



Women's perspectives on addressing the decline of Shea trees in Northern Ghana

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Abstract The Shea tree holds significance in the socio-ecological landscape of northern Ghana. With the escalating impacts of climate change, the diminishing presence of Shea trees has emerged as a significant concern. From a feminist political ecology standpoint, this research focuses on understanding the factors contributing to this decline in the Upper West Region of Ghana and the adaptation and mitigation strategies women propose to address the decline. Findings from eight (8) Focus Group Discussions (FGDs) reveal an interaction between anthropogenic activities like illegal logging, mechanized farming, and recurrent bushfires and climate-related factors such as heightened prevalence of pests and diseases and reduced pollination activity. To counter these challenges in the short term, suggested adaptation measures include promoting farmer-managed natural regeneration, beekeeping, restoring Shea landscapes, and establishing credit schemes for women based on Shea production. Long-term strategies like creating shea-conservation zones and planting

drought-resistant and fast-yielding Shea varieties are proposed. This research underscores the pressing need for policy frameworks that incorporate approaches for both mitigation and adaptation purposes. It emphasizes the role played by women in driving these solutions within their communities, stressing their inclusion in policy formulation processes to conserve Shea trees effectively.

Keywords Shea tree decline · Feminist political ecology · Climate change · Sustainability · Northern Ghana

Introduction

The Shea tree (*Vitellaria paradoxa*) is a semi-domesticated tree species that grows in the semi-arid and sub-humid savannahs of 21 sub-Saharan African countries (Ky-Dembele et al., 2021). Shea tree holds immense ecological and socio-economic importance (Boffa, 1999; Hatskevich et al., 2011; Teklehaimanot, 2004). Shea tree plays a role in preventing soil degradation and improving land health (Okullo et al., 2004). Shea tree produces non-timber forest products, with Shea butter being particularly valued for its nutritional, cosmetic, and medicinal applications (Elias & Carney, 2007; Issah, 2018). The significance of this tree becomes more apparent as women have integrated the benefits of this tree into their livelihoods (Hall et al., 1996; Kent, 2018; Pouliot, 2012).

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Women rely on it for sustenance, skincare solutions, and income generation (Boffa et al., 1996; Naangme-nyele et al., 2023; Pouliot & Elias, 2013).

However, there are concerns about the survival of the Shea tree. Ground observations and scientific research indicate that various factors contribute to this decline (Dapilah et al., 2019; Kansanga et al., 2020; Teklehaimanot, 2004), with climate variability and change overshadowing these observations (Dimobe et al., 2020). The Shea tree's disappearance threatens generations who rely on it for their livelihoods and goes beyond ecological imbalances. (Bondé et al., 2019). As the impacts of climate change continue to grow, it has implications for women who heavily rely on the Shea tree. Therefore, recognizing the decline and taking steps for adaptation and mitigation is crucial. Interestingly, communities in Ghana are not just observers; they have acted in many ways, including combining indigenous conservation knowledge with their needs within the Shea landscape. One remarkable initiative in this regard is Ghana's Community Resource Management Area (CREMA) initiative (Ghana Wildlife Division, 2000). CREMA is a structured, democratic, legally endorsed nature conservation approach through community-driven strategies (Forestry Commission (FC), 2020). CREMAs provide hope by prioritizing community-led management of natural resources. They represent conservation efforts where communities unite to oversee and conserve their natural resources. However, it is worth noting that not all communities have universally adopted the CREMA approach. Other communities, referred to as non-CREMA, have chosen different paths influenced by traditional practices, personal experiences, or practical requirements.

While the various communities have acted in different conservation efforts, it is crucial to delve into these community dynamics to understand the decline of the Shea tree and develop adaptation and mitigation strategies. This study utilizes focus group discussions to explore women's lived experiences as they relied on the Shea tree for their livelihoods. Our comprehensive objectives are to gain insights into how women in the two community types (CREMA and non-CREMA) perceive the Shea tree's importance, particularly as a livelihood resource. Additionally, we strive to foster conversations that encourage

learning and collaboration between communities by incorporating knowledge and perspectives from both CREMA and non-CREMA communities. Furthermore, integrating insights from these communities presents an opportunity to create a narrative by connecting empirical data, personal experiences, and adaptable measures. This wealth of knowledge is essential for developing short-term and long-term adaptation and mitigation strategies to address the decline of shea trees.

In this era of changing climate conditions, it is crucial to recognize that solutions to challenges like the decline of the Shea tree cannot be dealt with separately from their socioeconomic impact. This research brings to attention the often-overlooked women's perspectives in a male-dominated environment like northern Ghana and embraces grassroots insights from communities as a call for action. This action seeks to conserve the shea tree and safeguard the livelihoods of many individuals in northern Ghana.

