



David versus Goliath

Niche products and mainstream agricultural export commodities –
to what extent do they promote sustainable development?

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David versus Goliath: niche products and mainstream agricultural export commodities – to what extent do they promote sustainable development?

Study on behalf of the “Initiative for Sustainable Agricultural Supply Chains” (INA) as part of the GIZ programme “Sustainable Agricultural Supply Chains and Standards”, financed by the German Federal Ministry for Economic Development and Cooperation (BMZ)



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Abbreviations

CAR	Rural environmental cadaster
CmiA	Cotton made in Africa
CSR	Corporate social responsibility
FPIC	Free, prior and informed consent
GDP	Gross domestic product
HCV	High conservation value
ISPO	Indonesia Sustainable Palm Oil
LNOB	Leave no one behind
NTFP	Non-timber forest products
RSP0	Roundtable on Sustainable Palm Oil
P4F	Programs for Forest
PDR	Peoples' Democratic Republic
UEBT	Union of Ethical BioTrade
UNCTAD	United Nations Conference on Trade and Development

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1 Executive summary

The objective of the study is to assess the impact of promoting agricultural mainstream versus niche commodities on the three dimensions of sustainability to provide empirically grounded recommendations for improving the design of future projects. Ten development projects implemented by GIZ and the Swiss development organisation Helvetas in Asia, Africa and Latin America that strengthen different supply chains for niche products and mainstream agriculture export commodities were analysed. The analysis was conducted in the form of a desk study based on interviews with key actors from the project teams and the private sector, as well as a literature review.

The study clearly shows that mainstream commodities have a higher importance at the macroeconomic national level due to the sector's size and its relatively high contribution to the national gross domestic product (GDP) (e.g. palm oil in Indonesia), whereas the contribution of niche products to the GDP is often not even reported. However, this kind of assessment neglects the perspective of marginalised and poor rural communities for which the biodiversity-based niche products are often the only cash income option, as shown for styrax gum from Honduras and benzoin gum in Laos. In these cases, the producer communities are in remote areas with a deficient logistic infrastructure, which makes it hard to compete with mainstream commodities from other regions with a better infrastructure and market connection. Contrary to expectations, it has not been proven that strengthening commodities of a larger sector automatically leads to a higher number of people reached by a project. This relationship is not linear. Projects targeting a large sector may reach a smaller number of farmers than projects supporting a small sector. The differences here are due to the extent of the technical assistance provided. The number of beneficiary farmers identified in the study ranges from 83 (coffee in Honduras) to 5,400 (cotton production in Uganda).

In the analysed cases, the production of niche products significantly contributes to conserve biodiversity, since the collectors are highly motivated to maintain the ecosystem in which the used plant is growing (including native old-growth forests (styrax gum), secondary forests (benzoin gum) or single standing trees (illipe and shea nuts)). In

contrast, in some regions mainstream commodities have been found to be one of the main drivers for deforestation (e.g. palm oil in Indonesia, coffee in Honduras). Nevertheless, they also have the potential to recover degraded land (e.g. coffee in Laos on degraded maize fields and diversified cocoa plantations on degraded pastures in Brazil). Therefore, assessing whether mainstream commodities have a positive or negative impact on biodiversity and the environment depends on the baseline situation, as they can destroy the native vegetation or enhance the environment. Projects should clearly focus on restoring degraded lands when promoting mainstream commodities.

Overall, the study shows that mainstream and niche products are not simply “good or bad”. Both can be thought of as complementary elements within a sustainable landscape approach. Following the principle of yin and yang, they interact to form a dynamic system in which the whole is greater than the assembled parts, as shown in the examples of combined production of upland rice and benzoin gum in Laos, and illipe butter within the palm oil-dominated landscape in Borneo. To achieve truly sustainable development, both elements must be considered and strengthened in a region or landscape.

The study results show the need to apply a strict market approach in the promotion of alternative income options, and the project's impact matrix should allow adapting to new opportunities during project implementation, as it is usually difficult in the planning phase to identify and analyse all available market options. In the promotion of niche products, some projects on the ground have had difficulties reaching major players from international companies in the respective cosmetics, food, pharmaceutical and chemical sectors, thus making it more difficult to realise the full supply chain potential. A closer and more target-orientated coordination by the head office to investigate options for cooperation is recommended.

Crop diversification is a key element in increasing resilience to climate change, but should not be thought about only at the farm level but also within a landscape. Here, there might be potential to encourage international companies with a strong presence at the local level to focus their

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corporate social responsibility (CSR) actions – often implemented as donations to social projects – on supporting the creation of resilient landscapes and, in doing so, protecting their own interests. This can be in the form of investing beyond their core business or fostering market demand for diversified regional products which allows them to protect their supplier base against price volatility and – ultimately – strengthens their own core business. Promising examples currently exist from companies in the cosmetics and perfumery industries that are making efforts to identify multiple products sourced from one region (e.g. by the companies involved in andiroba production in Brazil and benzoin gum production in Laos).

To get the private sector on board, projects can be used to help better visualise the impact of sustainability and make for easy storytelling. Given the increasing attention to the challenges of biodiversity loss and climate change, there is great potential here for companies, but this potential is generally not documented and not realised by most certification schemes. What's more, for many sustainability certifications farmers do not have to invest any additional effort to comply with the sustainability requirements and the certifications only create “deadweight effects”, besides high additional costs for administration and certification fees. Here, companies can be supported in documenting deforestation-free supply chains as an option for further value-adding, based on the mapping of the producer's production areas, the quantification of carbon mass and a solid traceability system. When combining these activities with actions to increase the producers' security with respect to land or forest use rights and promoting fair payment terms, this may provide more benefits for the producer and environment than a traditional certification. At the same time, it gives companies the option to contribute to reducing their carbon emissions and, in the long term, to contribute to their science-based targets.

When promoting deforestation-free supply chains, attention should be paid not only to the volume of carbon stocks, but also to the quality of conserved ecosystems in terms of biodiversity. The study shows that addressing biodiversity is a challenge, as companies generally do not see it as part of their responsibility, and producers already have a

number of other issues to deal with. BioTrade initiatives are still highly fragmented and difficult to understand for key decision makers, preventing a stronger engagement of the financial sector due to a lack of clear investment rules and regulations. Development projects can play a key role to move the topic to a more prominent position with respect to corporate CSR programmes and the environmental, social and governance criteria needed to create clear indicators and rules for investing into resilient, biodiversity-friendly, deforestation-free and integral supply chains. At the local level, more attention and support is needed for the preparation and implementation of biodiversity action plans (BAP), for single supply chains or even entire landscapes as an integrated part of the development strategy.

Supporting exporters has been found to be an effective entry point to promoting sustainability along the supply chain, but it reaches its limitations when it comes to “critical” issues such as land use conflicts, labour safety and biodiversity conservation. Development projects can assume a key role here to improve communication between actors in the producing countries and from (western) processing companies to achieve a better understanding and functioning of international supply chains. Making a positive impact on all aspects of sustainability is still a challenge for both mainstream and niche products, since customers tend to focus on criteria that are directly linked to their business, such as prices, pre-financing, purchasing agreements, quality control and sometimes labour safety. Capacities and the framework should be strengthened to enable an independent monitoring of the supply chain, maybe even at the sectoral or landscape level. Besides clarifying funding options, this also requires the definition of mandates and the identification of a commonly accepted monitoring body, in addition to establishing clear procedures and responsibilities when shortfalls are identified.

In some cases, law enforcement may even be needed to tackle deforestation and other environmental crimes (often committed by third-party actors from outside the supply chain, but affecting the supply chain production) in order to relieve the first line of defence at the community level. Here, strengthening the dialogue between civil society,

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government and private actors in order to create locally adaptable solutions by supporting multi-stakeholder platforms for a single supply chain or an entire landscape are promising. In this sense, multi-stakeholder platforms are particularly important in countries with high levels of violence and corruption (e.g. deforestation in Honduras by drug traffickers), as they provide a space where sensitive information can be quickly disseminated to a large number of actors and institutions, promoting transparency between sectors while reducing opportunities for corruption and the risk to individuals as sole holders of knowledge. At the same time, they provide an opportunity to respond effectively to the threat at hand through cross-sector coordination.

Nevertheless, when using this specific approach (development initiatives), attention should be paid to ensuring that real impacts for the producers are created. The current hype on high-tech blockchain traceability systems for

sustainable supply chains brings questions about the benefits for the local people. Traceability alone should never be the goal, although it can help improve producers' land use rights by providing basic information about where production is taking place and can be helpful in proving the region or even country of origin for products whose actual origins are disputed. The main benefit of traceability, however, is achieved when it is used as a tool to review best practices or to highlight where improvements are needed. It is not necessary to choose the most sophisticated system, but it should be adapted to the local context. Care must be taken to ensure that sustainability standards for biodiversity-based products are not set too high to avoid discouraging nature-rich countries and making it too costly and difficult for smallholders to meet these standards, while mainstream commodities are allowed to be traded without further requirements.



2 Guiding questions of the study

To increase the sustainable use of natural resources, many development projects focus on promoting sustainability in the production and trade of main and conventional agricultural export commodities, often while promoting organic or other sustainable certification schemes. The idea behind this is to create benefits for a large number of people involved in these high-volume supply chains through improved production and living conditions for farmers and workers. It is also expected that environmental benefits will be achieved through the dissemination of best practices, although in most cases¹ the cropland competes with more biodiverse natural vegetation and the “benefits” may be more accurately described as the mitigation of negative impacts on biodiversity. Other projects promote the sustainable use of niche commodities from local biodiversity, often under the term “BioTrade” (see info box page 10) or “Bioeconomy”². These commodities are usually of partial relevance at the local or national level, although some are also produced exclusively for export, usually in small quantities. In particular, the niche commodities are expected to create positive impacts on conserving biodiversity and improving the income and living conditions of marginalised groups such as indigenous peoples and rural women.

The impacts of social and environmental benefits are difficult to measure and quantify. Therefore, the assessment of the potential of agricultural commodities with respect to their contribution to sustainable development is usually done based on economic and even macroeconomic criteria. In this context, niche products often perform poorly. Moreover, the wide variety of niche products makes it difficult to create a blueprint for high-impact best practices. Consequently, traditional mainstream commodities such as coffee, cocoa and palm oil appear to be better suited to deliver measurable and rapidly scalable positive development impacts.

In its 2030 strategy, the German Federal Ministry for Economic Development and Cooperation (BMZ) places a strong focus on cooperation with the private sector. As expected, partnerships are mainly being built with large, often multinational companies involved with traditional

export commodities. However, the highly volatile world market prices and the high dependency of mono farming smallholders on these products increase the risk of poverty and vulnerability to climate change. It is therefore questionable whether the strong focus on promoting sustainability among mainstream commodities really contributes to improve the livelihood of the rural poor. Moreover, some of these agricultural commodities are the main drivers for the ongoing deforestation in the tropics. It is therefore reasonable to take a closer look at the experiences gained from promoting niche commodities in order to assess if combined approaches can be developed with the overarching goal of promoting the development of sustainable landscapes or growing regions.

>> The objective of the study is to assess the impact of promoting agricultural mainstream commodities versus niche commodities on the three dimensions of sustainability to provide empirically grounded recommendations on how to optimise the cooperation strategy of sustainable agricultural supply chains. The key questions are as follows:

1. Are there significant differences in the impacts of promoting mainstream export commodities compared to niche products in terms of social, ecologic and economic sustainability, such as improvement of the livelihood and resilience of rural families, empowerment of the poorest, impacts on the conservation of biodiversity and stopping deforestation?
2. What are the challenges of sustainable supply chains for niche products compared to mainstream agriculture commodities?
3. What lessons can be learned from both approaches for designing future projects that promote sustainable supply chains in the agricultural sector with a maximum impact on sustainability? What does the optimal design for partnerships with the private sector look like with respect to fostering sustainable landscapes?

¹ Exceptions can be seen in the case of coffee or cocoa production in natural forest stands.

² FAO defines “bio-economy” as: *the production, utilization, conservation and regeneration of biological resources, including related knowledge, science, technology and innovation, to provide sustainable solutions (information, products, processes and services) within and across all economic sectors and enable a transformation to a sustainable economy.* <https://renewable-carbon.eu/news/fao-and-jrc-launch-new-guidance-note-on-monitoring-bioeconomy-sustainability/>

3 Study methodology and working hypothesis

The study is based on the comparison of mainstream agriculture export commodities with niche products from different countries in Asia, Africa and Latin America. Overall, there is no official classification of “niche products”. In this study, the term refers to non-timber forest products (NTFP) that are wild harvested, either in natural forests or on fallow agricultural land, and not specifically cultivated. Given the substantial number of niche products that could have been considered in the study, the following criteria have been established to facilitate the selection:

- the commodities are produced in the tropics;
- the products are traded on the international market;
- the niche and the mainstream commodity co-exist in the same growing region and country;
- the commodities originate from perennial plants (with the exception of cotton);
- the products are or have been promoted by a development project, and information of achieved impacts and persisting challenges is available.

Based on these criteria, four mainstream agriculture export commodities were selected (cocoa, coffee, palm oil and cotton) in different countries, as well as five niche products that are produced in the same countries (Fig. 1). With respect to the niche products, two product groups were considered: a) tree seeds for cosmetics and food and b) aromatic tree balsam (gum). This focus was not intentional but rather the result of the application of the above mentioned criteria. Other typical niche products are, e.g. aromatic herbs and spices, plant fibres (e.g. rattan, tree barks), medicinal plants, plants for ornamental use (palm leaves, ferns, orchids, cacti) and others (leaf waxes for industrial uses). The info box provides a summary of the classification of “biotrade” or “BioTrade” products (Fig. 2).

Fig. 2: Info box: what is BioTrade?

Despite the increasing interest in BioTrade, there is still no standardized definition for it. Many stakeholders adapt the definition provided by the United Nations Conference on Trade and Development, UNCTAD (2017) for **biodiversity-based goods and services** (BBGS) from plant and animal species found on land and water:

1. Products derived from wild collection (“harvest”) from fauna and flora and its derivatives;
2. Products coming from cultivation practices which include native species that are domesticated and/or from wild varieties through activities such as agriculture, aquaculture or breeding;
3. Services that are derived from biodiversity (e.g. sustainable tourism) (adapted from Sasaki, 2020 based on UNCTAD 2017).

UNCTAD furthermore differentiates between “biotrade” and “BioTrade”. “biotrade” is used to describe the trade of biological resources, such as plant material for food, cosmetic or industrial products, but not necessarily with an adequate consideration of conservation and sustainability issues. The term “BioTrade” is used for activities driven by the respect for environmental, economic and social criteria governed by a set of formal rules, although these are non-binding. BioTrade activities must conserve the ecosystems of the used species, and adequate income should be generated for all actors of the value chain.

For each product, a development project was identified that is or was involved in promoting sustainability in the respective supply chain to discuss the impacts achieved, remaining challenges and lessons learned. For some products it was also possible to interview representatives from the private

Fig. 1: Commodities that were selected for this study and the producing countries

Country	Mainstream commodity	Niche product
Brazil	Cocoa (<i>Theobroma cacao</i>)	Andiroba (<i>Carapa guianensis</i>)
Honduras	Coffee (<i>Coffea arabica</i>)	Styrax balsam (<i>Liquidambar styraciflua</i>)
Indonesia	Palm oil (<i>Elaeis guineensis</i>)	Illipe butter (<i>Shorea stenoptera</i>)
Laos	Coffee (<i>Coffea arabica</i>)	Benzoin gum (<i>Styrax tonkinensis</i>)
Uganda	Cotton (<i>Gossypium sp.</i>)	Shea butter (<i>Vitellaria paradoxa sub. nilotica</i>)

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sector (local collectors, exporters and international processors). Furthermore, an extensive literature review was performed. The information found on palm oil production in Indonesia, coffee production in Honduras and for the niche products illipe butter (*Shorea stenoptera*), styrax gum (*Liquidambar styraciflua*) and Siam benzoin gum (*Styrax tonkinensis*) is so extensive that certain sections of the analysis are presented in the annex to keep the core study short and readable.

Together with members of the INA research group, three working hypotheses were formulated that were used as a guide for the interviews and the literature review. Based on the analysis of the selected commodities (chapter 4), these hypotheses are discussed in chapter 5. The final conclusions are presented in chapter 6.

