

In collaboration with  
Archipel&Co and Regenopolis



# The Untapped Potential of Great Green Wall Value Chains: An Action Agenda to Scale Restoration in the Sahel

INSIGHT REPORT  
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# Foreword

Harnessing the potential of the Great Green Wall value chains is both a huge opportunity and a moral imperative.



**Nicole Schwab**  
Co-Head, Nature-Based Solutions;  
Executive Director, 1t.org

In a year of unprecedented heatwaves, wildfires and flooding across the world, the need to address the drivers of climate change and help the people most affected is becoming urgent. This is why the World Economic Forum's Trillion Trees initiative (1t.org) chose to back the African Union's Great Green Wall Initiative for the Sahara and Sahel. 1t.org was set up in support of the United Nations Decade on Ecosystem Restoration, with the vision of conserving, restoring and growing 1 trillion trees by 2030.

In the Sahel, landscape restoration has the potential to achieve environmental, biodiversity and carbon mitigation benefits, while boosting the resilience, welfare and food security of the population. This is crucial given that the people of the Sahel are predicted to be among those most affected by climate change while having made the least contribution to it.

Despite environmental and sociopolitical challenges, the African Union-led Great Green Wall Initiative can be held up as a beacon of hope for its bold vision to restore 100 million hectares across the continent. Designed to push back the encroaching Sahara Desert, the Great Green Wall is uniting countries

across the Sahel and inspiring restoration in Africa and the rest of the world.

To support this vision, 1t.org commissioned Archipel&Co and Regenopolis to undertake a study to identify the commercially viable tree-based value chains that have the greatest potential ecological and socioeconomic benefits. The study builds the business case for the restoration of non-timber forest product value chains in the Sahel and identifies vital levers to stimulate multistakeholder collaboration and action at scale.

The analysis and recommendations laid out in this report show the huge potential and multiple benefits of landscape restoration in the Sahel, and suggest clear avenues for the private sector to engage as part of multistakeholder partnerships that will advance the collective response to the escalating ecological and socioeconomic crises.

We hope this report will inspire you to engage with the opportunities highlighted throughout and that you will join us in building new models of development that arise from landscape restoration to deliver better livelihoods for all.

# Executive summary

Multistakeholder partnerships will support systemic value chain development that delivers environmental, social and economic benefits for the Great Green Wall.

## **An urgency to act, an opportunity to accelerate change**

The Sahel is a region both of extreme challenges and significant opportunities. One of the poorest regions in the world, it is particularly vulnerable to its challenging environmental conditions, including an encroaching Sahara Desert, and drought and heatwaves from a rapidly changing climate, as well as political instability and violent extremism. Nevertheless, the Sahel is rich in natural resources, has a rapidly growing urban and middle-class population and is home to an innovative and young populace, enabling agile small and medium-sized enterprises (SMEs) to emerge.

In this context, there is both an opportunity and a need to harness commercially viable restoration to help take advantage of the Sahel's potential and address its challenges. Launched in 2017, the African Union-led Great Green Wall (GGW) Initiative for the Sahara and Sahel offers a vision of restoring 100 million hectares of land across the continent, from Senegal to Djibouti, and creating 10 million green jobs by 2030.

This report aims to provide the necessary fact base and insights to stimulate multistakeholder collaboration for accelerated, responsible landscape restoration linked to crucial non-timber forest product value chains that contribute to the vision and goals of the GGW.

The study, which draws on extensive data collection, including interviews with more than 100 stakeholders, focused on identifying the tree crop value chains with the greatest potential, understanding how they function, and identifying challenges, gaps and opportunities to achieve impact at scale through multistakeholder partnerships.

## **Leveraging markets for commercially viable restoration**

Based on the research, nine tree crop value chains at various stages of market development were prioritized for their environmental, social and market potential: African locust beans (*Parkia biglobosa*), African baobab (*Adansonia digitata*), balanites (*Balanites aegyptiaca*), the gum arabicas (*Acacia*

senegal [*Senegalia senegal*] and *Acacia seyal* [*Vachellia seyal*]), kinkeliba (*Combretum micranthum*), moringa (*Moringa oleifera*), shea (*Vitellaria paradoxa*) and tallow tree (*Detarium senegalense*).

These prioritized tree crops have strong environmental and social potential. They already provide environmental and social benefits within the Sahel, including increasing community resilience, food security and financial opportunities for women, as well as improving soil quality, supporting biodiversity and sequestering carbon. All nine tree crops are well adapted to Sahelian climatic conditions, require no fertilization nor watering (with the exception of moringa) and show resilience to climate change. A landscape approach to restoration would augment the environmental and social benefits of the tree crop value chains.

The Sahel provides local and international market-relevant products. However, despite a strong global personal care market estimated at \$240 billion per year, the Sahel is estimated to capture only \$5 billion in value (across all products) and, with the exception of shea, GGW oils currently have limited competitiveness in the natural cosmetic oil market due to quality and processing challenges and limited market demand. In the \$150 billion superfoods market, however, the selected GGW value chain products are already relatively competitive, although with comparatively higher production costs and low product awareness. In addition, despite the high potential for carbon finance, there are currently almost no natural resource carbon projects being implemented in the Sahel.

Nevertheless, with the right support and investment, the prioritized tree crops offer significant potential to capitalize on regional and international markets and deliver environmental and social impacts on the ground. Multistakeholder engagement and partnerships could accelerate and scale up the multiple social and ecological impact benefits of these restoration-focused value chains and unlock development finance and carbon finance for restoration and value chain development. These partnerships would build on the existing network of innovative local SMEs and emerging sector-wide support organizations that are already driving change within their respective value chains.

## Maximizing the potential of GGW value chains

To overcome the challenges and gaps identified, and scale the prioritized value chains to harness their full potential for environmental, social and carbon impacts, this report recommends the following actions:

1. **Strengthen the enabling environment:** to help address the complexity of the political, regulatory and business environment in the Sahel, strengthen and streamline GGW governance and participatory processes, facilitate access to finance for SMEs, and overcome market-entry barriers to international markets arising from complex standards and regulations.
2. **Empower and strengthen GGW supply:** to structure markets to enable consistent, quality supply at more competitive prices, invest in research and development (R&D) to demonstrate GGW value chains' beneficial attributes, support the development of a critical mass of SMEs, support partnerships between SMEs and product buyers ("off-takers") to build capacity, and accelerate technology and innovation.

3. **Generate demand and build awareness of GGW products:** to improve local value generation for SMEs and communities, help to build demand through awareness creation and the development of a GGW brand, and support local SMEs to devise their own individual brands.
4. **Develop new revenue streams based on carbon market opportunities:** to harness the potential of carbon finance for the Sahel, facilitate the development of GGW carbon sequestration projects, which would require: assessing current carbon stocks; building SME technical capacity; reducing certification costs by bundling multiple carbon projects; and improving value by harnessing technology for monitoring, reporting and verification (MRV) to improve transparency and quality.

### An agenda for multistakeholder action

This report proposes a strategic action agenda to mobilize and engage actors at every level in support of a landscape approach to tree crop value chain development that accelerates commercially viable land restoration in the GGW. The proposed approach is community-focused, mobilizing multistakeholder action from public, private and civil society actors at the local, national and international level, while ensuring that local SMEs and entrepreneurs remain at its centre.

# Acronyms

<b>CAGR</b>	compound annual growth rate
<b>CBO</b>	community-based organization
<b>COVID-19</b>	coronavirus disease
<b>DFI</b>	development finance institution
<b>EU</b>	European Union
<b>EU NFR</b>	European Union Novel Food Regulation
<b>GDP</b>	gross domestic product
<b>GGW</b>	Great Green Wall Initiative for the Sahara and Sahel
<b>GRAS</b>	generally recognized as safe – USFDA
<b>IECIC</b>	Inventory of Existing Cosmetic Ingredients in China
<b>MRV</b>	monitoring, reporting and verification
<b>NGO</b>	non-governmental organization
<b>NTFP</b>	non-timber forest products
<b>OECD</b>	Organisation for Economic Co-operation and Development
<b>PAGGW</b>	Pan-African Agency of the Great Green Wall for the Sahara and Sahel Initiative
<b>R&amp;D</b>	research and development
<b>SADC</b>	Southern African Development Community
<b>SME</b>	small and medium-sized enterprises
<b>UNCCD</b>	United Nations Convention to Combat Desertification
<b>UNFCCC</b>	United Nations Framework Convention on Climate Change
<b>USFDA</b>	United States Food and Drug Administration
<b>WTO</b>	World Trade Organization

# 1 An urgency to act, an opportunity to accelerate change

Despite a challenging context, innovative SMEs and high-potential tree crop value chains are ready to deliver landscape restoration in the Sahel.



The Sahel is one of the poorest regions in the world, ranking the lowest on the Human Development Index<sup>1</sup> and prone to political instability and violent extremism.<sup>2</sup> It is on the front lines of climate change, with persistent droughts, food insecurity and conflicts over dwindling natural resources resulting in mass migration across Africa, Europe and beyond.<sup>3</sup>

Market-based solutions that address the Sahel's socioeconomic reality and its ecological vulnerability to climate change are urgently needed. In this context, the successful engagement of the

private sector in commercially viable, socially and ecologically responsible restoration efforts constitutes a major opportunity to deliver restoration at scale while providing additional livelihood opportunities.

This report aims to provide the necessary fact base and insights to stimulate multistakeholder collaboration for accelerated, responsible landscape restoration linked to crucial non-timber forest product (NTFP) value chains that contribute to the vision and goals of the Great Green Wall (GGW) Initiative for the Sahara and Sahel.

↓ Credit: Tree Aid



## 1.1 The GGW: a historic opportunity to drive change

Launched in 2007, the GGW is the African Union's flagship initiative to restore a green belt across the width of Africa to combat desertification. Initially focused on tree-planting, the GGW has shifted to become a comprehensive integrated ecosystem management and rural development initiative to combat land degradation and desertification and fight poverty.<sup>4</sup> By 2030, the GGW aims to restore 100 million hectares of currently degraded land, sequester 250 million tonnes of carbon and create 10 million rural jobs.

The GGW brings together 11 Saharan-Saharan countries (Burkina Faso, Chad, Djibouti, Eritrea, Ethiopia, Mali, Mauritania, Niger, Nigeria, Senegal and Sudan) and 10 international partners under

the leadership of the African Union Commission and the Pan-African Agency of the Great Green Wall for the Sahara and Sahel Initiative (PAGGW). The GGW countries are committed to turning their natural assets – a young population and abundant natural resources – into levers for sustainable development.

As of June 2022, more than \$19 billion<sup>5</sup> had been pledged to support the GGW. Finance continues to be mobilized, with increasing participation from the private sector. However, despite growing global support and the enormous potential for positive change, realizing the objectives of the GGW has been challenging to date; in part, this is due to the complex ecological and socioeconomic environment.





