Fruited Shea trees growing on Maize field, Mali
Photo credit: Seydou Diawara

CHAPTER 8

Shea Tree Crop Management in West Africa

Catherine Ky-Dembele, Jules Bayala, Jean-Marc Boffa, Antoine Kalinganire, Peter A Minang

Highlights

- Shea tree (*Vitellaria paradoxa*) is a semi-domesticated species indigenous to sub-Saharan Africa's semi-arid and sub-humid savannas, growing in 21 countries.
- Shea is valued for its ecosystem services, including cultural (myths, social representations), supporting (soil carbon), regulating (water infiltration, reduced run-off and erosion, temperature moderation), and provisioning (fruit pulp, seed nuts providing shea butter used for cooking, equivalent to cocoa butter, in cosmetics and medicine, the high protein rich caterpillars and income).
- The recently growing demand for shea products in local, regional and international markets is increasing as a nutritional and economic resource, especially for women.
- However, there are many challenges, including, shea landscape degradation, a slow domestication process, processing and market issues, and weak policies and regulations, affecting the entire value chain as a tree commodity.
- Active roles of all stakeholders, including shea collectors, processors, traders, researchers and policy makers, are needed to jointly address the challenges for sustainable shea production, and fair and equitable marketing.

1. Introduction

The shea tree, *Vitellaria paradoxa* Gaertn. C. F., known as Karité in Francophone countries, is a multi-purpose tree species (deliberately grown and managed for more than one output) indigenous to the semi-arid and sub-humid savannas of sub-Saharan Africa. It occurs along a 500 km-wide zone ranging from Senegal to Uganda (Bonkoungou 1987, Hall et al 1996) across 21 countries, including Benin, Burkina Faso, Cameroon, Central African Republic, Côte d'Ivoire, Chad, Ethiopia, Gambia, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, South Sudan, Sudan, Togo, Uganda, and the Democratic Republic of the Congo.

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Vitellaria is a monospecific genus with two subspecies: *paradoxa* and *nilotica*. The subspecies paradoxa occurs from Senegal to the Adamawa Highlands, along the border of Cameroon and Nigeria, while nilotica is found in The Central African Republic, Sudan (known locally as 'Lulu' tree) and Uganda, with small populations in Ethiopia and DR Congo (Allal et al 2011, Bonkoungou 1987, Hall et al 1996, Lovett and Haq 2000a). Both subspecies are found in areas with temperatures ranging from 24 to 40 ^{o}C and annual rainfall of between 500-1400mm.

Shea trees grow naturally in farmlands, fallow lands and other woodlands where oil palm cannot grow due to low rainfall (Bonkoungou 1987, Lovett and Haq 2000a). On farmlands, shea trees are preserved according to farmers' choices, keeping or cutting regenerating saplings during land clearance for cropping that forms part of agroforestry parklands, the main agricultural systems in the shea belt. Tree preservation is also based on locally valued criteria such as tree maturity, fruit sweetness, fruit yield, tree vigour, reduced competition with annual crops, etc. (Bayala et al 2015, Lovett and Haq 2000b, Lovett and Phillips 2018, Maranz and Wiesman 2003).

As a source of one of Africa's most ancient food oils, the utilisation of shea butter dates back to at least 3000 to 4000 years (Lovett 2015, Wardell et al 2022a). Shea was first documented as a high-value commodity in regional trade across West Africa as early as 1354 by the Moroccan traveller Ibn Battuta and the magnitude of its distribution and local importance caught the attention of early explorers such as Mungo Park in 1798 (Bonkoungou 1987, Park 1983, Wardell et al 2022a). It is also recorded that since the 1720s, shea butter has been considered a highly prized medicinal substance in many parts of Africa (Dogbevi 2009, Hatskevich et al 2011).

The recently growing demand for shea products for local and international markets is increasing its role as a nutritional and economic resource within its distribution area of West, Central and East Africa (Pouliot 2012, Wardell et al 2022b). Despite this increasing importance, shea tree densities in natural stands are declining as the remaining trees age, and natural regeneration remains low. This is due to various natural and human driven factors, including climate variability and change, increasing demographic pressure with the disappearance of fallows and uncontrolled tree cutting for fuelwood and charcoal as well as large-scale land investments in intensive mechanised agriculture (Lovett and Phillips 2018, Seghieri 2019). The declining resources of the species and the time-consuming shea collection and processing that generate low returns per unit of labour constitute major impediments to shea development as a tree commodity that can lift local people, mainly women, out of poverty (Bockel et al 2020, Pouliot 2012).

This chapter aims to present the ecological and economic importance of the species as a tree crop commodity, but also the challenges of its governance, regeneration, and value chain.