>> Hypothesis 1

(economic sustainability):

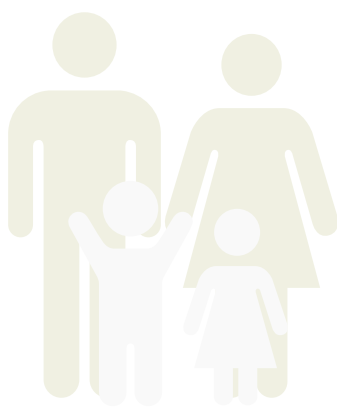
Given the large trading volumes and the high number of producers and workers involved in the production of mainstream commodities, the strengthening of these supply chains has the potential to reach a large number of people and to improve their living conditions. However, prices for these products are set on the stock market, and producers who focus only on one of these products are exposed to high economic vulnerability. In contrast, niche products with short and transparent supply chains are more likely to enable stable and long-term commercial relationships.



>> Hypothesis 2

(social sustainability):

Niche products are primarily an alternative for marginalised groups in remote areas where mainstream products are not competitive due to poor access to transport and communication services. Promoting niche products can contribute to improving the management of traditional knowledge and strengthen the role of marginalised groups as knowledge carriers. In contrast, the promotion of mainstream products tends to perpetuate structural social inequalities.



>> Hypothesis 3

(ecological sustainability):

Niche products contribute more to biodiversity conservation than conventional agricultural commodities as they often originate from intact ecosystems, especially forests. Producers are therefore motivated to conserve these ecosystems and thus preserve the habitat of many species. However, usage regulations for niche products are often lax or non-existent. As a result, they are likely to be overexploited if the market becomes attractive, as is the case, for example, with gutta-percha³ in Indonesia (Gofrey, 2018) and rattan in South-east Asia (Meijaard et al., 2014). On the other hand, when mainstream agricultural crops are cultivated, the entire natural vegetation is often removed, and therefore the negative impacts on biodiversity are much worse. Furthermore, agricultural chemicals are more frequently used, which may also pollute groundwater and nearby ecosystems.



³ https://pkporthcurno.com/collections_and_archive/gutta-percha-ecological-impacts-and-unsustainability/

4 Results: deep dive into selected supply chains

4.1 Niche products

a) Cosmetics from the rainforest: multi-use production system with andiroba (*Carapa guianensis*) in the Brazilian Amazon

>> The species: Andiroba oil is processed from the seeds of the *Carapa guianensis* tree (from the mahogany tree family *Meliaceae*), also known as crabwood. *C. guianensis* can be found in the Amazon and Central America. It grows in tropical lowland rainforests and prefers swamp land (várzea), but also grows in upland forests (terra firme). It is a mid- to large-sized, semi-dominant canopy tree, reaching 25 to 35 metres (Nardi et al., 2016). Seed dispersion depends on animals and on floating along rivers (Hartshorn & Machargue, 1983). Indigenous people have traditionally used andiroba oil to treat skin problems and other diseases, and artisanal production is still common (Nardi et al., 2016). The high content of limonoid, linoleic and acidic fats makes the oil attractive for the cosmetic industry, as well as for medicinal and repellent purposes. Andiroba oil is used in Brazil, but is also exported to Europe, the U.S. and to Southeast Asia. From 1974 to 1985, between 200 and 350 tons of the oil were exported annually, mainly from the states of Pará and Amapá. One proof of andiroba's popularity in the Amazon region is the high number of soaps, creams, oils and candles made from its oil (Shanley & Londres, 2011). The Brazilian cosmetic company "NATURA" has created a special product line of andiroba-based cosmetic products, called the "Ekos line".

>> Production: The labour intensive, artisanal production of the oil is mainly done by women. Andiroba seeds are generally collected from naturally established trees ("wild harvest"). There is one main harvest season, and seeds are collected from the ground. The trees start to flower and produce fruits with a stem diameter at breast height of ≥ 30 cm. In literature, very high yields of 50 up to 300 kg seeds per tree are reported, however, Plowden (2004) has observed a much lower productivity with only one kg of seeds per tree in indigenous communities. Productivity is probably related to the tree's age and stand density. After the collection from the ground, the seeds are washed and cooked, often on wood-burning stoves. After being boiled, the seeds should rest for 30 days. The chemical processes that take place during this rest phase are not fully understood, however, they allow for an easier cracking of the



seeds. Furthermore, fermentation processes might take place that increase the desired medicinal properties, and industrially pressed oils are reported to have fewer active substances. After the rest phase, the seeds are broken using a piece of wood, knives or small hammers, and the dough is taken out and kneaded into a paste. The paste is formed into balls or put into large wooden trays in order to drain the oil with the help of the heat from the sun. In some regions, an artisanal press made of fibres ("tipiti") is used to extract the oil, or the dough is boiled in water for oil extraction (Nardi et al., 2016). The ratio of seeds to oil is said to be between 3.5 to 9 kg of seeds to one litre of oil, in some cases even up to 14 kg of seeds per 1 litre of oil (Plowden, 2004). Damage to the seeds caused by mammals and insects is quite common, and this affects the yields. Despite the high popularity of andiroba, little effort has been made to carry out systematic research on productivity and best processing techniques.

>> Challenges: The Brazilian Amazon is known for its high biodiversity. At the same time, the region is strongly affected by deforestation, and incentives are needed that make a sustainable use of natural resources more competitive and attractive. In this sense, andiroba oil is a promising product, as it is obtained from a native tree species that plays a key role in the ecosystem (while being a food source for many

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animals), and its production can contribute to biodiversity and forest conservation by motivating the local people to keep the trees and related forest stands. However, the artisan production process is time-consuming and labour intensive. Klimas et al. (2012) found that manual andiroba oil extraction in the Amazon may even have negative returns and recommends, in addition to the introduction of mechanical presses, to combine oil production with timber harvest. The communities lack homogenous quality and struggle to access fair markets (Plowden, 2004). Furthermore, many producers do not meet the legal environmental requirements, which hinders access to the formal market. In addition, the potential negative impact of the seed collection on biodiversity (reduction of a natural food source for wildlife) and tree regeneration has not been properly identified (see lessons learned).

>> Strategic approach: GIZ has signed a partnership (DeveloPPP) with Symrise and Natura to strengthen sustainable supply chains for natural products, including andiroba, in the Amazon. Symrise, a German manufacturer of fragrances and cosmetics, is processing andiroba oil for Natura who commercialises it on the Brazilian market. The goal of the PPP is to support producers in diversifying their product range, and to enable them to earn higher incomes through technological innovation, improved product quality and market access. GIZ focuses on organizational development of the producer groups in order to create the capacities needed to meet market requirements and to comply with environmental regulations. The partner companies promote improved techniques for planting, harvesting and post-harvest processing, in addition to conducting research that enables them to develop new products made of different species.

>> Impacts on economic sustainability: The project benefits about 2000 families from 17 producer organisations in the state of Pará. The production of andiroba and the supply chain got certified by the Union for Ethical Bio Trade (UEBT). It is the first initiative to have been certified under the UEBT seal. The UEBT standard is in line with the UNCTAD BioTrade principles and covers economic, social and environmental aspects⁴. The producers sell their products directly to Symrise without intermediaries. This direct business model makes it possible to align the selling prices with the production costs. To this end, the average costs are estimated annually and taken as the basis for transparent price negotiations with producers. Quality

standards were introduced and the producers were trained on how to achieve the highest quality and reduce waste. The introduction of equipment for improved post-harvest processing (dryers for andiroba seeds) increases productivity while lowering costs. To increase the producers' resilience, market access has also been promoted for other NTFPs, such as ucuba (*Virola sebifera*), babaçu (*Attalea speciosa*) and cupuacu (*Theobroma grandiflorum*). Furthermore, the cultivation of cocoa in agroforestry systems is promoted, in order to combine the use of NTFPs in an agriculture system that supports a robust farming economy. Here, the project also supports the establishment of alternative selling channels to avoid a high dependence on one single buyer.

>> Impacts on social sustainability: The projects support the organisational development of 17 producer groups, allowing them to successfully participate in the value chain with international and national companies under fair conditions on a long-term basis. The producers are mestizos whose ancestors participated in chicle production. The project particularly benefits a large number of women who participate in the collection and post-harvest processing of andiroba and other NTFPs, as well as youth. Young people are especially attracted by the support offered with respect to digitizing the management of the producer organisations and the andiroba oil traceability system. The oil is traceable at any stage of the supply chain through a digital system that includes data reconciliation and a barcode system. A key element of the traceability system is the mapping of harvest areas by remote sensing. The mapping gives producers the opportunity to learn more about their own area, which is sometimes difficult to explore due to its size and poor accessibility. The producers also use this information to register their land in the rural environmental cadastre (CAR) to comply with environmental law in the Amazon. Furthermore, the project puts a strong focus on improving knowledge management between producer communities and communicating the positive socio-economic and environmental impacts of the NTFP supply chains to public institutions as a valid alternative for local economic development in the Amazon.

>> Impacts on ecological sustainability: The creation of market options for wild harvest NTFPs and cacao produced in permanent agroforestry systems gives local people a real alternative to monocrop, traditional slash-and-burn and pastureland use in the Amazon. Farmers are encouraged to grow native trees, either through planting or by facilitating

⁴ <https://www.ethicalbiotrade.org/setting-the-standard>

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natural regeneration, and thus contribute to restore degraded areas. The producers benefit from improved land management through the elaboration of land use plans. The remote sensing forestry inventories allow for the identification of potential harvest trees and constitute the basis for the estimation of the sustainable production potential. Based on this information, annual collection quotas are established with the producers for a sustainable use of the trees that avoids overexploitation.

Lessons learned from andiroba (*Carapa guainensis*) production in Brazil:

- The importance of activities at the micro level for strengthening producer organisations is often underestimated when designing development projects – the focus here lies mainly on effects at the meso and macro levels. In this case, however, GIZ specifically focuses on organisational development at the local level. The supported processes form the basis and prerequisite for the partner companies to invest in the value chain and explore further products to expand their cooperation with the communities. Although both companies are committed to sustainable and ethical sourcing, they do not see it as their responsibility to build the basic capacity of producer organisations needed to enter the supply chains they offer. Therefore, GIZ's work at the grassroots level is quite important, as it provides the foundation for stable and reliable value chains.
- The use of niche products and the cultivation of conventional mainstream products such as cocoa are not in conflict with each other; rather, they are produced in a combined approach. The mixed production system creates positive impacts, which cannot be achieved in a monoculture production system, on biodiversity and the environment, but also for the farmers. While cocoa farming requires year-round agricultural activities, the labour required for harvesting and post-harvest processing of non-timber products is reduced to shorter periods, allowing for optimal use of labour throughout the year and increasing farmer resilience. The risk of production losses due to disease and climate change is reduced since in a mixed system it is very rare that all products are affected at the same time. In addition, market risks are also reduced because different markets and buyers are supplied.
- On a macroeconomic level, however, the positive effects of multiple land use are not visible, as the contribution of NTFPs to the national gross domestic product is

marginal. This shows that when assessing the potential of sustainable development strategies, it is important to consider not only macroeconomic data, but also the importance of a product or production system in the local context. In this example, andiroba production in combination with cacao and other NTFPs provides livelihoods for several communities and contributes to the conservation of parts of the Brazilian Amazon rainforest (wild harvested) or even to the restoration of the forest cover when andiroba trees are planted as shade trees in cocoa agroforestry systems on degraded pastureland.

- A key element of the project is the creation of know-how and technical solutions to increase the efficiency of producers and the competitiveness of natural products for their use in the cosmetics industry. The focus is on improving post-harvest technologies by introducing equipment to reduce the time required to process seeds and increase profits from oil extraction through lower labour costs. However, unintended negative impacts may occur by excluding vulnerable people from the value chain. Seed processing is often done by women and young people who could lose their income opportunity if their work is replaced by a machine. This argument is particularly relevant when products are sold by a co-operative as a community commodity (e.g. NTFPs or timber from a community forest), as the economic objective of the community may not be to obtain the highest profit margin for the producer group, but rather the highest labour cost since this represents direct income for the community member. This setup is commonly found among indigenous communities.
- The andiroba production and supply chain is certified by UEBT. This requires environmental compliance among other criteria, and strong efforts are made by the project to support the producers on their journey to comply with the environmental legal regulations. A fully digitised traceability system has been set up to verify compliance. In contrast, little attention is paid to the sustainable management of the species used, and an analysis of the impact of seed collection on associated biodiversity and tree regeneration is still missing. As a result, the long-term impacts on wild life and tree regeneration are unknown. Producers are required to meet an annual harvest quota, but there is no public or private body to monitor compliance with the collection quota. This raises the question of what will happen if demand for the natural product continues to grow, and how sustainable use can be ensured in the long term.

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b) On its way to enter international markets: illipe butter (*Shorea stenoptera*) from Indonesia (Kalimantan)

>> The species: Illipe butter is obtained from the seeds of the *Shorea stenoptera* (Dipterocarpaceae) tree which is endemic to the island of Borneo. The species can be found in tropical rainforests and reaches heights of up to 50 m (Adriyanti et al., 2015), but also grows well in plantations on open land. The trees can live more than 100 years and produce up to 800 kg of nuts per harvest season, which occurs every 3 to 4 years. The so-called “butter” is in fact an oil with a mild coconut-like smell and taste. It can be used to substitute dairy or cocoa butter (Banjeri et al., 1984; Naik & Kumar, 2014). On the international market it is primarily used for cosmetics as an emollient agent for skin care products due to its moisturizing characteristic and high oxidative stability (Banerji et al., 1984; Blicher-Mathiesen, 1994; Lykke et al., 2001; Naik & Kumar, 2014; Bahari & Akoh, 2018; Muhammad et al., 2019). According to P4F (2020), production in West Kalimantan in 2017 was between 2000 and 6000 tons (Dataintelo, 2019).

>> Production: The main production area of illipe butter is West Kalimantan on Borneo. The illipe nuts are collected from single trees in an anthropogenic formed park-like landscape in Kalimantan or remaining tree groups near villages and water streams. Seed production takes place in mast circles, with large seeds volumes only every 3 to 4 years. For oil extraction, seeds are generally dried on open fire and then peeled and grounded. Recently, sun-drying of the nuts has been promoted instead of roasting to reduce the emission of greenhouse gases (GHG). The oil can also be obtained using the solvent extraction method. For more details about illipe butter production, please see the annex.

>> The challenges: Illipe butter is widely used on the domestic market. Although it has interesting properties for a broad range of uses, its international marketing is difficult. The main challenge is to ensure constant supply volumes despite the high fluctuation in annual seed production and the rapid deterioration of seeds (nuts germinate quickly and then lose their desired properties). The decentrally organised production by various producers and small producer groups makes it difficult to comply with a uniform quality standard which is required by international clients. The lack of direct market access has led to very low prices for producers. Many farmers tend

to cut down the remaining illipe trees to make quick money by selling the timber since they feel that the nuts are not beneficial to them.

>> Strategic approach: GIZ Indonesia⁵ has started a partnership with the European company Forestwise. Forestwise opened an illipe nut processing and storage centre in West Kalimantan in 2019. The subsidiary factory’s objective is to produce high quality illipe butter for export markets at constant volumes. The company’s marketing strategy is based on promoting efforts to stop deforestation by creating economic benefits for local communities through sustainable forest use. Recently, the company became a member of the Union of Ethical BioTrade (UEBT), which promotes integral and sustainable supply chains based on the UNCTAD principles of BioTrade. Furthermore, GIZ has established a partnership with a local NGO that boasts years of field experience in illipe butter production in cooperation with local ethnic groups while respecting culture and traditions.

>> Impacts on economic sustainability: The investment in centralised storage and processing facilities for illipe butter is key for international market access, as these facilities allow for high volumes of nuts to be processed quickly in mast years and thus reduce losses due to rotting. Adequate storage conditions for up to three years further contribute to overcoming the cyclic availability of the seeds. Centralised processing enables homogenous quality in line with international market requirements. Recently, the Indonesian Government has restricted the export of raw illipe nuts, which demonstrates an even higher need for value adding, as is done by the new company. Forestwise buys the nuts directly from the farmers based on individual contracts. Since the company has started operations, only one mast year has occurred. About 1,200 households from 32 Dayak villages were involved with the seed collection; it is thus estimated that 40% of all villages participate in illipe butter production in Kalimantan. For the next harvest, the company has signed contracts with 3,000 households. The direct purchase model without middlemen allows better compensation for producers – payments have been up to six times higher compared to when local middlemen are involved. The company keeps the same price during the whole harvest period, unlike the intermediaries who often lower prices at the end of the season (Programs for Forest (P4F), 2020).

