Strategies to Promote Sustainable Development: The Gendered Importance of Addressing Diminishing African Locust Bean (Parkia biglobosa) Resources in Northern Ghana’s Agro-Ecological Landscape

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Abstract: As the topic of gender and forests gains international attention through programs related to addressing the Sustainable Development Goals, we focus on a case study of the African Locust Bean (Parkia biglobosa) in the savannah landscape of northern Ghana. Although this tree holds high cultural significance for Dagomba women, it is unfortunately becoming scarcer in our study area near Tamale. We investigate the reasons for this decline in relation to the agricultural, ecological, and cultural landscape and discuss the gendered impacts of these changes. Research in these communities was conducted between 2018 and 2021 as part of a transdisciplinary action research approach to process underutilized species with women’s groups. The research started with a survey that included 27 women’s groups in 13 communities with 524 women participants. Out of a selected number of groups, our research team has worked more intensively with three women’s groups near Nyankpala, which selected for their processing focus the African Locust Bean, locally known as dawadawa. More than 45 group sessions were organized with seven groups in a collaborative learning process in 2019. Additionally, the three groups in Kpachi who chose to process the African Locust Bean sustained facilitation of group activities until the end of 2021. Specifically, on the topic of the decline of this tree, 19 semistructured interviews were conducted in August 2020 with 8 female farmers, 7 male farmers and 4 chiefs in the local governance system. Our results show the cultural significance of the African Locust Bean for women in the Dagomba culture as well as practical uses of all parts of the tree. Although seeds of the African Locust Bean are considered a women’s crop, their access to this tree is mediated by the local chiefs and often male land-users. Most farmers interviewed reported a reduction in trees in their fields. The reasons for the decrease can be summarized in six different categories, (1) aging tree populations, (2) challenge caring for saplings until maturity, (3) agricultural changes with increased mechanization and pesticide use, (4) over-use as a firewood resource, (5) usufruct rights between traditional chiefs, male land-owners, and women who should be granted access to the trees according to Dagomba cultural values, and (6) reduced water availability inhibits seed yield. In conclusion, there is an urgent need for action to protect and restore the African Locust Bean within northern Ghana’s savannah landscape to ensure continued access and benefits of the tree to women in the region.

Keywords: gender; underutilized species; Dagomba; food security; agricultural landscape; cultural landscape; dawadawa; nere; iru; African Locust Bean
1. Introduction

Forests directly support livelihoods of over 1.6 billion [1] people, including around 350 million people living in or near dense forests [2] who use forest resources for income and subsistence [3]. People living near forested areas often have limited access to markets [4], and thus can be even more dependent on forest livelihood sources [5]. This is particularly true for women who may rely for up to half of their income [6] on forests, and thus require secure access and use rights to these resources [7].

There is a growing body of research pointing to gender differences between women and men in terms of the extent to which they rely on forests for their livelihoods, and for which purposes [8–10] men often control the most valuable forest resources that can be sold on the market, such as timber [11–13]. Women’s control over resources may be more commonly centered on management and use of fuelwood, fodder, and nontimber products [14–16]. Forest degradation has meant that women have had to walk longer distances into the forests to source materials, with negative impacts on their time poverty, income, and personal safety [17–19]. Sustainable forest management projects with an explicit gender [20] lens can help reduce women’s vulnerability [21] by enhancing their socioeconomic empowerment [22], by supporting nontimber forest products [23] where women dominate, by promoting legal reforms in land tenure [24], and by institutional development through enhanced training and leadership development for women [25].

Most countries have incorporated reforms in their legal frameworks [26–28] to guarantee equal land tenure rights to men and women [28–31]. However, relatively few women hold titles to land [32]. Women and men have different household responsibilities due to the gendered division of labor that structures their forest priorities and preferences for planting tree species with different characteristics [33,34]. Women’s participation in value chains is usually limited to harvesting and small-scale retail trade, while men dominate larger businesses and tend to engage in higher value chains [35,36]. Women’s time poverty and physical safety concerns [37] limit their access to and use of forest resources [38,39]. Women and men’s practices, knowledge, and priorities in forest resource use are different [40,41]. Increasing women’s participation in forest decision-making bodies improves forest sustainability, gender equity, and women’s empowerment [42].

As the topic of gender and forests gains international attention through programs related to addressing the Sustainable Development Goals, we focus on a case study in Ghana. The steady expansion of Ghana’s agricultural and industrial sectors has brought considerable economic growth [43], but with a high environmental cost [44]. Having lost over 60% of its forest cover from 1950 to the turn of the last century (2.7 million hectares) [45], Ghana has continued to lose its forests at a rate of approximately 3% per year (320,803 ha/year) [46]. During 2013 to 2015, the annual deforestation rate rose further to 794,214 ha [47,48].

In the savannah zone in the northern part of Ghana, we focus on the African Locust Bean (Parkia biglobosa) (Figure 1). It is known in Ghana as dawadawa and, in the Dagbani language, the tree is specifically referred to as dòó (singular) or dòhí (plural), and the seeds are known as zuna [49]. It is a perennial deciduous multipurpose tree of the Fabaceae family that normally grows to be between 7 and 20 m high, and in some cases up to 30 m [50]. This naturally occurring tree species is usually found scattered across the savannah landscape and is guarded by strict prohibitions against cutting it due to the numerous benefits it offers [51]. The harvest, processing, and marketing of products from the tree have traditionally been a women’s activity [50], often enabling women to meet their household provisioning responsibilities [52]. The high protein, strong-smelling fermented seeds are shaped into balls and used as a condiment to flavor food or make tea. The yellow powder from inside the pods can be boiled to make a sweet drink or can be consumed directly as a snack. The raw beans are inedible without processing [53]. The tree has further uses: for use in building houses and waterproofing walls (roots and empty seed pods), as fodder for livestock (leaves), and medicine (roots and bark) [49]. Some of the seeds are also
considered to be medicinal; those that are resistant to the boiling process are selected out for this use.