Theoretical framework

The study is grounded on the theoretical framework of Feminist Political Ecology (FPE), which provides a critical lens to examine the nexus of gender, power, socioeconomic dynamics, and ecology (Rocheleau, 1995). FPE underscores the importance of gender analysis in research and highlights how power dynamics shape challenges (Elmhirst, 2011). In the Shea landscape in Ghana, the Shea tree holds immense ecological, cultural, and economic significance, and women play a crucial role as custodians (Kansanga et al., 2019). The dwindling shea tree populations and their vulnerability to climate change reflect broader environmental, socio-economic, and gender-related processes. Within this context, FPE offers a comprehensive approach to exploring gender dimensions often overlooked in conservation efforts (Baruah, 2011; Nightingale, 2011). It illuminates power imbalances and disparities that negatively impact the effectiveness of shea conservation initiatives (Schreckenberget al., 2006). Despite women's critical involvement in shea tree management, women in Ghana are often marginalized in environmental conservation decision-making processes (Schreckenberget al., 2006). This study

acknowledges the value of indigenous knowledge accumulated by generations of women regarding shea tree care, harvesting practices, and butter extraction (Agarwal, 1992). Furthermore, FPE recognizes that land use and socio-economic development changes are intertwined, which can profoundly impact the shea tree landscape (Ingram et al., 2015). Women play an essential role in the shea value chain and are at the forefront of these changes. They encounter numerous challenges, from adapting to new practices to confronting economic vulnerabilities. It ensures that conservation plans and measures are ecologically sound but also equitable and

inclusive (Leach et al., 1999). The FPE framework provides a nuanced perspective for understanding the gender perspective concerning Ghana's decline of shea trees.

Study context

The semi-arid region of Ghana falls within the Guinea Savanna zone of the country, encompassing various administrative regions such as Northern, Upper East, Upper West, Northeast, and Savannah. This study was

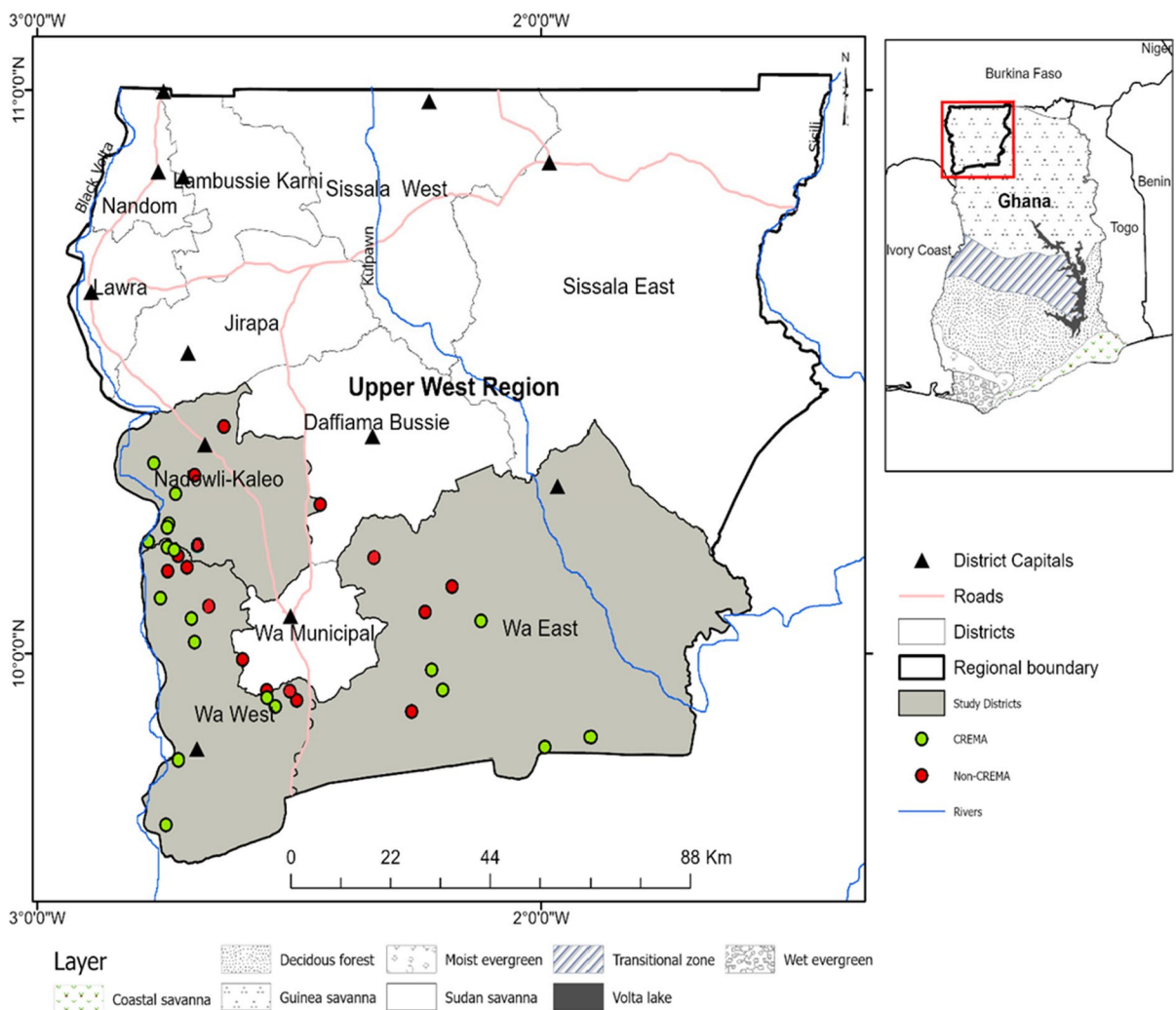


Fig. 1 Map of the study area in the Upper West Region (prepared utilizing ArcGIS Desktop 10.5.1, Department of Geography and Environment, University of Western Ontario)