⁵ IKI Support Project for the Design and Implementation of the New Global Biodiversity Framework (BioFrame)

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>> Impacts on social sustainability: Seberuang-Dayak communities and Malay people collect the seeds. The Dayak communities in particular have been marginalised with regard to socio-economic development, political participation and respect of their culture. Since the 1970ies, their territory has been affected by governmental colonisation and threatened by timber concessions, rubber and palm oil plantations (Minority Rights Group International, 2018). The conservation of illipe trees is important for the Dayak culture, as the trees not only have several religious functions but are also important in daily life in the communities (used as landmarks). The communities have expressed a high need for improving their land security. However, since the illipe market is still under development, the company's social sustainability activities are currently focused on fair benefit sharing through the payment of higher prices. The implementation of further social-related investments is planned for the future (pers. com. Riak Bumi Foundation). The participation of women has been promoted but is still low with currently 22%. The introduction of improved processing techniques (sun drying instead of smoking) is expected to improve the producers' health (no exposure to smoke) and should reduce the work load and costs (P4P, 2020).

>> Impacts on ecological sustainability: The opportunity to sell to a stable market at fair prices motivates farmers to keep their illipe trees instead of cutting them for timber⁶. The company is supporting the communities in converting part of their administrative areas with illipe trees into 'village forests' under Indonesia's social forestry scheme (1,800 hectare). Positive impacts on biodiversity can be achieved as the trees provide a food source for mammals and birds and provide habitat for smaller animals since they are covered by numerous epiphytes. Illipe trees often grow near watercourses and contribute to erosion control and the preservation of the micro climate. Recently, Forestwise successfully obtained organic certification for part of its production (by Ecocert according to the Fair for Life and organic standards).

Lessons learned from illipe butter (*Shorea stenoptera*) production in Indonesia:

➤ The investment of the foreign company in building a centralised processing and storage centre can be seen as the turning point for the illipe butter sector when it comes to international market access because it addresses

the main challenges, i.e. homogenous quality and stable volumes. However, the stand-alone position of the company in terms of technology and market access brings an elevated risk of creating a monopoly, with possible negative impacts on the prices paid to producers in the future. Within this context, the established partnership with the local NGO is of special importance, as the NGO can implement independent monitoring and advising mechanisms for the sector in order to maintain balanced benefit sharing along the supply chain and to keep an eye on ecological impacts.

- The company assumes that increased prices will motivate the communities to protect the trees and forests. However, a more detailed analysis of drivers of deforestation is needed, as members of the local communities are not the only ones responsible for logging. In fact, there are also external players involved that are sometimes connected to high level politicians. Shifting the responsibility for forest conservation exclusively to the communities could have unintended negative impacts by worsening conflicts over forest use rights. Further measures that involve different stakeholders from the public and private sector at various levels to agree on land use planning under a landscape approach are needed. In the given example, the Dayak communities could be supported in mapping the trees and production areas as part of a traceability system. The results can then also be used as a basis for an agreement with governmental authorities on illipe production areas within a spatial land use planning framework, which will be taken into account in case of future concessions for palm oil production or other land uses. The total area where illipe nuts are collected in West Kalimantan is estimated to be 200,000 ha (PFP, 2020).
- Despite the fact that the company is highlighting their efforts to contribute to the conservation of native forest with illipe butter production, the nuts are not collected in the forest, but from free standing remaining trees in an open landscape close to the villages. The contribution to biodiversity conservation is therefore focused on maintaining single trees, and not on an entire forest as the promotion strategy suggests.
- In IUCN's red list, *S. stenoptera* is classified as nearly threatened (Rendi et al., 2019). Nevertheless, the impact of seed collection on the tree's regeneration has not been

⁶ For timber, current prices are between EUR 18 to 36 per m³. Prices for illipe seed have been around EUR 0.07/kg, and have been increased to EUR 0.40/kg by Forestwise.

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properly studied yet. Also, it can be assumed that the natural mortality of the seeds and saplings is high anyway (Curran & Webb, 2000), and thus the collection may have little impact. More information is needed to establish sustainable seed collection rates. Best practices that ensure long-term tree sustainability may need to be identified, e.g. whether to expand illipe tree planting in natural forest stands, forest gardens, or even in pure plantations.

- The recently obtained organic certification for illipe butter production by Forestwise can be seen as part of their strategy to enter the international market. However, the certification does not bring any benefit to the environment, as seed production was conducted in a completely organic production system anyway.
- The use of illipe nuts is based on the ancient knowledge of the Dayak people. Nevertheless, so far there are no specific actions in place that meet the spirit of access and benefits sharing that go beyond fair payment. This issue should be tackled with the company in the medium-term. In addition to the potential to improve the Dayak communities' land use rights, there are further opportunities such as compiling ancient knowledge on the traditional use of illipe trees and promoting the recognition of the Dayak culture, as well as strengthening the identification of Dayak people with their forest-related traditional life.

c) Promoting unknown finest quality: East African shea butter (*Vitellaria paradoxa subsp. nilotica*) from Uganda

>> The species: Shea butter is obtained from the seeds (kernels) of *Vitellaria paradoxa*, a tree native to a sub-Saharan land belt crossing the African continent in the semi-arid and subhumid savannas of over twenty countries. Shea butter is known on the western market as an ingredient for cosmetic skin care products; however, it also plays an important role as a cooking oil on the domestic market. The *V. paradoxa* species is divided into two subspecies: the western African subspecies (*V. paradoxa subsp. paradoxa*) and the East African subspecies (*V. paradoxa subsp. nilotica*). Uganda is home to *V. paradoxa subsp. nilotica* which is known to have better characteristics for use by the cosmetics industry (Otegera et al., 2021).

The trees are also used for timber (poles), fuel wood and charcoal (Ferris et al., 2004; Okumu-Alya, 2009; Gwali et al., 2012). Shea trees are generally not planted, but naturally regenerated. They are slow growing and can live up to 400 years. Fruit production starts relatively late, at the age of 15 to 20 years. One tree can produce up to 45 kg of fruits, however, average yields per tree are lower, at about 15 to 20 kg (Otegera et al., 2021). Shea trees are quite resistant to bush fires and are often preserved by the local people during the clear cutting of the vegetation when preparing agriculture land due to the various benefits provided by the trees. Thus, *V. paradoxa nilotica* is one of the remaining tree species in a park-like landscape in the north of Uganda today.

>> Production: The ripening of shea fruits takes place once a year at the end of the dry season. The fruits are collected from the ground by individual collectors, mostly women and youth, but also by collector groups. Collection is generally done on family or communal land, but recently, private land tenure is increasing and in some cases affects traditional access and user rights. In traditional production, the fruits are processed in the villages, mainly by women. Since the fruits start to rot quickly, the pulp has to be removed from the nutshell within a couple of days. The seeds are boiled, cleaned and dried on the ground in the sun. The dry seeds are then cracked by hand or with locally crafted machines and the chunks are roasted and grounded into a paste. The shea butter is finally separated from the paste while adding water and skimming the fatty parts⁷. 100 kg of nuts produce about ten litres of shea butter. On international markets, only cold-extraction methods are accepted. These require specialised processing techniques and often expensive equipment.

>> The challenges: Uganda remains among the poorest nations in the world. The country is facing one of the highest population development rates and pressure on natural resources is increasing, while traditional land use is changing. Shea trees are increasingly cut to make quick money by selling timber or fuel wood, destroying an essential element for rural peoples' climate and economic resilience. Despite the excellent properties of Uganda's shea butter subspecies *nilotica* for the cosmetics industry, it is not as commonly used internationally as shea butter from West Africa (Greig, 2006; Francois et al., 2009). The decentralised production by various producers and small producer groups makes it difficult to comply with

⁷ "Global Mamas: Shea Butter Production Process". <https://www.youtube.com/watch?v=pYe1lqKSuVM>

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uniform quality requirements in line with international standards. In addition, *V. paradoxa nilotica* is more expensive than West African shea butter (Otegera et al., 2021), which makes being competitive even more difficult.

>> Strategic approach: The Promoting Rural Development Programme (PRUDEV) (BMZ/GIZ) in the north of Uganda aims to strengthen capacities for local agricultural-based economic development among public, civil and private actors while promoting climate-smart agriculture in planning processes. In addition to agriculture crops, shea butter has been identified as a key product to improve farmers' resilience within a diversified farming system. To support this niche product, the project considers the farmers' organisation as the strategic entry point within a multi-actor and multilevel framework. In addition to entrepreneurship training for the producer groups, a sector-wide coordination process has been initiated to bring all relevant stakeholders together in order to jointly improve the market position and market access of *V. paradoxa nilotica*. Furthermore, business-to-business (B2B) is promoted between women-dominated producer groups and national companies, and connections to international companies are underway.

>> Impacts on economic sustainability: Although *V. paradoxa nilotica* is globally regarded as a niche product and Ugandan shea butter is barely traded at an international scale, it is estimated that there are several ten thousands of families involved in shea butter production. The project is estimated to have benefited about 5,000 producers, most of which are women, through improving market access and increasing selling prices by promoting B2B via field tours for traders to the production villages. The income of shea butter is of special importance with regard to the annual farmers' calendar, as the harvest season coincides with the end of the dry season when other crops are scarce and money is needed to prepare the farmland for next season in addition to other family needs. Shea butter further contributes directly to food security when being used as an energy-rich cooking oil. In some regions, the tree leaves are used for animal (goat) forage (Yousuf & Adeloje, 2011) and the seed cakes to feed other livestock (Dei et al., 2007; Kumar et al., 2010). The tree also provides protein-rich caterpillars for both human and animals (Bonkoungou, 2002).

>> Impacts on social sustainability: Shea butter production takes place in the poorest region of Uganda, whose economy is still affected by the consequences of the Luwero war. Shea plays an important role when it comes to reducing poverty, as the nuts can be collected even by the poorest, including people displaced by the war. The reason for this is that no initial investment is needed if the nuts are collected from already existing, not cultivated, trees on communal or clan land. (on private land, some land owners charge a collection fee). The high participation of women in shea butter collection, processing and selling is remarkable. Women are also involved in the production of other agriculture crops; however, men generally do the selling here. In contrast, the local marketing of shea butter is dominated by women, while men become involved at the wholesale level. Therefore, shea is locally also called "women's gold"⁸ because its sale allows women to secure additional food for their families once the cereal harvests are over and to generate cash for household expenses such as medicine and school fees, which are particularly high in the poor country of Uganda.

>> Impacts on ecological sustainability: *Vitellaria paradoxa* has been classified by Lovett & Haq (2000) as a 'Cinderella' woody plant species which provides economic and environmental benefits through traditional utilisation but has been overlooked with respect to domestication. The definition of Cinderella fits well in terms of "being like the quiet kids in the back of the gym"⁹, as described by the Wildlife Conservation Network in contrast to flagship species. Scientific literature on the interaction of *V. paradoxa* with African wildlife and its significance and on the role of the ecosystem is almost non-existent. Shea trees are pollinated by insects (Stout et al., 2018) and their fruits and leaves are edible for many wild animals, including birds and mammals. Shea trees are also important for reducing micro-climatic extremes and for soil conservation, nutrient cycling, wind control and shade (Gwali et al., 2012).

Shea butter production is usually described as a wild harvest system, since most of the trees are not planted. So far, no systematic scientific breeding has been done for genetic improvement. However, the trees grow on cultivated land, and farmers actively select shea trees to be conserved when clearing fallow or woodland. In doing so, farmers implement a tree selection system which is based on criteria such as fruit productivity and competitive effects with

⁸ <https://www.unh.edu/unhtoday/2021/09/saving-shea>

⁹ Wang, J. 2017: Cinderella, Cinderella. Wildlife Conservation Network. <https://wildnet.org/cinderella-cinderella/>

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respect to annual crops. Therefore, the trees can be described as semi-domesticated (Lovett & Haq, 2000). This wild harvest system has worked well in the past, but it is now exposed to increased human population pressure and the threat of other land use for agriculture purpose. Productive shea trees are ageing, and natural regeneration is affected by the reduction of fallow periods (Buyinza & Okullo, 2015). Thanks to the creation of better market access and stable B2B by the project an increased interest to promote shea regeneration by conducting specific conservation measures for young trees (prevention of fire) is expected, in addition to the implementation of trials to shorten the time period required for young trees to start with fruit production (breeding or grafting).

Lessons learned from shea butter (*Vitellaria paradoxa subsp. nilotica*) production in Uganda:

- The baseline survey conducted by the project on relevant crops to improve farmers' resilience has shown that shea butter is a key product in northern Uganda. It is a source of income, food and fodder, and its seasonal production of fruits at the end of the dry season when other products are scarce is of special importance. Nevertheless, the product was not considered for promotion by GIZ in the initial project framework. In order to be able to highlight the importance of shea butter for local rural socioeconomics, the project team adapted the project framework and added this niche product to the portfolio of supported products.
- During project implementation, the significance of shea butter for rural women became even clearer. Nearly all producers involved are women, and for many of them this is the only cash income that they can manage on their own. Many women use the shea income to pay their children's school fees. This demonstrates the high social impact of shea butter production.
- The project still faces the challenge of promoting the *nilotica* subspecies on the international market. The potential of the Ugandan subspecies to be used in high-end cosmetics is not being realised, and the project is limited to strengthening the supply chain on the domestic market. Although the national market is also benefiting the producers and they must ensure that the domestic demand stays satisfied, it has the limiting factor that some of the local companies are more interested in the option of fundraising through international donors, and less invested in stable, long-term business than international companies. Reaching out to international companies has been difficult for the project team, and so far the team has not been successful in identifying companies that could be potential buyers. Here, better use could be made of existing collaborations on the sustainable sourcing of natural products between GIZ and key private sector partners, such as companies in the cosmetics sector like BASF, Symrise and others. These collaborations already exist, but are usually focused on a specific product without any connections to other initiatives and do not address the sustainable promotion and sourcing of biodiversity-based niche products in general. To sustainably strengthen the shea butter sector in northern Uganda, the project pursued a multi-stakeholder approach at various levels, bringing together all relevant stakeholders from public institutions, the private sector and civil society. A sector plan for shea butter was developed based on participatory processes. However, implementation has been much slower than expected (partly due to COVID-19 constraints), demonstrating the limitations of a very broad multi-stakeholder process. To speed up the processes, it was agreed to focus more on collaboration with the private sector as a strategic direction for the near future.
- A still unresolved problem is the low long-term security of tree use rights. Otegera et al. (2021) report occasional fights between collectors on community land, as well as fees being charged to collectors by private landowners, despite the fact that the collection of shea nuts has traditionally been free for all. Sometimes the nuts are stolen, and in other cases, uncontrolled bushfires set by farmers that are not involved in shea nut production affect the trees. Furthermore, shea trees have a very extensive, but delicate root system, which gets easily affected when the surrounding land is worked by tractors. It is evident that proper and integral land use planning is needed to keep the trees. The project can help to collect basic information on the location of the trees and the respective land tenures, which can then be used as a basis for a traceability system for better market access, as well as for providing information to improve the tree use rights framework in cooperation with the relevant public institutions.
- The knowledge about the role of *V. paradoxa* with respect to the local wildlife and ecosystem still needs to be improved, as this information is essential to understand the risks of unintended impacts on biodiversity by an increased use of the species once *nilotica* is successfully promoted on international markets.

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d) Rescue of a collapsed market and promotion of benefit sharing along the styrax gum supply chain (*Liquidambar styraciflua*) in Honduras

“Styrax gum” is a balsam extracted from the *Liquidambar styraciflua* (Altingiaceae, formerly Hamamelidaceae) tree. *L. styraciflua* is a pioneer species that develops well on bare soils and lives up to 400 years. The tree has a wide geographical range from Panama to the south of the U.S., but gum production has historically been limited to Mexico and Honduras due to climate conditions (humidity and temperature). However, for centuries now, Honduras has been the only producer of styrax gum in the world, as Mexico is no longer producing it. The gum has a strong, pleasant smell and is used internationally as an ingredient in perfumes and tobacco and as a fixing agent in other smelling substances. Overall export volume of styrax gum is about 40 tons/year and has been more or less stable during the last decade¹⁰ with a value of 1.2 million dollars (about USD 30 to 35/kg). The profit margin of middlemen and exporters along the supply chain is extremely high: Producers receive between USD 8 and 14/kg, resulting in a profit of up to USD 27/kg, which is distributed to the middlemen and exporters who incur very little cost as the gum is not further processed before export (apart from filtering and packaging). At the local level, it is also used as a medicine to treat wounds and inflammations due to its antiseptic and antibacterial characteristics (Alarcón, 1984). Styrax gum production is based on indigenous knowledge. In Honduras, the indigenous Pech people have produced and sold the gum to European traders for centuries (Wells, 1857; Conzemiuss, 1927). The main production area is in the ancestral territory of the Pech. Until 50 years ago, exporters bought directly from the producers, but this came to an end in 1970 due to governmental regulations. During that time, about five collectors had been established at the local level who bought gum from the producers and then sold it to exporters. But at the same time, the Pech territory became subject to a governmental colonisation programme, and the Pech had to abandon their villages and find new ones. Many of the mestizo settlers got involved in styrax gum production. Today, Pech production only amounts to about 15% of the national volume. For more details about styrax production, please see the annex.