Figure 1. An African Locust Bean Tree (*P. biglobosa*) in northern Ghana. Photo: Konlan, 2019. Trees are scarce in northern Ghana, which gives them a special cultural value, reflected in songs and proverbs [49,54]. The African Locust Bean is connected to chieftaincy in the Dagomba culture. When the tree grows on farmland, the landowner has the right to harvest it, and not the farmer who cultivates the land. Traditionally the harvest of most African Locust Bean trees belongs to the *dawadawa* chief. The landowner might be a *dawadawa* chief or another sub-chief in the village. The *dawadawa* chief title is one of the types of sub-chief titles that exists in a village. All the sub-chiefs including the *dawadawa* chief have portions of land they oversee including the resources found on them such as the African Locust Bean trees.

Although this tree holds high cultural significance particularly for Dagomba women, it is unfortunately becoming increasingly scarce in our study area near Tamale in Ghana’s Northern Region. We investigate the reasons for this decline in relation to the agricultural, ecological, and cultural landscape, and discuss the gendered impacts of these changes. Integrating geographical concepts of cultural landscape detailed in Section 2, to unpack qualitative research from a transdisciplinary project detailed in Section 3, offers results, in the first half of Section 4, that ground a deeper understanding of the sociocultural value of the tree and its multifaceted uses. In the second part of the results, an overview of the perceptions of female and male farmers and male chiefs in the community provides reasons for why the tree has been diminishing. The discussion and conclusions that follow then contextualize the power relations and practices that concurrently shape the emerging landscape and offer some insights for moving forward.

2. Theoretical Framework

The study of landscape and how to consider the different natural, social, and cultural elements that contribute to it has been the subject of theoretical debates within the discipline of Geography. In the 1800s, Siegfried Passarge and Otto Schlüter developed the concepts of
Landschaft and Landschaftsbegriff. Building on these ideas, Carl Sauer brought landscape into Anglo-American Geography with his 1925 text, the Morphology of Landscape, and in the following decades he and his students became known as the Berkeley School. Rather than follow an environmental determinist approach that had been in vogue in the 1800s, this tradition sought to decipher how the natural landscape was changed over time by practices associated with culture, creating what was described as a cultural landscape. Rural landscapes received particular attention from these early geographical studies. In the 1980s and 1990s the new Cultural Geography integrated critical social theory including post-structuralist, Marxist, and feminist analyses [55,56].

Agricultural landscapes are shaped by the demands and practices of agriculture for food or fiber and are caught within the tensions of global population demands and local ecosystem services [57]. Working landscape is a term that can be applied to agricultural landscapes emphasizing how the shaping of the landscape emerges from the everyday working practices in rural areas, including its connection to the food system. Notable examples of working landscape research have been conducted in Vermont [58].

Understanding the interplay of people and the agricultural practices they enact in specific places, brings us to the issue of culture. As described by Kay Anderson, “culture is a process in which people are actively engaged… a dynamic mix of symbols, beliefs, languages and practices that people create, not a fixed thing or entity governing humans…” [59]. Based on this, we can use qualitative research approaches to learn about perspectives, values, views, and experiences of people in a changing landscape to decipher the interplay of culture, agriculture, and ecology.

For understanding gender dynamics within this mix, a feminist lens influences both the topics to focus on and the methods for approaching them. The diverse histories of feminist thought have taught us to look from the center to the periphery [60]. Feminist analyses of agriculture and rural development [61–63] reveal ways of understanding how sex and gender intersect with other axes of social differentiation in specific agri-food contexts. Transdisciplinary research approaches level hierarchies between researchers and research stakeholders through a process of co-creating knowledge [64]. This sensitivity to power in the research process is coherent with feminist methodologies to integrate gender in agricultural research [65].

Using knowledge generated through transdisciplinary approaches, we reveal the gendered consequences of the decline of a tree species; reflecting power in multiscalar processes shaping the agricultural and cultural landscape.

3. Study Area and Methods
3.1. The Agro-Ecological Context

Most of northern Ghana falls within the Guinea savannah zone, which is the largest agro-ecological zone in the country. Rainfall is unimodal with a range of 800–1200 mm. The major rainy season is from April/May to September/October and unlike in the south of the country, the north has no minor rainy season [66]. The dry season lasts from October to April with harmattan winds picking up in intensity in January. Compared to other parts of the country, the north is relatively hot and dry with an average annual maximum temperature in Tamale of 33 °C and minimum of 22 °C. The hottest months are February and March when temperatures can reach well over 37 °C.

The soil is sandy loamy and the natural vegetation consists mostly of “grasses of varying heights along with generally fire resistant, deciduous, broad-leaved, and gnarled trees” with a transition to more open grassland and shorter trees going north [67]. Traditionally, smallholder farmers used bush fallow, allowing land to rewild and restore fertility when not actively cultivated [68]. Crops tended to be grown around trees with multiple uses such as Shea (Vitellaria paradoxa), African Locust Bean (Parkia biglobosa) [69] or Neem (Azadirachta indica). However, these practices are on the wane with rising population pressure, increased demand for agricultural products, and constrained space for agricultural cultivation [70]. Increasingly, farmers feel pressure to incorporate packages of practices including fertilizers
and pesticides [71]. Crop diversity is challenged by preference for staple crops such as maize, rice, sorghum, cassava, and yam.