conducted in the Upper West Region (UWR) (Fig. 1). UWR is situated in the northwest part of Ghana and shares borders with Burkina Faso to the north, the Northern Region to the south, the Savanna region to the west, and the Upper East Region to the east (Ghana Statistical Service [GSS], 2022). The geographic coordinates for UWR are between 9.8° 11.0° N latitude and 1.6° 3.0° W longitude (GSS, 2014). The population of UWR is 901,502 people and covers an area of 18,476 square kilometers, constituting 7.8% of Ghana's total landmass (GSS, 2022). It is worth noting that a significant concern in this region is that around nine out of ten residents live on less than one dollar per day. This makes it the poorest region in Ghana (GSS, 2019). The study was conducted in Wa East, Wa West, and Nadowli-Kaleo of the UWR. These areas have poverty rates of 92.4%, 83.8%, and 68.5%, respectively, with an average of 70.7% for the region (GSS, 2015).

Most households in the UWR are engaged in agriculture (80.4%), with a significant percentage represented by women (42%) (GSS, 2019). Despite Ghana's efforts towards improving food security, the UWR remains the country's most food insecure (64% of the population) region (Atuoye & Luginaah, 2017). In addition to poverty and food insecurity, factors like crop failure and extreme climate events (Pienaah et al., 2023; Batung et al., 2023) ensure that many individuals opt out-migration to other parts of Ghana (Baada et al., 2019; Luginaah et al., 2009).

The landscape of the UWR is characterized by grasslands interspersed with trees such as the Shea tree (Rademacher-Schulz et al., 2014). This tree has adapted well to the climate of the region, which usually experiences rainfall predominantly from May to October (Ministry of Food and Agriculture [MOFA], 2019). This is then followed by a period influenced by the Harmattan winds. The Shea tree holds significance within this context. In the UWR, the shea business is known to contribute more than half of a household's annual income in some cases (Carette et al., 2009). The UWR faces climatic challenges characterized by erratic weather patterns, putting pressure on natural resources such as the Shea trees, which are vital to society and the environment (MOFA, 2019; IUCN, 2017). Investigating and addressing these changes is crucial.

Methods

Focus groups

FPE researchers have long drawn upon qualitative methodologies, especially in-depth interviews (Agarwal, 1992; McDowell, 1992; Rocheleau, 1995). In line with that, we utilized the Focus Group Discussion (FGD) method in this study to establish a conversation platform that promotes learning and collaboration among communities. To achieve this, we highlighted women's perspectives that often go unnoticed in society regarding natural resource conservation. We wanted to embrace their collective insights from CREMA and non-CREMA communities to inspire action on the decline of the shea tree. FGDs allow for more interaction and exchange of ideas within a limited timeframe (Kidd & Parshall, 2000). A focus group setting is like a version of society where social norms are collectively shaped through debate and argument (Lunt & Livingstone, 1996).

Selection of participants

In this study, we conducted eight focus group discussions (FGDs) with women from CREMA and non-CREMA communities. The four FGDs in CREMA communities involved 26 women, while the other four FGDs in non-CREMA communities involved 25 women. A total of 51 women participated in the study. We selected participants with the help of community leaders and two resident research assistants (RAs) who also acted as interpreters during the interview sessions. To ensure that we included women with experience in the decline of shea, we specifically chose those who had lived in their communities for at least ten years and whose main livelihood depended on shea resources. Each participant was assigned an identification number based on their order of arrival during recruitment, starting with the first to arrive. We organized focus groups with 6–8 women from each community. The discussions were moderated under shea trees and audio-recorded in languages including Dagaare, Waali, Brifor, and Sissale. These discussions, which lasted between 1 and 2 h, revealed challenges and successes related to shea conservation practices. Before conducting our study, we only obtained verbal consent from

adult participants aged 18 and 70. Participation was voluntary; participating women were informed about the study's purpose and objectives, and to document this agreement, we collaborated with knowledgeable local community leaders (Unit committee member and Assembly member) who understood the ethical implications before participants participated. The University of Western Ontario's Non-Medical Research Ethics Board approved our research ethically. A summary of participants' and households' background characteristics is provided in Table 1.

Data analysis

We translated the audio interviews verbatim from the local languages into English and proofread and examined them for accuracy. Following Strauss and Corbin's (1990) thematic approach, we analyzed the data using line-by-line coding into emerged themes guided by our research objectives and theoretical construct related to women's perceptions. To ensure consistency and credibility, we employed strategies. First, member checking was involved by sending the scripts and initial themes to the participants for confirmation. Secondly, we used source triangulation by comparing the transcripts from all eight focus group discussions to ensure that our emerging themes were comprehensive. Finally, an investigator triangulation method was involved whereby two investigators independently coded a portion of a script using the same coding scheme to identify similarities or differences. To reinforce our themes, we incorporated quotes from the interview transcripts to guarantee we captured participants' voices precisely.