>> Production: To stimulate gum flow, producers make a couple of wounds (size: 15 x 15 cm, depth: 8 cm) in the tree trunk with the help of an axe (so called “huacas”), as the gum is produced in the wood. Despite the fact that the wounds go deep into the wood, the trees can heal and close them completely if they are done correctly (only one circle of “huacas” per year and a phloem “lifeline” needs to be maintained from the base of the trunk to the crown (Woda, 2014). Trees should have a trunk diameter of at least 30 cm, and a maximum number of 70 huacas per tree has been shown to be critical for tree vigour (Woda et al., 2012). The “huacas” are made at the beginning of the raining season, and the gum is collected 5 to 9 months later. The gum flows very slowly, and the average production per tree is about 0.2 kg (Woda, 2014). Although styrax trees could be grown easily on fallow land, all production is done as wild collection from trees in more or less intact tropical mountain forests.

>> The challenge: Honduras holds a monopoly position in the world market for styrax gum production. Producers and exporters should turn this into a strategic advantage with respect to direct marketing but unfortunately the sector is characterised by a lack of transparency and communication along the supply chain, which almost led to the collapse of production. In 2010, selling prices on the international market increased significantly due to production scarcity. At the same time, however, prices paid to producers were kept low by exporters and collectors,

¹⁰ Personal communication with M. Mane from MANE, Grasse.

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as they were not willing to share their profits from the increased prices on the international market with the producers. For many producers, styrax production was no longer profitable and they abandoned production. The gum became even scarcer and more expensive at the international level, and the main clients from the fragrance industry considered replacing styrax with synthetic substances.

>> Strategic approach: In view of the collapse of the Styrax gum production, several international fragrance companies based in France were joining and supporting the non-profit organisation “Natural Resource Stewardship Circle, NRSC”, that signed a DeveloPPP partnership with GIZ with the aim to strengthen sustainability along the styrax supply chain. The initiative was driven completely on market demand and implemented under a value chain approach. GIZ’s objective was to promote the conservation of natural resources through creating sustainable income opportunities. Special attention was paid to the fact that the use of styrax is based on indigenous knowledge, and a focus was put on promoting Pech indigenous producers on the market.

>> Impacts on economic sustainability: As a first step, a register of producers was established in order to understand where production takes places. The information obtained was used to create a traceability system, which has been a key element for creating a scheme for fair pre-financing for the up to 9-month period between tree tapping and harvest. The traceability system also facilitated quality improvements, as the origin of impurities could be easily identified. This has long been one of the major interests of the exporters. Furthermore, best practices for cleaning in field conditions were developed together with a national research institution and resulted in increased income for producers at the village level. In addition, clients were asked to align their purchase orders to the production cycle, so that producers can factor in this information when planning the tapping, thus avoiding overproduction. Production costs were calculated in a participatory way, and among international companies, a minimum price for producers was promoted. The indigenous producers’ organisation provided an opportunity to establish direct market access to an international company. In this supply chain, prices paid to producers increased by up to 50%, and additional premiums were paid to the producers’ group for administration and the implementation of social community projects. This supply chain has been active from 2014 until today. In some years, producer prices increased across the whole styrax sector (about 350 producer families).

However, today, producers who are not organised are exposed to volatile prices again. Multi-year contracts were promoted among clients, but have been successful in only a few cases.

>> Impacts on social sustainability: The small size of the styrax sector (3 exporters, 5 local collectors and about 350 producers) has made it possible to reach out to all actors involved in production, although with different intensity. About 100 producers of 4 producer organisations especially benefited with regard to capacity building. This resulted in the improved management of their organisation, labour safety, and social community projects for the village school, a medical centre and church, all financed by styrax income. The uniqueness and global monopoly position of Honduras in styrax production was promoted among authorities and the public, as well as its indigenous origin. As a result, styrax got declared a patrimony of ancient indigenous knowledge by two municipalities. The increased attention given to the Pech indigenous people has led to another important impact: The Pech culture is known to be closely related to forests, and the forests around their villages are well preserved. During project implementation, a nearby forest area was declared a national park, but this would have made styrax production for the Pech producers in the area illegal, as production would no longer have been allowed. The declaration process was stopped, and a consultation process was conducted in line with the principles of free, prior and informed consent (FPIC). As a result, the “Anthropologic and Forestry Reserve El Carbon Mountain” with 34,000 ha of forest land was created, and special permission was given to the Pech people allowing them to continue with styrax extraction. This process has led to the Federation of the Pech Tribes FETRIP being awarded the UNDP Equator Prize 2017 for its commitment to preserve forests and its sustainable use practices. It was also recognised as a best practice of Access and Benefit Sharing (ABS) within the styrax gum supply chain. Years later, a similar process was put into place for a mestizo organisation that been producing styrax in a protected area for decades. Here, a solution was also found in cooperation with the forest administration to extend a special usage permit to the producers, in consideration of the fact that styrax gum production motivates the producers to preserve forests, instead of converting them into pastures or agriculture land.

>> Impacts on ecological sustainability: All styrax gum is produced from naturally regenerated trees in native forests. The income generated by styrax gum is high enough to keep producers strongly motivated to keep the forests instead

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of converting them into agriculture land. However, producers are forced to defend the forests against foreign invaders. This has already led to violent conflicts as public institutions do not adequately prosecute environmental crimes. The project has supported the indigenous producers in juridical processes, assisted with setting up field inspections to stop illegal deforestation and helped them defend their own territory. Positive impacts also resulted from improved styrax tree management. Best tapping methods were identified in a participatory way and promoted to reduce tree damage (Woda et al., 2012; Woda, 2014). The forest administration has established guidelines for sustainable forest management plans for styrax that have become binding. They have also created a producer register and implemented a traceability system. Until now, 3 styrax gum management plans have been approved, of which one has been financed by the GIZ and two by the private sector, covering a forest area of about 30,000 ha.

Lessons learned from styrax gum (*Liquidambar styraciflua*) production in Honduras

- The initiative to strengthen the styrax gum supply chain is based on the expressed market demand, and the develoPPP were initiated by international companies. The potential of this niche product was not recognised by GIZ, which was originally focusing on the promotion of traditional mainstream commodities in the project region. However, the remote geographic location and limited infrastructure was hindering a successful promotion of these commodities (coffee, cocoa, timber), whereas the exclusiveness of styrax gum made it highly competitive and much more feasible for the region.
- As demanded by international clients, the “black box” of the supply chain was lifted and clients that formerly exclusively purchased through brokers were presented to exporters, collectors and producers. This was necessary since it appeared that the styrax market collapsed due to speculations by middlemen and exporters. The promotion of transparency was initially rejected by them, as they feared that they would get kicked out from the supply chain or lose their margin. However, it quickly became clear to all that more transparency and fewer speculations were needed to ensure fair prices for producers and to save the supply chain. The involvement of an independent national research institution in the project’s activities was a key factor for trust building and made it feasible to provide technical assistance in postharvest practices to all stakeholders including producers, collectors and exporters. Given the political instability in Honduras and the frequent staff rotation within public institutions, the institution also became a key player in long-term knowledge management.
- It is critical to note that a former GIZ technician took advantage for his own benefit of the trustful sharing of knowledge by the actors inspired by the project’s promotion of transparency throughout the sector. He became personally engaged in the styrax business and has pushed out other collectors and exporters from the supply chain. Today, he is one of the largest intermediaries for styrax gum.
- It was a challenge to curb the expectations of private and public actors about growing market demand in order to avoid overproduction and resulting price drops. The supply chain should not be focused on increasing production, but rather on the creation of fair and sustainable production conditions in order to maintain the volume and quality of current production over the long term.
- Close coordination with the forest administration has facilitated improvements to the taxing system for styrax gum. The authority was also assisted in creating easy-to-follow regulations for styrax forest management. However, the regulations set are similar to those for logging, and, in addition to cost-intensive forest inventories require the elaboration of complex forest management plans that are difficult to understand and implement by the communities. Indigenous producer organisations that do not use the services of intermediaries have had difficulties in getting their forest management plans approved, whereas producers that work closely with intermediaries are helped by them to overcome the bureaucratic barriers – a situation that is not in line with the idea of strengthening the sector and building up strong and independent producer organisations.
- The impact of forest management plans with respect to improving the quality of forest use seems to be relatively small since their implementation is not really monitored. The plans are mainly used by the forestry administration as an administrative document to prove the legal origin of the gum when extending export permits. Nonetheless, producer organisations appreciate having a forest

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management plan as it increases the security of forest use rights and might constitute a first step toward community land titles.

➤ The indigenous Pech people are facing serious problems when it comes to defending their territory and forests against land grabbing by settlers. During the project implementation phase and with the international companies on board, the pressure was reduced. Nevertheless, long-term sustainability of forest conservation has not been assured. Land conflicts continue, and since the end of the PPP, public institutions have reduced their attention to the ongoing problem. While this is a general problem in the area of cooperation, it is particularly severe here, as environmental crimes are mixed with human rights violations, and land conflicts can easily culminate in violent acts. The clients were encouraged to pay a premium enabling producers to cover their costs for administration, forest inventories and measures such as fire prevention and thinning, and social projects to compensate the use of community forests. These additional funds were successfully managed by the producer organisation during project implementation, but funds were no longer properly administered after the project ended and the additional income was just distributed among the members for their personal use. Today, the organisation has a very reduced capital. Here, longer assistance and monitoring of the organisations would have been needed.

➤ Despite the excellent characteristics of styrax gum and it being a commodity that allows local people to produce an income while actively contributing to forest conservation, no certification is in place that provides a form of proof and shows the associated benefits. This can be attributed to the fact that in the perfumery sector certifications are not demanded by clients. The customers' interest in aromatic natural products is rather focused on organic certifications, as these are required by the food sector if the product is used as a flavour-adding ingredient, but these would not have any real effects as production comes from wild harvest. Furthermore, it is not clear who would bear the extra costs, and the benefits to producers could be very small.

➤ The smallness of the market has thus become a success factor in achieving real changes and being able to reach out to all actors involved. All of the different actors (350 producers, five collectors and exporters) benefited in different ways (e.g. improved knowledge about market demand, quality requirements, technological improvements, more stable and higher prices for producers and fair pre-financing), and became aware of the fragility of the supply chain in which each actor has an important role to play, especially the producers who are most vulnerable. The support provided to the international clients with respect to contacting producers directly and setting up onsite visits, which allowed them to gain insights into the producers' reality and needs, had a major impact. As a result, they were more open to implementing fair trade principles, and one of the DeveloPPP partner companies has purchased the same amount of styrax gum year after year, despite low demand in the 2020 and 2021 COVID-19 years, because it recognised its responsibility as a strong company to mitigate market risks rather than shifting them to the (poor) producers. This strong partnership is perhaps more valuable than any certification.

e) Dealing with a monopoly: strengthening of an alternative supply chain of Siam benzoin gum (*Styrax tonkinensis*) in Lao PDR

Siam benzoin gum is an aromatic balsam (Wang et al., 2006; Wang & Zang, 2012; Wang et al., 2020) obtained from the broad-leaf *Styrax tonkinensis* (*Styracaceae*) tree.¹¹ The vanilla-like smelling “gum”¹² is used by the international fragrance industry, and, at smaller scale, in the food sector, in addition to a local demand for medical purposes. *S. tonkinensis* is native to the region of the Tonkin Bay in Southeast Asia. It is an abundant tree in early succession stages of natural forests, often mixed with bamboo. The tree has a life span of up to 60 years and is of “least concern” on the IUCN red list (Liu, 2019). For decades, Lao People's Democratic Republic (PDR) has been the only producer of Siam benzoin gum in the world. However, benzoin gum production got reactivated in Vietnam in 2017 due to severe market disturbances in Lao PDR (Woda, 2017).

11 The name “Siam” gum refers to the traditional port of delivery in Thailand, although the gum is mainly produced in Lao PDR and to a small extent in Vietnam. It is distinct from Sumatran benzoin gum, which is produced in Indonesia. The author uses the term “benzoin gum” to refer to Siam benzoin gum from Lao PDR.

12 The term “gum” is incorrect since benzoin is not a water-soluble polysaccharide that is a main characteristic for tree gums (Kashio & Johnson, 2001). However, it is used on the international market.

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Siam benzoin gum is used as an ingredient in floral-oriental perfume compositions. Additionally, there is also an increasing demand by the food sector, and the gum is used in the Middle East, India and North Africa as incense (Yokoyama, 2004). The demand by western perfumery companies has been quite stable at around 50 tons per year during the last 20 years (Kashio & Johnson, 2001; GIVAUDAN, 2009; Woda, 2019). Overall, the challenge is not the development of the market, but maintaining production volumes, as the agricultural rotation system circles have been shorted in the past. This means that there may not be enough time for styrax trees to reach productive age.

>> Production: Benzoin gum is produced by farmers who mostly tap trees on fallow land in their agricultural areas as part of a long-term agricultural rotation system (Kashio & Johnson, 2001). In very remote areas, the gum is also harvested in native secondary forests. At a small scale, styrax plantations are used that have been established with timber purposes in mind. To stimulate the gum flow, cuts are made into the bark once a year. Since the trees are more productive at the upper part of the trunk, the producers have to climb all the way up the tree crown. The gum flows very slowly and is harvested a couple of months later. This requires climbing up the trees again. The gum is then hand-cleaned and classified according to its size for export. If tapping cuts are well placed, the trees survive and remain productive for many years. However, the trees are generally cut before they die naturally, as the fallow land is needed again for other agricultural purposes. For more details about Siam benzoin gum production, please see the annex.

>> The challenge: After the collapse of the Soviet Union, the benzoin gum sector in Lao PDR suffered from market uncertainty but recovered thanks to demand from western companies. In 2012, a new trading company in Lao PDR began offering very high prices to producers so that the already established companies could no longer compete. In this way, the new company built up a monopoly position for benzoin gum for the western export market. After some time, the company lowered the prices for producers, but, at the same time, increased prices on the international market. Many producers gave up production. Benzoin gum became scarce, which pushed prices even higher at the international level. The situation became critical for the perfume industry which depends on a constant supply since perfume formulas cannot be quickly adapted. Alternative supply options needed to be created. This situation was similar to what was experienced on the styrax market in Honduras.

>> Strategic approach: The Regional BioTrade Project Southeast Asia, financed by SECO and implemented by Helvetas, provides support to export companies while promoting the UNCTAD principles for BioTrade. The strategic approach is to strengthen exporters' capacities for bio-products since they are key actors when it comes to promoting sustainability along the upstream and downstream supply chain. To strengthen the benzoin gum sector, a partnership was created with a national benzoin gum trading company to promote direct market access for producers from the province of Luang Prabang. Sustainability criteria for Siam benzoin production were established in a participatory process (Woda, 2019), and the company was assisted in becoming compliant with the standard and improving its export skills. Direct market access was successfully promoted with two European companies.

>> Impacts on economic sustainability: The export company that suffered from the recently created monopoly position of the competing company could re-establish its direct engagement with producers after 6 years of interruption. Purchasing agreements were signed with more than 300 producer families from 10 villages in 3 districts. Information about production conditions and location of the production areas was collected in order to establish a traceability system. Production costs were calculated in a participatory way, and a minimum price was established that covered producers' costs while being 50% higher than the formerly offered price. So far, 10 tons of benzoin gum have been bought by the company under direct purchasing agreements with an overall value of USD 120,000, providing an average income of USD 400 per producer. Producers are not obligated to sell to the company and can choose their best market option. The direct purchasing model with full traceability and communication with international clients made it feasible to clarify quality requirements and introduce a quality standard. One customer has expressed its interest in organic certification in order to enter new markets in the food sector. The company is currently preparing for this certification.

>> Impacts on social sustainability: The producers belong to the Khmu and Hmong ethnic groups, which are historically marginalised. The company appreciates especially the Hmong for their high quality gum resulting in one of the Hmong village chiefs being appointed to become the company representative for the district. This has increased the social respect for the Hmong people at the local level. The company has supported the mapping of the production areas in order to be able to review the land use rights situation. 56% of the producer families have legal land

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use documents, but 44% are working under customary law. Despite the lack of land use security, many of those producers have made long-term investments in the form of benzoin tree plantations. The information compiled provides the basis for future actions to improve land use security, but so far no action has been taken. In addition, the company has analysed labour safety risks. It donated medicine and first aid kits to five villages, and contacted a hospital to coordinate a major donation of medical products. Personal safety equipment was identified to be useful, but so far no equipment has been handed out yet due to a lack of funds.