In the northern savannahs of Ghana, male farmers gain the right to cultivate lands of the chief through usufruct. Female farmers are denied this pathway to access land and so must leverage their social connections through their husbands, brothers, or fathers [67]. Land that women do finally access tends to be more marginal and difficult to work [72]. Further, sales of land with incoming external companies including land grabbing have further strained gender inequalities regarding land access [73].

3.2. The Cultural Context

Of the more than 100 ethnic groups in Ghana [74], 16.6% of the total population identify as Mole–Dagbon (including the Dagomba) [75]. This is the most common ethnicity in northern Ghana [76]. A group of Dagomba can also be referred to as Dagbamba, an individual as Dagbana, and the language is known as Dagbani (or Dagbanli) [77].

The Dagomba have a strongly patriarchal society reflected in language and practice. Salifu explains how as a man ages, there are fewer and fewer people to whom he must address with terms of respect (similar to the difference of Sie/Du in German). However, a woman is always expected to address even her husband in such a way in addition to kneeling before him at requisite times [77]. Polygamous marriage is common, in which wives are categorized as senior wife, junior wife, and cooking wife. For example, status is gained to become a cooking wife after “Passage of life” when a Dagomba woman is deemed to be ready to fulfill cultural norms of what it means to be a wife and a mother [78]. Women in polygamous homes divide household responsibilities among themselves, especially with regard to cooking and buying ingredients for the family, and this motivates many of the women to engage in various income-generating activities on and off-farm [79].

In agriculture, men are perceived to be responsible for cultivating staple crops while women are expected to grow “soup” crops such as vegetables—following this pattern even with newly introduced crop varieties [78]. However, women are only accorded time to work on their own plots of land after they have finished all of their other duties. As Apusigah explains, “if women are unable to give the farms the required attention, yields become poor rendering their endeavors unproductive” [52]. Thus, gender inequality reverberates across spheres.

3.3. Approach to Starting the Collaboration and Identifying Study Sites

Research was conducted between 2018 and 2021 as part of a transdisciplinary action research approach to process underutilized species with women’s groups through a German–African collaborative project called UPGRADE Plus. One of the partners was the University for Development Studies (UDS), Nyankpala, located near Tamale in Ghana, which influenced the area chosen for the initial survey of women’s groups (Figure 2a). UDS and the Agricultural Extension Gender Officer for Savelugu–Nanton assisted with the identification of groups.

The survey in 2018 included 27 women’s groups in 15 communities (Figure 2b) with 524 women participants (Table 1).
It is a common practice across West Africa for women’s groups to engage in group savings and loan. Traditionally this started with “susu”—a kind of merry-go-round funding circle. Recently, NGOs and government officials popularized a form of group savings and loan with a specific money box that requires 3–4 keys to open. This serves as a check to ensure that all of the funds cannot be stolen by one person. In Ghana, this system was formalized with groups of exactly thirty women for longer-term savings. In the Dagbani language, it is referred to as the “adakabila”, which literally translates as “small box”. The groups were predominantly formed by external organizations such as World Vision, United States Agency for International Development (USAID)—Resiliency in Northern Ghana (RING) Project, Millennium Development Authority (MiDA), Christian Children’s Fund of Canada (CCFC) and the Mennonite Economic Development Associates (MEDA); only six formed through their own self-initiative. The group names that women chose reflect their religious faith and the importance of working together.

A subset of seven groups located in four different communities (Sankpala, Jana, Cheyohi 1, and Kpachi) was selected for further engagement in 2019. In Table 1, these seven groups can be discerned through a gray highlight. Out of these groups, our research team worked more intensively with three women’s groups in Kpachi (marked in bold) to process African Locust Bean until the end of 2021 and with outreach activities that continued into 2022. These three groups in Kpachi are (1) Bobgunyeyaa (Together there is strength), (2) Pumayaa (Thanking God for a blessing), and (3) Suglonborbuni (Patience is power).
Table 1. Women’s groups involved in the research. All were initially involved in the 2018 survey. Those that continued in 2019 have the row highlighted in gray. Three groups that continued with activities focused on the African Locust Bean until 2022 are bolded.