2. Nutritional, ecological and economic importance of shea tree crop in West Africa

2.1. Food and other products of shea

Shea tree provides food and various ecosystem services. Locally, shea trees are valued for their fruit pulp (rich in vitamins and minerals), high-protein-rich caterpillars and the kernels. They provide shea butter, widely used as a staple cooking oil, cosmetics, medicine and charcoal produced from their wood. The fruit pulp is an important local nutritional resource, widely eaten by adults and children. It is rich in vitamins and minerals (ascorbic acid, iron and calcium) and constitutes a source of protein and carbohydrates during the annual 'hungry season' (Akihisa et al 2010, Maranz et al 2004). Its rich kernels provide edible oils and fats known as shea butter, used for cooking, cosmetic and medicinal application (Lovett 2015, Maranz et al 2004, Teklehaimanot 2004). Even though shea's contribution to West African economies is well known as an exported commodity, over half of the total shea harvest in West Africa, amounting to about 350,000 tons per year, is still consumed domestically (Abdul-Mumeen et al 2019, Lovett and Philipps 2018). This consumption is assumed to be annually constant and growing in line with the population. Traditional shea consumption as an ingredient for cooking was estimated to be about 22 grams of butter per person daily in rural areas (Fleury 1981, Lovett and Philipps 2018). Cooking with shea butter was also associated with lower blood pressure in the Ghanaian population (Kofi Amegah et al 2019).

Shea butter from the West African part, with a solid-state at ambient temperature, is considered a useful cocoa butter substitute. This is because it has a similar melting point (32–45°C) and high amounts of di-stearin (30%) and some stearo-palmitine (6.5%), which make it blend with cocoa butter without altering flow properties (CBI Market Intelligence 2015, Kapseu and Ngongang 2002, Nikiema and Umali 2007). Refined fat has also been used as margarine and as baking fat (Wardell et al 2022b).

Shea tree is an important source of honey, assuring a good supply of nectar and pollen (Lassen et al 2016). Another food product provided by the shea tree is the protein-rich caterpillar, *Cirina butyrospermii*, produced in many parts of the shea belt (Anankware et al 2015, Boffa 2015). These caterpillars, feeding on shea leaves, are a source of food with high protein (62.74%) and moderate lipid (14.34%) content (Anankware et al 2015, Anvo et al 2016, Payne et al 2015, Yapo et al 2017). These caterpillars are eaten across the West African region. Harvested at the larva stage, caterpillars are an important source of nutrition and income for many subsistence farming households in the region. Like shea butter, demand for shea caterpillars is also increasing within shea distribution areas (Dabire et al 2018, Payne et al 2020), adding value to the shea sector while improving nutritional security as well as income generation, which is beneficial for the most vulnerable women and youth.

Moreover, all parts of the shea tree, including the flower, fruit pulp, nuts, bark, root, and leaves, are all used in rituals or traditional medicines to treat various diseases and injuries while the wood and charcoal are used for building, mortar and cooking (Choungo et al 2021, Maanikuu and Peker 2017).

2.2. Shea, climate change and resilience

Besides nutrition, shea also has great potential to mitigate the effects of climate change and therefore increase the climate resilience of value chain beneficiaries. This is evident in West Africa, where 99% of global shea exports originate, and the Intergovernmental Panel on Climate Change (IPCC) expects temperatures to rise by 3 to 6°C by 2100. In this context, the predicted trend of shea distribution is unclear as some authors reported a sift towards the south of the actual shea belt as illustrated in figure 8.1 (Allal et al 2011, Naughton et al 2015), while others projected a decrease up to 13.25% of its current suitable habitat area (Dimobe et al 2020). Nevertheless, more than the climate, the shea tree is rather largely at risk from human practices, including annual crop cultivation, collection of nuts, bush fires, use of the tree species for firewood and charcoal, etc.

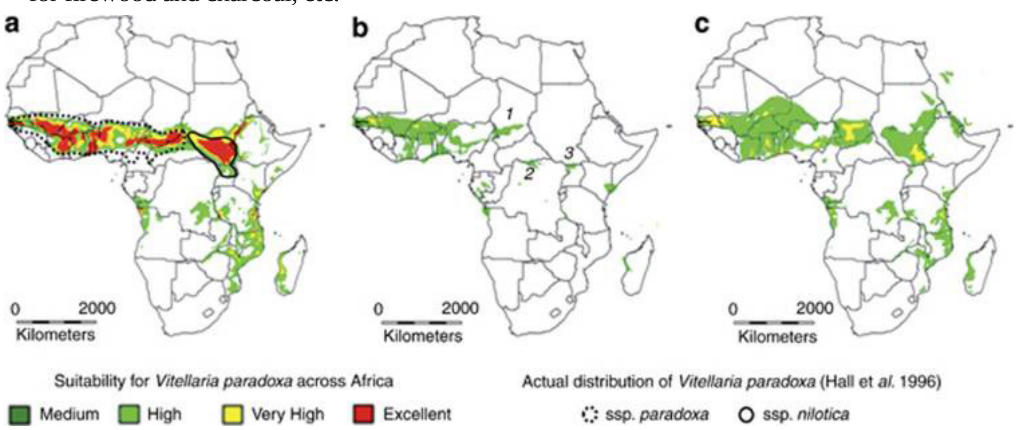

Figure 8.1: *Ecological niche modelling of Vitellaria paradoxa at three different periods: (a) today's predicted and reported natural range; (b) potential distribution during the LGM (20 000 years BP) and refugia (1: around Lake Chad; 2: northern Congo; 3: northern Uganda); (c) potential natural range during the LIG period (B120 000–140 000 years BP). Colors represent the probability of suitable climatic conditions from red (excellent) to green (medium).*

Source: Allal et al 2011.

