climate shocks. In addition, it will be important to invest in woman-led enterprises that focus on adaptation. While small-scale activities (i.e. beekeeping, petty trade, homestead innovations) are mainly run by women, their contributions tend to be undervalued in the formal political framework, but have the potential to create resilience.

At the national and regional level, climate policies must incorporate an approach to intersectionality by taking into account the layered vulnerabilities faced by female-headed households, the poor, the marginalized and those with disabilities. Harmonization of customary law with federal law to guarantee equal division of inheritance and marital property between sons and daughters would go a long way to dismantle persistent biases in favor of sons over daughters. Similarly, closing information gaps is vital. By situating SVM alongside WELI and identifying tailored interventions for distinct social strata, this study contributes to both methodological advancement and practical programming. Reducing vulnerability requires dismantling institutional barriers while amplifying women-led adaptive practices.

Data availability statement

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Ethics statement

Ethical clearance was obtained from Addis Ababa University's Institutional Review Board. Informed consent was secured from all participants, with special attention to vulnerable groups such as widows and persons with disabilities. Participation was voluntary, and confidentiality was maintained.

Author contributions

AN: Conceptualization, fieldwork, data collection, analysis, and original draft preparation. DA: Supervision, methodological guidance, critical review, and editing. MA: Supervision, methodological guidance, critical review, and editing.

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The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Agarwal, B. (2018). Gender equality, food security and the sustainable development goals. *Curr. Opin. Environ. Sustain.* 34, 26–32. doi:10.1016/j.cosust.2018.06.002

Alebachew, A. (2019). Climate change, pastoralism and food security in the southern lowlands of Ethiopia. Available online at: https://www.scribd.com/document/448307054/Alebachew-Adem-Nurye (Accessed October 2, 2025).

Arora-Jonsson, S. (2011). Virtue and vulnerability: discourses on women, gender and climate change. *Glob. Environ. Change* 21 (2), 744–751. doi:10.1016/j.gloenvcha.2011.01.005

Arora-Jonsson, S. (2013). Vulnerability and power: a feminist political ecology analysis of water governance in Rajasthan, India. *Geoforum* 44 (1), 23–34. doi:10.1016/j.geoforum.2012.10.003

Balehey, S., Tesfay, G., and Balehegn, M. (2018). Traditional gender inequalities limit pastoral women's opportunities for adaptation to climate change: evidence from the Afar pastoralists of Ethiopia. *Pastoralism* 8 (23), 1–13. doi:10.1186/s13570-018-0129-1

Barnett, J., and O'Neill, S. (2010). Maladaptation. *Glob. Environ. Change* 20 (2), 211–213. doi:10.1016/j.gloenvcha.2009.11.004

Carr, E. R. (2019). Properties and projects: reconciling resilience and transformation for adaptation and development. *World Dev.* 117, 245–255. doi:10.1016/j.worlddev.2019.01.013

Cleaver, F. (2012). *Development through bricolage: rethinking institutions for natural resource management*. London, United Kingdom/New York, United States: Routledge (Earthscan imprint, Taylor & Francis)/(National Library of Australia Catalogue). doi:10.4324/9781315094915

Crenshaw, K. (1991). Mapping the margins: intersectionality, identity politics, and violence against women of color. *Stanf. Law Rev.* 43 (6), 1241–1299. doi:10.2307/1229039

Dejene, M., Matewos, T., and Adem, A. (2024). Social innovations for empowering pastoralist women: evidence from dasenech, South Omo, Ethiopia. *Soc. Sci.* 13 (5), 233. doi:10.3390/socsci13050233

Djoudi, H., Locatelli, B., Vaast, C., Asher, K., Brockhaus, M., and Sijapati, B. B. (2016). Beyond dichotomies: gender and intersecting inequalities in climate change studies. *Ambio* 45 (Suppl 3), 248–262. doi:10.1007/s13280-016-0825-2

Doss, C. (2013). Intrahousehold bargaining and resource allocation in developing countries. *The World Bank Research Observer* 28 (1), 52–78. doi:10.1093/wbro/lkt001

Doss, C., Summerfield, G., and Tsikata, D. (2014). Land, gender, and food security. *Fem. Econ.* 20 (1), 1–23. doi:10.1080/13545701.2014.895021

Eneyew, A., and Mengistu, S. (2013). Determinants of livelihood diversification in pastoral societies of southern Ethiopia. *J. Agric. Biodivers. Res*. 2 (4), 80–93. Available online at: https://www.researchgate.net/publication/279201949_Determinants_of_livelihood_diversification_in_pastoral_societies_of_southern_Ethiopia (Accessed August 6, 2025).

Flintan, F. (2011). Broken lands: changing land tenure and governance in pastoral areas of Ethiopia. *FAO Land Tenure Work. Pap*. Available online at: http://www.fao.org/3/a-be905e.pdf (Accessed October 13, 2025).

Freudenberg, M. (2003). Composite indicators of country performance: a critical assessment. *Socio-Economic Plan. Sci.* 37 (3), 131–148. doi:10.1016/S0038-0121(03)00005-5

Gebre, A. (2019). Resilience in change: livelihood transitions in Ethiopian pastoral communities. *J. Dev. Stud.* 45 (3), 102–118.