<table>
<thead>
<tr>
<th>Nr.</th>
<th>Community</th>
<th>Area</th>
<th>Total Members</th>
<th>Nr. Participants 2018 Survey</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chidrupe</td>
<td>Central Gonja</td>
<td>30</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>Chidrupe</td>
<td>Central Gonja</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Chidrupe</td>
<td>Central Gonja</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>Chidrupe</td>
<td>Central Gonja</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>Snkpa’ala</td>
<td>Central Gonja</td>
<td>30</td>
<td>18</td>
</tr>
<tr>
<td>6</td>
<td>Cheyohi 1</td>
<td>Kunbungu</td>
<td>73</td>
<td>28</td>
</tr>
<tr>
<td>7</td>
<td>Cheyohi 1</td>
<td>Kunbungu</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>8</td>
<td>Cheyohi 2</td>
<td>Kunbungu</td>
<td>20</td>
<td>17</td>
</tr>
<tr>
<td>9</td>
<td>Cheyohi 2</td>
<td>Kunbungu</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>10</td>
<td>Cheyohi 3</td>
<td>Kunbungu</td>
<td>30</td>
<td>14</td>
</tr>
<tr>
<td>11</td>
<td>Cheyohi</td>
<td>Kunbungu</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>12</td>
<td>Kpachi</td>
<td>Kunbungu</td>
<td>30</td>
<td>19</td>
</tr>
<tr>
<td>13</td>
<td>Kpachi</td>
<td>Kunbungu</td>
<td>30</td>
<td>16</td>
</tr>
<tr>
<td>14</td>
<td>Kpachi</td>
<td>Kunbungu</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>15</td>
<td>Jana</td>
<td>Nanton</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>16</td>
<td>Libga</td>
<td>Savelugu</td>
<td>30</td>
<td>17</td>
</tr>
<tr>
<td>17</td>
<td>Libga</td>
<td>Savelugu</td>
<td>30</td>
<td>17</td>
</tr>
<tr>
<td>18</td>
<td>Nakpazu</td>
<td>Savelugu</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>19</td>
<td>Nakpazu</td>
<td>Savelugu</td>
<td>30</td>
<td>14</td>
</tr>
<tr>
<td>20</td>
<td>Nyoglo</td>
<td>Savulugu</td>
<td>30</td>
<td>22</td>
</tr>
<tr>
<td>21</td>
<td>Nyoglo</td>
<td>Savulugu</td>
<td>30</td>
<td>21</td>
</tr>
<tr>
<td>22</td>
<td>Pong Tamale</td>
<td>Savelugu</td>
<td>30</td>
<td>14</td>
</tr>
<tr>
<td>23</td>
<td>Tumahi</td>
<td>Savelugu</td>
<td>30</td>
<td>28</td>
</tr>
<tr>
<td>24</td>
<td>Dimabi</td>
<td>Tolon</td>
<td>30</td>
<td>24</td>
</tr>
<tr>
<td>25</td>
<td>Tolon</td>
<td>Tolon</td>
<td>30</td>
<td>11</td>
</tr>
<tr>
<td>26</td>
<td>Tolon</td>
<td>Tolon</td>
<td>28</td>
<td>18</td>
</tr>
<tr>
<td>27</td>
<td>Yobzeri</td>
<td>Tolon</td>
<td>30</td>
<td>33</td>
</tr>
</tbody>
</table>

The highlighted rows show the groups that were brought into the collaborative learning process that started in 2019. The bolded text indicates those that were active until the end of 2022.

3.4. Methods

Participatory approaches emphasizing collaborative learning formed the core research activities contributing to transdisciplinary knowledge production. The research design was deliberately flexible in order to respond to changing inputs and needs. Table 2 offers an overview of the methods used over time, with whom, and the resultant data presented in this paper.

In 2018, a participative group story activity was used to gain insight into group function while enabling groups to appreciate what they have built together and visualize next steps forward. This first contact allowed for an evaluation of group function and also provided insights into gender dynamics.
As collaborative research approaches are very resource and time intensive, a smaller subset of seven groups were invited to continue participation in 2019. Over 45 different group sessions were held with these groups using a variety of different facilitation tools. Facilitation plans were developed for each step of the process including establishing the relevance of underutilized species, co-identifying species available in their communities and systematically assessing them. Examples of tools that guided the group sessions included pairwise discussion (beehive method), clustering motivations, brainstorming, expert presentation sessions, responsibility chart, resource mapping, constraint analysis, and opportunity matrix—all adapted to the specific needs of each group.

Researchers sustained facilitation of group activities until the end of 2021 including experimenting to improve processing, market surveys and learning excursions to processing centers, activities to overcome constraints such as water, assistance with sourcing more affordable dawadawa seeds from other parts of Ghana. Outreach activities including live radio programs continued into 2022.

Specifically, on the topic of the decline of the African Locust Bean, 19 semistructured interviews were conducted in August 2020 with 8 female farmers, 7 male farmers, and 4 chiefs in the local governance system. Selected group sessions and all semistructured interviews were audio-recorded with consent. These were then transcribed with translation from Dagbani into English.

Qualitative content analysis of the transcripts was done using the software program MAXQDA Plus 2020 (Release 20.2.2). Separate coding frameworks were developed for the first and second part of the results. In the first, the emphasis was on the different uses and benefits of the African Locust Bean and in the second, the focus was on the reasons for the reduction in the tree.

Table 2. Overview of methods and data over the course of the research project.

<table>
<thead>
<tr>
<th>Year</th>
<th>Methods</th>
<th>Participants</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>21 group sessions with 21 transcripts</td>
<td>27 groups with 524 participants</td>
<td>Preliminary assessment of gender dynamics</td>
</tr>
<tr>
<td>2019</td>
<td>45+ group sessions with 44 transcripts</td>
<td>7 groups with 283 members *</td>
<td>Evaluation of uses and benefits of multiple underutilized species including cultural value</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Selection of underutilized species of interest for processing business</td>
</tr>
<tr>
<td>2020</td>
<td>19 individual interviews with 19 transcripts</td>
<td>8 female farmers, 7 male farmers, and 4 chiefs</td>
<td>Availability and access to dawadawa trees Reasons for diminishing dawadawa resources</td>
</tr>
<tr>
<td>2021–2022</td>
<td>3 radio programs in the Dagbani language (two live and one prerecorded)**</td>
<td>3 groups with 90 members *</td>
<td>Outreach activities to raise awareness about the need to conserve dawadawa trees and the value of dawadawa condiment and tea</td>
</tr>
</tbody>
</table>

* Total number of members in participating groups is used since the activities were conducted over time. ** One of the three is included in the Supplementary Materials.