Conversely, shea is relatively resilient to the changing climate and is beneficial to the overall resilience of the ecosystem and communities. This is through maintaining soil fertility (soil carbon) and biodiversity of flora and fauna, improving microclimate, improving water infiltration, and reducing wind and water erosion, and consequently mitigating climate change (Bayala et al 2014, Bockel et al 2020). Indeed, a recent study has demonstrated that shea has an enormous potential to mitigate climate change effects in West Africa, with an estimated production of 1.5 million tons of CO_2 every year. It is then assumed that every ton of shea kernels produced has a negative carbon footprint of 1.04 tons of CO_2 (Bockel et al 2020). The carbon sequestered by shea trees above ground and in the soil leads to a whole range of ecosystem services, including protecting the land against degradation, regulating runoff and the micro-climate, and conserving biodiversity. Within the parklands, the associated annual crops growing under them are likewise less exposed to excessive temperatures while benefiting from the ecosystem impact of shea trees (Allal et al 2013, Bayala et al 2006, 2014, Félix et al 2018).

2.3. Shea as an income-generating tree crop

The shea value chain, including production, transformation and marketing, provides employment and business opportunities to communities, not only in the shea belt of Africa but also outside Africa. Shea constitutes an important tree crop for women and youth, the main shea collectors, bringing 12-32 % of household income with a mean gross income of USD 75 per woman (Bockel et al 2020). According to Global Shea Alliance, shea nut collection and processing into shea butter provides about 16 million women with income in the shea distribution countries (USAID 2016). These amounts are substantial for households in the rural areas that shea is considered as "women green gold" in West Africa (Pouliot 2012, Naughton et al 2017). However, most of the collected shea nuts are processed into butter for home consumption and the local market (Lovett 2015).

This local processing activity is labour intensive and yet provides low returns, adding to the drudgery of the most active actors, who are women. To address these issues, mechanised processing that increases yields from 20% to 40% and improved product quality has been promoted (Bockel et al 2020). Such small-scale industries are meant to improve the quality of the butter extracted while adding value to the shea sector and providing opportunities for job creation among women collectors and their families, processing equipment makers, and dealers. Indeed, one of the most direct ways to add value to shea as a tree commodity is to transform the raw nuts into higher value finished products such as shea butter, which has a higher value than the nuts (Bockel et al 2020, Bonkoungou 2002, Masters et al 2004, Seghieri 2019). Nevertheless, this value depends to a very large extent on the labour invested in the processing, the market in which the butter is sold, the local markets and the time of year (Bockel et al 2020, Lovett 2015).

Moreover, there are a growing international and regional markets for shea butter for its use in chocolate as well as pharmaceutical and the luxury cosmetic industries. However, it has great potential yet to be realised in mitigating rural communities' vulnerability to food insecurity and alleviating rural poverty across the 21 sub-Saharan countries in which it is distributed (Lovett 2015, Seghieri 2019, Tom-Dery et al 2018).

Shea butter has become a dynamic industry because of its importance as a raw material for chocolate, cosmetic and pharmaceutical products. In addition to conventional butter, organic butter has also become of great interest for international industries, especially the luxury cosmetic companies, to the point where the local companies who are actively involved in that segment are not able to satisfy all the demands because of a lack of appropriate production systems and processing (Badini et al 2011, Lovett and Phillips 2018). Entrepreneurship is growing at a promising pace in the shea sector in West Africa, especially in Ghana, Burkina Faso, and Mali. Many enterprises or mini-enterprises are established in all shea-producing countries to process shea nuts or make various products, including butter and cosmetics (soaps, moisturisers, lotions and lipsticks) and caterpillars, commercialised within local, regional and worldwide markets (Lovett 2015, Tammy 2017). Cosmetic and pharmaceutical applications form a relatively small part of shea production. However, they present a fast-growing and potentially high-value market niche for shea nuts and shea butter (Allal et al 2013, Maranz et al 2004, Wardell et al 2022b).

The shea export trade is characterised by two main segments (cocoa butter equivalent and cosmetics) that offer contrasting income generation potential to producers. The largest (90%) export demand for shea is linked to the extraction of edible stearin used in the formulation of cocoa butter equivalents (CBE) for chocolate confectionery (Rousseau et al 2015). In this first strand, shea is mostly traded as unprocessed kernels, and the crushing of nuts and fractionation of oils is done outside of Africa. Despite the recent EU obligation to list ingredients in manufactured products, shea remains mainly invisible to the consumers of these confectionary products because the big brands in the chocolate industry do not want it to be seen as anything other than a cocoa butter substitute, rather than as something with a name and identity. Usually, shea butter is mentioned as vegetable oil or fat in the list of ingredients included in edible and non-edible products such as chocolate, ice cream, baking, and margarine (Lovett 2015).