Results

This section presents some of the main perceptions and experiences of women. The results are organized around three major themes: drivers of shea tree decline, short-term coping and adaptation strategies, and long-term mitigation strategies. The themes that arise from women are highlighted using quotes from the transcripts. Each quote includes a pseudonym, the participant's age, and educational level. Table 2 provides a summary of the coded responses generated from the analysis.

Table 1 Summary of sample characteristics

Variable	Number of mentions (number of participants)	
	CREMA	Non-CREMA
Age of respondent		
18–29	3(26)	2(25)
30–39	5(26)	6(25)
40–49	9(26)	8(25)
50–59	5(26)	4(25)
60+	4(26)	5(25)
Gender of respondent		
Male	0(26)	0(25)
Female	26(26)	25(25)
Marital status		
Single	7(26)	7(25)
Married	12(26)	14(25)
Divorced/Widowed	7(26)	4(25)
Gender of household headship		
Male	19(26)	16(25)
Female	7(26)	9(25)
Household size		
1–4	6(26)	5(25)
5–8	11(26)	9(25)
9+	8(26)	11(25)
Religion		
Christian	14(26)	12(25)
Muslim	8(26)	7(25)
African Tradition	4(26)	6(25)
Ethnicity		
Dagaaba	9(26)	7(25)
Sissala	5(26)	6(25)
Brifo	7(26)	8(25)
Waala	5(26)	4(25)
Education		
No formal education	14(26)	16(25)
Primary	8(26)	6(25)
Secondary or above	4(26)	3(25)

Drivers of Shea tree decline

Women are worried about the depletion of shea trees due to bushfires started by men and boys for food and income. They also point out that group hunting for personal consumption and commercial purposes often leads to bushfires and burnt vegetation. The women lamented seeing the once-thriving shea tree population destroyed by bushfires. They emphasized

Table 2 Summary of responses from the focus group discussions

Responses	Number of mentions (number of participants)	
	FGDs in CREMAs (n = 26)	FGDs in non-CREMAs (n = 25)
Theme 1: Drivers of Shea tree decline		
Perennial bushfires	40 (26)	36 (24)
Aging trees driven by climatic changes and global warming	44 (26)	35 (24)
Increase agriculture mechanization	36 (24)	46 (25)
Growing demand for fuelwood	39 (23)	30 (20)
Surface mining	32 (25)	27 (23)
Woodcarving	27 (26)	26 (25)
Illegal logging	20 (26)	34 (24)
Urbanization and Infrastructural Development	35 (25)	49 (25)
Land tenure system	41 (26)	38 (25)
Reduced pollinator activity	24 (25)	39 (24)
Increasing pesticide use on farms	41 (26)	40 (25)
Pest, diseases, and invasive species	28 (25)	34 (25)
Lack of enforcement and conservation efforts	24 (25)	39 (23)
Theme 2: Short-term coping and adaptation strategies		
Restoration programs, e.g., nurseries, seeds, grafts	42 (25)	39 (25)
Promote farmer-managed natural regeneration	38 (25)	20 (24)
Promote harvesting tools and innovations	31 (26)	27 (25)
Shea-based credit scheme	49 (24)	35 (25)
Regulations against illegal logging	15 (24)	39 (23)
Education and awareness creation	35 (22)	29 (24)
Partnering with NGOs for conservation	42 (24)	37 (23)
Promotion of alternative livelihoods	30 (23)	41 (22)
Agroforestry practices, e.g., intercropping	32 (25)	27 (23)
Sustainable harvesting practices	39 (23)	25 (22)
Incentives for conservation	27 (26)	26 (25)
Incentives for bushfire management	40 (25)	28 (24)
Beekeeping	44 (26)	35 (24)
Instituting traditional shea festivals	40 (23)	19 (24)
Promotion of local foods made with shea	30 (21)	35 (24)
Promote shea-based cooperatives like Village Savings and Loans Associations (VSLA)	26 (25)	36 (24)
Scale up the CREMA approach	39 (26)	17 (25)
Support shea-based medications	34 (26)	27 (23)
Use organic pesticides and fertilizers	38 (25)	35 (22)
Theme 3: Long-term mitigation strategies		
Plant drought-tolerant and high-yielding shea	40 (25)	50 (25)
Plant <i>Faidherbia albida</i> in Shea Parklands	38 (24)	40 (24)
Create shea tree protection zones	36 (20)	35 (24)
Shea conservation in broader land-use planning	39 (22)	27 (24)
Establishing Shea product certification	27 (23)	29 (22)
Develop a Shea tree health monitoring system	20 (23)	30 (20)
Promote shea seed and scion banks	28 (24)	15 (22)

Table 2 (continued)

Responses	Number of mentions (number of participants)	
	FGDs in CREMAs (n = 26)	FGDs in non-CREMAs (n = 25)
Payment for Shea ecosystem services	32 (25)	26 (25)
Develop Shea breeding systems	29 (23)	40 (24)
Shea tree integrated pest management	48 (25)	38 (25)
Develop shea tree productivity technologies	32 (25)	38 (25)
Collaborating with international partners	38 (26)	39 (24)
Shea school/field days	23 (25)	20 (23)

that shea trees used to produce abundant fruit, but yields have declined significantly due to frequent fires during the dry season. During the discussion, participants highlighted that aging trees are more susceptible to pests and diseases, and global warming exacerbates this vulnerability. Shea trees are affected as climatic changes accelerate their aging process, making them more vulnerable to pests and diseases at an earlier life cycle stage. It was emphasized that global warming has caused these pests and diseases to metamorphose and become more resistant, causing more significant damage to Shea trees. In their words, a woman from a non-CREMA community pointed out.