## 1.2 Ecological and socioeconomic context

↑ Credit: Sahara Sahel Foods

Despite a growing middle class, nearly 50% of the Sahel's more than 450 million people<sup>6</sup> live in extreme poverty.<sup>7</sup> In addition, the Sahel is home to a young population expected to more than double by 2050, with approximately two-thirds of people under the age of 25.<sup>8</sup> Political instability and state capacity challenges have allowed militant groups to prevail and expand. Over the past decade, there have been several military coups (in Chad and Mali in 2021, and in Burkina Faso in 2022), and an increasing number of deadly jihadist attacks in the region (Mali, Niger and Burkina Faso).<sup>9</sup> Corruption and suboptimal fiscal and tax policy further exacerbate poverty and inequality and limit public and private investment and economic growth.<sup>10</sup> Increased social tensions related to internal and cross-border displacement (due to climate hazards and violence), and conflicts between farmers and nomadic pastoralists over lack of water and fertile soils, further impede development.

Nomadic and agricultural people compete for resources within the Sahel, with overlapping claims and rising conflicts (e.g. livestock feeding versus farming). This is an evolving challenge, with nomadic people increasingly settling, reducing the success of past solutions, such as transhumance corridors.<sup>11</sup> These conflicts are further complicated by insecure forest and land tenure rights, and this uncertainty constrains the sustainable management and use of natural resources. Additionally, a lack of clear regulations governing local communities' access to communal spaces – and the rights and responsibilities of community members in these areas – poses a significant constraint for private-sector investment and conservation-restoration projects.

Agriculture is the primary sector in the Sahel (40% of GDP) and employs up to 60% of the population.<sup>12</sup> Farming is predominantly seasonal

and family- or community-run, limiting intensive commercial farming opportunities and generating a fragmented ecosystem of multiple small farmers and collectors. Although complex, this has created a farmer-to-farmer agroecological approach that has improved livelihoods, increased agricultural productivity, decreased soil erosion and improved water management in the region.<sup>13</sup>

Given the Sahel's semi-arid and challenging farming conditions, farmers use a variety of innovative planting and irrigation methods to adapt to seasonal variations in temperature and rainfall.<sup>14</sup> Nevertheless, the sector is highly vulnerable to extreme weather events that regularly lead to widespread crop failure and reliance on food assistance programmes, and with temperature increases in the area already one-and-a-half times higher than the global average, the region will be extremely vulnerable to climate change.<sup>15</sup>

The impact of climate change is expected to further exacerbate declining crop yields and water scarcity. To mitigate these effects, a number of non-governmental organizations (NGOs) and small and medium-sized enterprises (SMEs) are addressing the main drivers of deforestation (animal grazing and firewood) by providing improved ovens, charcoal substitutes and alternate sources of energy.<sup>16</sup>

Despite the challenging conditions, Sahelian countries have the agro-ecological climatic conditions to grow a broad range of tree crops with high socioeconomic and environmental potential. Moreover, in a context where local communities, farmers and pastoralists play a decisive role in land preservation (and degradation), non-timber forest products from tree crops are ideally placed to contribute to employment opportunities, raise household incomes and provide significant medicinal and nutritional benefits.

“ Sahelian countries have the agro-ecological climatic conditions to grow a broad range of tree crops with high socioeconomic and environmental potential.

“Distributors and off-takers, primarily in the food and cosmetics industries, are already expanding their product and ingredient range to include Sahelian high-potential tree crops that fit the needs of fast-growing and high-value markets.

Local communities are central to managing agroforestry resources independently or through NGOs and SMEs, as well as occasionally through product buyer (“off-taker”) programmes.<sup>17</sup> Village cooperatives collect raw materials using limited means, depending on seasonality and economic opportunities, with women accounting for more than 70% of the workforce responsible for harvesting, informal production and local distribution of many Sahelian tree crops.<sup>18</sup> As a result, increasing productivity within these value chains has the potential to improve livelihoods and food security, and could help encourage gender equality in the region provided projects are designed in such a way as to ensure revenues flow back to women.

Local demand for agriculture-based products is also changing due to a rising population, rapid urbanization and increasing incomes. Urbanization in the Sahel is among the highest in the world, with an expected annual growth rate of 3.75% between 2025 and 2030.<sup>19</sup> Alongside urbanization, although most people still face poverty, the sub-Saharan African middle class is forecast to grow by more than 70% by 2030, boosting household consumption and spending on discretionary goods and services, as well as necessities, including food, cosmetics and wellness products that are derived from NTFPs.

This projected growth in regional demand is accompanied by a nascent international market for

Sahelian NTFPs, where distributors and off-takers, primarily in the food and cosmetics industries, are already expanding their product and ingredient range to include Sahelian high-potential tree crops that fit the needs of fast-growing and high-value markets, notably plant-based foods, superfoods and natural cosmetics.

In response, agile SMEs are emerging across the region, tapping into modern technologies to succeed and expand into marketing, processing and retailing. However, most GGW SMEs are small and vulnerable: they operate using small sales margins and their average revenue is below \$500,000, with some “champions” reaching \$1 million. Therefore, they have limited access to working capital and loan financing and are highly dependent on their international clients. Some committed entrepreneurs engage local communities to encourage local development while expanding their businesses.

Nevertheless, SMEs are constrained in their ability to grow and thus often cannot play such a role. Furthermore, despite their importance, international funders and other established organizations associated with the GGW often overlook the critical role of SMEs as leading partners in achieving the land restoration vision of the GGW, resulting in them not generally being included in support mechanisms for the GGW.

## 1.3 Purpose of this report

This report sets out to identify the tree crop value chains with the highest potential to provide landscape and soil restoration benefits through market-based incentives in the Sahel. It identifies the levers necessary to scale them, and establishes the business case for multistakeholder partnerships (including SMEs and the private sector) to accelerate socially and ecologically responsible restoration efforts in the Sahel as part of value chain development and enhancement.

The report relied on a two-phase approach, starting with the selection of tree crops and associated value chains with the highest potential – based on an analysis of more than 100 indicators – across the following areas: international market potential, regional/national market potential, environmental potential and socioeconomic impact potential. Nine tree crops were prioritized, with four having the greatest potential. These were taken to a second phase that involved an analysis of gaps and opportunities along the selected value chains.

In this second phase, an additional analysis was conducted on the potential for carbon sequestration as a complementary source of financing.

Data sources included extensive primary data collection through interviews across the value chains (from SMEs in five Sahelian countries to distributors, international off-takers and international organizations), as well as interviews with environmental experts and other key stakeholders. This was complemented through desk research and secondary data sources. The methodology is presented in the Annex.

Section 2 presents the findings on the prioritized tree crops and their associated value chains. Section 3 lays out recommendations on the main levers to maximize the potential of these value chains for restoration in the Sahel. Section 4 concludes by providing a multistakeholder action plan for socially and ecologically responsible GGW restoration.

2

# Leveraging markets for commercially viable restoration

Products derived from GGW tree crops that deliver ecological and socioeconomic benefits show great potential to compete in the personal care and superfood markets.

↓ Credit: Aduna



Of the 20 tree crops shortlisted for their land restoration, socioeconomic and market potential, nine were prioritized for their contribution to a resilient socioecological system in the Sahel. These were classified into three subcategories:

1. **Structured tree crop value chains:** shea (*Vitellaria paradoxa*) and the gum arabicas (*Acacia senegal* [*Senegalia senegal*] and *Acacia seyal* [*Vachellia seyal*]) have highly structured value chains backed by significant sector support organizations such as the Global Shea Alliance. These crops already benefit from more than \$100 million in exports, a strong concentration of international off-takers, high levels of community-based organizations (CBOs), SME traders and manufacturers and more than 5 million individuals in the value chain. However, they share a need for improved local value distribution.
2. **Emerging tree crop value chains:** African baobab (*Adansonia digitata*), balanites (*Balanites aegyptiaca*) and moringa (*Moringa oleifera*) have high-impact value chains with considerable potential for social, economic and ecological impact. With less than \$10 million in exports, they have some existing international demand and competitive markets, established local consumption, existing SMEs, manufacturers and brands, as well as the capacity to increase production from existing forest landscape resources. They share a need for further value-chain structuring and awareness-raising.
3. **Unmarketed tree crop value chains:** kinkeliba (*Combretum micranthum*), African locust beans (*Parkia biglobosa*) and tallow tree (*Detarium Senegalense*) have value chains that are well developed locally, with high local consumption and partially organized markets. However, there is limited transformation to packaged products, few brands and scarcely any or no exports.

↓ Credit: Tree Aid



## 2.1 Environmental and socioeconomic potential

“ The selected value chains support local food security, income generation and employment, with baobab, moringa and tallow tree showing the greatest potential.

Table 1 presents select environmental and socioeconomic indicators for the nine prioritized value chains.

**Environmental potential:** all of the prioritized tree crops can adapt to Sahelian climatic conditions and show resilience to climate change. While none of them contributes to nitrogen fixation, they all have medium-to-high carbon sequestration potential, provide nutrients for pollinators and, apart from shea, offer microhabitats that support biodiversity in the region. They require no pesticides and few or no fertilizers, and grow and produce under natural conditions, largely through self-propagation (except moringa, which requires irrigation during planting and

for intensive production). A landscape approach that supports various value chains in mixed agroforestry systems would yield compounded environmental benefits, particularly for soil fertility and quality.

**Socioeconomic impact:** the selected value chains support local food security, income generation and employment, with baobab, moringa and tallow tree showing the greatest potential. In addition, except for gum arabica, the value chains entail strong participation from women. However, shea and gum arabica are not generally used as a local food source and have low levels of value-addition (most products are not transformed before sale) and low corresponding revenues per hectare.

TABLE 1 | Overview of prioritized tree crop characteristics

	Acacia senegal	Acacia seyal	Balanites	Baobab	Kinkeliba	Locust beans	Moringa	Shea	Tallow tree
Seasonality	Gum: Nov–May	Gum: Nov–May	Fruit: Nov–Jan	Leaves: Sep–Oct / Fruit: Dec–Jan	Leaves: Nov–Dec	Pods: Jun–Sep	All year with irrigation	Nuts: May–Aug	Fruit: Oct–Jan
Rainfall/water needed to grow and produce (mm/year)	200–600	200–600	200–600	200–600	200–600	600–800	400–1,000	600–800	200–600
Bioclimatic type	Saharo Sahelian	Saharo Sahelian	Saharo Sahelian	Sahelian	Sahelian	Sahelo Sudanian	Sahelian	Sahelo Sudanian	Sahelo Sudanian
Adaptability to drought and heatwaves	+++	+++	+++	+++	+++	+++	++	++	+++
Adaptability to significantly more rainfall	++	++	+++	+++	+++	ND	–	+++	+++
Tree density observed in agricultural landscapes (trees/ha)	500	100	10	80	200	15	5,000*	28	58
Soil health	+++	+++	+	+	+	+++	+	+	+++
Carbon sequestration	++	+	++	++	+	+	++*	++	+
Biodiversity (microhabitat)	+++	+	++	+++	++	+	++	+	+
Estimated current annual revenues for local communities** (\$/ha)	\$100	\$10	\$70	\$5,100	\$2,500	\$550	\$15,200	\$120	\$5,600
Employment potential from harvest and transformation** (person days/ha/year)	15	10	25	100	40	30	500	35	1,510
Nutritional local use	+	+	++	+++	++	++	+++	+	++
Pharmacopoeia local use	+	+	++	+++	++	++	+++	++	++
Gender (women’s involvement)	+	+++	+++	+++	++	+++	+++	+++	++

**Note:** Adaptation/benefit: + some, ++ moderate, +++ strong, – negative impact, ND no data.

\* Moringa is an introduced species. This figure estimates tree density in an integrated mixed-agroforestry system.<sup>20</sup>

\*\* Local community revenues and jobs were estimated by experts in Senegal and Burkina Faso working with CBOs based on the estimated number of trees per hectare, harvest volumes (and corresponding volumes of products: fruit, leaves, seeds etc.) at local prices for non-transformed (bulk) and transformed products (by CBOs), and the number of people harvesting and transforming these products (e.g. extracting oils from seeds or producing powders).