The remaining 10% of exported shea goes into cosmetic and pharmaceutical markets. Here, shea is exported as butter and used as an ingredient in both luxury and mainstream cosmetic and personal care (e.g., moisturising creams, sun lotions, and soaps) and pharmaceutical (e.g., cholesterol-lowering and anti-arthritic remedies) products. The cosmetics market uses shea heavily in its marketing claims and is less constrained by cost than the confectionery sector (LMC 2017). In this second strand, women's cooperatives and niche markets in the international cosmetics industry are directly linked in an effort to enhance returns to women producers for higher quality shea products (Sidibé et al 2012). Prices vary depending on clients and the quality of butter produced, with premiums offered in traceable production chains. To reduce the incidence of distressed sales and secure markets for shea products and sell them at the best price, women, the main actors in the shea sectors in most of the shea producing countries, are actively involved in associations, groups, unions or cooperatives. They are supported by various projects and institutions, including national and international NGOs, United Nations' organisations and local and national authorities, to empower the numerous women involved in the sector and strengthen the shea value chain. Some of them could improve the quality and quantity of their products and increase exports.

The international market provides more than €175 million per year to traders in West African rural communities, where about 400,000 tons of shea nuts were exported from Francophone Africa in 2018 (COMMODAFRICA, https://shar.es/abyDkX). Likewise, the production of seven West African countries (Benin, Burkina Faso, Ghana, Côte d'Ivoire, Mali, Nigeria, and Togo) is estimated at about 500,000 tons of shea nuts, of which an estimated 270,000 tons are exported as raw nuts. Processors convert the remaining 230,000 tons into roughly 60,000 tons of crude shea butter, half of which is then exported. Rural-based women, using traditional methods, process about 60% of all the crude butter produced in West Africa at a relatively low extraction rate of about 20% (Bello-Bravo et al 2015, Seghieri 2019). However, reliable statistics regarding shea exports, and especially shea nut production, are difficult to find. Nevertheless, it appears that in West Africa, shea production varied between 638,890 and 777,433 tons from 2005 to 2012 (FAOSTAT 2020), with Nigeria having the largest quantity, followed by Mali (Table 8.1).

Table 8.1: *The seven largest producers of shea nuts (tons)*

Year	Benin	Burkina Faso	Côte d'Ivoire	Ghana	Mali	Nigeria	Togo	Total
2018	12,989	40,992	31,998	32,929	101,435	263,374	12,940	496,657
2017	13,104	42,437	31,811	34,024	49,640	273,770	12,750	457,536
2016	13,270	43,882	31,624	34,300	173,800	288,544	12,480	597,901
2015	13,645	46,200	32,382	34,300	50,699	314,418	12,550	504,194
2014	14,917	44,445	32,060	34,300	48,960	355,199	12,364	542,245
2013	15,000	45,000	31,535	33,630	175,000	359,337	12,800	672,302
2012	14,000	47,000	32,050	33,310	210,000	362,083	12,000	710,443
2011	13,000	55,903	32,106	32,655	208,000	326,828	11,200	679,692
2010	13,131	65,000	32,631	36,687	154,581	325,610	11,250	638,890
2009	12,961	62,830	29,820	38,823	154,117	332,770	10,900	642,221

Year	Benin	Burkina Faso	Côte d'Ivoire	Ghana	Mali	Nigeria	Togo	Total
2008	12,797	64,971	29,100	40,932	190,000	384,435	10,500	732,735
2007	12,640	67,009	28,874	49,708	182,202	425,000	12,000	777,433
2006	12,491	69,062	27,951	53,251	53,407	414,948	9,300	640,411
2005	12,351	71,572	27,058	60,935	126,680	410,029	9,000	717,626

Source: FAOSTAT 2020/UNDATA

However, the production decreased from 2013 to 2018 to less than 500,000 tons (FAOSTAT 2020). In contrast, global shea export from the 8 West African countries (Benin, Burkina Faso, Cote d'Ivoire, Ghana, Guinea, Mali, Nigeria and Togo) has increased from 2007 to 2017 (Figure 8.2). This increase is due to the booming of the international demand for shea products, to which actors respond by increasing the share of the production going to export versus local consumption. Europe remains the main destination for shea, for both nuts and butter, followed by Malaysia for butter and India for nuts (n'kalo/ Commodafrica).

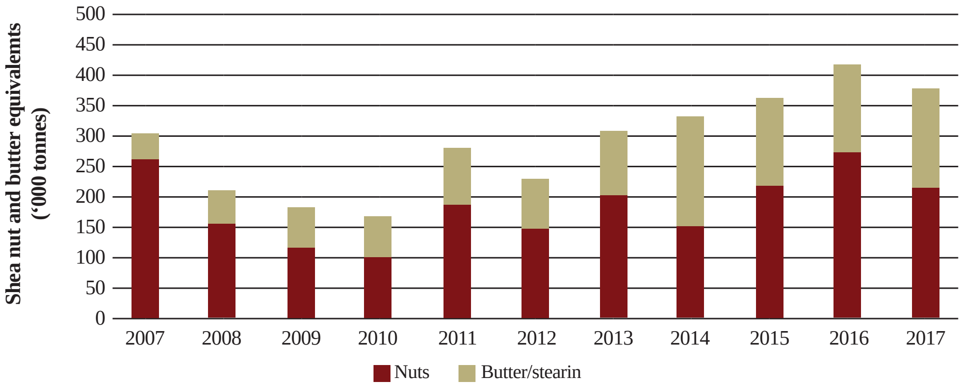

Figure 8.2: *Evolution in thousand tons of shea nuts and butter exports between 2007-2017 from eight West African countries.* Source: LMC International brochure

3. Challenges for shea development as tree crop commodity

Like many tree species in West and Central Africa, shea trees build the economic and socio-ecological resilience of the populations living in their distribution area. However, many challenges are affecting the entire value chain of this tree commodity. These include rapid degradation of shea landscapes, the slow domestication process, inadequate processing and marketing methods and weak policy and regulation.