"As these trees age, they gradually lose their strength and ability to produce fruits. They often must withstand bushfires, which leaves them scorched and vulnerable" (Sarah, 35, no formal education).

The advent of mechanization brought about a paradox in group discussions. While it signifies progress, it has also come at a price. During the discussion, participants recognized that using tractors and other machinery has accelerated farming processes and caused a reduction in Shea trees. The women restated that using tractors and other machinery has led to an unintended decline in the Shea tree population because farming has now taken up more land. This is particularly true for younger Shea trees that are still growing, as farmers often need to prune their branches or uproot them to make way for tractor operations.

As our discussions progressed, we discovered the ever-increasing demand for fuelwood and its severe

impact on the Shea landscape. The participants highlighted the dire situation caused by the unsustainable harvesting of fuelwood. They explained how the depletion of trees leads to a scarcity of cooking fuel, negatively affecting wildlife, the environment, and the community's livelihood. One woman from a CREMA community quickly uncovered that:

"Almost all households in our communities depend on firewood, which creates strain on our forests. Despite community rules against felling Shea trees for firewood, there is increasing demand from "Pito" brewers and large cooking establishments. Even though there are regulations in place, some individuals still cut down Shea trees to meet the demands of these brewers. If you explore areas where Pito is brewed, you will notice heaps of Shea wood waiting to be utilized as fuel" (Cynthia, 44, secondary education).

During our discussions, a significant concern was the impact of surface mining activities, commonly known as "Galamsey." The participants in all the districts lamented and expressed their worry, stating that the uncontrolled expansion of galamsey is causing harm to our environment and depleting our shea resources. Further emphasizing that the prevalence of these mining operations threatens the ecosystem and disrupts community structures and local economies. A participant from a non-CREMA community highlighted that:

"While some people view galamsey as a means of livelihood, the long-term consequences on

our land and scarce water bodies are devastating...the proof of this activity is right at our doorsteps. Many galemsey activities currently taking place in communities such as Takpo, Chirikpong, Danyuokuraa, and Dorimo.... anyone can witness the aftermath by visiting these mining areas where scarred landscapes serve as testimony to the toll of Galamsey" (Mary, 53, no education).

In addition, the participants raised concerns regarding the negative impact of woodcarving on the decline of Shea. The practice of woodcarving, especially for making cooking utensils, has contributed to deforestation. This issue is not limited to Shea woodcarving alone. Illegal logging, particularly of trees like rosewood, has been increasing, causing severe environmental damage to the Shea landscape. One participant from a non-CREMA community stressed the gravity of the situation, stating,

"When loggers target rosewood, they unintentionally harm shea trees, jeopardizing our Shea ecosystem. To witness the severity of this issue, one can visit logging sites; you will see shea wood, including rosewood, serving as evidence of the crisis we face" (Amanda, 40, no education).

Invariably, participants brought up a point stating that the constant development of buildings and infrastructure often takes a toll on Shea trees. It was discovered that with each new building constructed, there is an increased demand for wood, whether for roofing or other wood-related projects. Unfortunately, a significant amount of this wood is obtained unlawfully from shea trees, further accelerating their decline. One of the participants from a CREMA community expressed worry, saying:

"In our communities, it is common to come across construction sites where wood from shea trees can be easily identified. This situation is quite frustrating, as development is necessary but not at the cost of jeopardizing the livelihood and environment of our community that heavily relies on the significance of Shea trees" (Cecilia, 53, primary education member).

While many concerns were grounded in direct human actions, worries were raised regarding

pronounced systemic challenges that indirectly endanger the Shea ecosystem. Participants echoed their sentiment on land sale and ownership rights, underscoring that these systemic changes have become a reality that communities must confront. A participant from a non-CREMA community shared their thoughts on the matter:

"The rising number of land sales and changes in ownership systems pose significant challenges that we must address. Our ancestral lands, which host shea trees, are sold right before our eyes. It feels like we are losing a part of our heritage." (Zuliah, 62, no formal education)

Moreover, the discussion also emphasized the negative impact of declining pollinator activity on pollination and the production of Shea fruits. Participants expressed concern regarding the harmful effects of farm pesticide application on the natural ecosystem and the survival of pollinators. One respondent from a CREMA community highlighted the urgency of addressing these challenges with action. She has this to say.

"Our farms now rely on pesticides more than before while seeing fewer bees. This affects pollinator activities" (Kojoma, 46, secondary education).