**Source:** Data collated from expert interviews and specialized websites (refer to Annex)

The detailed environmental, social and market analysis undertaken for the 20 initially selected tree species is available upon request from [1t@weforum.org](mailto:1t@weforum.org).

## 2.2 Competitiveness and market potential

A lack of robust baseline data on the number of trees, production levels and export volumes and values from GGW countries makes it difficult to accurately quantify the market potential of the prioritized value chains. Except for shea and gum arabica, few market studies have been conducted at the regional level. However, functionalities and pricing trends in leading markets allow some

conclusions to be drawn on the value chains with the greatest potential.

Based on the medicinal and nutritional properties of the prioritized tree crop value chains (Table 2), the personal care and superfood markets are of most interest.

TABLE 2 Properties of prioritized tree crop value chains

Tree	Value chain	Sector	Properties
Acacias	Gum arabica	Superfood Food	Commonly used in some food and pharmaceutical industries as an emulsifier, thickener and stabilizer
Balanites	Oil	Personal care Food	Known for its emollient, regenerating and nourishing properties Rich in antioxidants Maintains skin hydration
Baobab	Oil Powder	Superfood Superfood	Antioxidant, anti-inflammatory, rich in fibre, moisturizing Promotes wound-healing and rejuvenates skin cells Promotes digestive health, balances blood sugar levels
Kinkeliba	Leaves	Superfood Food	Antioxidant, anti-inflammatory, diuretic, digestive aid
Locust beans	Seeds	Food	Nutritionally useful ingredient
Moringa	Oil Leaf powder Dried leaves	Personal care Superfood Superfood	Antioxidant, anti-inflammatory Moisturizer that can be used as a cleansing agent Antioxidant, anti-inflammatory, highly nutritious May lower blood glucose levels
Shea	Butter	Personal care Food	Antioxidant, anti-inflammatory, antifungal Treats acne, psoriasis, eczema and other skin disorders Boosts collagen production, promotes cell regeneration and lessens sun damage
Tallow tree	Juice	Food	Local drink highly popular for its taste and vitamin C content

Source: Derived from literature review, and expert interviews (industry and agroforestry farmers)

### The personal care market

The personal care market is estimated globally at \$240 billion, with 70% of sales attributed to skincare and the remainder to haircare. The market has been growing at a compound annual growth rate (CAGR) of 4.5% globally (2007–2019 average).<sup>21</sup> The cosmetic sector offers the highest gross profit margin (58% plus) of all retail sectors.<sup>22</sup>

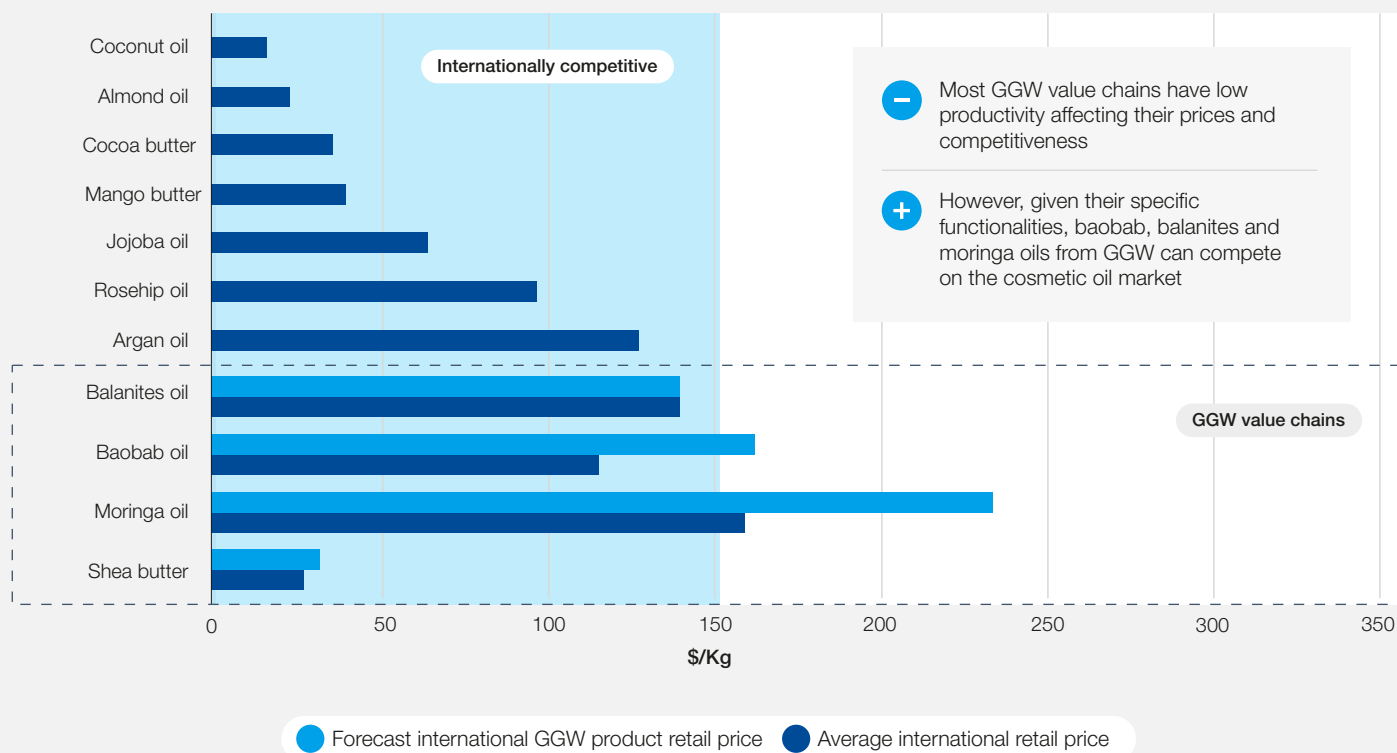
The sub-Saharan cosmetic market is estimated at approximately \$10–20 billion (excluding South Africa, which accounts for approximately 3% of the global market), of which the Sahel is worth as much as \$5 billion (\$1 billion in Senegal alone), with significant growth estimated at 8–10% per year.<sup>23</sup> Additionally, increasing consumer demand for cosmetics and toiletries that avoid chemicals is expected to fuel market growth and provide opportunities for suppliers in GGW countries.

Oil from plant seeds and leaves is the primary extract developed by SMEs and CBOs in the GGW.

However, GGW oils face competition from other natural oils in international markets (such as argan, rosehip or jojoba oils), and from the same oils produced in other regions.

Compared to current average global retail cosmetic oil prices (Figure 1), most GGW retail prices are not very competitive. Prices are significantly higher for moringa (with Asia accounting for 50% of global exports) and baobab (with the Southern African Development Community accounting for more than 80% of exports). Only balanites and shea are relatively competitive. However, balanites oil is mainly sold in domestic and traditional markets with limited quality standards. Its limited productivity, and the need for SMEs to industrialize the transformation process, have so far prevented balanites oil from entering international markets. Nevertheless, its high-end properties, especially its light texture, mean that it has potential in the cosmetic market.

FIGURE 1 | Cosmetic oils – competitiveness analysis based on international market retail prices



**Source:** Analysis of average international retail price on e-commerce platforms and/or potential export prices based on local prices and additional costs of bringing products to international markets (e.g. transport, marketing etc.)

TABLE 3 | Competitiveness gap for identified GGW oils/butter (international markets)

	Competitiveness with competing products	Competitiveness with other regions producing same product	Market potential	Differentiation
<b>Baobab oil</b>	Can be competitive	Prices in GGW 40% higher vs. SADC oil	++	Need for scientific evidence of properties (emollient, softening, regenerating and nourishing)
<b>Balanites oil</b>	Needs to be improved	Competitive	++	Need for scientific evidence of properties (light texture, regenerating, antioxidant, nourishing, haircare)
<b>Moringa oil</b>	Needs to be improved	Prices in GGW 45% higher vs. Indian oil	+++	Organic, lack of contamination
<b>Shea butter</b>	Competitive	Competitive	+++	Properties (skin moisturiser, haircare, anti-inflammatory, antioxidants, anti-ageing)

**Source:** Derived from literature review, and expert interviews (industry and agroforestry farmers)

## The food and superfood markets

The superfood market includes all fortified foods and products primarily eaten for their purported health benefits. This market is estimated globally at \$150 billion, with profit margins of approximately 30% for plant-based foods and 50–75% for superfoods (depending on market demand, supply costs and proprietary mixes). The superfood market is growing rapidly (with 7% annual growth expected over the next five years). North America accounted for 39% of total market revenue share in 2020, with increased health concerns in many populations following the COVID-19 pandemic and the growing interest in plant-based diets,<sup>25</sup> further supporting envisioned market growth. Consumer demand is particularly high for:

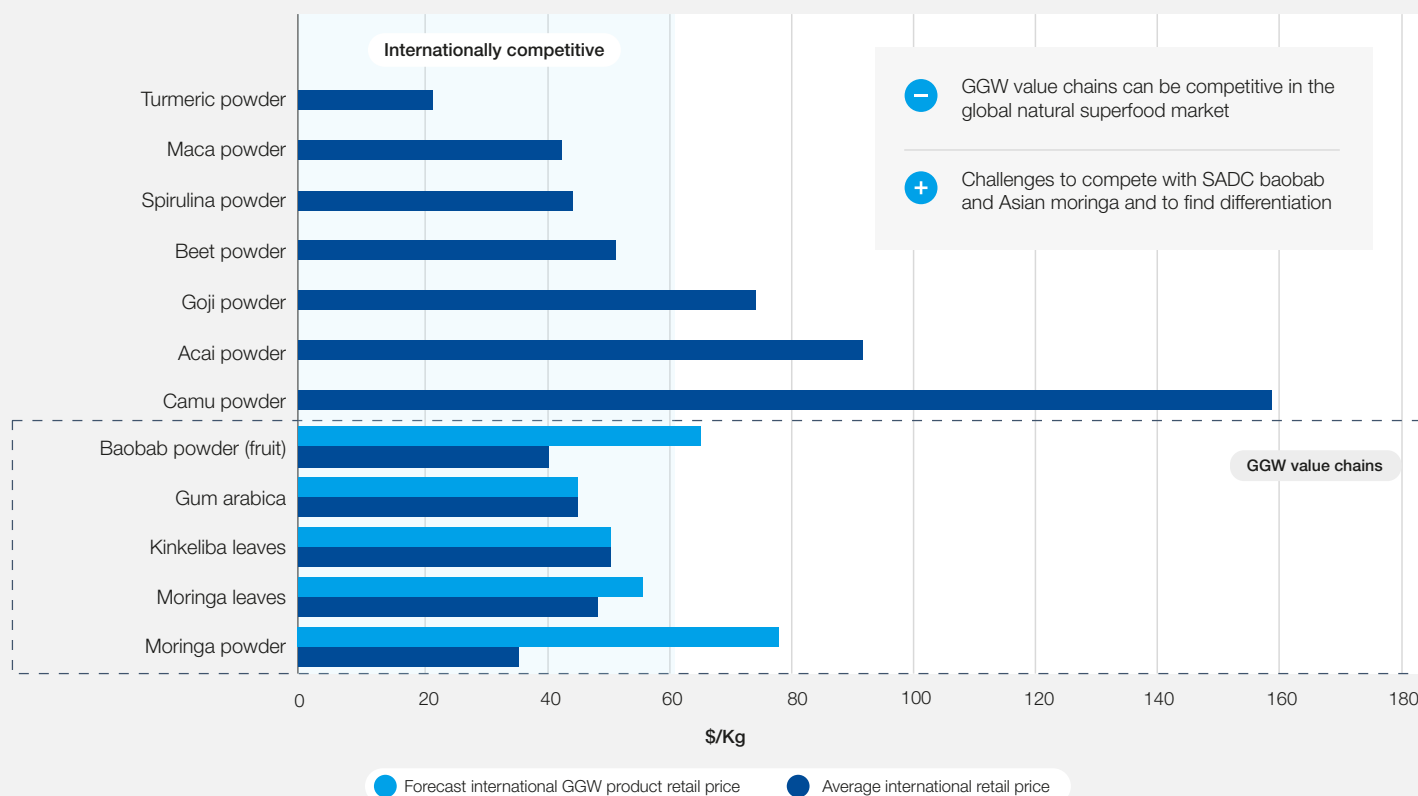
- Products with antioxidant properties; those that fight hypertension, weight control

and/or diabetes; those helping to reduce stress and boost immunity (10–15% annual growth)