>> Impacts on ecological sustainability: The company's president participated in a systematic and participatory research project by FAO to determine the best production techniques (Kaisho & Johnson 2001). The company now strives to promote these techniques, which also include aspects of biodiversity conservation and labour safety, to other producers. The application of best tapping techniques helps to maintain the trees' vitality and productivity in the long-term. The production of benzoin gum motivates farmers to extend the growing period of benzoin trees in their agricultural rotation system. The trees are a food source for insects, birds and rodents. Managed under natural-like conditions, the stands can form green corridors to link spatially fragmented high biodiverse forests such as mountainous evergreen broadleaved and coniferous forests (Wilson et al., 2019).

Lessons learned from Siam benzoin gum (*Styrax tonkinensis*) production in Lao PDR:

- Due to the limited number of exporters for benzoin gum from Lao PDR there is still the risk of a monopoly and, as a result, of price setting by exporters on the international market. This setup is supported – probably involuntarily – by governmental regulations since the local forestry administrations extend concessions to companies that include “harvest quotas” they are allowed to purchase from a certain district. Therefore, even though producers are not officially forced to sell to this company, pressure by governmental institutions is sometimes felt, which prevents additional companies from being established.
- Nevertheless, besides the official concessions, there are informal buyers, often from neighbouring countries (Vietnam, China), that are not officially registered and do not pay any taxes. Therefore, they have fewer costs and can offer higher prices to producers, putting pressure on the national company to do the same.
- The conclusion of multi-year contracts by clients was promoted by the project in order to increase planning security, but has not been feasible, and trading volumes have been quite low due to COVID uncertainties. Here, the potential to encourage companies to assume responsibility while making use of their larger capacities to amortise financial deficits and market risks instead of shifting everything back to the producers has not been fully utilised.
- Direct business with international clients has allowed the pre-financing schedule to be adapted so that funds can be given to producers at the start of tapping. However, in practice this did not work since the pre-financing was provided to exporters with the expectation that they would pass it on to producers and ensure that the funds were properly used to cover the producers' cost of tapping the trees. The exporters, however, set different priorities for what needed to be financed, such as the establishment of a traceability system, the mapping of production sites, the elaboration of didactic material and getting prepared for organic certification. Thus, the pre-financing meant to support producers turned into pre-financing that benefits exporters. A stronger external voice would be needed to promote a more balanced sharing of benefits here.
- A further issue that hinders the implementation of adequate pre-financing that enables producers to cover the period from tapping until harvest is the low commitment of the producers to the export company. The company is facing strong competition from informal buyers from China and Vietnam who offer higher prices. This carries the risk that producers may sell to them despite the pre-financing obtained from the export company.
- To overcome this bottleneck, the idea came up to support the creation of a producers' organisation. However, working closely with governmental authorities seems to be more efficient when using existing structures instead of newly created ones. Therefore, it was decided to coordinate all activities through the village chiefs, who traditionally hold social and hierarchical functions in the villages. The village chiefs work closely with the authorities and are responsible for organising the purchase, payment and storage of the gum. They receive a small fee in exchange for their services. This strategy has been quite successful, and even the mapping of the production areas, which required an extensive amount of work, was done in an efficient manner.

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- Despite the fact that all producers and production areas are registered, the traceability system is still not in place, as this requires the registration of all production activities carried out by the producers (tapping date, number of tapped trees, labour days spent etc.), which still is not done. The reason behind this may be the lack of pre-financing made available to producers. Without these payments, producers do not feel any obligation to the company with respect to carrying out additional administrative work.
- Another challenge for building long-term relations between producers and the export company with regard to the traceability system is the fact that many producers do not have constant gum production due to their agricultural rotation system in which benzoin only grows in the interim phase between rice and other crop production. However, if market conditions became more attractive with stable demand and prices, producers would likely plan their rotation system in a way that allows for a stable benzoin gum production.
- Although the traceability system is still not fully in place, the baseline information gained has been crucial for establishing direct business with international companies, as it shows commitment to working transparently. The information available on producers and production conditions has been further used to design an action plan for organic certification. The export company further expects that the gum quality will improve based on the traceability system, as the origin of impure batches can be easily identified and traced back to an individual producer.
- Despite the fact that benzoin gum is produced in a system that is similar to the wild harvest system and no agrochemicals are being used, one of the clients insists on organic certification, as this is required by the food sector. It is expected that this certification will have no real effects and the production system will not be changed. Meanwhile, the real challenges of biodiversity conservation remain unaddressed. A special challenge is the periodical clear-cut of the benzoin trees and burning of the production area once it is turned back to agricultural use. There are strong negative impacts on biomass, microorganisms and soil fertility in the long term since the nutrients in the burned ash on the steep slopes easily erode when it rains and are no longer stored in biomass. It is still uncertain how this issue will be addressed in the certification.
- The current focus of the company when it comes to promote ecological sustainability is on promoting the best tapping techniques to minimise tree damage and on adequate land use planning to ensure long-term production, whereas options to promote biodiversity conservation, such as enrichment planting of fruit trees and surrounding hedges in order to create a more structured and biodiverse production area, are still untapped. Overall, the knowledge of *S. tonkinensis* and its interaction with wild life is still very limited, and specific studies are needed for a better understanding and for drawing effective actions plans that improve biodiversity conservation in connection with benzoin gum production.



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4.2 Strengthening sustainability in mainstream export commodities

a) Land restoration with cocoa (*Theobroma cacao*) in agroforestry systems in the Brazilian Amazon

Brazil is the biggest cocoa producer in Latin America, and the sixth largest cocoa production country in the world¹³ with an estimated production of 200,000 tons in 2020/2021¹⁴, mainly in the form of cocoa butter, not cocoa beans (Conceição et al., 2020). Brazil is also the world's fifth largest chocolate consumer country, and national production does not cover domestic demand. Thus, Brazil imports approximately 70,000 tons of cocoa annually¹⁵. There are more than 93,000 cocoa farms in Brazil, mainly in the states of Bahia and Pará. 84% of the farms have an area of less than 50 hectares¹⁶, and 70% (70,000 producers) are working on even smaller properties in family agriculture (MAPA 2021). The producer structure is in contrast to the high concentrated market power of the national cocoa industry, which is dominated by four companies, three of them being transnational (Archer Daniels Midland, Cargill, Barry Callebaut) and one Brazilian (Indeca). The three foreign companies account for 97% of the grinding and roasting of cocoa beans in Brazil and supply major chocolate brands such as Nestlé and Lacta (Mondelez) on the national market.¹⁷ To improve the position on the world market for cocoa beans, efforts were made to distinguish the Brazilian cocoa from bulk cocoa: In 2019, the country was certified by the International Cocoa Organization (ICCO) as an exporter of 100% fine and aroma cocoa, thanks to its genetic characteristics ("cacao trinitario") and the superior post-harvest treatment of the beans. However, fine cocoa is a niche market (MAPA 2021), and cocoa beans amount to less than 1% of the export value of cocoa products from Brazil (Conceição et al., 2020).

>> Production: Cocoa production is labour intensive and requires year-round farming activities. The harvest is spread over several months, usually with a major and minor peak of pod ripeness; however, fruit ripening takes place at a smaller scale throughout the year. The pods are highly susceptible to diseases, especially to fungi infections, and require permanent attention by the farmer in order to maintain them through pruning and shade regulation, and

the elimination of affected fruits. These requirements are one of the reasons why cocoa production is still mainly performed by small holders, as it is difficult to mechanise the work. In order to develop the full flavour of the cocoa beans, they must be fermented. For optimal fermentation, a minimum volume is needed, which often cannot be produced by one small producer alone. Therefore, cocoa farmers have to coordinate their harvests to ferment their crops together. After being fermented, the beans must be gently dried, which is another challenge due to the wet conditions experienced in tropical climates.

>> The challenge: The deforestation of the Amazon in Brazil continues. The cleared land is used as farmland for subsequent years, but due to the decline in soil fertility it is often turned into pastures for extensive cattle grazing soon thereafter. The ongoing loss of biodiversity and soil fertility and effects on the local climate by forest conversions threaten the smallholder farmers' resilience and food security. At the same time, the domestic supply gap for cocoa persists (Igawa et al., 2022). Thus, the government is interested in expanding cocoa production. If well managed in agroforestry systems, cocoa is also a valuable option to restore degraded land¹⁸ and improve farmers' resilience. However, cocoa takes several years to reach full production, and many farmers do not properly manage the agroforestry system which requires special attention to adequate shade regulation, resulting in a high disease infection rate, low yields and low income. At the same time, cocoa in monoculture is promoted to be more productive and easier to handle, which leads farmers to abandon the implementation of biodiversity-rich agroforestry systems (Andres et al., 2016; Utomo et al., 2016).

>> Strategic approach: GIZ has started a partnership (develoPPP) with Mondelez to support the implementation of the Cocoa Life programme. Cocoa Life was launched by Mondelez in 2012 as an initiative to improve the conditions along their cocoa supply chain in 6 countries, including Brazil. The idea is to support farmers in increasing their productivity and income within a sustainable cocoa farming environment while restoring land and

13 <https://worldpopulationreview.com/country-rankings/cocoa-producing-countries>

14 <https://www.statista.com/statistics/497876/production-of-cocoa-beans-in-brazil/>

15 <https://www.worldcocoafoundation.org/initiative/cocoaaction-brasil-en/>

16 <https://uaiaagro.com.br/cacau-gera-r-18-bilhoes-mas-brasil-ainda-tem-problemas-de-producao/>

17 <https://reporterbrasil.org.br/2020/08/slave-labour-and-inhuman-wages-labour-violations-in-brazils-cocoa-industry/>

18 <https://www.nasdaq.com/articles/cocoa-processors-in-brazil-see-5-grind-jump-as-country-reopens>

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protecting forests¹⁹, as in this case degraded pasture land in the Amazon state of Pará. The PPP is implemented in partnership with The Nature Conservancy who promotes agroforestry techniques that allow the creation of alternative income for cocoa farmers, while increasing local biodiversity and restoring the ecosystem. GIZ's focus is on capacity building of farmers, besides supporting the development of a market strategy for farm diversification, environmental land use regulation processes and improved knowledge management.

>> Impacts on economic sustainability: In view of the large cocoa sector in Brazil with more than 90,000 farms, the Cocoa Life programme reaches out to a relatively small number of farmers. In all of Brazil, there are 875 farmers participating in the programme, of which 300 are located in Pará. One of the most important economic impacts achieved by GIZ is the successful linking of cocoa farmers to local government programmes so that the different products from the agroforestry systems are marketed and used in the implementation of social public programmes, such as school feeding programmes (so-called “Mercado institucional” in Brazil). The farmers are further assisted in the value-added processing of their products from the agroforestry systems, such as manioc, banana, açaí and cupuaçu, for local markets or even for own consumption. Farmers receive additional technical assistance to increase their cocoa yields, which should lead to increased incomes (cost-benefit analysis of additional labour/input compared to the achieved benefits is still pending).

>> Impacts on social sustainability: The production of different tropical fruits in the agroforestry systems has allowed for the creation of jobs at the local level thanks to the processing of diverse products. Adequate processing equipment has been provided to the communities. Most of the people involved in the processing are women and young people. They benefit from additional and alternative income within their communities by processing and selling nuts, fruits and pulp to the local market or social public programmes. Here, an important task was to prepare the farmers to meet the administrative and organisational requirements to join the “institutional market” through the public programmes. The diverse production system furthermore improves the food security and quality of life of 300 families.

>> Impacts on ecological sustainability: Since 2018, 1,000 ha of degraded pastureland have been recovered and converted into higher biodiversity areas with more habitats for wildlife and improved soil health. The species composition of the agroforestry systems varies according to the age of the plantation and the local availability of species (manioc, banana, coco, acai, andiroba, cupuaçu and babaçu, in addition to others). The production of cocoa in agroforestry systems gives producers the opportunity to comply with the Amazon Forest Code of Brazil, a law that requires landowners to maintain 80% of their property under native vegetation. The project contributes to the implementation of the code by supporting farmers in the mapping of their property, sustainable farm use planning and the registration of the property in the governmental environmental cadastre system (*Cadastro Ambiental Rural*, CAR). Besides this, further ecological impacts are achieved through the promotion of solar dryers for agroforestry products and cocoa beans, which replace the traditional drying method and reduce the use of firewood.

Lessons learned from cocoa production in the Brazilian Amazon

- The process to convert traditional cattle farmers to cocoa farmers that manage a labour-intensive and complex agroforestry system requires intensive technical assistance to build up the necessary capacities and motivation. In this regard, the relatively small number of farmers reached by the project is justified due to the personalised, direct and high quality technical assistance given to the producers, including farm visits and tailored extension services for case-based solutions. It shows that the size of the sector is not an adequate indicator of the number of producer families who benefit from a project; rather the success of the project is defined by the quality and intensity of the provided technical assistance.
- The main challenge of the project is to provide evidence to farmers that cocoa production in diversified agroforestry systems is a real alternative to extensive pastoralism, with benefits not only for the environment but also for the families' economy. To achieve this, the project does not pursue the promotion of premium cocoa and access to specialised niche markets, but strategically focuses on the valorisation of diversified production by promoting market access and income opportunities through selling the different products of the agroforestry system.

¹⁹ <https://www.cocoalife.org/the-program/approach>

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This approach has been successful and has, in particular, enabled women and young people to create income opportunities through the value-added processing of products in the communities.

- Close cooperation with municipal governments has been an important success factor in the commercialisation of products from the agroforestry systems. Farmers have easy and secure access to the market, since municipalities are requested by law to give preference to local products when implementing public programmes. However, in practice there have been some constraints, especially by public functionaries involved in pastoralism and cattle raising who sometimes have different personal preferences about where to source. Here, the specific promotion of certain resources and agroforestry lobbying activities might be considered. However, it should be clarified that not all fruits from the agroforestry systems can be successfully marketed, as some rot quickly and investments for pulp-processing equipment would be disproportionately high. The benefits here are clearly in the improvement of the producer family's nutrition (and that of neighbours), instead of making profit through the commercialisation of the product.
- The organisation “Reporter Brasil” (Campos & Diaz, 2020) reports that multinational cocoa companies in Brazil still purchase from supply chains that violate social and human rights. Slave-like labour and child labour, as well as undignified housing and sanitary conditions persist on some (larger) cocoa farms. According to this report, Mondelez has acknowledged that it is difficult to create good working conditions on plantations, and that the Cocoa Life programme can be seen as an attempt to improve production conditions. However, as has been said before, the overall number of families reached by the programme is still low. Furthermore, the programme does not specifically consider social criteria, and living wages, real incomes and minimum prices are not taken into account²⁰. A broader mainstreaming of the best practices experienced within the develoPPP at the pilot level is urgently needed to affect real change in Brazil's cocoa sector.



b) Improving the land use governance for palm oil (*Elaeis guineensis*) production using a landscape approach in Indonesia

Indonesia is the largest economy in Southeast Asia and the largest palm oil producer in the world. Palm oil contributes to 2% of Indonesia's GDP, and it is estimated that 8 million people are employed in the national sector. The main production areas in Indonesia are located in Sumatra and Borneo (Kalimantan). In Kalimantan, production has steadily increased over the last years to 50 million tons, and in 2019, around 426,000 ha of forest land were used for oil palms there. Palm oil production in Indonesia is commonly associated with deforestation, peatland fires, biodiversity loss and human rights abuses (Obidzinski et al., 2012; Gaveau et al., 2016; Purnomo et al., 2017), and Greenpeace's campaign against Nestlé due to their use of palm oil from Borneo for the *Kitkat* chocolate bar and the associated orang-utan habitat destruction became world famous. However, the extension of large scale plantations seems to have reached its peak in 2009, while today small holder plantations are increasing, often located close to or in protected areas or peatland.

²⁰ <https://labelchecker.de/label/114-cocoa-life/>

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>> Production: Palm trees are grown in mono-structured and mono-aged plantations. Seedlings are 16 to 24 months old when planted in the palm grove. Oil palms are monoecious, with male and female flowers on the same trunk. The first harvest takes place after around 30 to 44 months. Although oil palms can reach ages of up to 200 years (Verheye, 2010) they are generally replanted after 20 to 25 years in commercial plantations, as trees become too tall to be harvested, and productivity is decreasing (FAO, 1990; Corley & Tinker, 2016). For more details about palm oil production, please see the annex.