Short-term coping or adaptation strategies

As we delved deeper into our dialogues with the women, we discovered a wealth of insightful and creative solutions that combine traditional and modern practices to address the alarming decline of Shea tree populations in the short term. The women proposed these solutions, including restoring the degraded shea landscape with nurseries planting seeds and Shea varieties bred for faster growth and yielding.

Many of the women advocated for farmer-managed natural regeneration (FMNR). FMNR, a sustainable approach to revitalizing land, involves trimming and overseeing the growth of existing trees and shrubs to enhance soil fertility, agricultural productivity, and biodiversity. This method empowers local farmers to restore landscapes, tackle climate change, and improve their livelihoods by adopting improved land management practices.

One participant from a CREMA community maintained that:

"If every farmer takes responsibility for the trees on their land and including community lands, just imagine the change we could bring about!" (Sharon, 48, no education).

It was also clear that there was a need for improved harvesting methods as the women lamented the lack of tools, which led to a loss of nuts, rendering their efforts inadequate and influencing others to engage in inappropriate harvesting practices that decline shea resources. A participant from a non-CREMA community reinforced the crucial role of Shea harvesting tools and equipment; she said:

"We only depend on the hand-picking method, which is inefficient. Several of us have had reptile bites because of hand-picking shea nuts. We lost five women and two girls last year alone due to snake bites during harvesting. If we have tools, we can ensure no harm is caused to the tree during harvest" (Ama, 37, no education).

Financial strategies tailored to shea-dependent women also gained support. The women strongly proposed a credit scheme focused on Shea to empower women in many ways, such as investing in our small-holder farms and shea butter processing businesses. One woman from a CREMA community quickly suggested that such credit facilities should be called "*Shea-based credit schemes for women*" (Fatima, 44, no education).

Moreover, the rule of law was considered essential during the group discussions. The women emphasized implementing strict regulations to curb illegal logging activities. In addition, community awareness and education on environmental protection activities, such as avoiding burning bushes and good agricultural practices, were strongly advocated. A participant from a non-CREMA community added that:

"By promoting education and raising awareness, we can foster a community that values and protects Shea trees" (Suzanne, 54, no education).

Other short-term strategies called for by the women included support from NGOs in conservation efforts and promoting sustainable farming practices, such as agroforestry. They also endorsed income diversification measures, like investing in

Shea businesses and incentivizing conservation and bushfire management. Beekeeping was identified as a solution that could contribute to pollination and provide a source of income from honey. Cultural connections, such as Shea festivals, were recognized to rekindle community bonds with the tree, thus turning conservation into sustainable efforts. The women also advocated for developing cooperative groups such as the Village Savings and Loans Associations (VSLAs), aimed at growing women's savings culture to enable more significant investment in shea businesses and integrating Shea into healthcare through Shea-based medications. Finally, they recommended transitioning to organic agricultural practices to positively impact the environment and allow the Shea tree to flourish. The women's community-driven approaches have the potential to strengthen and secure the future of the Shea landscape.

Long-term mitigation strategies

During the discussion on long-term strategies, the women presented insightful solutions grounded in foresight and sustainability. Their ideas incorporated both advancements in technology and knowledge. The women passionately highlighted the importance of "big thinking" and suggested planting drought-resistant, fast-growing, and high-yielding shea varieties that would benefit future generations.

Buttressing this point, integrating nitrogen-fixing trees such as *Faidherbia albida* into shea landscapes was highlighted as it has an ecological impact. A participant from a CREMA community explained that the *Faidherbia albida* tree, locally called "Goora" or "Gozaangaa" in the Dagaare language, sheds its leaves during the rainy season, appearing dry when other trees are in full foliage. However, it flourishes when most trees shed their leaves in the dry season. It provides forage for animals and enriches the soil with valuable manure. Another woman from a non-CREMA community was quick to emphasize her opinion, stating that:

"Planting and protecting more of these trees within shea landscapes could help revitalize the soil and support ecological resilience" (Amalia, 46, primary education).

The notion of establishing protected areas specifically for Shea trees received overwhelming support.

The participants expressed that these areas would safeguard the preservation of Shea trees, considering mounting environmental challenges. Additionally, participants emphasized the critical role of integrating Shea conservation within land use planning frameworks. They recommended that Shea be included in their planning endeavors when engaging in land management considerations.

Marketing strategies, including shea product certification, were also considered crucial for conservation efforts. The women called for certifying Shea products to indicate their sourcing, encouraging producers and consumers to value Shea resources. A participant from a non-CREMA community stressed that:

“Shea certification will secure fair prices and access to the market” (Stella, 44, no education).

Furthering the long-term adaptation and mitigation strategies, technological solutions were considered crucial, like a monitoring system for Shea tree health and establishing seed and scion banks. Participants emphasized that, with a monitoring system, communities can proactively address threats to the shea tree, ensuring its long-term survival. There was also a suggestion to explore the idea of paying for the ecosystem services provided by Shea, highlighting its value. A woman from a CREMA community has this to say:

“By putting a value on these services, we can strengthen Shea’s ecological importance” (Amamata, 56, secondary education).