- Organic products; plant-based foods; alternative formulations to avoid ingredients considered less desirable by consumers, such as synthetic molecules or animal-derived products (10–20% annual growth)
- Ethical products offering transparency, place of origin claims, social impact and/or environmental commitments (15% annual growth)<sup>26</sup>

GGW dried products, such as kinkeliba leaves, baobab fruit powder and moringa leaves, show exciting potential for competitiveness in a high-value-added global market (Figure 2).

FIGURE 2 Leaves and powder – competitiveness analysis based on international market retail prices



Source: Analysis of average international retail prices on e-commerce platforms and/or potential export prices based on local prices and additional costs of bringing products to international markets (e.g. transport, marketing etc.)

Moringa, baobab, gum arabica and kinkeliba could draw on their outstanding nutritional properties (high vitamin, mineral and antioxidant content) and health benefits (improved digestive health, weight loss support, blood sugar level management, anti-inflammatory and antibacterial properties, etc.) to compete in the booming superfood and dietary supplement markets (Table 4).

Nevertheless, the majority of tree crops (apart from moringa) lack scientific evidence demonstrating their beneficial properties, which would support their high-end cost positioning and ability to differentiate from competing superfood powders.



TABLE 4 | Competitiveness gap for identified GGW superfoods (international markets)

	Competitiveness with competing products	Competitiveness with other regions producing same product	Market growth potential	Differentiation
<b>Baobab powder</b>	Can be competitive	Prices in GGW 60% higher vs. SADC powder	+++	Need for scientific evidence of properties (boosts digestive health, aids weight loss, hypoglycaemic action, antioxidant, anti-inflammatory and antibacterial, etc.)
<b>Gum arabica</b>	Competitive	Competitive (only produced in the Sahel)	++	Properties (digestive health, prebiotic properties, gluten replacement, low calorific value, etc.)
<b>Kinkeliba leaves</b>	Can be competitive	Competitive	++	Need for scientific evidence of properties (anti-inflammatory, diuretic and digestive properties, fights against diabetes and obesity, etc.)
<b>Moringa powder</b>	Competitive	Prices in GGW 120% higher vs. Asian powder	++	Need for scientific evidence of properties in Sahel context/organic/quality
<b>Moringa leaves</b>	Competitive	Competitive	+++	Need for scientific evidence of properties in Sahel context/organic/quality

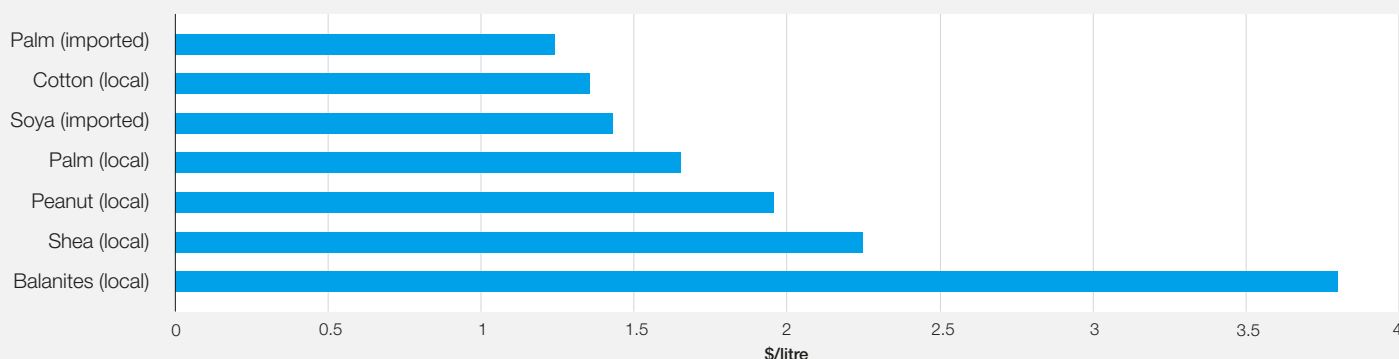
Source: Derived from literature review and expert interviews (industry and agroforestry farmers)

“ The international context of price inflation and potential supply disruption of more traditional oils could favour the emergence of new, locally produced cooking oils to replace imported oils in the Sahel and Africa.

In addition to the superfood market, GGW oils may compete in local and/or international cooking and edible oil markets (as is already the case for shea butter). The growing international demand for cooking oils fortified with vitamins and other micronutrients (for example, fat-soluble nutrients) coupled with the increased awareness of sustainable production are potential market drivers for cooking oils derived from GGW tree crops (e.g. balanites oil is reportedly rich in saturated fatty acids<sup>27</sup> and is traditionally consumed for its medicinal benefits). The international context of price inflation and potential supply disruption of more traditional oils, such as colza (rapeseed), due to the Ukraine war could also favour the emergence of new, locally produced cooking oils to replace imported oils in the Sahel and Africa.

However, the cooking oil market is highly competitive, driven by volumes and prices (Figure 3). At present, few GGW SMEs transform and sell balanites oil. In Burkina Faso, balanites oil is double the price of other cooking oils and therefore appeals to a limited segment of consumers. On the international market, edible oil prices vary significantly depending on their quality, taste and benefits. Very little scientific data exists showing evidence of potential for balanites, which would be a prerequisite for accessing international markets given its current price point. Technologically advanced manufacturing processes and significant R&D investments (refining, quality etc.) would be required to achieve competitiveness.

FIGURE 3 | Food oils – competitiveness analysis based on domestic market retail prices



Source: Analysis of domestic oil prices in Burkina Faso

## 2.3 Carbon finance restoration potential

Carbon has become a valuable economic commodity and offers an additional source of financing through the purchase of carbon credits by governments or corporates wanting to offset their emissions. However, current climate finance levels in Africa fall far short of requirements. Africa needs \$2.5 trillion in climate finance between 2020 and 2030 (an average of \$250 billion annually) to implement its Nationally Determined Contributions, whereas total annual climate finance flows to Africa for 2020 were only \$30 billion – approximately 12% of the amount needed.<sup>28</sup>

Given the level of investment needed and the current constraints on African public domestic resources, public funding alone will be insufficient to meet Africa's climate finance requirements. Carbon finance could therefore help close the gap by using private finance to contribute towards GGW countries' restoration commitments. However, there

are currently almost no natural resource carbon projects in the Sahel.

A number of barriers impede access to carbon finance in the Sahel. First, there are few studies on tree cover and carbon stocks, making it difficult to establish baseline carbon stocks or reliably estimate restoration and carbon sequestration potential.<sup>29</sup> Second, the dearth of natural resource carbon projects in the Sahel combined with existing capacity and financing challenges more broadly mean there are technical capacity challenges for SMEs and restoration actors to develop projects that could access carbon finance. Finally, the geography of the Sahel and political insecurity in the region increase the potential costs of developing and monitoring carbon projects. These barriers would therefore have to be addressed before carbon finance for restoration in the Sahel could be unlocked.

## 2.4 Tree crop value chain case studies

Based on the environmental and socioeconomic analysis, coupled with the assessment of competitiveness and market potential, four tree

crops and their respective value chains stand out: balanites, baobab, moringa and shea – details on each are presented in the following section.

↓ Credit: Tree Aid





CASE STUDY 1

**Balanites: products, properties, market, ecosystem**

**GGW balanites key figures**

Free on board (FOB) bulk price:

**\$25–\$35/l**  
for oil

Optimal potential revenues:

**\$70/tree/**  
year

Market size:

**< \$10**  
million

**Key markets:** EU,  
North America,  
Asia Pacific

Balanites (*Balanites aegyptiaca*), known as the “desert date”, is a medium-sized spiny tree widely distributed in dryland areas of Africa and parts of the Middle East. It is considered an important tree in semi-arid ecosystems due to its many beneficial attributes. The balanites tree grows abundantly in the GGW region without needing irrigation, fertilization or specific care, and requires six to 10 years to be productive. Despite being drought-tolerant, adaptable to different climatic conditions and fire-resistant, the tree is vulnerable to pests and human usage. The wood is commonly used for heating, while young plants and leaves are eaten by livestock and animals, and the fruits are widely consumed by local communities for their nutritional properties, leaving few seeds for natural regeneration.

**Single product with high-end properties**

Traditionally, balanites is used to treat various ailments (malaria, diabetes and cancer), and the seeds are consumed as a post-meal snack. The primary balanites-derived product is balanites oil. It is traditionally used for cooking, due to its similar composition to olive oil. As a transformed product, it is used for skin, body and haircare products due to its high-end emollient, regenerating, and nourishing properties. Such unique properties are yet to be scientifically validated, and further research is needed to explore its other potential uses (such as botanical extracts for food and cosmetic ingredients).

**High potential yet untapped value chain**

With few companies undertaking transformation locally due to the complexity of the extraction processes, the balanites value chain is underdeveloped, with local production estimated at less than \$10 million per year. A few cosmetic brands have already incorporated balanites in their active ingredients, particularly for its light texture and regenerative, antioxidant and nourishing properties. However, it remains a niche ingredient

largely unknown to Western consumers. The value chain is small and consists mostly of international SME ingredient companies, with few local SMEs producing oils that meet international standards due to complex processing requirements and low demand.

However, the increasing demand in personal care for natural products with additional health and cosmetic benefits – especially in Europe – creates high development potential for balanites over the coming years, particularly if its properties can be verified.

Although it is too expensive for local markets, given the global increase in raw material prices, balanites edible oil could also be promoted in the international food sector. Assuming that its taste meets consumers’ expectations, and its health benefits are verified, the oil could also be positioned internationally within high added-value markets. However, balanites as a food product currently lacks regulatory approval in key markets, such as the EU and North America, preventing sales opportunities.