>> The challenge: Palm oil production has been one of the main drivers of deforestation in Kalimantan, and is currently expanding into peatlands. In consumer surveys, palm oil has been deemed to be the least environmentally-friendly vegetable oil, and companies are trying to reduce the use of palm oil in their products (Ritchie & Roser, 2021). On the other hand, oil palms are the crop with the highest productivity of vegetable oil per hectare. A total ban of palm oil might cause the expansion of other oil plantations with lower yields, and then even more land would be used for oil production. Thus, options for a more sustainable way of palm oil cultivation are needed. In this sense, the Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004 in response to increasing concerns about the impacts of palm oil on the environment and society, and a production standard has been set with best practices. In 2010, the Indonesian government developed the Indonesia Sustainable Palm Oil (ISPO) certification, and in 2019 a moratorium was established to stop the conversion of primary and peat forest to palm plantations (Pacheco et al., 2018; Luttrell et al., 2018; Schoneveld et al., 2019). However, these certification schemes mostly focus on addressing environmental concerns related to deforestation, whereas social-economic issues remain unattended.

>> Strategic approach: The GIZ project “Low-Emissions Oil Palm Development – LEOPALD” has identified the low efficiency of land use planning as one of the main problems in the palm oil sector that generates social conflicts, ongoing deforestation and emission of greenhouse gases. The project applies a landscape approach at the district level to achieve jurisdictional sustainability with respect to land use. The local government system is strengthened in order to improve its land use planning, licensing and monitoring performance – all critical functions in land use governance. Furthermore, local communities are supported in the mapping of their territory so that they can be adequately considered in land

use planning and the elaboration of 25-year land use plans. In addition, capacities are built among smallholder farmers to implement best practices in palm oil production including the proper use of agrochemicals (mainly fertilisers) to increase productivity and income under the scheme of RSPO and ISPO standard certification. Partnerships with the private sector are promoted in order to jointly achieve the desired structural change towards a highly-productive and sustainable palm oil production.

>> Impacts on economic sustainability: Overall, there are around 2,000 farmers trained in best production practices under a standard certification scheme. The impact hypothesis is that the farmers will increase their incomes through applying improved production techniques, as well as by being certified under the RSPO and ISPO standard. Capacities are strengthened for organisational development of the farmer cooperatives, such as improvement of internal regulations, the decision-making systems; skills to elaborate and work under a business plan as well as data management and administration, in order to facilitate access to better markets while being organised and offering certified palm oil.

>> Impacts on social sustainability: The project contributes to prevent land use conflicts, which are mainly community-company conflicts, through the dissemination of knowledge about villagers’ and farmers’ rights (e.g. workers’ rights, land and farm legalities, right to participate in decision-making processes according to FPIC). In addition, formal rooms for multi-stakeholder processes have been created in which villagers and farmer groups implement participatory land-use planning in coordination with local governments and the private sector. At the same time, public institutions are strengthened with regard to data management for land use planning, and existing maps and data are analysed to identify an eventual overlaying of areas that have been identified for different land use purposes. The stakeholders are supported in the elaboration of a spatial plan for the district that integrates village land use plans, as well as concessions of palm oil companies and their plantation development plans.

>> Impacts on ecological sustainability: The project focuses on biodiversity conservation through the protection of existing forests via improved land use planning and the reduction of greenhouse gases through improved energy management. So far, 10,000 ha have been identified as high conservation value (HCV) areas in coordination with the partners. These are now integrated in the

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participatory land use planning and will be conserved as agreed upon by all involved stakeholders. Also, capacities were built in public institutions to monitor land use change and to carry out strategic environmental impact assessments before land use permits are issued. At the smallholder farm level, recommendations were given for site-specific fertilisation for a total plantation area of 4,100 ha, which helps reduce the use of agrochemicals and thus provides improved groundwater quality.

Lessons learned from palm oil production in Indonesia

- The fact that the palm oil sector in Indonesia is very large – it employs 8 million people – does not mean that a project in this sector will automatically have a large impact. In this case, the target area of the project – about 4,000 ha of farm land on which improved production techniques were implemented by about 2,000 farmers – is similar in size compared to other projects that deal with less common products, including niche and wild harvest products.
- The project design is based on the assumption that the private sector is interested in participating in a multi-stakeholder processes to achieve commonly shared consensus on land use planning. In reality, interests are more complex and cooperation with private sector companies is more difficult (for example, meetings are usually attended only by company representatives with little decision-making power). The fact that the companies were not involved in the initial planning of the project and that the geographical area of the project was defined without considering the potential interests of the cooperating companies was critical.
- In the palm oil sector, the most significant pressure on the remaining natural and peat forests currently comes from smallholder farmers, not from large companies. The project's strategy to work with smallholders to increase productivity so that they do not have to expand their production areas is therefore consistent with the goal of reducing deforestation.
- The project aims to reduce the negative environmental impacts of palm oil plantations by promoting best agricultural practices among smallholders. It is assumed that the income of producers will increase due to optimised production processes and better market access through certification. However, this cannot be guaranteed, as palm oil prices depend on various factors, including the world market price. The government at least guarantees a minimum price to farmers, but even this is often not enough for them to cover their farm maintenance costs and livelihood (see annex). The support of and assistance with farm diversification to reduce the dependency on palm oil would be important to improve the resilience of farmer families and to increase agro-biodiversity in the region.
- The project applies a multi-stakeholder approach to prevent company-community conflicts through coordinated land use planning, and it is expected that the government will align land use permits to the plan over the next 25 years. However, reality is dynamic, and the region is also attractive to migrants (intra-Indonesian or foreign migrants) in search of agricultural land (for palm cultivation or other uses). Therefore, in addition to the company-community conflicts there are also land use conflicts between local villagers and smallholder migrant farmers. These cases of environmental conflict will most likely not be addressed by the authorities since chasing away poor farmers is unpopular for them. As a result, they will not demand that the land use plans are respected. This may have large negative impacts on biodiversity, as the areas where the conflicts between villagers and migrant farmers take place are often highly valuable forest areas and peatland, since smallholder farmers are generally working in these marginalised areas (see palm oil section in the annex). It may therefore be necessary to implement specific processes in order to address these villager-migrant conflicts which are not covered by formal land use planning.
- The promotion of palm oil certification (RSPO/ISPO) is an important strategic pillar of the project. However, the market demand for conventional, non-certified palm oil is still very large, especially from India and China, the main palm oil consuming countries. As long as there is enough market demand for non-certified palm oil, the incentives for palm oil farmers, companies and smallholders to invest in higher standards are not high enough. This is rather critical, as the currently certified farms do not provide any real protection against further deforestation within the sector. To counteract deforestation, a consistent implementation of the “zero deforestation” policy and an obligation to provide full traceability for the entire sector could be more effective than individual certification schemes.

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c) Increasing cotton (*Gossypium sp.*) farmers' resilience in Uganda through improved market access

Uganda is one of the poorest countries in the world. Cotton was introduced by the British colonial government in 1900, which enforced its production via a colonist poll tax (Baffes, 2009). After the colonial period, the cotton sector became nationalised with only a few monopolised co-operative ginneries. Uganda's cotton production collapsed in 1976 when cotton markets became globalised (Chell, 2013). From a global perspective, Uganda today is a very small cotton producing country (ranked #38 globally) with an annual production of 26,600 tons. Nevertheless, cotton is – besides coffee – the most important cash crop for Uganda. There are about 250,000 farming households engaged in cotton production on farms smaller than < 0.5 hectares, which cover two thirds of Uganda's land (Baffes, 2009). The national cotton sector employs 2.5 million people, including farmers, farm labourers, seed traders, transporters, ginnery workers, textile and garment manufacturers, oil millers and exporters.

>> Production: Cotton is obtained from 40 species of the genus *Gossypium* (*Malvaceae*) which is native to the tropics and subtropics. Besides the use of the cotton fibres (seed hairs) for yarn and textiles, the seeds are used for cooking oil and soap production, seed cakes for animal feeds and fertiliser, and cotton stalks as fuel wood. It takes 8 to 9 months from seed to harvest (UNCTAD, 2005). Cotton cultivation is considered difficult, because the plant is sensitive to droughts, low temperatures and insect attacks. In some countries, genetically modified (GM) cotton varieties are used in order to reduce insecticide and herbicide use (Kooistra & Termorshuizen, 2006). In addition to the ecological risk of spreading GM cotton genes to wild species (Altieri & Rosset, 1999), this creates unfair competition for poor farmers who do not have access to the expensive seeds. While cotton production in the U.S. and Australia is highly mechanised, in Uganda it is done by hand on small farms under rain-fed conditions.

>> The challenges: Uganda's cotton sector is characterised by very low technology development which makes it difficult to respond to changing market demands and to adapt to climate change (Lugojja, 2017). Irregular rainfall patterns and volumes are affecting the yields on the rain-fed cotton farms. Heavy rainfall causes lodging and continuous rain and cold winds during flowering and boll opening

impair pollination, cause buds and young bolls to fall and reduce fibre quality (Kooistra & Termorshuizen, 2006). Many of Uganda's farmers cannot afford the costs of chemical fertilisers, pesticides and spray pumps. To maintain soil fertility and structure, crop rotation is recommended to reduce erosion and pests. However, since cotton is the main income source for many farmers, they are tempted to forgo crop rotation and instead focus solely on cotton production. As a result, diseases increase and soil quality decreases and more chemicals are required to maintain production levels. In the worst case, the land is abandoned due to salinisation and the complete loss of soil fertility (Kooistra & Termorshuizen, 2006). The relatively small cotton production of Uganda compared to other countries makes it difficult for the country to even get noticed on the world market, not to mention negotiating fair prices.

>> Approach: The BMZ/GIZ project "Promoting cotton cultivation in Sub-Saharan Africa" followed the approach "aid by trade". Smallholder farmers in remote areas of sub-Saharan countries, including Uganda, were supported and trained in sustainable cultivation practices in order to improve market access to global supply chains and to increase productivity and income. To this end, private partner companies were encouraged to work with the farmers on a contract basis as part of the Competitive African Cotton Initiative (COMPACI), supported by the Bill & Melinda Gates Foundation, Walmart and the Gatsby Foundation. Furthermore, sustainability criteria were introduced according to the Cotton made in Africa (CmiA) standard and trainings were carried out to enable the producers to meet the standard and to enter international value chains under the certification scheme.

>> Economic impacts: The main goal of the project and of supporting the CmiA initiative has been to help Uganda and other sub-Saharan cotton production countries to maintain or even recover access to the global textile market. CmiA motivates fashion brands and retailers to source cotton from Africa produced under a certified standard. The companies pay a licence fee to the foundation which allows them to use the CmiA label. This money is reinvested in the countries and used to pay for the CmiA verification process, but also for agricultural and business management training and social initiatives. The CmiA standard includes criteria for diversification of agricultural practices, pre-financing, premiums, market access and local trade practices for small producers and promotes

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their implementation. According to CmiA, the initiative has reached out to 1 million producers²¹. CmiA reports that farmers have seen a 10 to 40% increase in productivity thanks to the initiative. However, even within Africa, Uganda is just a small player among African cotton production countries. It has been reported that about 5,400 smallholder farmers have benefited from the CmiA initiative in Uganda²² – quite a high number, but still way too low to affect any real change in the national cotton sector.

>> Social impact: Cotton production under the CmiA certification scheme is fully traceable along the entire value chain, from cultivation to the final product. The standard is regulated and further developed in a public consultation process involving various stakeholders, and the companies must conduct human rights due diligence and systematic risk assessments in their supply chain. Participating companies also implement trainings on workplace safety. Audits are conducted by an independent body and include confidential interviews with workers. Nevertheless, despite the efforts to achieve traceability and protect human rights, several weak points in the CmiA initiative with respect to social criteria were reported. The standard does not require the payment of a living wage/income, and the guidelines do not apply to the employment of seasonal workers. The right to freedom of association, organisation and collective bargaining (ILO Convention 87, 98) is not promoted, and trade unions are reported to be insufficiently involved in grievance management²³.

>> Ecological impacts: The CmiA standard calls for the protection of existing natural ecosystems, their sustainable use and measures to revitalise them. It prohibits the use of highly hazardous pesticides and promotes integrated pest management measures based on ecological principles and the use of physical, mechanical and biological pest control. The standard further requires farmers not to grow GM cotton, and to reduce emissions of greenhouse gases and the dependence on non-renewable energy. Producers are also required to refrain from using irrigation systems in order to contribute to improved water management. There were no numbers available on the size of farm land cultivated in Uganda under the CmiA standard.

Lessons learned

- The high importance of cotton for the national economy of Uganda does not correspond to the country's small share in the global cotton production. The low technological standard prevalent in Uganda's cotton sector is a real challenge for smallholder farmers as they have to compete with large, highly mechanised and highly productive cotton farms from overseas. In this sense, the market driven "aid by trade" initiative under the CmiA standard provides a valuable opportunity for Uganda's producers to gain initial entry into the global market and to maintain this access.
- CmiA reports that 5,400 smallholder farmers have benefited from the initiative in Uganda. On the one hand, this is quite a high number for a regional project that is active in different countries, but on the other, it is a small number compared to the size of the national cotton sector with 250,000 farming households. This is especially true when taking into consideration the large number of international brands involved in the CmiA initiative²⁴ who could contribute in a more impactful way. A broader approach is needed to move past the pilot stage and to create a true sector-wide impact with respect to improved market connection.
- Cotton farming is highly seasonal, with harvest occurring within a few months. Farmer groups are rarely permanent, as farmers tend to enter and exit cotton production each season, deciding whether or not to cultivate based on current prices and opportunity costs (Lugojja, 2017). Therefore, the size of the land cultivated with cotton and the number of farmers involved fluctuates annually, making it difficult to include all of them in the initiative and its traceability system. In order to address this challenge and to have a broader impact with respect to promoting minimum best practices, working closely with public institutions to integrate the CmiA cotton farming rules into official regulations, combined with corresponding incentives and sporadic monitoring by the public institutions, may present a good alternative.
- A comprehensive traceability system has been set up by the CmiA initiative which enables clients to check the origin of their products and involved farmers in case of

21 <https://cottonmadeinafrica.org/was-wir-bewirken/>

22 <https://cottonmadeinafrica.org/news/cotton-made-in-africa-sorgt-fuer-nachhaltige-baumwollproduktion-in-uganda/>

23 <https://labelchecker.de/label/91-cmia-cotton-made-in-africa/>

24 <https://cottonmadeinafrica.org/partneruebersicht/>

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any quality problems or other issues. However, traceability alone is of no use to the producers – the quality of the criteria that are being promoted is of importance here. It should be mentioned that the CmiA standard is strongly market-oriented, and that environmental criteria have not really been adapted to the reality in Uganda; thus, they create no additional ecological impacts. For example, GM cotton is not allowed – however, Uganda’s smallholder farmers generally do not produce GM cotton because they cannot afford to pay for the seeds or do not have access to them. A similar situation exists in the case of pesticide use which is intended to be reduced by the standard. Berocan et al. (2014) report the use of heavy pesticides in cotton production in northern Uganda²⁵, but their use is not widespread. This is not because of the certification effort, but rather due to a lack of money. The goal of reducing CO₂ emissions does not correspond with the farmers’ reality and is probably of little impact, since most of the farmers depend on organic material, such as fuel wood, dung and cotton stalk, as an energy source and the certification probably will not be able to change this.

- The CmiA standard does not allow irrigation in cotton production. This can be seen as a positive contribution towards promoting the responsible use of water resources, but it does not meet the needs of the farmers, whose rain-fed production systems struggle with the effects of climate change and irregular rainfall patterns. Here, supporting the development and promotion of technological, locally appropriate solutions, such as low-cost drip irrigation systems, could be an alternative option that would, at the same time, contribute to a fairer and more equitable participation of the poor cotton farmers in the global market, as they have to compete against highly mechanised, large-scale plantations in the U.S. and Australia.
- Overall, the positive impacts of the CmiA initiative which enable African countries to stay in the global cotton business are undeniable and of highest importance. However, when expanding the initiative, care should be taken to clearly communicate that the standard is poor in terms of social and environmental criteria to avoid devaluing higher quality standards such as fair trade and organic cotton.

d) Farm diversification and organic arabica coffee production in a biosphere reserve in Honduras



Coffee is one of the most traded raw products in the world. It is mainly grown in countries along the “bean belt” between the Tropics of Cancer and Capricorn. Honduras is the fifth largest coffee producer in the world, with an annual production volume of 5 to 6 million tons. It has been overlooked for a long time since the rural infrastructure is poor and, as a result, most of the Honduran coffee has been sold domestically. Recently, Honduran coffee has been “discovered” to have high aromatic flavours. Germany is the most important destination of Honduran coffee: after Brazil and Vietnam, Honduras is Germany’s third biggest import source for coffee²⁶. Most Honduran coffees are grown on small mountain farms (fincas) at high altitudes of between 1400–1700 m a.s.l. All coffee in Honduras is *coffea arabica*, covering an area of about 300,000 ha managed by around 120,000 coffee producing families, of which 95% are classified as small producers. For more details about coffee production, please see the annex.