Furthermore, strategies such as progressive breeding systems, integrated pest management techniques like good agriculture practices, and productivity technologies like the establishment of shea orchards, also known as "scion-banks" to supply bud or shoot for grafting seedlings, were identified as means to bolster the resilience and productivity of shea trees. Collaboration was seen as indispensable at local, national, and international levels. The women emphasized partnering with organizations to leverage their knowledge and resources.

Education emerged as a crucial factor in the effort to mitigate Shea’s decline, with a unique twist. Undoubtedly, sensitization and educational programs provided a solid foundation for this cause, as identified by the participants. To enhance awareness about the significance of Shea, the participants proposed a farm-level education strategy called "Shea-School

Farmer Days." These events can educate people of all ages about Shea’s importance and serve as beacons for spreading awareness. The women’s collective vision portrays a future where advanced methodologies and community stewardship ensure the Shea tree thrives for generations.

Discussion

The study’s findings support the core principles of feminist political ecology theory. It emphasizes the critical issues related to the decline of shea trees in northern Ghana and the associated impacts on the environment and women’s livelihoods. From FPE thinking, the research connects local realities with broader scientific and socio-economic perspectives of women to provide a comprehensive understanding and offer solutions to the Shea decline in Ghana’s semi-arid UWR region.

Our findings demonstrate that despite women having little to no formal education, those who rely on shea trees for their livelihoods often have nuanced and sophisticated understandings of environmental issues, conservation, and sustainability. These findings resonate with the works of Bello-Bravo et al. (2015) and Dapilah et al. (2019) across rural Africa and the UWR of Ghana, respectively.

Invariably, the valuable perspectives from women highlight the depletion of Shea tree populations in the UWR of Ghana, which results from a complex interplay between human actions and climate-related factors. This underscores the significant impact that can be achieved by acknowledging the importance of FPE on women’s deep understanding of the interactions between nature and society (Elmhirst, 2011). Anthropogenic activities, which are human-driven, have been identified as contributors to the decrease in Shea tree populations in the Upper West Region of Ghana. Consistent with the works of Derbile et al. (2022), one primary cause is the occurrence of bushfires, often started for hunting or clearing land for farming, which impacts the natural environment where Shea trees grow. Illegal logging activities also threaten grown Shea trees, and the lack of adequate enforcement of forestry laws worsens this problem (Derbile et al., 2022). Using machinery in farming has made it easier to clear areas for agriculture but unintentionally leads to the removal of Shea trees and disrupts their

regeneration cycles. Our findings resonate with Kansa et al. (2020) works on agriculture mechanization and environmental degradation in Ghana. Additionally, the prevailing land management system in this region needs to restrict practices contributing to the depletion of Shea trees. Moreover, Shea trees are a source of fuelwood for some poor and lacking people, and excessive harvesting for energy needs contributes to their decline. Our findings on the unlawful use of Shea as firewood are consistent with the works of Agana et al. (2018). Developmental projects, like housing and road construction, often require land clearance and sale (see Biitir & Nara, 2016). They add to the loss of Shea tree habitats, mainly when carried out without conducting sufficient environmental impact assessments (Antabe et al., 2020). Our findings on surface mining activities that impact the habitats of Shea trees align with the works of Antabe et al. (2020). Disrupting the soil speeds up these trees' decline. In the region, artisans often use Shea wood for carving. Some people prefer cooking utensils like molar and pestle carved from Shea trees because they perceive it as non-toxic. If not managed sustainably, the felling of Shea trees for these reasons worsens the depletion of Shea trees. Moreover, the extensive use of pesticides in the area has been found to affect Shea trees by reducing nut yields and making them more vulnerable to diseases. Moreover, the extensive use of pesticides in the area has been found to affect Shea trees by reducing nut yields and making them more vulnerable to infections.

Likewise, climate-related factors also contribute to the decline of Shea tree populations in the UWR. As climate change continues, environmental conditions like hot spells and droughts accelerate Shea trees' aging process. This makes older trees more susceptible to diseases and reduces their fruit and seed yield productivity. Additionally, climate change has been linked to decreased pollinator activity, affecting Shea trees' ability to spread. The decline in pollinator populations can be attributed to habitat loss and changes in weather patterns that disrupt their life cycles and foraging behaviors (Stout et al., 2018). As climate conditions change, pests and diseases become more widespread, impacting Shea trees' health and productivity (Singh et al., 2023). Indeed, a collection of recent evidence suggests that when the weather becomes warmer and wetter, it creates an environment for pests like borers and diseases like root rot

to thrive (see Singh et al., 2023). Invasive species, often better adapted to changing conditions, can use Shea trees for essential resources. These invasive species can intensify the impacts of pests and diseases by weakening Shea trees and making them more vulnerable to stressors (Singh et al., 2023). All these climate-related factors interact in ways with existing human-induced stressors, further worsening the decline of Shea trees in the region.

Nevertheless, the decline of Shea trees in the UWR of Ghana, caused by human actions and climate change, has led to short-term adaptation strategies proposed by women. This highlights the women's ability to take a central role in making impactful ecological decisions, power, and policy dynamics, which is fundamental to FPE (Elmhirst, 2011; Rocheleau, 1995). These solutions can be grouped into four categories: restoration of Shea tree populations, financial programs, community involvement, and policy interventions.