**A growing industry**

The emerging balanites industry is at a very early stage of development and needs help from sector support organizations acting on behalf of producers to unlock finance and market opportunities. Following the model of other indigenous plant alliances, intermediary organizations could take the lead in securing regulatory approvals, researching properties, validating health benefits, improving the product transformation process and productivity, and opening markets through international trade fairs and consumer awareness campaigns.

As a result of increasing collaboration with researchers, brands and support organizations, such as the Institut Balanités in Senegal, the balanites industry has the potential to thrive and overcome its competitiveness challenge.



Credit: Aduna



## CASE STUDY 2

### Baobab: products, properties, market, ecosystem

#### GGW baobab key figures

Free on board (FOB) bulk price:

\$6–\$15/kg for powder

\$20–\$25/l for oil

Optimal potential revenues:

\$380/tree/year

Market size:

Global market: \$11 million

Key markets:

US, UK, Germany, France, Netherlands, Austria

Occurring in seasonally arid areas, the African baobab (*Adansonia digitata*) is present in all GGW countries (except Djibouti).<sup>30</sup> Due to its tolerance of various precipitation levels, it can be found across the continent, from the drier Sahel to the savannahs of southern Africa, and it demonstrates excellent environmental resilience. Its non-flammable bark means it is resistant to wildfires and is not used for heating, leaving it subject to fewer human pressures. However, baobab is vulnerable to animals, including livestock that graze on its roots, and elephants, which use the bark as a source of hydration when water is scarce.<sup>31</sup> Baobab saplings are propagated naturally and can then be wild-harvested and cultivated in agroforestry systems without fertilizer. The baobab is slow-growing, requiring 25 to 60 years before being productive, but can then remain productive for more than 1,000 years. Its deep roots offer high potential for below-ground carbon sequestration.

#### Outstanding yet-to-be-scientifically validated health benefits

Baobab offers a broad range of products, including fruit powder, oil (from its seeds) and powdered leaves. Baobab fruit powder is used locally in traditional beverages and for cooking and medicinal purposes. Internationally, it is deemed a “superfood” due to its antioxidant and anti-inflammatory properties, outstanding nutritional characteristics (vitamins C, B1, B2 and B6), and extensive health and prebiotic benefits (including promoting digestive health and balancing blood sugar levels).<sup>32</sup> Baobab oil is used in cosmetics for its moisturizing, healing and rejuvenating properties. Powdered leaves are used locally as a meal condiment, snack or binding agent. However, further peer-reviewed scientific studies are required to demonstrate baobab’s outstanding properties.

#### A promising but internationally underdeveloped value chain

Despite its high potential at the international level, baobab has an emerging, relatively unstructured value chain, and production remains low. Current production of powder and oil are estimated at approximately \$10 million and \$1 million

respectively.<sup>33</sup> In southern Africa, where baobab production is the most structured, more than 1,000 seasonal jobs have been created, and more than 50 SMEs are involved in the processing and value-addition of 4,000 metric tonnes of baobab fruit annually, including 726 tonnes of powder and 18 tonnes of oil.<sup>34</sup> On the other hand, the Sahel baobab value chain is in its very early stages, with substantial untapped potential for SMEs.

Although not yet mature, structuring of the baobab industry is under way. Its early development was boosted by sector support organizations, such as PhytoTrade, and more recently by the African Baobab Alliance. These organizations have played a crucial role in securing regulatory approval for baobab products to access vital global export markets, including the EU and North America (with the notable exception of China, largely due to the complexity of product registration).

In addition, wider awareness of baobab’s benefits is required to increase demand. A 2018 survey of UK consumers showed that only 23% had heard of baobab, and only 6% had tasted it.<sup>35</sup> Although a growing number of brands and ingredient companies are incorporating baobab into their products, the number doing so remains small. From 2013 to 2017, there was 53% annual growth in new food and beverage products containing baobab, with Europe accounting for 52% of new product launches and the US for 35%.<sup>36</sup> As a notable growth driver, some brands built entirely around baobab have emerged (such as Aduna in the UK, Baobab Foods in the US, Matahi in France and Baola in Germany).

The African Baobab Alliance is central to the promotion of a sustainable industry. It aims to increase baobab’s use in local and international markets, and support the adoption of a research agenda to validate baobab’s health benefits, and ensure its members (representing an estimated 70% of the baobab powder industry) adopt common quality practices and standards. Its long-term goals are to grow the baobab industry to annual revenues of \$1 billion, with 1 million rural African women benefitting, 10 million hectares of baobab woodland effectively conserved and managed, and 300 million tonnes of carbon sequestered.



### CASE STUDY 3

## Moringa: products, properties, market, ecosystem

### GGW Moringa key figures

Free on board (FOB) bulk price:

**\$10–\$20/kg**  
for powder

**\$40/litre**  
for oil

Optimal potential revenues:

**\$3/tree**  
/year

Market size:

Global market: **\$5.8 billion**

**Key markets:** Asia Pacific, Europe and the US

Moringa (*Moringa oleifera*) is a fast-growing deciduous tree native to the Indian subcontinent. It grows well in various climates, including the Sahel, where it has been present for over a century and is considered non-invasive. The tree grows exceptionally quickly and is productive six months after planting. Tolerant of drier climates and poor soil quality, it can be cultivated throughout the year with the addition of compost or manure in either monoculture systems – with potential negative impacts on biodiversity, environmental services and water use – or intercropping on private plots. These qualities equip moringa with a high carbon sequestration potential. Despite moringa’s ability to withstand arid and challenging conditions, it is fragile and requires attention, particularly under heavy rainfall conditions and during its initial period of development and growth. In addition, moringa requires watering during planting and an irrigation system to achieve high yields, which is a limiting factor in the semi-arid Sahelian climate.

#### Well-recognized health and nutritional properties

Moringa is one of the most nutrient-rich plants in the world, being a rich source of vitamins, calcium and iron, as well as antioxidants.<sup>37</sup> The three moringa-derived products currently marketed include dried leaves, powdered leaves and moringa oil. These products are well-known internationally, particularly moringa powder, which is deemed a superfood. All moringa-derived products have anti-inflammatory and antioxidant properties. The fruits and leaves are rich in protein, vitamins A, B and C, and minerals, while the leaves also contain calcium and iron. Moringa oil is also known for its anti-ageing properties and is high in protein and oleic acid (a monounsaturated fat beneficial for restoring the skin’s natural barrier to pollution). From a local perspective, the tree is often used in traditional regional dishes and is planted by households for family consumption.

#### High market development potential

Moringa-derived products have a substantial market size, estimated to be more than \$5.8

billion (2018) and a CAGR of 8.9% (2019–2025).<sup>38</sup> Demand for moringa is growing, especially in the US market, due to increasing consumption of dietary supplements and plant-based products, as well as growing awareness of the medicinal benefits of moringa-based products.

Most moringa production occurs in India and Thailand, with India accounting for approximately 80% of global moringa supply. Moringa production in the Sahel region is estimated at \$10 million for powder and \$1 million for oil. Considering its production complexity, processing would need to be improved at scale to meet international quality standards. Local SMEs would also need to emerge to increase the Sahel’s market share. Entrepreneurs could exploit the tree’s rapid growth to expand their business and further develop the as yet limited production of Sahelian moringa.

However, as moringa is not endemic to the Sahel, there are some competitiveness challenges, especially when it comes to pricing. Nevertheless, the Sahel may be able to capture some of the growing market as it has an advantage over Asian moringa, which is sometimes of poor quality and contaminated with heavy metals,<sup>39</sup> resulting in a failure to meet European market standards. This challenge provides a potential opportunity for GGW moringa to meet growing international demand, specifically when farmed naturally and without pesticides. In addition, investment in improved processing is required to deliver cost reductions and ensure that GGW products meet international quality requirements at scale.

#### A fragmented industry

Creating a sector support organization grouping together African moringa producers could be a vital success factor in structuring and advocating for the African moringa industry. Following the model of other indigenous plant federations, such an organization could play a central role in promoting common quality standards, exploring the broad range of potential uses for moringa products and representing moringa producers at international trade fairs.



## CASE STUDY 4

# Shea: products, properties, market, ecosystem

### GGW Shea key figures

Free on board (FOB) bulk price:

\$2–\$8/kg for butter

Optimal potential revenues:

\$20/tree/year

Market size:

< \$300 million export value in 2020

CAGR estimated at 14%/5 years

Key markets: EU, North America, Asia Pacific

Shea (*Vitellaria paradoxa*) is a deciduous tree that grows naturally in the dry savannah belt of Africa, stretching from Senegal to Sudan and South Sudan. The shea fruit consists of a thin, tart, nutritious pulp surrounding a relatively large, oil-rich seed from which shea butter is extracted.

Shea trees have a notable ability to sprout and germinate well naturally. However, shea is difficult to raise given its long roots and requires specialized and accurate techniques to manage reforestation projects. The tree takes approximately 11–20 years to become productive but can then remain so for up to 50 years. Shea is resistant to hydric stress<sup>40</sup> but is vulnerable to insects and has no resistance to wildfires. It should be noted that the local value of shea production strongly drives people’s incentives to protect the trees. In some countries, where the commercial value of the crop is not yet comparable to other trees, shea is a threatened species as the trees are often felled (the wood is used for building materials) and replaced by other higher income-generating trees.

#### Well-established products, mainly used as a commodity

Shea butter (the fat extracted from the shea tree nut) is a well-known product within the food and personal care sectors (85% and 15% of global exports, respectively).<sup>41</sup> Within personal care, the butter is widely used as a moisturizer, salve or lotion due to its antioxidant, anti-inflammatory and antifungal properties. It is used to treat various skin ailments, with strong potential for treating acne, psoriasis and eczema. Shea butter also boosts collagen production, promotes cell regeneration and protects against sun damage. It is widely used locally, with approximately 50% of production earmarked for the local market (primarily for skincare products and cooking). Although shea products do not display exceptional nutritional properties, they are often integrated into West African dishes. In the food industry internationally, shea butter is primarily used as a cocoa butter equivalent in the chocolate industry.

#### Structured value chains for local and global markets

With global shea nut exports estimated at \$100 million to \$300 million annually (800,000 tonnes of shea kernels), the shea industry is a major employer locally. Women in particular are involved in shea production: 16 million women living in rural communities in Africa collect fresh fruits and kernels for processing.<sup>42</sup> Nigeria and Mali are the largest producers of shea kernels in Africa. Shea value chains are highly structured, with a high concentration of important international players (e.g. AAK, Bunge Loders Crokiaan and Fuji Oil Europe),<sup>43</sup> and an increasing number of brands are emerging. However, approximately half of export production is still unprocessed, resulting in low value capture locally. In some countries, specific regulatory frameworks have been set up to encourage local transformation. For example, in Burkina Faso, the government is taxing shea nut exports to encourage the export of shea butter instead.<sup>44</sup>

The shea market is growing due to a rise in consumer spending power, especially in the domestic food and beverages and personal care product sectors, coupled with growing awareness of shea’s health benefits, its low cost, ability to remain solid at room temperature in warmer climates and its widespread usage in food products. The global transformed shea market is expected to reach \$2.9 billion annually by 2025.<sup>45</sup> Europe is the primary importer of shea products, purchasing approximately 300,000 tonnes a year, including 50,000–90,000 tonnes of shea butter. Shea’s export prices are highly dependent on international cocoa market prices, restraining local value creation and limiting negotiating power within the value chain.