>> Production: Coffee trees are perennial shrubs with a commercial life span of 20 to 25 years. The plants need 3 to 4 years to bear fruits. There is usually one main harvest per year – and in some regions a secondary harvest – that determines the annual income distribution for many rural households. The coffee cherries are mainly hand-picked in a labour-intensive process. For quality coffee, beans are processed in wet mills where the pulp is removed. After fermentation, the beans are sun or artificially dried with

²⁵ such as cypermethrin, lambda-cyhalothrin, permethrin and profenofos

²⁶ <https://de.statista.com/statistik/daten/studie/152075/umfrage/import-von-rohkafee-aus-ausgewaehlten-laendern-nach-deutschland/>

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only the parchment skin left after (green beans). The roasting of beans is generally done in the consuming countries.

>> The challenge: Smallholder farmers in Honduras often practice subsistence agriculture (maize and beans), with coffee being the only cash crop. The effects of climate change have resulted in lower coffee yields, and the volatile world coffee prices have severely impacted smallholder income and food security. In the Cacique Lempira Biosphere Reserve in Honduras, many farmers face severe poverty. Others are looking for new land for coffee farms and expand their farms into protected forests at higher altitudes, since it is believed that soils are more fertile there and that these locations are less affected by climate change.

>> Approach: The PROCAMBIO project promotes the sustainable management of resources in the light of climate change in the Cacique Lempira Biosphere Reserve. During its first phase, the creation of model farms, which were used as training centres for smallholder coffee farmers, was supported. Particular focus was given to organic and agro-ecological production to increase coffee productivity, plant vigour and resilience to climate change, while, at the same time, reducing the use of pesticides and chemical fertilisers. Agricultural diversification has been promoted through the introduction of fruit and vegetable production to increase farmers' food security in the face of climate change and fluctuating coffee prices. In addition, the creation of alternative income options was supported, for example honey, styrax gum and blackberries.

>> Impacts on economic sustainability: On 83 model farms for organic and diversified coffee production, 1,300 smallholders were trained on sustainable coffee farming. Using the newly learned techniques, producers were able to reduce their monetary production costs by 10% at the farm level while preparing their own organic fertiliser and plant protection agents. In cooperation with local nurseries, the farmers got free access to fruit tree seedlings and seeds for vegetables which contributed to increased food production on the farm. The associated economic impact was not quantified. Approximately 100 families have participated in training programmes that teach farmers about the production and collection of blackberries, honey, and styrax gum as the processing of value-added products such as cosmetics, marmalade

and honey products can provide alternative income sources. However, the overall income from these activities has remained below expectations since market demand has been limited, and production volume and quality have not met expectations.

>> Impacts on social sustainability: Part of the project's strategy to promote agro-biodiversity was to disseminate "old" indigenous plant varieties among regional seed exchange markets, such as traditional maize varieties and indigenous honey bees. The promotion of this non-commercial germplasm has contributed to a greater respect for indigenous knowledge of sustainable agriculture and an appreciation of the indigenous culture at the local level, which can mainly be observed here in the form of mestizo farmers' increased interest in traditional, indigenous used plants and species. The Honduran Ministry of Agriculture has also recognised the potential of these old varieties in the fight against climate change and has supported the cultivation of endangered indigenous bee varieties. Furthermore, capacities to strengthen women's entrepreneurial and networking skills were developed.

>> Impacts on ecological sustainability: On the 83 model farms, 1,300 smallholder farmers were also trained in organic farming. The coffee plantations of these trained farmers correspond to a cultivated area of around 5,000 hectares, which are now expected to be managed with reduced use of agrochemicals. The agrochemical pollution of surrounding ecosystems is diminished, and farm workers are less exposed to health risks from chemical use. The production systems are also believed to be more resilient to climate change thanks to improved soil management (organic matter enrichment, green fertiliser, terracing of slopes and erosion control) and contribute to the growing of plants that are more resistant to pests and diseases.

Lessons learned from coffee farm diversification in Honduras

🍯 Organic farming gives farmers, especially those lacking cash, the opportunity to continue adequately managing their farms without spending money on fertilisers and herbicides – by achieving the effects of agrochemicals through increased labour. However, in years of higher coffee prices and farm incomes, these farmers often turn back to using agrochemicals be-

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cause they have enough money to do so and prefer to reduce their workload. Thus, the decision whether to use agrochemicals is mainly economically, not ecologically motivated.

- Despite the fact that more than half of the coffee exported from Honduras is classified as specialty coffee through 22 different programmes and certifications such as UTZ Certified, Association 4C, Fair Trade/Organic (FLO/ORG), Rain Forest Alliance (RFA), Organic (ORG), Bird-friendly, Starbucks C.A.F.E, Café Practices, Japanese Agriculture Standard (JAS), Cup of Excellence, and others²⁷, the farmers supported by the project were mostly against joining a certification programme, fearing additional costs and (administrative) work with little benefit.
- None of the mentioned certification schemes address the improvement of working conditions of coffee workers, who are often indigenous migrant workers from Guatemala, facing very poor working conditions in Honduras (CIR – Christliche Initiative Romero, 2018).
- Farm diversification for self-consumption has been successful in introducing long-lived fruit trees and shrubs. Once planted and well established, the plants continue to grow without much care from farmers. However, following the initial provision of vegetable seeds, it has been difficult to establish a sustainable system that ensures long-term seed access. For one thing, commercial vegetable seeds are not readily available in rural areas in Honduras, so seeds are difficult to get. The treatment of own produced seeds is quite complex for some species (e.g. simulating a winter period for carrots in the refrigerator to break dormancy), which makes it difficult to establish a long-term management system for self-grown seeds. Furthermore, there has been somewhat of a cultural barrier to experimenting and trying “new” foods and vegetables that often get rejected, whereas the promotion and creation of access to old landraces of native vegetables such as squash, tomato and corn has been more successful and seen a larger demand among farmers, while also contributing to conserve the local agrobiodiversity and increasing the use of underutilised, locally adapted species.
- The commercialisation of other products besides coffee as an alternative income has remained below expectations for several reasons; these include uncertainty about the legality of collecting blackberries in the core zone of the biosphere reserve (by local communities living in the core zone but whose presence is not officially recognised) and the lack of market access for styrax gum. The failed integration of local styrax gum into the existing international value chain of styrax gum in Honduras – a product for which Honduras has a global monopoly – demonstrates the need for a careful analysis of the sector and market potential before promoting a niche product. Only honey production has been fairly successful in commercial terms. This is likely due to the political attention paid to honey by the Ministry of Agriculture, which has established its own intersectoral technical working group on this topic, the Beekeeping Roundtable.
- The project has not been able to reduce deforestation pressure on the biosphere reserve’s forests through improved coffee farm management. There is currently a coffee boom in Honduras, which is actively promoted by the government. Especially the higher altitudes with still intact natural forests are of interest to coffee farmers, as coffee from these areas can be better marketed as specialty coffee (café de altura), and farms in that area are believed to be more resilient to climate change. Thus, new coffee plantations continue to be illegally established in the forests of the biosphere reserve. Especially critical is the fact that farmers get the shade trees planted in their coffee plantation certified by the National Coffee Institute IHCAFE as plantations for subsequent timber use, despite the fact that these actually replaced natural forest. Thus, illegal forest conversion in the protected area is gradually legalized. Although tree certification is not the same as a land title, it is an initial form of an official land use right, which may in future lead to full land tenure. Thus, this practice promotes gradually legalizing illegal forest conversion. The ongoing deforestation by coffee cultivation in the protected areas of the biosphere reserve was one of the reasons why the project chose to no longer promote coffee cultivation in its second phase.

²⁷ USDA 2021: Coffee Annual Report
https://apps.fas.usda.gov/newgainapi/api/Report/DownloadReportByFileName?fileName=Coffee%20Annual_Tegucigalpa_Honduras_05-15-2021.pdf

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e) Specialty arabica coffee from Laos: a niche product within the large coffee sector

>> Production: Coffee got introduced to Lao PDR in the 1920ies. The main production takes place in the south at Bolaven plateau and mostly involves robusta coffee. The total production area is assumed to be 70,000 ha (Phommavong et al., 2019). It is estimated that 25,000 farming families are involved in coffee production in Laos, and 100,000 jobs are linked to the sector – quite a significant number for a country with an overall population of slightly more than 7 million people. According to official statistics, Laos exports 20,000 to 30,000 tons of green beans per year. However, it is likely that the export volume is much larger, as shipments to neighbouring countries, especially to Vietnam, are often not registered. A considerable part of Lao coffee ends up in the processing centres of multinational companies such as Nestlé. In the north of Laos, there are arabica coffee plantations on small farms that are focusing on specialty coffee (LURAS, 2020).

>> The challenge: Lao PDR is one of the 50 least developed countries in the world and has a high rate of poverty²⁸. The technified *coffea robusta* production in the south creates coffee picking and washing jobs, but struggles with several social and economic issues. The value chain is heavily split up with a complex system of farmers, hired workers, collectors and middlemen, as well as private processing enterprises (wet mills and drying) operating under an unbalanced scheme of shared benefits, with the seasonal workers at the poorest level. Many of them come from other parts of Laos (internal migration). Most of the jobs are limited to the harvest season, which means that there are no income opportunities for workers during the rest of the year. In northern Laos, development initiatives have promoted the cultivation of arabica coffee as an alternative to opium cultivation. Farms are small, widely scattered, and have limited access to processing and transportation facilities. Many families have abandoned their coffee fields due to a lack of market access and technical assistance to increase productivity and quality.

>> Strategic approach: The Lao Upland Rural Advisory Services (LURAS) project by the Swiss Development Agency SDC provides technical assistance to smallholder farmers in the north of Lao PDR to increase their productivity and to establish access to attractive markets while

ensuring food security. The project is focusing on farmers that have established, but abandoned their coffee plantations, with the aim to assist in their reactivation while promoting specialty coffee for small markets in partnership with the clients.

>> Impacts on economic sustainability: The project provides direct assistance to about 100 coffee producing families in remote mountain villages. Producers are organised in two organisations with a current annual production volume of 5 tons of coffee beans. The producers are assisted in implementing value adding solutions, from coffee harvest to the processing and selling of the green beans. All of the labour is done by the farmer's families and by contracting additional workers from the same villages, creating a major positive impact within the communities. The production is not certified, but the farmers' organisations participate in specialty coffee ratings in which coffee is being scored according to its growing conditions and processing quality. Thanks to this rating, the farmers are able to get premium prices while selling to small- and middle-sized companies. Furthermore, the project cooperates with governmental authorities at the district level to promote best coffee production practices among 40 villages with about 900 coffee farmer families involved, and experiences are then disseminated at the national level.

>> Impacts on economic sustainability: The project puts a strong focus on strengthening the farmers' economic resilience. The highly seasonal coffee production rhythm matches up perfectly with the annual production calendar for upland rice cultivation, as its production rhythm begins when the rice harvest ends. While the rice is grown mainly for own consumption and only surpluses are sold, coffee is grown as a cash crop with a focus on the export market.

>> Impacts on social sustainability: The coffee farmers in the north of Lao PDR belong to the Hmong people and other ethnic minorities that live in remote areas with poor market access and poor access to public services. The illegal cultivation of opium is still the only opportunity for many local people to get cash²⁹. The connection of the mountainous farmers to stable and attractive coffee markets provides an opportunity for them to leave this illegal environment. Assisting producers in establishing and managing their own producer organisations has also set social processes that strengthen community cohesion

²⁸ <https://unctad.org/topic/least-developed-countries/list>

²⁹ <https://www.unodc.org/unodc/en/press/releases/2015/December/opium-production-in-myanmar-and-the-lao-peoples-democratic-republic-stabilizes-at-high-levels.html>

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in motion. The promotion of value adding activities in the communities, such as coffee wet milling and drying, but also administrative work, has provided income opportunities to many women. These types of activities, carried out within the villages, are generally more attractive to women than working far away from home in forests or fields because it is easier to organise and combine these paid activities near their homes with the domestic, unpaid work at home.

>> Impacts on ecological sustainability: In the project region, coffee is grown under the native forest cover, while replacing parts of the natural understory. At first glance, this production system is less productive than commercial coffee plantations on agricultural land with some shade trees in between. However, the native forest cover has been found to mitigate the effects of climate change on the coffee plants. In the past, frosts have severely damaged coffee flowers on other coffee farms in the project area, causing high crop losses. In contrast, on the farms where coffee is grown under the native forest cover, the coffee joins a more balanced micro-climate where minimum temperatures are up to 2 °C higher. This has helped to protect coffee flowers from frost. Apart from the fact that coffee cultivation under the native forest cover prevents regeneration of the native forest and interrupts forest succession, this cultivation system was found to have less negative impacts on biodiversity and carbon sequestration compared to other coffee cultivation systems, where the whole native vegetation is removed to plant a pure coffee plantation mixed with some selected shade trees (Philpott et al., 2008; Schmitt-Harsh et. al, 2012). All of the production is organic, and the coffee plantations, as a permanent crop, contribute to the conservation of soil on the steep slopes of the mountain areas. Coffee plantations in native forests near the villages form a buffer zone for more distant forests at the landscape level.

Lessons learned from specialty coffee production in Lao PDR:

- Although the project takes place within the large Lao coffee sector, it actually supports a niche product – specialty arabica coffee – which is marketed directly to the clients, as opposed to mainstream robusta coffee from the south which is used in the processing centres of large factories. The project directly reaches out to about 100 families.
- The market is unpredictable. Initially, the plan was to produce high-quality coffee for the export market. However, the presence of strong companies in the country, which buy almost all national coffee, prevents small national consumers such as hotels and cafés from buying cheap conventional robusta coffee, as they cannot compete with large buyers such as Nestle. Therefore, hotels and cafés also became interested in the specialty coffee from the north, even though it is relatively expensive. This was an additional, unexpected market opportunity and demonstrates that, ideally, the local market potential also needs to be considered during project planning. However, the COVID-19 pandemic subsequently drastically reduced national demand from the hospitality sector. These examples of unexpected market developments show how important it is for niche products to not just focus on one customer/sector, but to remain flexible in order to be able to adapt to different market options and to actively pursue multiple market opportunities.
- Within the project, however, the biggest challenge is not a lack of market options, but being able to meet the demand for larger quantities of specialty coffee. A new customer offers quite attractive prices, but is asking for high volumes, i.e. a whole container of about 20 tons, while producers currently produce barely 5 tons.
- Participation in the rating programme for specialty coffee is a valid alternative that allows producers to benefit from premium prices without having to get a certification. Even though producers have to pay for the external evaluation of the samples, it is still much less expensive than the fees being charged by the certification schemes. Production is done in an organic way anyway, and may even be more ecologically friendly than would be required by an organic certification. In this case, an organic certification would not have any real effects, and a certification process would not result in any additional positive impacts on the environment.
- An important lesson was not to follow a fixed plan for the promotion of producer organisations. The original plan was to establish a single processing centre for all villages. However, the different cultures of the ethnic groups to which the farmers belong required the establishment of two separate centres, which are now run by two groups with different organisational forms. While one processing centre is operated under a family-based

4 Results: deep dive into selected supply chains

business model, the other centre utilises a traditional cooperative model. Currently, the family-based organisational model in which the village members sell their crops to the leading family seems to work more effectively. However, profit sharing is not as balanced there as it is in the cooperative.

- In any case, it is important to plan a long enough project period which allows enough time for solid organisations to be built and to connect them to the market. The project works with producers who have been supported by previous development initiatives that have helped to establish coffee plantations but have not created market access. The process from farm establishment to solid market linkage can take up to 10 years or even longer.
- Due to their success in the coffee business, the producers are strongly motivated to keep their coffee plantations in the forests and have started to fence the forest stands with coffee to protect them from freely grazing cows and buffaloes. However, this is not done in coordination with the forest authority and is in fact a kind of “unofficial land grabbing”, since all forests in Lao PDR belong to the state. It is difficult to resolve this phenomenon as there is no clear legal status for land use under agroforestry.

There is the risk that farmers will expand their coffee plantations into more forest areas. The project is aware of this and has successfully promoted the reforestation of abandoned cornfields with coffee under shade trees to give producers alternatives for coffee cultivation and to avoid further encroachment into the forests. This can be seen as a best practice that could be promoted in other countries (e.g. Honduras, where coffee cultivation is increasingly expanding into intact forests, while large parts of agricultural land are degraded by devastating pastoralism and remain unused).