4. Results

The first section establishes the importance of this underutilized species within the cultural landscape in northern Ghana. In an action research activity focused on small-scale agro-processing, women’s groups selected an underutilized species of interest to focus on in 2019. The focus group discussions that were part of this process elaborated practical uses of the tree and affirmed the gendered significance of the African Locust Bean tree in Dagomba culture. The second section details issues related to access to dawadawa seeds. It reports the decline of the tree based on individual interviews with female and male farmers and local chiefs in 2020 revealing actionable points for sustainable development.
4.1. The Importance of the African Locust Bean to Dagomba Women

4.1.1. Choosing the African Locust Bean above Other Underutilized Species

Of the seven women’s groups, five reached the point of selecting an underutilized species of focus. The research team did not approach the groups with a pre-formed list of underutilized species. Of the five, three chose the African Locust Bean of the groups highlighting the importance of this tree in the cultural landscape (Table 3).

Table 3. The selected underutilized species by each women’s group and the associated products to be processed.

<table>
<thead>
<tr>
<th>Community</th>
<th>Species Selected</th>
<th>Selected Processing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kpachi (Group 1)</td>
<td>Locust Bean</td>
<td>Dawadawa condiment and tea</td>
</tr>
<tr>
<td>Kpachi (Group 2)</td>
<td>Locust Bean</td>
<td>Dawadawa condiment and tea</td>
</tr>
<tr>
<td>Kpachi (Group 3)</td>
<td>Locust Bean</td>
<td>Dawadawa condiment and tea</td>
</tr>
<tr>
<td>Jana</td>
<td>Groundnut</td>
<td>Groundnut cake, cooking oil, butter/paste, and flour</td>
</tr>
<tr>
<td>Cheyohi 1</td>
<td>Orange-Fleshed Sweet Potato</td>
<td>Flour</td>
</tr>
</tbody>
</table>

4.1.2. Uses of the African Locust Bean Tree

The African Locust Bean tree, known as *dawadawa*, has multiple uses that include economic and nutritional benefits described by the participating women’s groups (Table 4). The women involved in the research emphasized that every part of the plant species is useful to them. One woman exclaimed “Dawadawa benefits are many, and if we are to mention them, we will not finish!” (WG/KS03). More detail about the labels used to link the quote to the particular interview can be found in Appendix A.

Women described that they would also use dried leaves for starting fires. Once a fire is started with parts of the African Locust Bean tree, its ash is prefered for cleaning purposes. One woman described that, “When you break the branches; you can use it to set fire without any other wood included, and the ash will be so white, and you can collect it into a bucket for ‘bochaa’ (local caustic soda)” (WG/KP02). The waxy property of the outer covering of the seed is used for protecting earthen walls. This is reflected in the quote: “Even the seeds when we remove it and leave the covering, we call it ‘dasendey’ when you make it, you plaster with it. Because you cannot afford cement . . . .” (WG/KB02).

In the study area, the women explained that the tree flowers in January, has green pods in February and then the dried pods are harvested at the end of March or in April. When the long pods are opened, there is a yellow powdery substance (Figure 3). This can be eaten as it is and can also be used in cooking as a sweetener. One woman explained that “. . . the dawadawa fruit is also used to prepare porridge or even if you like you can take some and lick” WG/CC02. Importantly for pregnant and lactating women, a nutritional benefit is that the fruits contain folate. The InFoods database reports that 100 g of *P. biglobosa* fruits contain 380 mcg of the 400 mcg that are recommended for daily nutrition [81]. When stored, the yellow pulp is the most likely to become infested, so its use is more limited. However, it is the seeds that have the greatest longevity and are most coveted for taste and nutrition (Figure 4).
It is considered women’s work to process the seeds including labor-intensive steps: soaking, boiling, pounding, boiling a second time, fermenting, drying and grounding. The resulting molded black balls are used as a condiment to make savory food more flavorful. In one focus group, a woman described that “… when you want to cook soup, dawadawa is the main thing. Whatever you want to cook—even if you want to cook rice or even tomatoes—you can put dawadawa inside and it will be delicious …” (WG/KS03). Describing this, a woman said, “the reason why we have picked dawadawa is that when you are hungry, and a child is waiting for you, when you go and pick dawadawa and put salt in it and mash it and put on the T.Z. [a local maize meal] for the child” (WG/KP03). It is described as a substitute for meat due to its relative affordability and the nutritional content. The following quote shows the importance of this in relation to local religious practices: “And truly we only eat meat during Salah festive season, and we know that if you do not get meat to put in your soup, and you put in dawadawa, it will be the same thing you will get as the person with the meat will get in the body. That is why we are on the dawadawa because if it is not a Salah day when they slaughter a fowl and you cook, any other day it is a sin” (WG/CC02.WG/JM02WG/SS02WG/KS02).
Dawadawa is held in high esteem by the local community for its perceived health and nutritional benefits. It is used locally as part of a holistic medicine approach for treating circulatory issues and malaria. One woman explained that “When you go to hospital, and the doctors tell you that you do not have blood, they always advise that you should add dawadawa to your every meal, and when you eat it, you will become healthy, and if you are to get a stroke they would tell you to eat dawadawa very well” (WG/SS02). It is also viewed to be beneficial when applied topically. For example: “If you have a hernia on any part of your body and you apply it on the part, the hernia will be stopped, but if you drink it, it makes the healing faster” (WG/KB04). As pharmaceutical treatments are often prohibitively expensive, the option of having a home-grown remedy available is reassuring.