New applications and products will need to be developed to create added value. Some innovations are already taking place (e.g. some SMEs are developing products using dried shea fruit pulp in the food sector). The Global Shea Alliance could play a vital role in exploring high-added-value applications and contributing to the further development of the shea industry, bringing more economic value to local communities.

3

# Maximizing the potential of GGW value chains

Action is needed to strengthen the enabling environment for GGW value chains, boost supply, generate demand and develop carbon finance.



Based on the analysis of ecological, socioeconomic and market potential outlined thus far, this section identifies important gaps and associated actions necessary to scale the prioritized value chains in the Sahel. The findings draw on extensive interviews as well as best practices from other regions/value chains.

The identified actions can be grouped into four areas:

1. Strengthen the enabling environment
2. Empower and strengthen GGW supply
3. Generate demand and build awareness of GGW products
4. Develop new revenue streams based on carbon market opportunities

## 3.1 Strengthen the enabling environment

The political, regulatory and business environment in the Sahel is complex and if not adequately addressed could hinder the success of commercially viable land restoration projects in agricultural value chains. The role of supranational and national governments, as well as international organizations and development finance institutions (DFIs),

is key to ensuring a conducive environment where businesses thrive and local communities participate in, and benefit from, value chain development. This entails actions to strengthen governance mechanisms and make them more participative, as well as to facilitate SME access to finance and international markets.

### Bolster governance

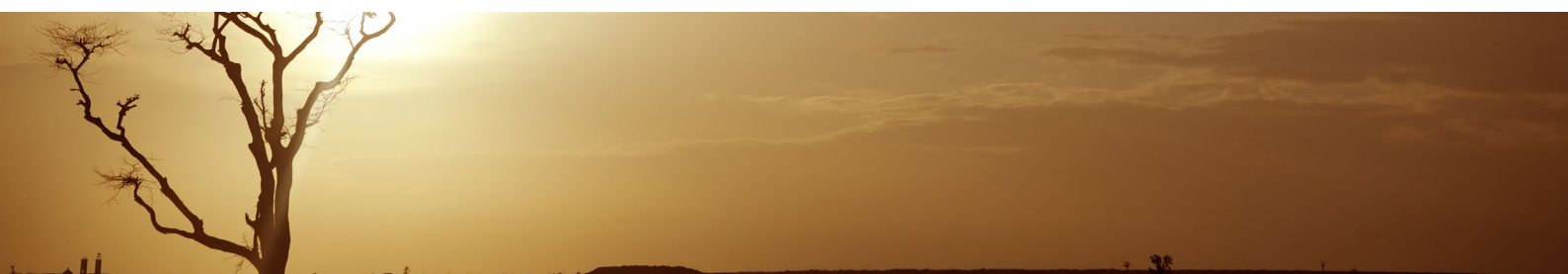
**Elevate the priority of GGW initiatives at the national level:** In the face of countries' conflicting priorities in terms of their political stability and economic development, the GGW is not perceived with the same sense of urgency and allotted the same importance by all. Governance of the GGW is not streamlined at the country level and is often subject to isolated approaches by different ministries. Oversight at the presidential or prime minister's level would facilitate coordination and fluidity among major stakeholders and ensure that GGW initiatives are not lost in administrative bureaucracy. Efforts should ensure the active participation of all relevant stakeholders (from SMEs to international off-takers and NGOs) to advance the regional agribusiness ecosystem in support of the GGW.

**Consider access to land:** Land ownership is an issue that goes beyond the GGW. Since the endorsement of the Voluntary Guidelines on the Responsible Governance of Tenure (VGGT) by the Member States of the Committee on World Food Security in 2012,<sup>46</sup> Sahelian countries have made commitments to abide by international conventions, including the need to promote an equitable, peaceful and decentralized approach to land tenure

management, acknowledging the legitimacy of grassroots communities and granting powers to them, as well as building capacity and transferring ownership over natural resources. As part of this, there is a need to consider the legitimate rights and interests of all stakeholders, especially those often excluded from land ownership (women, youth, pastoralists). In addition, there is a need to pay special attention to prevention and management of land tenure-related conflicts.

**Strengthen community participation and decision-making:** Local communities currently fail to capture the full benefits of GGW investments. To address this, national governments and the PAGGW have made it a priority to steer efforts towards increased community participation and local value transformation. Greater inclusion of communities is needed in decision-making across the design, operation and monitoring of partnerships with international off-takers and SMEs. This can be achieved by: building mechanisms for participation into partnership design; ensuring that project evaluation criteria include local ownership and benefit-sharing metrics; and providing technical assistance on community engagement to local and international stakeholders.

“ Greater inclusion of communities is needed in decision-making across the design, operation and monitoring of partnerships with international off-takers and SMEs.





## Improve access to finance

Access to finance remains a challenge and prevents local SMEs from expanding to meet domestic and international demand. SMEs need financing mostly for small capital expenditure or working capital requirements, which are well below the threshold of traditional investments. This makes it difficult for local commercial banks or DFIs to develop financial tools that fit SMEs' business reality. In addition, the agribusiness risk profile leads to high interest rates that may put small businesses at risk.

**Enable local banks and DFIs to widen the scope of instruments offered:** This entails: building agriculture risk assessment capacity with local

banks; enhancing DFI guarantee mechanisms to facilitate SME financing; and releasing funds to support smallholder farmers, as well as capacity-building with SMEs to bring them to a level of maturity that enables them to access finance.

### **Support SMEs to access and deploy financing:**

This means: providing capacity-building and business support to enable SMEs to progress towards maturity and bankability; facilitating access to international markets and long-term partnerships with international off-takers to encourage sourcing, innovation and investment in SMEs; and increasing the availability of digital financial services in rural areas.

↓ Credit: Serious Shea



## Overcome regulatory complexity

“ Although developed to ensure quality, improve benefit-sharing and mitigate risks, new standards and rules have also created market-entry barriers for GGW value chain stakeholders.

Many standards and rules have been established to regulate the export and import of new food or cosmetic products. Although developed to ensure quality, improve benefit-sharing and mitigate risks, they have also created market-entry barriers for GGW value chain stakeholders.

For example, the Nagoya Protocol, which has been ratified by almost all GGW countries,<sup>47</sup> seeks to regulate the use of genetic resources and associated traditional knowledge. Adherence to the protocol brings systematic complexity for stakeholders, who are required to align with the competent national authorities in each operating country, creating a potentially lengthy process to identify a country's contact point and understand the precise local requirements. As a result, only off-takers who work with well-established local suppliers can meet national and international standards and, while most actors working in the region have developed win-win partnerships with local SMEs that are in keeping with the protocol's

spirit of resource-sharing, many others have chosen not to invest. In addition, in some cases, adherence to the protocol requires SMEs to provide production and cost forecasts that are prohibitively time-consuming and expensive to create.

International import regulatory complexity can also be a barrier for value chain stakeholders, especially for novel tree crops whose products are not yet registered (Figure 4). In the Chinese cosmetic market, registration with the Inventory of Existing Cosmetic Ingredients in China (IECIC) is a mandatory requirement for many ingredient companies. United States Food and Drug Administration (USFDA) and European Novel Food Regulation (EU NFR) registration are also required to enter the respective North America and European Union markets. Registration can be complex and requires substantial investment (e.g. €300,000 [\$308,000] and two to three years to register a new product under the EU NFR).<sup>48</sup>

FIGURE 4 | GGW value chains and associated IECIC, EU and USFDA status

Tree crops		IECIC status*	EU status for food	USFDA status*
Acacias	– Gum arabica (ingredient)	✓	Food additive only	Dietary fibre
Balanites	– Oil	✓	✗	✗
Baobab	– Oil – Fruit extract, pulp extract – Leaves powder, leaf extract	✓	Novel food	✓*
Kinkeliba	– Leaves (tea)	✗	Novel food*	✗
Locust beans	– Seeds, seed powder (seasoning)	✗	Food additive only	✗
Moringa	– Oil – Dried leaves – Leaf powder (capsules, tea) – Seeds, cake	✓	Authorized	✗
Shea	– Butter (balm, lotion) – Fruit extract	✓	Authorized	✓
Tallow tree	– Fruit (juice, jam)	✗	✗	✗

\*Authorized for food and drink applications

**IECIC: China's list of cosmetic ingredients**

- The **Inventory of Existing Cosmetic Ingredients (IECIC)** is a list of ingredients that have been used in products manufactured and sold in China
- All ingredients excluded from this inventory are classified as "new ingredients" and are subject to regulatory action

**EU novel food status**

- Novel food is defined as food that had not been consumed to a significant degree by humans in the EU before 15 May 1997, when the first regulation on novel food came into force
- Novel food can be newly developed, innovative food or food produced using new technologies and production processes, as well as food that is or has been traditionally eaten outside of the EU
- The underlying principles underpinning novel food in the European Union are that they must be:
  - **Safe for consumers**
  - **Properly labelled, so as not to mislead consumers**
- Pre-market authorization of novel foods based on an evaluation in line with the above principles is necessary

**US Food and Drug Administration**

- The **United States Food and Drug Administration (FDA or USFDA)** is responsible for protecting and promoting public health through the control and supervision of food safety, dietary supplements, prescription and over-the-counter pharmaceutical drugs, biopharmaceuticals, medical devices, cosmetics, animal foods and feed, and veterinary products
- To market a new food or colour additive (or before using an additive already approved for one use in another manner not yet approved), **a manufacturer or other sponsor must first petition the FDA for its approval.** These petitions must provide evidence that the substance is safe for the ways in which it will be used

Source: Analysis based on EU Novel Foods, IECIC and USFDA

BOX 1

**Strengthen sector-wide organizations and programmes that can facilitate access to international export markets:** A trade association or programme to help GGW products meet

**PhytoTrade Africa: opening global markets for baobab**

PhytoTrade Africa is a membership-based trade association created in southern Africa in 2001. It aims to collate common efforts and funding needs among stakeholders working on similar indigenous plants and support them through a regional value chain approach. Acting on behalf of baobab producers, PhytoTrade played a vital role in securing regulatory approvals and

international regulatory requirements – such as the DFI-funded PhytoTrade Africa support to baobab (Box 1) – could ease access to export markets for local SMEs.

opening international markets, including EU NFR and USFDA generally recognized as safe (GRAS) statuses for baobab fruit powder in 2010. Having unlocked regulatory barriers, PhytoTrade attended international trade fairs on behalf of producers, led consumer awareness campaigns and encouraged scientific research validating baobab's benefits.

## 3.2 Empower and strengthen the GGW supply

Despite their high potential to meet growing national and international market demand, Sahel tree crop value chains lack the structured supply needed to facilitate and encourage off-takers, distributors and brands to invest. Investment is needed for R&D and to generate new income incentives, particularly for regional SMEs directly sourcing from CBOs and engaged in land restoration. Furthermore, except for shea and the gum arabicas, most value chain stakeholders lack precise data on sector potential. Overcoming

supply complexity is paramount. Some actors, such as value chain-related organizations, innovation funds and accelerator programmes, are building sector legitimacy through pragmatic solutions that could be scaled and/or accelerated. For example, Sud Expert Plantes' Développement Durable programme is facilitating networking and public-private partnerships between local and international actors to strengthen plant biodiversity through research, education and the support and promotion of African researchers.