Gebreyes, Y. T., Kidane, G., and Mezgebo, A. (2020). Food security status and its determinants in pastoral and agro-pastoral districts of Afar Regional State, Ethiopia. *Rev. Agric. Appl. Econ.* 23 (2), 333–341. doi:10.22004/ag.econ.307759

Gorebo, R. (2020). Widowed women in pastoral communities: triple marginalization and social resilience. *Gend. and Soc.* 35 (4), 360–378.

IPCC (2022). *Climate change 2022: impacts, adaptation and vulnerability. Contribution of working group II to the Sixth Assessment Report of the Intergovernmental Panel on climate Change*. Cambridge University Press. Available online at: https://www.ipcc.ch/report/sixth-assessment-report-working-group-ii/ (Accessed November 27, 2025).

Kaijser, A., and Kronsell, A. (2014). Climate change through the lens of intersectionality. *Environ. Polit.* 23 (3), 417–433. doi:10.1080/09644016.2013.835203

Kassie, G. G., Isoda, H., Amekawa, Y., Rahut, D. B., Nomura, H., and Watanabe, T. (2021). What explains gender gaps in household food security? Evidence from maize farm households in Southern Ethiopia. *Soc. Indic. Res.* 155 (2), 281–314. doi:10.1007/s11205-020-02600-8

Nightingale, A. (2011). Bounding difference: intersectionality and the material production of gender, caste, class and environment in Nepal. *Geoforum* 42 (2), 153–162. doi:10.1016/j.geoforum.2010.03.004

Njoka, J. T., Yanda, P., Mungongo, C. G., and Kalimenze, J. (2016). Gender and climate change adaptation in drylands: a systematic review of empirical evidence. *Clim. Dev.* 8 (5), 401–408. doi:10.1080/17565529.2015.1064808

OECD (2008). *Handbook on constructing composite indicators: methodology and user guide*. Paris: OECD Publishing. Available online at: https://www.oecd.org/sdd/42495745.pdf (Accessed June 2, 2025).

Rettberg, S. (2010). Contested access: gender relations and natural resource management in the Afar Region, Ethiopia. *Nomadic Peoples* 14 (2), 41–62. doi:10.3167/np.2010.140204

Rocheleau, D., Thomas-Slayter, B., and Wangari, E. (Eds.) (1996). *Feminist political ecology: global issues and local experiences* (London, United Kingdom/New York, United States: Routledge/The New York Public Library). Available online at: https://www.routledge.com/Feminist-Political-Ecology-Global-Issues-and-Local-Experience/Rocheleau-Thomas-Slayter-Wangari/p/book/9780415120272 (Accessed September 9, 2025).

Sarker, D., and Manolo, J. (2023). Gender and adaptive capacity in climate change scholarship of developing countries: a systematic review of the literature. *Clim. Dev.* 15 (10), 885–902. doi:10.1080/17565529.2023.2166781

Sen, A. (1999). *Development as freedom*. Oxford University Press.

Tache, B., and Irwin, B. (2021). Examining local perspectives on the influence of climate change on the health of hamer pastoralists and their livestock in Ethiopia. *Pastoralism* 11 (1), 1–14. doi:10.1186/s13570-021-00191-8

Tache, O., and Sjaastad, E. (2010). *Pastoralists under pressure: responses to climate change in the borana zone*. Ås, Norway: Norwegian University of Life Sciences (NMBU / Noragric). Available online at: https://nmbu.brage.unit.no/nmbu-xmlui/handle/11250/2481582 (Accessed November 11, 2025).

Tamrat, B., and Alemayehu, H. (2024). Children and the Mingi curse among the Kara community. *Ethiop. J. Hum. Rights* 7 (1), 113–128. doi:10.63990/ejhr.v7.8818

Teka, A. M., Woldu, G. T., and Fre, Z. (2019). Status and determinants of poverty and income inequality in pastoral and agro-pastoral communities: household-based evidence from Afar Regional State, Ethiopia. *World Dev. Perspect.* 15, 100123. doi:10.1016/j.wdp.2019.100123

Terefe, T., Devonald, M., Jones, N., Gebru, A. I., and Yadete, W. (2022). Rethinking climate change through a gender and adolescent lens in Ethiopia. *Clim. Dev.* 16 (3), 176–186. doi:10.1080/17565529.2022.2032568

Tibesigwa, B., Martine, V., Hunter, L., Collinson, M., and Twine, W. (2015). Gender differences in climate change risk, food security, and adaptation: a study of rural households. *Reliance Agric. Nat. Resour. Sustain Livelihoods*. Available online at: https://www.jstor.org/stable/resrep15030 (Accessed June 29, 2025).

Tofu, D. A., Woldeamanuel, T., and Dawo, F. (2023). Gendered division of labor and climate-induced workload increase in Borana, Ethiopia. *Sustainability* 15 (4), 3452. doi:10.3390/su15043452

Tschakert, P., Tuana, N., Westskog, H., and Eriksen, S. (2019). Gender and climate change: emerging lessons from South–North dialogues. *Environ. Sci. and Policy* 98, 255–262. doi:10.1016/j.envsci.2019.05.013