3.1. Degradation of shea landscapes

Parklands across the Sahel-Savanna eco-zones are significantly threatened by extended land-use change. Millions of shea and other native trees are being cleared to make way for modernised farming, urbanisation, mining, and fuelwood extraction (Lovett and Phillips 2018). In addition, fallows, which are vital for wood fuel production and the natural regeneration of indigenous tree species of the savanna woodland system, are shrinking or disappearing, while at the same time, herbicide use is increasing. It is known that pesticides, coupled with habitat and fodder loss, reduce insect populations. Notably, honey/stingless bees are the main vectors for pollination, resulting in lower shea fruit yields and fewer resources available for migratory bird populations (Lassen et al 2016, Lovett and Phillips 2018, Kalinganire et al 2020, Stout et al 2018).

The natural regeneration of shea trees is mostly impeded by disappearing fallows, new emerged seedling destruction during ploughing and excessive exploitation of the fruit (leaving only a few seeds to contribute to the soil seed bank for the regeneration), bushfire, and roaming livestock (Aleza et al 2018, Korbo et al 2012, Raebild et al 2012). The parklands are rapidly and widely degrading with ageing trees, which are also attacked by pests and parasites (Augusseau et al 2006, Brandt et al 2018, Wardell 2022b). Furthermore, the undiscriminating cutting down of shea trees for timber, firewood and charcoal threatens the sustainability of this species listed as vulnerable (https://www.iucnredlist.org/species/37083/10029534) and constrains the expansion of its value chain. With a decrease or absence of fallowing, there is a need to engage in vigorous restoration actions to ensure the regeneration of shea trees in West Africa.

3.2. Slow domestication process

Shea is not a wild, but a semi-domesticated tree crop resulting from long-term anthropogenic selection by indigenous farming communities for specific desirable attributes (vigor, fruit productivity and characteristics such as sweetness and size of the nut, combining ability with crops, etc.) through cultivation and fallow cycles (Boffa 1999, Lovett and Haq 2000a, Maranz and Wiesman 2003). Shea trees are mostly grown on farmlands, mainly through farmer-managed natural regeneration. The decision to keep or to cut naturally regenerating saplings as a component of an agroforestry system means the semi-domestication may occur through an ‘automatic’ or ‘unconscious’ selection (Boffa 2015). Selection favoring superior trees by farmers may have slowly improved the productivity, fruit yield and fruit quality of the species (Lovett and Haq 2000b), but not to the extent that differences between improved and unimproved trees are easily observed. The complete germination process is also challenging because the recalcitrant seeds lose their viability quickly. It takes a long time for the shoot to emerge, which is a major challenge for shea to be planted by farmers (Ky-Dembele et al

2022). Shea trees remain largely naturally regenerated with an irregular year-to-year yield of trees (Aleza et al 2018, Lamien et al 2007, Rousseau et al 2015) with limited and rare plantations. However, shea planting is taking some steps forward with the availability of grafted and selected plant materials (Bayala et al 2009, 2018). The grafting of mature trees in situ within the field has been successfully implemented by smallholders and communities in Benin, Burkina Faso, Ghana and Mali. The species is not fully domesticated with few appropriate conservation of genetic diversity, unavailability of reliable national/local statistics on the potential of the shea resource and the extent of its degradation, and the lack of good agronomy and silvicultural practices for enhanced fruit production and resource preservation. The extended juvenile period makes traditional breeding approaches untenable for this species. However, with the recent development of foundational resources, the way has been paved for its genome-enabled conservation and long-term improvement (Hale et al 2021). Such an exercise must use a 'systems approach' to address the production challenges of this species (Graudal et al 2021).

3.3. Processing and market issues

In the shea producing countries, the process of extraction falls into 3 main categories: manual traditional, semi-mechanised (using hydraulic /screw presses) and fully mechanised industrial systems (Abdul-Mumeen et al 2019, Lovett 2004). Rural women use the traditional method to extract about 60% of all the crude butter with about a 20% extraction rate. The semi-mechanised and mechanised methods improve oil extraction by 30-40%. But this is still less than the yield rate of 42-50% obtained by the big industries using mechanical and chemical technology. The most critical constraints faced by the local processors include the seasonality of the nuts, time conflict, lack of storage facilities and lack of capital. Shea trees fruit once in the year, lasting for three months during the rainy season, coinciding with the annual crop growing season (Kabiru et al 2017). Good storage facilities would help the collectors and the processors store the nuts for a relatively long-term and allow them to wait for the best-selling period. They also need funds to invest in the processing or storage equipment to get a higher income along the value chain. Transportation can sometimes be a constraint for traders. Most shea traders do not have access to the international market because of a lack of government assistance or the lengthy bureaucratic process of obtaining licences and certifications. The high cost of butter during the off-season is an additional challenge that industries face for shea processing and marketing (Kabiru et al 2017).