“ Some 1.2 million young Sahelians enter the job market each year looking for employment and entrepreneurial opportunities. The agricultural sector provides significant potential to meet this demand.

### Enable the emergence of a critical mass of GGW SMEs

Given the complex business environment, only a few SMEs are working on the identified GGW value chains. There is therefore an urgent need to accelerate the emergence of a critical mass of organizations supporting GGW value chain development, including those engaging with CBOs, improving processes and establishing brands that promote local and international distribution.

**Offer at-scale accelerator programmes:** These would be used to encourage the development of national and international entrepreneurs looking to enter, innovate and promote GGW tree crop value chains, which are vital to boosting the GGW SME ecosystem. Accelerator programmes support project development, business-plan design and access to funding and client networks. They are also well positioned to connect entrepreneurs with their peers, mentors or companies that offer pro bono SME-relevant support (technical assistance and fundraising). For example, the Barka Fund works with incubators to support impactful climate

entrepreneurs building sustainable ventures by providing access to innovative working-capital funding and business mentoring. It employs a flexible lending approach that uses equity as collateral while allowing SMEs to buy back equity to build credit history.

**Encourage youth ecopreneurship:** Some 1.2 million young Sahelians enter the job market each year looking for employment and entrepreneurial opportunities. The agricultural sector provides significant potential to meet this demand.<sup>49</sup> According to the Organisation for Economic Co-operation and Development (OECD), the value of the G5 Sahel's food economy has more than doubled since 2010, and nearly 90% of expected job creation in the subregion by 2030 will be in this sector.<sup>50</sup> The young populations of the Sahel could be encouraged and supported to drive a new regenerative development model that prioritizes value creation through the restoration of degraded natural ecosystems while also benefiting the well-

### Foster partnerships to accelerate technology transfer and innovation

Sahelian agribusiness SMEs navigate a complex business environment. Limited access to investment and working capital at competitive interest rates, and the ineligibility of SMEs to access most investment funds,<sup>51</sup> restrict value chain development. In addition, SMEs avoid large inventory, resulting in short-term purchases and sourcing from local buying agents at higher and more volatile prices. As a result, few local SMEs have developed a large direct-sourcing network. This impedes traceability, as buying agents are not necessarily transparent regarding their sourcing. Traceability is already challenging because of the fragmented Sahelian value chains, weak land tenure and unpredictability of resource availability. While seasonality and associated tensions between communities (farmers and nomadic pastoralists), all within a context of financial scarcity, make sourcing standardized raw materials and steady volumes complex to manage.

To cope with this complexity, successful GGW SMEs build strong partnerships – primarily with international off-takers. These go beyond supply and provide the SMEs with financial and technical assistance. As a result, SMEs benefit from pre-financing,<sup>52</sup> which enables them in turn to pre-finance CBOs and farmers for resource collection. These tripartite partnerships strengthen SME sourcing capacity, provide steady resources for CBOs and address international companies' sustainable sourcing commitments by improving traceability. Off-takers buy transformed products, and thereby reduce their transport costs, as well as potentially reducing production and taxation costs.<sup>53</sup>

These win-win partnerships also result in innovation at multiple levels. Most domestic SMEs do not have the technical knowledge to produce the types and quality of high-value-added products



and extracts expected on international markets. The cost and complexity of acquiring the required technology from overseas and the subsequent need for technical assistance limits their capacity to upgrade production processes and innovate. International off-takers can play a crucial role in helping to address these barriers and have shown an interest in strengthening, co-investing and facilitating technology transfer to enable local SMEs and farmers to integrate production methods and innovate. Box 2 highlights examples of where this has been undertaken successfully.

**Promote SME/off-taker partnerships to accelerate collaborative innovation, transfer more value-add to local SMEs and communities and encourage local value chain integration and traceability:** This will support the level of innovation and R&D necessary to identify and market GGW value chain products successfully, while ensuring Sahel SMEs and communities benefit from their

full value. It entails promoting and funding joint innovation projects, and creating incentive systems to mitigate risks for ready-to-engage stakeholders, including employing blended funding opportunities.

**Strengthen sector-wide organizations that can represent industry players and combine efforts:** SMEs alone cannot develop the entire value chain, especially in such a complex and challenging environment. Organizations such as the Global Shea Alliance and the African Baobab Alliance have emerged as representatives of their respective value chain stakeholders. They play a catalytic role in unlocking opportunities for GGW value chains. Not only do they support the growth of resilient and sustainable supply chains, they open access to local and international markets, drive research to validate products' benefits and build capacity to meet international quality standards of production, as well as acting on the demand side to help increase market awareness.

## BOX 2 Examples of lasting SME/off-taker partnerships

### **Innovation and new value chain integration: baobab and gum arabica**

Nexira is developing a baobab value chain in Mali thanks to a successful partnership with local company Sodepam. Research conducted by Nexira found a complementarity of nutritional benefits between baobab powder and gum arabica. Based on its existing collaboration on gum arabica, Nexira trained Sodepam on baobab standardization and production, and helped it achieve an eco-cert certification for its baobab powder. In return, Sodepam sells its entire baobab production to Nexira, which pre-finances the raw material, allowing Sodepam to operate at scale during the harvesting season. Baobab is now part of Nexira's main prebiotic ingredient: inavea™ BAOBAB ACACIA.

### **Tripartite partnerships as a success factor for sustainable supply chains: balanites**

Pierre Fabre has developed a balanites supply chain in Senegal that encourages sustainable sourcing and local impact. Funds have been mobilized for multiple purposes (corporate social responsibility, sustainable sourcing and marketing) to build a partnership that includes: capacity-building and technical assistance to Baobab des Saveurs to support women harvesters; a scientific research partnership with Klorane Botanical Foundation and the Centre National de la Recherche Scientifique; and resource preservation programmes in partnership with the local GGW agency and Klorane Botanical Foundation.

“ For the most part, international off-takers and SMEs lack scientific data on the beneficial properties of GGW tree crop value chains.

## Demonstrate the properties of GGW value chain ingredients

Proven benefits are a prerequisite for international ingredient companies and brands navigating the cosmetic and superfood markets, motivating them to integrate the products into their portfolios and R&D pipelines, and undertake subsequent brand building (from differentiation to positioning).

However, for the most part, international off-takers and SMEs lack scientific data on the beneficial properties of GGW tree crop value chains. This limits the capacity of local SMEs to take advantage of high-potential business opportunities and restricts usage diversification and the creation of value-addition to international off-takers.

Some value chain-related organizations (e.g. the Global Shea Alliance and African Baobab Alliance) and public and private research centres (e.g. the Balanites Association) hope to provide this necessary empirical data, but funding is limited. Communication of research findings is also limited. Off-takers and SMEs do not share their results with each other, and research-based organizations do not communicate their findings with relevant business sectors. Nexira’s gum arabica research is an example of good practice in this area: demonstrating gum arabica’s beneficial physiological effects contributed to its classification as a “dietary fiber source” by the USFDA. Another innovative example to promote Sahelian ingredients with new consumers is shown in Box 3.

### BOX 3 African diaspora raising awareness of Sahelian products

The France-based La Fabrique 621 is a cosmetic incubator equipped with production tools, an R&D laboratory and a natural cosmetics department. It supports entrepreneurs in product development, from idea to market, and collaborates with suppliers to enhance their ingredients through the

assessment of new formulations. La Fabrique 621 works with entrepreneurs from the African diaspora and has built a strong network of natural material suppliers in Senegal, enabling them to support entrepreneurs in France and Senegal, including the successful Senegalese brand Chouette Mama.

#### Create a centralized research platform:

This would be invaluable, and could centralize findings, share and communicate results among stakeholders and raise funds to support research centres, sector support organizations and others investigating the nutritional and pharmaceutical

benefits of GGW products. This research would help identify and communicate new product offerings that could maximize the value of the tree crops at the local level, access high-value markets and generate demand for GGW products.

## 3.3 Generate demand and build GGW product awareness

Value generation within the Sahel is limited for most SMEs working on GGW tree crop value chains due to low in-country value-addition (and margins) and limited consumer awareness and demand. For many SMEs, developing added-value usages and

markets (e.g. cosmetics and foods) and diversifying their income with additional higher value-added tree crops (e.g. baobab and moringa) is an aspirational and strategic goal.

### Promote GGW products more effectively

Raising awareness of GGW products is key to generating demand in domestic and international markets, especially for emerging value chains. Despite the strong potential of identified tree crops, most Western markets are unfamiliar with GGW products due to lack of awareness of product properties and the lack of major international brands promoting them.

**Create effective marketing campaigns:** The aim is to educate consumers on tree crop benefits

and encourage market demand. However, doing this is costly, complex and generally beyond the capacity of GGW SMEs. Even specialized brands – such as the UK company Aduna, which has been promoting baobab in the European market for the past decade – lack the marketing resources and mass impact needed to generate significant sustained demand. Similarly, African consumers would prefer to purchase local brands. However, fewer than 20% of products and product mixes sold in supermarkets are sourced locally, and

established African brands have limited capacity to invest in marketing and media campaigns for locally sourced products.

**Explore international business-to-business events and trade fairs:** These are another avenue to increase awareness and demand for GGW crops in domestic and international markets; an example is in-cosmetics Global, the world-leading cosmetic trade show for personal care ingredients that connects growers, off-takers and brands. These events generate business opportunities, promote GGW value chains within professional ecosystems, and encourage the development and integration

of new products. GGW value chains and local stakeholders – SMEs, entrepreneurs and start-ups – are currently not showcased at these events.

**Launch a GGW label:** Doing so could create visibility for trusted local SMEs in global markets and facilitate connections with off-takers and international distributors. Communication agencies could develop campaigns to boost GGW label promotion, and SMEs could participate in major fairs under a GGW umbrella to share costs and increase visibility. These activities could be led by a sector support organization representing the interests of value chain stakeholders.

↓ Credit: Rewild.Earth



## Support local SMEs to expand and develop their own brands

“ International development remains a strategic growth factor for SMEs in a position to scale, which could support significant growth and help them exceed the \$500,000 revenue ‘glass ceiling’ that few GGW SMEs have been able to surpass.

Currently, national and local product distribution remains limited. SMEs often work directly with a limited number of large-scale modern trade actors (e.g. supermarkets or their equivalent) or specialized stores targeting the upper middle class and therefore do not reach their full national distribution potential. Supermarkets represent less than a fifth of trade in most Sahelian countries, but traditional traders, such as convenience stores, kiosks and informal traders, which account for most trade volumes, are not fully served or drawn upon.<sup>54</sup> Additionally, few brands work in partnership with local or regional distribution agents to reach full distribution capacity, requiring tailored and somewhat complex accounting, logistics and traceability approaches. Furthermore, SMEs lack the technical and financial resources to reposition their branding to reach multiple targeted markets and design efficient market routes.

Although the region’s middle class is growing rapidly, it remains a niche market, with

approximately 1–2 million potential customers per country (except Nigeria where the customer base could be above 12 million).<sup>55</sup> International development therefore remains a strategic growth factor for SMEs in a position to scale, which could support significant growth and help them exceed the \$500,000 revenue “glass ceiling” that few GGW SMEs have been able to surpass.

**Scale distribution networks for domestic markets:** SMEs and brands scaling a business-to-consumer model for GGW value chains should prioritize domestic markets and ensure modern and traditional distribution channels reach their full potential.