Table 4. Summarized uses as reported by the three women’s groups processing dawadawa.

<table>
<thead>
<tr>
<th>Category</th>
<th>Uses of the African Locust Bean Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutritional</td>
<td>Fruits, seed pod pulp, and seeds are a source of carbohydrates, protein, and fat. Important for pregnant and lactating women. When the long pods of the tree are opened, there is a yellow powdery substance. This can be eaten as is and can also be used in cooking as a sweetener. Caustic soda (ash), firewood (branches and leaves), plastering (outer covering), starting cooking fires (leaves), plastering utensils (outer covering of seeds).</td>
</tr>
<tr>
<td>Economic</td>
<td>Bark, black seeds (chest pain and hernia remedy). The women reported that it was used locally as part of a holistic medicine approach for treating circulatory issues and malaria.</td>
</tr>
<tr>
<td>Medicinal</td>
<td></td>
</tr>
</tbody>
</table>

4.1.3. A “True” Dagomba Woman Has Dawadawa

Dawadawa is ascribed with sociocultural significance. Exemplary of this, one woman interviewed proclaimed, “Dawadawa, is something that defines us as the Dagomba women”.
During social gatherings and other community events, it was emphasized that *dawadawa* needed to be there. One woman explained that: “During pregnancy, funeral, marriage ceremonies, *dawadawa*, is of immense importance to the community. Offering *dawadawa* as a gift is a respectful act” (WG/KB03). It was further acknowledged that ownership of *dawadawa* confers status among women in Dagomba communities. In this regard, one woman said: “The reason why we chose *dawadawa* is that we looked at life; it is a solid walking stick for us. It is coming from us the Dagombas and not everyone, when it is not there, we cannot have a headway” (WG/KP03). Even beyond the women, it was explained that: “*Dawadawa* has benefits because it is our delicacy and when a Dagomba person is going somewhere, if there is not *dawadawa* the fellow cannot go” (WG/KP04).

4.2. Northern Ghana’s Changing Agricultural Landscape and the Decline of the African Locust Bean

4.2.1. Access to Dawadawa

Unlike other trees such as Shea, the right to harvest seed pods from the African Locust Bean (*dawadawa*) lies with the owner of the land and not those who are farming the land. Within the Dagomba Kingdom, it is the chief who has the right to harvest *dawadawa*, and this tradition is upheld in the community of Kpachi. There are multiple levels of chiefs, and some are referred to specifically as the *dawadawa* chief locally referred to as ‘dohin - naa’ for specific sections of land. Only after members of the chief’s household or landowner have harvested the seeds can others glean what remains. For example, the following dialogue between the researcher and a male farmer:

“So who has been harvesting the *dawadawa* fruits [seed pods]?
—The *dawadawa* chief.
So is it that after the chief of the *dawadawa* tree has harvested that your wife also goes to gather the rest?
—Yes, after the chief of *dawadawa* has harvested then my wife will also go.
So do your household women go to harvest?
—Yes, but not only them, anyone [women from other households] who gets there early”
(K/SIMF1)

However, as there is not enough to be harvested, most of the community relies on the market to buy their *dawadawa*. Even a Chief who was interviewed reported needing to buy *dawadawa* because the yield was insufficient for his household. An excerpt from the interview is:

“Since you were enskinned chief have the *dawadawa* trees decreased or are they increasing?
—It is finishing.
As it is finishing, what makes you think that it is finishing?
—Some of them are dead.

When you initially got the chief title, how many bowls of the *dawadawa* seeds were your households preparing?
—At first we could get more than ten, but we don’t even get two bowls now.
So if the *Kpachilana* [main chief of Kpachi] says he wants *dawadawa* seeds, what do you do?
—We go to the market to buy”
(K/C2)

Owing to this increasing scarcity, most households primarily sourced *dawadawa* from the market. In the market, prices follow a seasonal pattern with lower prices in the Tamale
region during March–April when local seeds are harvested. In the Tamale market and surrounding markets such as in Nyankpala, *dawadawa* seeds that are sold are additionally sourced from the southern part of Ghana. In the south, *dawadawa* has historically not been as esteemed as in the Northern Region and so there was usually a surplus. However, as there is increasing awareness of the health benefits of *dawadawa* among urban populations, demand is beginning to increase. Some *dawadawa* is also sourced from further north, near the border with Burkina Faso.

4.2.2. Reasons for Diminishing Dawadawa Resources

With the exception of two female farmers interviewed, all others reported a decrease in the number of African Locust Bean trees in their fields. The reasons for this decline can be summarized as shown in Table 5:

<table>
<thead>
<tr>
<th>Reason for Decrease</th>
<th>Example Quote(s)</th>
<th>Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aging tree populations</td>
<td>“What accounts for the decrease? It’s the wind. Sometimes it will rain and push a <em>dawadawa</em> tree down or the tree just dries up. Then it means that they are old trees because they have been there for long” (K/SIFF1,2,3,4).</td>
<td>Female Farmer</td>
</tr>
<tr>
<td>Challenge caring for saplings to maturity</td>
<td>“So why, do you like to plant trees like this [Neem] and not the <em>dawadawa</em> trees? Because the <em>dawadawa</em> trees are more beneficial? —The way the <em>dawadawa</em> tree is, it is challenging to plant. I won’t lie; when you plant it, and it grows, is very tiresome. Why will you be tired? Until it becomes a big tree, you can’t leave it alone” (K/SIC1).</td>
<td>Chief</td>
</tr>
<tr>
<td>Agricultural changes with increased mechanization and pesticide use</td>
<td>“Why doesn’t it grow again? The farmers weed them off” (K/SIC2). “( . . . ) I think it is the weedicides too that are destroying the trees” (K/SIMF6) “( . . . ) because the tractors plow the land and it cuts its roots. That is what kills it” (K/SIMF7).</td>
<td>Male Farmer</td>
</tr>
<tr>
<td>Over-use as a firewood resource</td>
<td>“They are old trees and the tree cutters also have been cutting them down... Because there is no firewood around...” (K/SIFF5).</td>
<td>Female Farmer</td>
</tr>
<tr>
<td>Usufruct rights between traditional chiefs, male land-users and women who use the trees</td>
<td>“The reason why it is decreasing is that those days during our parents’ time, they used to put the seeds in their hats and they walk they broadcast it but today when you do that you do not own the <em>dawadawa</em> tree is that why for the <em>dawadawa</em> trees we do not know how to make them be in existence. If not, we could also then have the <em>dawadawa</em> tree but when you do it, you do not own it” (K/SIMF7).</td>
<td>Male Farmer</td>
</tr>
<tr>
<td>Reduced water availability inhibits seed yield</td>
<td>“So it is not only that the trees die, but also that the ones left do not fruit? —Yes. And we do not know the reason why they no longer fruit? —Water . . . it was the <em>dawadawa</em> trees closer to the river/dam that were always yielding. Those days every branch would fruit a lot but now you will not find such a tree. Now when it fruits, you can only see a few fruits” (K/SIC1).</td>
<td>Chief</td>
</tr>
</tbody>
</table>

In recent times, rural women are being drawn in the global economy owing to the growing demand for value-added products such as *dawadawa* condiment and *dawadawa* tea. Communities are, however, faced with reduced quantities of seeds because the trees are often very old and do not fruit as much as they used to. Further, some are dying off, have been cut down, or have been destroyed by bush fires. There have not yet been conscious efforts to replace the *dawadawa* trees despite its numerous benefits because of the belief that they only grow wild and cannot be planted intentionally. This neglect has direct consequences on rural women. Although aging and nonproductive Shea trees are being replaced with fresh ones in the study area, this is not the case with *dawadawa*. The issues with ownership and access to the trees have resulted in a situation where young trees are
becoming scarce. Despite this, no conservation programs have been enacted to protect and replenish the African Locust Bean.

5. Discussion

Our research documents the alarming decline of the African Locust Bean through the observations of farmers and chiefs in one community in northern Ghana and contrasts this against the enduring practical and symbolic importance of the tree among Dagomba women. Our results affirm the continued relevance of earlier research about the myriad uses of different parts of the tree [49] and about the cultural and social value ascribed to it [82], particularly for Dagomba women [51,54,78].

Resoundingly, the observations of farmers and the chiefs were that the remaining African Locust Bean trees in their community are not being replaced by new saplings and are yielding less. The observation that they are “aging trees” has to do with the decline in health of the trees. The analysis presented in the second part of the results can be triangulated by the pressing need to find alternative sources of dawadawa seed for the women’s collective business and observations of the researchers active in the community for more than three years. Other research also reports declines in P. biglobosa. In Nigeria, no saplings for P. biglobosa could be found in sites across three agro-ecological zones (Nigerian humid savannah, dry woodland, or southern Guinea savannah, and northern Guinea savannah) [83]. In Burkina Faso, Raebild et al. report, “P. biglobosa trees were almost exclusively old trees. The few seedlings recorded disappeared after one to a few months” [84].

The place-specificity of threats to the African Locust Bean is highlighted by Musara et al. [85], who contrast the “stable” listing in the 2012 International Union for the Conservation of Nature [86] Red List of Threatened Species with the “endangered” listing in a review of the conservation status of different types of vegetation in northwestern Nigeria [87]. The published 2021–2023 IUCN database continues to list P. biglobosa as “stable” [86]. As the tree has a significant extent across western Africa and all the way eastward to Uganda, their numbers are still substantial as compared to other endangered species. A global review of conservation of P. biglobosa concluded that there are significant gaps in knowledge and very little about the status of the tree in central and eastern Africa [88]. However, our research shows that where the African Locust Bean is declining, as in our case-study community, it has negative repercussions that warrant attention.

In this case, the consequences are gendered, as cultural values ascribe that it is women who harvest and make use of the multiple benefits of the tree. However, in this strongly patriarchal society, the governance by the dawadawa chief that had been functioning for more than the past hundred years to protect the tree, is no longer effective and may even act as an impediment. The layers of rights, ownership, and access in this particular case show that the long-term stewardship by the chief, paired with the short-term use by the farmers, and the customary use by the women have resulted in a disincentive for action to replant and/or protect saplings. This concern echoes what was described by Poudyal, who also looks to the overlay of rights for land and for the trees in northern Ghana as a contributing factor for low regeneration [89]. As described in the quotes, it is a tree that requires more care to bring to maturity than other trees, such as Neem, which grows in the Guinea savannah agro-ecological zone. Land for the trees and dedicated care for them are needed for proactive restoration efforts to succeed. Women who directly benefit from the trees, will not only need to negotiate for this land and care within a strongly patriarchal society, but will need to do so in the face of challenges stemming from other global drivers of change including the Green Revolution in Africa and the climate crisis.