International CBE manufacturers rely on a complex pyramidal purchasing network established in colonial times because it is more profitable for them due to the low price paid to the farmers. The pyramidal trade comprises a small number of wholesalers, region-level traders, district-level retailers, and numerous municipal-level village traders who source shea directly from individual producers in the countryside and local markets (Rousseau et al 2015). Terms of purchase can be arbitrary and inequitable, and women's short-term financial needs during the hungry season put them in a position of being price takers (François et al 2009).

3.4. Weak governance, land and tree tenure

Traditionally, men would manage the land and own the woody species that were strong land tenure markers, while women would control shea production (Boffa 2015, Seghieri 2019). The land is communally owned with shea and other native trees, usually considered the property of tribal lineages. In contrast, trees with more valuable products such as *Parkia biglobosa* (Nere) can be individually owned in the same landscape. For some regions, a woman married into a founding lineage collects shea fruits from trees retained in the fields and fallows of her husband's lineage (Serpantie et al 1996, Lovett and Phillips 2018). As shea parklands have arboriculture characteristics, the trees they harbour are regulated by national policies, which generally do not integrate the above-mentioned local and customary rights. Consequently, implementing the policy related to parkland tree tenure or usufruct is complicated as it does disincentivise farmers from preserving and nurturing shea trees in their fields and more so for those who are not landowners, like the migrants.

Indeed, there are many restrictions originally intended to protect forest trees that are also applied to agroforestry parkland trees, including shea. In contrast, farmers are prevented from carrying out basic silvicultural practices such as pruning, thinning or coppicing, which are crucial in optimising their land-use systems. In most shea producing countries, shea is a protected tree species and Forest Codes prohibit cutting shea for fuelwood or charcoal production (Ministère de l'Environnement et du cadre de vie, Burkina Faso 2004; Ministère de l'Environnement, Mali 1998). Despite such regulations, illegal cutting is still common (FAO 2013, Lovett and Philips 2018) because it involves mature trees and not regeneration. The cutting ban often runs counter to adopting techniques for the rejuvenation of shea populations. If tree density is deemed too dense, field owners tend to pull up non-productive young trees, which are not targeted by legal texts, rather than cut older trees that may not be very productive (Elias 2015, FAO 2013, FAO and ICRAF 2019).

4. Outlooks for a sustainable and environmentally friendly shea tree crop development in Africa

Shea is important for the African economy, both as a commodity for export and in providing subsistence and various ecosystem services for local communities. It generates wealth and employment for a large number of people, especially women and youth (Bockel et al 2020, Pouliot 2012, Seghieri 2019). However, this can be optimised by addressing the critical issues regarding processing, marketing and improvement of shea parkland management and production that are still affecting the entire value chain of the shea sector, with various stakeholders playing different roles at various stages (Figure 8.3).

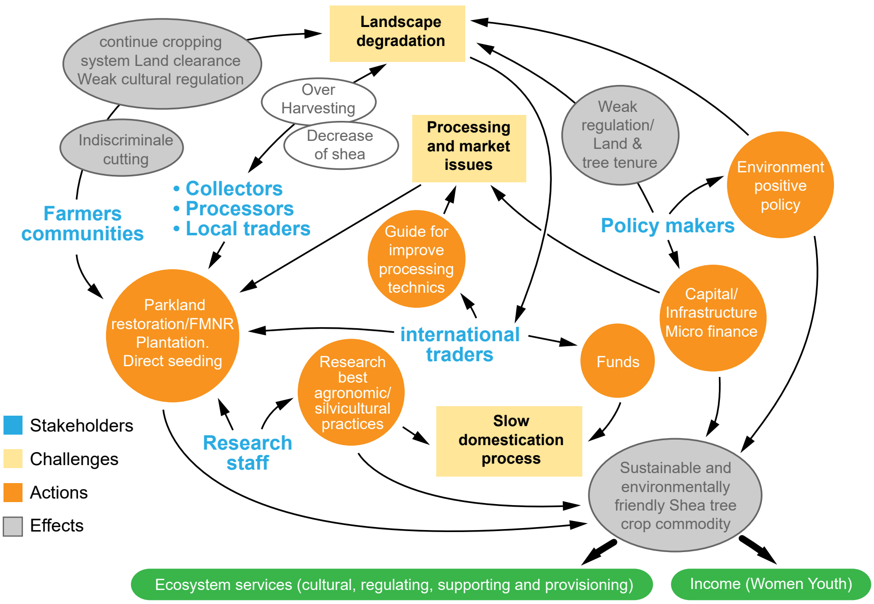

Figure 8.3: *Outlook diagram for shea as tree crop commodity*

4.1. Sustainable management of parklands for enhancing shea production

The core problem to be addressed is the decline of the shea tree population across the shea belt. This needs to be stopped through the involvement of various stakeholders, including village collectors and post-harvest processors of kernels, local buyers, large-scale exporters of shea kernels and processors, small-scale entrepreneurs formulating cosmetics in Africa, external entrepreneurs or companies formulating cosmetics and edible products, farmers, extension services, research organisations. Addressing shea parkland degradation issues appears as a prerequisite for developing a sustainable sector. Indeed, a decline in the shea population is expected to lead to an overall degradation of vegetation cover, increased soil erosion, decreasing crop yields and loss of income for the most vulnerable groups, namely women and youth.