**Employ a marketing facility tool to support GGW brand expansion:** This could encourage the emergence of stronger GGW brands. Branding agencies, distribution agents, market experts and others could assist GGW SMEs and enable them to compete with international brands.

## 3.4 | Unlock carbon finance for the Sahel

Voluntary carbon markets present a growing opportunity to channel international finance towards ecosystem regeneration projects. At the SME level, carbon finance could generate significant additional revenues to support GGW value chain production and market growth. However, there is still a lack of mechanisms to make these resources accessible for SMEs and agroforestry smallholders in the Sahel. Barriers to entry are high due to the complexity (of methodologies and registration procedures) and cost of onboarding.

To unlock this potential for the prioritized value chains, the following barriers would need to be overcome:

- **Assess current carbon stocks on the ground:** There is currently insufficient data to measure the carbon potential of each tree crop in each geographical area. Supporting on-the-ground analysis in the Sahel could attract more private capital by increasing confidence and making investor involvement less risky.
- **Build technical capacity for SMEs to enter the carbon markets:** The certification of carbon sequestration projects is outside the current scope and abilities of SMEs. Most SMEs cannot cover the high transaction costs of carbon certification, while lead time and outcome uncertainty can further discourage them. Multistakeholder engagement, significant

research and financial resources are needed to build technical capacity within the region. Supporting SMEs with tailored technical assistance could enable them to generate new income through carbon credits.

- **Increase the attractiveness of Sahel carbon projects for investors:** One possibility is to bundle several small-scale projects to lower the upfront capacity and carbon assessment and certification process costs, as well as increasing the quantity and value of carbon credits generated. The bundling of carbon projects could be undertaken across countries to reduce project development costs, while still enabling carbon finance flows to be country-specific.
- **Facilitate the use of innovative monitoring and verification tools:** Such tools would help account for the region's security challenges, limited financial resources and weak carbon assessment capacities. Accurate monitoring of carbon sequestration would build trust and legitimacy and increase potential carbon prices.
- **Make advance financing available through a blended finance Carbon Fund:** This would be used to support on-the-ground data collection, provide capacity building for local stakeholders and SMEs, cover carbon certification costs and bundle multiple projects into large carbon sequestration programmes in the Sahel.

↓ Credit: Rewild.Earth



# An agenda for multistakeholder action

Multistakeholder partnerships are needed to support a systemic and landscape-level approach on value chain development.

In conclusion, this report calls on stakeholders to pursue an action agenda that would: (1) mobilize the private sector to support the acceleration of land restoration in the GGW through a market-based approach; (2) focus on commercially viable tree crop value chains that show the highest potential for environmental and social impact; and (3) put communities, grassroots SMEs and ecopreneurs at the centre of the strategy to ensure local value capture.

Such an action agenda could generate rapid growth in the markets for GGW oils, powders and dried leaves over the next decade, at both domestic and international levels. Nevertheless, growth alone does not necessarily equate to shared value. A systemic and landscape-level approach on value chain development needs to be encouraged to ensure that GGW stakeholders, particularly local communities and SMEs, benefit from the value that will be generated.

The challenge of implementing this action agenda lies in finding the right leaders to carry out each action over the long term. Nevertheless, in each area, there are actors ready to take the lead, develop solutions and share them with the value chain ecosystem, as well as stakeholders able to co-create and/or co-finance solutions – many

of whom have been mentioned throughout this report. Furthermore, there are opportunities to use additional sources of finance and to create blended finance approaches that match the presented action agenda.

The existing champions need to be supported, and new ones encouraged, to tackle the complexity of operating in the GGW context. Such champions need to be connected and integrated through partnerships across the entire value chain, with resources made available accordingly, and an enabling policy and regulatory environment that can favour and encourage their development.

As a restoration-focused, multistakeholder platform, 1t.org, the World Economic Forum's trillion trees initiative, will continue to facilitate exchanges among stakeholders and inspire action, focusing on the recommendations outlined in this study.

All actors along the value chain have a role to play in prioritizing new models of development that are centred on landscape restoration and delivering benefits for people and planet. We encourage all actors to take up this opportunity and contribute their respective expertise, resources and ecopreneurial spirit to realize the potential of the Great Green Wall.



# Annex: Methodology

This study focuses on prioritizing and analysing the tree crop value chains with the highest potential to provide both environmental restoration and socioeconomic benefits to local communities in the Sahel to enable the development of an agenda for multistakeholder action. The analysis was conducted in two phases.

**Phase 1:** A four-stage prioritization process to identify the tree crop value chains with the highest potential:

- *Step 1:* Identification and selection of restoration-relevant tree crops:
  - *Pre-identification:* 56 trees were identified through a review of academic and grey literature<sup>56</sup> relating to the GGW and regional land restoration.
  - *Shortlisting:* 20 trees were shortlisted through an analysis of geographic presence, environmental and economic potential (Table 5).
- *Step 2:* Macro-level analysis was conducted on the selected 20 tree crops and their related 27 value chains. For each tree crop value chain, data was collected for more than 100 sub-indicators to assess environmental,

socioeconomic and market potential.\* Value chains were restricted to personal care, superfoods, seasonings and gum markets, largely due to the high correlation between crop attributes and current market demands.

- *Step 3:* The potential of the tree crop value chains was evaluated based on a restoration-focused, market-driven approach using the indicators presented in Table 5. Scores on each indicator were normalized, rated on a standardized scale and then aggregated.
- *Step 4:* Nine priority tree crops were selected for further detailed (micro-level) analysis, including four prioritized for the greatest international market potential.

\* A dataset was created presenting these indicators for the 20 selected tree crops. Limitations included: (1) data availability: when available, the data was categorized for the assessment; (2) differences in situation between countries: in terms of availability, differences in tree crop production in different contexts, variability in access to markets and differences in regulatory regimes (i.e. export rules, conventions, etc.), the most relevant country data was selected; and (3) missing data: in which case an informed neutral or realistic value was assigned to construct the respective indices used in Step 3.

TABLE 5 Indicators used in tree crop selection and prioritization process

Criteria	Indicators
<b>Step 1: Shortlisting</b>	
Geographical distribution	– Number of Sahelian countries in which the tree grows
Information availability	– Number of search results
Community use	– Traditional use by local communities (medicine, food etc.)
Ecological interest	– Already used in reforestation programmes within the Sahel
Product commercialization	– Number of processed products on the market; sales volumes; existing brands
Exports	– International demand for tree products/raw materials
Existence of local value chains	– Presence of local SMEs transforming raw materials

TABLE 5 | Indicators used in tree crop selection and prioritization process (continued)

Criteria	Indicators
<b>Step 2: Macro-level analysis</b>	
Multiple criteria	– The full list of 100+ indicators and data is available upon request from 1t@weforum.
<b>Step 3: Prioritization</b>	
<b><i>International market potential</i></b>	
International demand (existing current distribution)	<ul style="list-style-type: none"> <li>– Sold in supermarkets/specialist shops/online etc.</li> <li>– Global market size/trends/growth (Africa/global)</li> </ul>
Offer	<ul style="list-style-type: none"> <li>– Product value-add/differentiation (product attributes, relevance to market demand trends)</li> <li>– Existing and potential volumes (actual volumes from collection, potential based on transformation/trends)</li> <li>– Competitiveness (price comparison with other products within category/other suppliers)</li> </ul>
<b><i>Regional/national market potential</i></b>	
Cost of transformation	<ul style="list-style-type: none"> <li>– Cost of potential investment (investment needed to integrate project at local level)</li> <li>– Transformation complexity (complexity of transformation process, skills/capacity required, inputs required)</li> </ul>
Cost of entering market	<ul style="list-style-type: none"> <li>– Barriers (existing technical barriers to trade)</li> <li>– Market size and export potential (existing market size, level of exports)</li> <li>– Existing product awareness (national and international distribution, level of online presence)</li> <li>– Affordability (price, product competitiveness locally and potential market size based on local socioeconomic data)</li> </ul>
<b><i>Environmental impact potential</i></b>	
Environmental impact	<ul style="list-style-type: none"> <li>– Soil improvement (nitrogen fixation; mulch from leaves)</li> <li>– Biodiversity impacts (supports pollinators, provides habitat)</li> <li>– Climate change mitigation potential (e.g. above-ground carbon sequestration)</li> </ul>
Restoration potential	<ul style="list-style-type: none"> <li>– Resilience to arid and semi-arid climates</li> <li>– Vulnerability to extreme weather (drought, water stress, flooding, fire)</li> <li>– Vulnerability to human demands (use of wood for firewood/construction, animal feed)</li> </ul>
Avoidance of negative impacts	– Not invasive in the Sahel
<b><i>Socioeconomic impact potential</i></b>	
Economic impact	<ul style="list-style-type: none"> <li>– Job creation</li> <li>– Income (value and quantity of product; labour inputs)</li> <li>– Local transformation (level of value-addition at the local level)</li> </ul>
Health benefits	<ul style="list-style-type: none"> <li>– Nutritional properties (e.g. potential to fight malnutrition)</li> <li>– Use in pharmacopoeia</li> <li>– Food security</li> </ul>
Gender equity	– Degree of women's participation in production, collection, distribution etc.
Avoidance of negative impacts	– No socioeconomic risks (e.g. health concerns, child labour)

**Phase 2:** Detailed assessment of the selected high-impact tree crops and their value chains to identify value chain development challenges, best practices and potential opportunities for engaging the private sector in new partnerships.

Analysis of the relevant personal care and superfood markets was undertaken based on an assessment incorporating expert interviews, desk research and field data.

In this phase, a qualitative analysis of the potential for carbon finance was undertaken, focusing on carbon market gaps and carbon finance needs for the Sahel, based on a review of voluntary and compliance carbon market reports, and studies on the carbon potential of the four focus tree crops, as well as interviews with carbon market experts, the private sector and DFIs.

**Data sources:** Extensive data collection was undertaken to support the study, including:

a. *Primary data:* Primary analysis was conducted through interviews with market and environmental experts in the field in Burkina Faso, Mali, Niger, Nigeria and Senegal. Additional structured interviews were undertaken with actors at each stage of the prioritized value chains, including:

– *Upstream stakeholders:* 28 SMEs

– *Downstream stakeholders:* 27 international companies, including 11 brand companies, 13 ingredient suppliers and three distributors – with a balance between the personal care (15 companies) and food and superfood (12 companies) sectors

– *Enabling environment:* 30 representatives of the financial ecosystem (DFIs, local banks, funds), international organizations, government officials (ministries of the environment, GGW local agencies etc.), corporate organizations and NGOs

b. *Secondary data:* Desk research assessed more than 20 public and private internet databases and reports. Data sources included but were not limited to: the African Union, Botanic Gardens Conservation International (BGCI), Centre for Agriculture and Bioscience International (CABI), Euromonitor International, Global Biodiversity Information Facility (GBIF), Institut de Recherche pour le Développement (IRD), International Labour Organization (ILO), International Union for Conservation of Nature (IUCN), Plant Resources of Tropical Africa (PROTA), Plants for a Future (PFAF), United Nations Convention to Combat Desertification (UNCCD), UN Statistics Division, UN World Tourism Organization (UNWTO), World Agroforestry (ICRAF) (part of CGIAR), World Bank, World Trade Organization (WTO), World Travel & Tourism Council (WTTC) and the World Database on Protected Areas (WDPA).



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