Restoration activities involve replenishing Shea tree populations using seeds and seedlings from nurseries as farmer-led natural regeneration. The aim is to bring back Shea trees to their habitats (World Wildlife Fund [WWF], 2022). Agroforestry practices can also play a role by integrating Shea trees with crops and livestock, creating supportive ecosystems (Sanou et al., 2019).

Financial programs include credit schemes for women in the Shea industry and cooperatives like Village Savings and Loans Associations (VSLA) (Pienaa et al., 2022) focusing on Shea-based initiatives. These programs promote the management of Shea resources while empowering women financially. Additionally, beekeeping has been suggested as a livelihood contributing to pollination and providing economic benefits for individuals and communities (Stout et al., 2018). Our findings align with initiatives emphasizing finance-driven conservation (Clark et al., 2018).

Community engagement strategies encompass approaches such as campaigns raising awareness about the importance of Shea resources. Traditional methods, like organizing festivals centered around Shea products, are also used to foster community pride while promoting harvesting practices (Bonye, 2011). Furthermore, local cuisines incorporating Shea are encouraged to support its conservation efforts (Dzifa et al., 2022).

Collaborating with non-governmental organizations (NGOs) can offer valuable technical know-how and financial aid to support successful bushfire management and nature preservation goals. To tackle logging concerns, policy measures suggest implementing regulations and incentives and promoting responsible harvesting methods by endorsing appropriate tools and equipment. Experts have recommended expanding the community-based resource management approach known as CREMA. Moreover, policy suggestions include promoting the use of pesticides and fertilizers to enhance the health and productivity of Shea trees, along with utilizing Shea-based medicines to increase yields and bolster the value of this significant resource.

Notably, the women in the region have identified a need for long-term mitigation strategies in response to the decline of Shea trees, which cannot be solved by short-term adaptation measures alone. Taking an FPE viewpoint, it can be explained by the women's high level of self-efficacy and their holistic and sustainable approach to resource conservation. The four categories of strategies are proposed: farming methods, regulatory frameworks, technological advancements, and collaborative initiatives. Adaptive farming methods, including planting drought-tolerant and high-yielding varieties and incorporating *Faidherbia albida* in Shea parklands to improve soil fertility and water availability, align with global practices that highlight the importance of restoration in mitigating biodiversity loss (WWF, 2022; Hale et al., 2021).

Regulatory frameworks recommend establishing protected areas for Shea tree conservation and integrating them into national planning frameworks. Certification schemes for Shea products could also incentivize high-quality Shea tree stocks (Aleza et al., 2018). In perspective, the emphasis on certifying Shea products and establishing breeding systems indicates an approach that combines ecological preservation with market-oriented strategies. Certification can increase Shea's market value, ensuring products obtain stable prices. This creates an incentive and rewards for conservation efforts (Wardell et al., 2022).

Technological advancements include monitoring systems for Shea tree health, integrated pest management tailored for Shea trees, seed and scion banks to preserve diversity, and technologies to enhance productivity. These measures can enable interventions

to safeguard the health and productivity of Shea trees (Waswala & Mburu, 2022). Payment systems for the services provided by the Shea ecosystem could also encourage management practices. By providing incentives for conservation, communities can be motivated to adopt practices that ensure the long-term health of Shea landscapes. This approach aligns with efforts to assign value to ecosystem services (Salzman et al., 2018).

Collaboration is also crucial, with partnerships and Shea School Farmer Days as platforms for exchanging resources and knowledge. The focus on cooperation with association shows an understanding of the global importance of Shea conservation. These partnerships can help exchange knowledge, take advantage of advancements, and gather resources to support efforts. The findings complement farmer field days (Emerick & Dar, 2021; Heiniger et al., 2002).

Based on the research focused on women's perceptions, it is essential to note that potential limitations could have affected the findings. The group discussions may have introduced biases and allowed dominant individuals to steer the conversation in specific directions. The subjective interpretation of these dialogues may have impacted the themes that emerged from the gathered data. Furthermore, relying solely on verbal interactions may have caused a disregard for non-verbal cues that could have been valuable insights. It is also essential to consider the impact of societal norms, particularly on sensitive issues.

Conclusion

Ghana's Shea tree populations are complex ecosystems influenced by human activities and climate change. However, their decline can be addressed effectively through a comprehensive and multi-pronged approach that combines short-term and long-term solutions. This approach should encompass community-driven initiatives, regulatory measures, financial incentives, international collaborations, and educational efforts. To achieve this, policymakers must prioritize creating Shea tree protection zones, certification for Shea products, Shea-based credit schemes, and integrated land-use planning. Women have been instrumental in driving community-based solutions, and their involvement is crucial. Combining traditional knowledge with scientific innovation

and engaging the public and private sectors is necessary for success. An inclusive and policy-driven approach is the most promising way to halt the decline of Shea tree populations and secure the future of communities that rely on them.

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Data availability The paper includes all necessary data.

Declarations

Conflict of interest The authors state that they have no conflicts of interest.

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