For sustainable planning and management of shea resources, it is important to first know the potential of the resource and estimate productivity in the distribution area (Masters 2002). However, the extensive range of the species associated with shea in the agroforestry parklands and the lack of reliable figures make estimating the total production of shea nuts difficult (Masters 2002, Lovett 2004). Estimates of shea tree frequency and relative densities exist for some areas but are not accurate for all distribution zones. Therefore, shea tree resource mapping and yield monitoring should be addressed in each country as a basis for effective planning and monitoring for sustainable resource management (Masters 2002). Such work could be done using modern GIS tools to identify shea individuals within the parklands.

Due to the decline of shea trees and a decrease in parklands in the suitable area (Allal et al 2011, Wardell et al 2022b), we investigated the impact of the last glacial maximum (LGM) and the considerable damage done to the health and sustainability of shea parklands over the last 10 years (Bockel et al 2020, Lovett and Phillips 2018), the restoration of shea parklands has become an urgent requirement. The depletion of parklands strongly affects every level of the shea value chain starting with nut collectors, women and youth. For shea nut collection and production at the village level, more labour and time is required to collect shea fruit than in the degraded parklands (Lovett and Phillips 2018).

Lovett and Phillips (2018) have presumed that 100 million ha of parklands need at least 5-10 shea trees per ha to be planted over the next 10 years. This is a total of 500 million to 1 billion seedlings, assuming that such a level of planting would be sufficient to supply domestic and export needs in the coming 10-20 years. As shea is usually associated with other tree species within parklands, the shea improvement strategy should seek to build upon existing parklands and tree management practices, integrating a landscape-wide approach (Bockel et al 2020). This approach combines various agroforestry practices and innovations such as Farmer Managed Natural Regeneration (FMNR), soil and water conservation techniques, and recent domestication results and genome work (Boffa 2015, Hale et al 2021). In the past 10 years, various studies carried on shea have led to a greater understanding of the genetic variability in shea populations (Allal et al 2011), mastering sexual propagation at nursery (Muhammad et al 2020), direct seeding on-farm using deep holes (Ky-Dembele et al 2022) and vegetative propagation through nursery plant grafting (Sanou et al 2004), *in-situ* plant grafting (Ky-Dembele et al 2020), and stem cuttings (Opuku-Ameyaw et al 2002). It is important to maintain or enhance biodiversity by combining all the results and adapting the regeneration techniques to the socio-ecological conditions. There is still a need for fast mass propagation using tissue culture in order to capture the genetic diversity of shea landscapes. Other studies regarding pruning (Bayala et al 2008) and fruiting (Aleza et al 2018, Lamien et al 2006, Kalinganire et al 2020) can be helpful for parkland management and advantageous interaction with annual crops (Bayala et al 2015).

4.2. Harvesting and processing

Shea collection, post-harvest processing, butter extraction and the first stages of commercialisation are still exclusively female activities. Indeed, shea commodity is a source of income for women who have traditionally collected, processed and used shea butter for many centuries, probably for millennia (Bello-Bravo et al 2015, Rousseau et al 2015, Wardell et al 2022a). As a traditional gender-selective crop, shea can provide women with means to improve their livelihoods, resulting in the promotion of rural development. Local value addition could be done through improved shea nut quality and lower resource use in the processing (labour, water, wood, etc.); hence, more sustainable, village-based shea butter processing (Bello-Bravo et al 2015, Lovett and Phillips 2018, Rousseau et al 2015). When women extract butter from shea nuts, they can generate more local value-addition than when they sell the unprocessed kernels. Therefore, adequate information is required on the quality standards demanded in the regional and international market places, what packaging opportunities exist, and how their direct access to finance can be facilitated (Bello-Bravo et al 2015), highlighting the importance of training. Thus, educating these women in improved processing techniques becomes a logical step in the value chain where education can potentially result in increased income for those at the beginning of a value chain. This could reduce resource use (labour, firewood and water) while improving the sustainability of a growing sector and subsequently increasing the availability of high-quality raw materials for stakeholders later in the value chain (Bello-Bravo et al 2015).

Other value chain constraints include seasonality and variability of tree fruiting, time conflicts with cropping activities, lack of storage facilities in terms of knowledge, warehouse and equipment to store nuts for an extended period of time, and indiscriminate cutting of shea trees for fuelwood and charcoal. In addition to those constraints, nut traders and processors are faced with the following: the scarcity of kernels to buy, poor infrastructure (electricity, roads, water) that increases shea processing and transportation cost, labour intensity, low technological input, instability of international markets and weak policy.