As smallholder farmers become more indebted with mechanization and packages of pesticides and weedicides, individual farmers are pressed to act in ways to maximize their short-term monetary benefits within this system [71]. However, as flagged in the quotes about the causes for the decline of the African Locust Bean, the logic of mechanization is rationalizing eliminating trees in favor of more manageable and drivable fields—whether
intentionally or unintentionally. Further, broad-spectrum weedicides affect more than common weeds, but also the germination and growth of young saplings. The benefit gained from the tree is then weighed against the decline in crop production faced by a farmer who has the tree to contend with. In this regard, it is notable that the only two interviewees who reported having new African Locust Bean trees growing in their fields were female farmers. On the one hand, female farmers are more likely to see the benefit of preserving the tree and they are also less likely to receive credit to purchase inputs that adversely affect the trees.

Despite this, in the interviews that we conducted, women did not blame men for the decline of the trees (not directly or even indirectly, such as by bringing up mechanization). The main reasons they gave for the trees’ decline was cutting for firewood and the age of the trees. This reflects the power dynamics in the Dagomba culture in which women are, first, of lower social status than men (e.g., no usufruct right or inheritance rights), and second, face social restrictions to speak up against them. So, although women as a group are accorded benefits through the customary access they have for harvesting the African Locust Bean, they individually might have very immediate needs for collecting firewood to cook daily meals for their families, which may take precedence. This contradiction concurs with findings from Kansanga et al. [51], who found that women increasingly switched to unsustainable subsistence practices such as “the burning of charcoal and harvesting of fuelwood” because of few other alternatives to provide for their households.

More research is needed about the dynamics influencing the African Locust Bean in different communities across western and central Africa. Although some modeling has been performed, such as in Benin [90], there is a need for research that shows the landscape looking back, such as through mapping the current and historical extent of the tree populations. An example of how this could be achieved is Tuil [91], whose work on oak trees in California’s Central Valley shows how the rise in industrial agriculture has left only remnant patches of the trees. Qualitative research such as ours allows for specific sociocultural dynamics surrounding the African Locust Bean to be better understood and the gendered consequences to be unraveled. However, more such research is needed together with more communities. Ideally, action research could bring researchers and community stakeholders together in a process to co-investigate the issues facing the trees and what actionable steps can be taken.

6. Conclusions

In conclusion, there is an urgent need for action to protect and restore the African Locust Bean within the northern region’s savannah landscape to ensure continued access and benefits of the tree to women in the region. The gendered impacts of the decline of the African Locust Bean are reflective of the reshaping of the agricultural, ecological, and cultural landscape of which the community of Kpachi is a part.

To address this pressing problem, we recommend the creation of collaborations and partnerships to increase efforts to conserve and replant the African Locust Bean. There needs to be a shift in the power dynamics regarding whose actions and decisions most affect the landscape. A step in these directions would be supporting women’s governance and ownership of land. Whether it is sparsely wooded savannah or a dense forest, there is a need to improve women’s power in relation to multiscale drivers of change in the landscape.


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Institutional Review Board Statement: For fieldwork, M.A.L. followed an oral consent process guided by the Human Subjects Bill of Rights from the University of California, Davis. She then trained all of the other researchers doing fieldwork in this approach. Separate consent was followed for participation in different steps of the research, for audio recording, and for photography and other visual media. At the time that this research started, the University of Kassel had not yet founded its Central Ethics Committee for Research.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The qualitative data have been archived at the German Institute for Tropical and Subtropical Agriculture in Witzenhausen, Germany. To protect the anonymity of the research participants, it is not publicly available.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

First section of the results: The labels are used from the initials of the community names together with the groups. The names of the communities here include: Kpachi, Cheyohi, Jana, and Sankpala (K = Kpachi, C= Cheyohi, J = Jana, and S= Sankpala) and the names of the groups: Suglonboriboni S, Bobgunyeyaa B, Puumaya P, Chelinyukabo C, Maltiti M, and Suhuyini S. The labels for group meetings, individual interviews, participated entrepreneurs, are identified with the following abbreviations: (WG) represents Women’s Groups. For example, “WG/K” means women’s group at Kpachi. Coding structure to show group meetings with different sessions, the numbers such as 1, 2, 3, 4 . . . , are applied. Other codes are Group Reflection Session (GRS), Narrative Interviews (NI) and Semistructured Interviews (SI). Interviews are labeled as follows; Participant (P) and Participated Entrepreneur (PE). Demonstrating this as an example, if a quote is extracted from a group at Kpachi, in a group meeting at session four (4), this is tagged as WG/K4.
Second section of the results: The labeling system used to label the transcripts starts with the first letter of the community (K = Kpachi, S = Sankpala) followed by a slash, the method of data collection (SI = semistructured interview and GM = group meeting), and chronologically numbered anonymized participant abbreviations (C = Chief, MF = male farmer, FF = female farmer, and WG = women’s group). In Cheyohi (C1, C2, C3), three specific locations were selected to perform fieldwork, which are numbered from 1 to 3. In Sankpala, S is used to demarcate the Suhuyini women’s group. The label N/GMWG2 describes a group meeting in Nakpazu with the second women’s group; the label K/SIFF6 describes a semistructured interview in Kpachi with the sixth female farmer; the label C2/GMWG1 describes a group meeting in the second location in Cheyohi with the first women’s group, and so forth.

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