The governments of shea producing countries need to invest and assist shea value chain actors involved in nut gathering and processing by providing good infrastructure of water, roads, electricity and storage facilities. In addition, commercial banks and microfinance structures should facilitate loans to solve the majority of the problems concerning lack of affordable capital, business skills, storage facilities or low technology input. It is also important that stakeholders, particularly women and youth involved in shea nut harvesting and pre-processing, form functional cooperatives and associations that enable them to obtain loans and advocating to the local or national authorities. Although progression is evident in developing village-level processing technologies, access to appropriate improved processing technologies remains a primary need for producers across the shea zone (Kabiru et al 2017). This can be helpful for getting certification, which is becoming important for the international market. As in the tradition, local industries can also value other products of shea, the pulp, the shells and waste after processing for various needs, including medicine, construction or nutrition. Likewise, the harvesting and processing of the edible caterpillars could be improved for enhanced nutrition and income generation, especially for the most vulnerable women and youth.

4.3. Market development

Shea commodities are now attractive to markets across Europe, America, and Asia. The demand for shea products is expected to increase for the international market, and the local and regional markets as well. Even though the majority (90%) of processed shea butter goes to the food industry, the main driver of the increasing demand is for natural and organic cosmetics in the European market (CBI) and several local cosmetic companies established in Africa (Badini et al 2011, Iddrisu et al 2019). Most of the shea products are sold locally or in the regional market. A recurrent obstacle to product quality control and market development is the current lack of commonly accepted standards for shea nut quality. Traders rely on shea nuts from a widely dispersed supply network of individual collectors, who use many different storage methods, often unsound. Given low farm gate prices for shea nuts, farmers have little incentive to invest their time and labour in sound drying and storage practices, which ensure a higher-quality product (Masters 2002, Lovett 2015).

The industries that use shea products (nuts, butter) as raw materials to produce other products like soap, candies, food, cosmetics and pharmaceutical products are mostly established outside the shea countries. Marketing of shea butter as food oil and extensive cosmetic product lines based on shea butter are grown in numerous countries across the shea zone. With about 403,838,710 inhabitants (ECOWAS) in West Africa in Worldometer 2020, the region alone constitutes a large market to which more attention should be given to cope with the variability of the international market. Once supply and quality issues are addressed, it is easier to identify existing markets or create new markets for more direct access by the primary producers, with the facilitation of support organisations. In addition to the socio-economical value, shea parklands play a green role in ecosystem services, especially with the great potential for carbon sequestration that can be part of the market.

4.4. Policy issues

Within shea production countries, the current trend is increased privatisation and decentralisation under a more 'open' trade environment. As a result, the shea trade is liberalised and dominated by private, professional organisations with the support and guidance of the state or NGOs.

Furthermore, the African Continental Free Trade Area (AfCFTA) that started on January 1st, 2021, represents a decisive step towards the continent's long-held regional integration aspiration. However, policy interventions are needed to assist the shea value chain in coping with the many constraints regarding land and tree tenure, tree usufruct, infrastructure, capital, regulations at the national, regional and international levels in favour of shea sustainable management and production, as well as fair and equitable trading of shea products.

The land tenure issues must be addressed together with the tree because of the customary links between them to avoid past mistakes (Elias 2015, FAO 2013, FAO and ICRAF 2019). Incentives to rejuvenate and preserve trees must be integrated at the interface of farm-forest in landscape planning approaches for mosaic management, which consider the diverse and dynamic interests of all stakeholders to avoid losers (Herrmann et al 2020, Mansourian 2017). Among those, the potential losers are women, who must be capacitated to make their voices heard and take part in the decision making about land use planning in general, tree management and the shea value chain in particular (Elias and Arora-Jonsson 2017). In this quest, vibrant cooperatives will be critical both in terms of skills and financial abilities for these women and youth, as well as in terms of supporting their entrepreneurship either through the conventional value chain channel or the one supported by NGOs (Elias and Arora-Jonsson 2017). Trustful cooperatives will facilitate the establishment of public-private partnerships, which will help capacitate the actors on cooperative governance and quality shea processing, thus removing investment barriers while favouring direct sourcing and connecting the women with the buyers. Besides, there are also individuals, women in general, becoming strong entrepreneurs in exporting and locally processing shea products (Bup et al 2014).

5. Conclusions

Shea represents a great but challenging value chain, especially since the various steps are in the hands of many different actors, including village collectors and post-harvest processors, local buyers, large-scale exporters, small-scale entrepreneurs, external entrepreneurs or companies formulating cosmetics and edible products, and state vision and priorities. Nevertheless, shea has a massive potential for creating jobs, especially for the most vulnerable population, of women and youth, enhancing the resilience of numerous farmers operating in the large area of shea agroforestry parklands, the dominant agricultural farming system in the region of the shea belt. Shea appears as an exclusive opportunity in the region and a chance to promote women and the environment. Models for continuous farming that allow shea regeneration and shea parkland restoration are mostly needed. Additionally, conducive local, national and regional policies and regulations are necessary for tree management and conservation, market improvement, for critical changes, and favourable value gain. The recent partnerships between rural producers, national policymakers, the private sector and international industry must continue to translate into concrete improvements in the sustainable management of shea based parklands throughout Africa. Therefore, various and combined reforms are needed, including land and tree tenure and tree usufruct policy and regulation, finance, public and private sector involvement, germplasm improvement research, security issues, suitable technology development and transfer, and international market regulation. Shea is essential for the West African economy, both as a commodity for export and in providing subsistence for local communities, generating wealth and employment for a large number of people, especially women and youth.

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