4.3 Key characteristics of the compared commodities at a glance

	Brazil		Honduras		Indonesia		Laos		Uganda	
	mainstream	niche	mainstream	niche	mainstream	niche	mainstream	niche	mainstream	niche
	<i>Cocoa</i>	<i>Andiroba oil</i>	<i>Coffee</i>	<i>Styrax gum</i>	<i>Palm oil</i>	<i>Illipe butter</i>	<i>Coffee</i>	<i>Benzoin gum</i>	<i>Cotton</i>	<i>Shea butter</i>
Estimated number of farmers	93,000	no data	120,000	450	2,000,000 (incl. processing)	est. < 10,000	25,000	4,000	250,000	several 10,000
Farmers reached by project	300	2,000	83 (1,300)	100 (450)	2,000	3,000	100	300	5,400	5,000
Area under improved production (ha)	1,000	no data	aprox. 2.000	34,000	4,100	1800	aprox. 2,000	1,500	no data	no data
Social characteristics of producers	mestizo, men & family	mestizo, mainly women and youth	mestizo, men & family	indigenous + mestizo, men	native and migrants, men & family	ethnic people, men and women	ethnic people men & family	ethnic people men & women	dominated by men	dominated by women
Production system	Agroforestry	wild harvest, agroforestry	Agroforestry	wild harvest in native forests	monoculture	wild harvest of remaining trees	Agroforestry	wild harvest on fallow land	monoculture	wild harvest of remaining trees
Drawn on local knowledge	partly	yes	no	yes	no	yes	no	yes	no	yes
Certification	Cocoa Life Program	ethical/BioTRade: UEBT	—	—	RSPO, ISPO	Fair for Life and organic (NOP and EOS)	—	organic: Ecocert	Cotton made in Africa	—
Benefit of certification	marketing for the partner company	fair prices, actions for biodiversity conservation	—	—	?	requirement of the food sector	—	requirement of the food sector	access to global cotton market	—
Commercialisation	diverse buyers, intermediary	B2B with social benefits	diverse buyers, intermediary	B2B, social benefits, financing	diverse buyers, intermediary	B2B (under construction)	specialty coffee and B2B	B2B, social benefits, financing	diverse buyers, intermedia	intermediary
Price setting	world market price + marginal premium	negotiations with client based on cost calculation	world market price	negotiations with client based on cost calculation	world market price + marginal premium	negotiations with client based on cost calculation	world market price + high premium	negotiations with client based on cost calculation	world market price + marginal premium	free negotiations
Economic risks	fluctuation of world market prices	low, but certain risk of monopoly	fluctuation of world market prices	few buyers and dependency on internat. demand	fluctuation of world market prices	risk of monopoly, market needs to be developed	fluctuation of world market prices	risk of monopoly	high fluctuation of world market prices	market still needs to be developed
Contribution to forest conservation	restoration of degraded pasture	conservation of native forests	driver of deforestation	conservation of native forests	driver of deforestation	conservation of single tree groups	driver of forest degradation	temporarily grown secondary forest	agiculture (antagonist of forest)	conservation of single tree groups
Biodiversity conservation	middle	high	negative	very high	negative	high	low - negative	middle	negative	high

5 Discussion: what is achieved by strengthening sustainable supply chains for niche products and mainstream commodities?

The objective of the post 2020 Global Biodiversity Framework of ‘living in harmony with nature’ by 2050 requires strengthening competitive, inclusive and value adding supply chains to ensure that [...] *areas of particular importance for biodiversity and its contributions to people, are conserved through effectively and equitably managed, [...] and well-connected systems of protected areas [...] are integrated into the wider landscapes [...]*³⁰. Furthermore, a special focus must be put on strengthening farmers’ resilience to handle the shocks and stresses of economic, ecological, climate and societal challenges (Meuwissen et al., 2019). Both aspects are integrated into the core area strategy “Sustainable Agri-Food Systems – a World without Hunger” of BMZ which places the focus of German cooperation for 2021–2026 on the areas of intervention 1) Food and Nutrition Security, 2) Rural Development and 3) Agriculture. The strategy explicitly mentions the frequent occurrence of conflicts of interest ... *that exist between intensification and extensification, food and the protection of resources, economic activity and nature*. Since overall there is not one right solution, different options have to be weighed under consideration of the “quality criteria”³¹ as defined in the BMZ 2030 reform strategy. Attention has to be paid to human rights by emphasising participation, transparency and good governance with a particular focus on disadvantaged and vulnerable groups.

The areas of intervention described in the core strategy follow an integrated approach on an “*agroecological and sustainable development path which includes climate change mitigation and climate resilience*”. The use of local and indigenous knowledge is identified as a strategic starting point. Further key principles are, among others, “diversification” to use the economic and social potential of a certain region in an effective way and to absorb shocks; “agroecology” to either strengthen or restore the foundations for sustainable agricultural and food systems; the “conservation of native and agrobiodiversity” which is essential for ecological functionality and resilience as well as for plant breeding; and the “conservation of natural resources and ecosystem services” as the very base in the fight against hunger and poverty. Herein, forests are recognised as “*allies*” and the sustainable use of timber and NTFPs is especially promoted. The need for more comprehensive agricultural research as a key source of innovation is highlighted, as well as the promotion of digital technologies for the social, environmental and economic improvement of agriculture, e.g. through their use in land (use) mapping and cadastres, production and supply chain traceability.

In the following, an assessment of the performance of these aspects is given for the different commodities that have been analysed in this study.

³⁰ <https://www.cbd.int/doc/c/abb5/591f/2e46096d3f0330b08ce87a45/wg2020-03-03-en.pdf>

³¹ The quality criteria are: Human Rights, Gender Equality and Disability Inclusion, Anti-corruption and Integrity, Poverty Reduction and Inequality Reduction, Environmental and Climate Impact Assessment, Conflict Sensitivity (Do No Harm) and Digital Technology.

5 Discussion: what is achieved by strengthening sustainable supply chains for niche products and mainstream commodities?

5.1 Impacts on economic sustainability

The initial hypothesis that mainstream commodities contribute more to economic sustainability than niche products (chapter 3) is only partially confirmed. Mainstream commodities indisputably have a higher importance at the macroeconomic level in consideration of their overall turnover and contribution to the national gross domestic product (GDP), e.g. the palm oil sector in Indonesia with more than 8 million people involved. In contrast, the contribution of niche products to the national GDP is often very small. Nevertheless, **the number of benefited people** that are reached by a project that aims to strengthen the sustainability of a certain commodity **is not linear to the sector's size**. Projects targeting a large sector may reach a smaller number of farmers than projects supporting a small sector, as shown by the projects in Honduras and Brazil, which promote sustainable coffee and cocoa production within large national sectors, directly reaching 83 and 300 farmers, respectively, compared to the promotion of the niche products andiroba oil and shea butter in Brazil and Uganda with 3,000 and 5,000 beneficiary farmers, respectively. The differences here are **due to the intensity of technical assistance** provided within the scope of the projects, not the size of the sector. The number of directly benefited farmers identified in the study ranges from 83 (coffee farmers in Honduras) to 5,400 (cotton production in Uganda).

Another argument for as to why it is not a good idea to only consider macroeconomic data is the fact that **niche products are often not recorded in official statistics**, such as styrax gum from Honduras, whose export data are mixed with those of pine resin in national statistics, or shea butter in Uganda, for which no data are available at all. The lack of official data does not mean that these products are not important to the local or national economy. It only means that the sector is **characterised by informality** and ignorance on the part of the government.

By focusing on **macroeconomic data, the impact achieved at the local level is not properly assessed**. A dramatic example is styrax gum, the **smallest sector** in this study with only 450 producers at the national level and a national turnover of USD 1.4 million. One hundred indigenous producers were intensively supported through a developPP with high benefits for the families, for whom styrax gum is the **only income source**, by increasing the selling price by 50%. Very high benefits were also achieved with respect to the conservation of native forests of nearly 35,000 ha – the **largest environmental benefit** identified in this study.

This highlights the **importance of considering the local perspective** of marginalised and poor rural communities when evaluating economic impacts. These are often located in remote areas with **deficient logistic infrastructure**, meaning that farmers **are basically unable to compete with mainstream commodities** on the market that are produced by other farmers in areas with better infrastructure and easier market access. In addition, **niche products often represent the only cash crop**, as is the case for styrax gum from Honduras and benzoin gum in Lao PDR. Here, the challenge is to convert the disadvantage of being remotely located into a comparative advantage by capitalising on the potential of biodiversity rich ecosystems and the uniqueness of only locally existing niche products. A good example of this is the production of andiroba oil in the Brazilian Amazon for cosmetics.

The characteristics of the production areas of mainstream commodities vary widely. Many farmers are located in areas with better access to public services and infrastructure, making market access easier overall and providing more opportunities for on-farm and off-farm employment. Nevertheless, there are also **many families in depressed, structurally weak areas** who struggle with market access for their mainstream commodities, such as cocoa and coffee. These producers are the most vulnerable, as they must **compete with high-tech farms in other well developed regions** (e.g. artisanal cotton production in Uganda competing with highly mechanised production in the U.S.) if they cannot turn to unique local products to overcome structural disadvantages. Here, **creating “niche” products within the mainstream commodity sector** is a promising option, as illustrated by the example of the successful commercialisation of specialty arabica coffee from the Lao highlands.

The creation of **economic benefits** for producers who rely on traditional **mainstream commodities is restricted** by the fact that prices are determined by the **stock exchange price** and producers are exposed to highly volatile markets. Here, **certifications** are often promoted to buffer the price fluctuations through the payment of a premium. However, these **premiums are often not high enough** to compensate for the drop in world market prices, and the **additional costs** that the producers and their organisations have to bear for certification are sometimes **even higher than the benefits** obtained. In some regions with high certification density, producers are already refusing to participate in certification schemes, as described in the case of coffee producers in Honduras.

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Here, there is a need to promote more strongly that the costs of certification are borne by the consumer countries, not the producers.

Since the total number of participants in supply chains for biodiversity-based niche products is usually lower, this often allows for direct **business-to-business (B2B)** transactions with the potential to encourage international companies to assume responsibility of the production process and conditions in the producers' country. Supply chains can be built without having anonymous brokers involved; this facilitates the **negotiation of minimum prices for producers together with the international clients based on participatory cost analyses**, and has been done for all of the niche products analysed in this study³². The B2B approach also **lowers transaction costs**, and **more benefits can be shared with the producer**. Within the niche product sector, current discussions by UNCTAD focus on how to define "fair prices", as those should not only consider the production costs, but ideally ensure that the farmer families have a living income³³.

However, this setup – small markets with direct company engagement – also limits the risk of creating a **high dependency** on one single client. Due to the lack of competition, niche product supply chains are often **vulnerable** as middlemen and traders can take advantage of the situation by creating **monopoly-like positions** for their own benefit. As long as there is no direct company engagement, wild price speculations by exporters of small niche products on the world market can lead to severe disruptions and even to the **complete collapse of the sector**. This almost happened in the case of styrax and siam benzoin gum. The perfume industry was considering to abandon the further use of these gums due to extremely high world market prices, while producers continued to be poorly paid and only the traders were profiting from the high margin. The recently established export company for illipe butter in Kalimantan might become similarly powerful, and despite the overall goodwill displayed by the company, support by an independent third actor may help to keep the focus on sustainability criteria.

To mitigate the economic risks for the producers, **farm diversification** should always be promoted to enable producers to at least ensure their family's **food security**. Wild harvest products are often **low-input intensive** and gen-

erally only require activities during a **limited time** period, enabling farmers to perform other farming activities throughout the year. There are also **mainstream commodities** that **allow for a combination** of different crops per farm, as shown in the Lao highlands, where coffee cultivation is combined with rice production in a perfect seasonal rhythm. However, finding suitable commodities is not always easy, as shown by the example of diversified coffee plantations in Honduras, where none of the promoted alternative products could be successfully brought to market.

When "new" niche products are promoted on the international market, their supply volumes are often not big enough to meet the expectations of international buyers since production still has to be developed. Often there is little information available about product characteristics, best processing practices and quality standards. This is where **donors play a key role in promoting and encouraging private companies to invest** in these unknown products, and the presence of projects on the ground helps companies establish links with producers, build trust, overcome cultural barriers and share knowledge. Once a niche product is successfully promoted, it can become a challenge to curb producer expectations about growing markets, as overproduction can easily happen on a small niche market, which can then lead to price erosion.

5.2 Impacts on social sustainability

The initial hypothesis that niche products are primarily an alternative for marginalised groups in remote areas where mainstream products are less competitive has been partly confirmed. In remote areas, biodiversity-based products from native forests are used, such as styrax gum and andiroba seeds, but niche products are also obtained from remaining, single-standing trees in intensively used cultural landscapes, such as shea tree nuts from a park-like landscape in Uganda and illipe seed in a similar landscape in Indonesia. Additional products are obtained while making use of fallow agricultural land, for example siam benzoin gum from secondary forests in Laos. All of the mentioned products have a high potential to benefit the poorest people in line with the **leave no one behind (LNOB)** principle of agenda 2030 and the core strategy of BMZ for the

³² With the exception of shea butter from Uganda and shorea from Indonesia for which no international supply chains have been established so far.

³³ <https://unctad.org/meeting/biotrade-congress-vi-trade-and-biodiversity-positive-future>

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agri-food sector, since they are characterised by a **low input intensity** compared to mainstream commodities, especially when wild harvested.

The use of all analysed **niche products is based on traditional or ancestral knowledge** in line with the strategic principle of BMZ's core area strategy and in contrast to the mainstream commodities that have been introduced to the production countries. The promotion of BioTrade criteria can contribute to increasing the recognition of indigenous/local knowledge and to **revitalising traditional cultures** and practices. Three of the five niche products are produced by indigenous or ethnic people, however, ethnic people are also involved in the production of mainstream commodities (coffee production in the Loa highlands) because of the need for cash. None of the niche products are subject to the Nagoya Protocol, since they were already used and commercialised on international markets before the reference date of October 2014 established in the protocol. Nevertheless, in some cases the projects have been able to persuade international customers to actively apply **due diligence** as part of their application of the BioTrade concept, ensuring that the knowledge used complies with national regulations and that there is fair and equitable benefit sharing. In the case of styrax gum from Honduras, which is traditionally produced by indigenous peoples, the **voluntary commitment of companies to go beyond their core business** and engage in social processes has led to the designation of an indigenous forest reserve.

In contrast, arguments to promote due diligence in the spirit of the Nagoya Protocol are weaker for mainstream commodities, as those have been introduced a long time ago and their production is done based on generally accessible, not traditional knowledge. Since their production systems are generally more labour and input intensive, they are often **highly hierarchically structured**, with land owners who may not even work or live on the farm on the top, followed by farm administrators, permanent workers and at the lowest level, daily and migrant workers. This can also be true for smallholder farms as shown for palm oil plantations in Indonesia. Apart from the fact that sustainability initiatives (certifications) aim to improve social and working conditions, they **often do not reach daily labourers**, and the associated benefits are mostly enjoyed by farm owners and permanent workers. Development projects often select larger farms and families with higher levels of education to participate in their programmes to ensure basic capacities and skills for a

successful integration into global supply chains. However, this selection marginalises poorer rural families and **does not contribute to the principle of LNOB**. This phenomenon applies to both mainstream and niche products, but with hierarchical systems being more prominent for mainstream products.

The study was unable to determine whether mainstream or niche products have a higher potential to contribute to **gender equality**. Also, the participation of women is particularly high in the collection of andiroba and shea seeds. The decisive factor here seems to be the **opportunity for women to work close to the village and to take advantage of flexible time management**, which enables them to combine monetary work with domestic responsibilities. This becomes evident when taking a look at other niche products such as styrax or benzoin gum, whose production requires hard physical labour and is done far away from villages, sometimes in remote forests, and whose labour activities are clearly dominated by men. Much more promising for women are value-added activities in villages, whether they involve processing mainstream or niche products, as shown for coffee production in Laos or fruit pulp processing in Brazil. Another plus for women's participation is the concentration of activities in a short period of the year, such as the seasonal collection of tree nuts once a year, as it is easier for them to organise child care and other family responsibilities for a short period of time. Another advantage of wild harvested niche products for promoting women's participation is that the forests used are often **state or communal land**, while agricultural crops are usually grown on private farms where men dominate as land title holders and control the production process, including the monetary income. As mentioned above, the **low-input intensive** nature of wild collection systems further facilitates the participation of poor people and women.

Child labour has been observed mainly in **labour intensive activities of mainstream crops**, such as coffee or palm production. It is usually the non-permanent workers who encourage their children to work, either because they cannot meet the set quota as pieceworkers (frequently seen in palm oil production, for example; UNICEF 2016) or because children of migrant workers do not go to school anyway and are thus expected to contribute to the family income. **Promoting better working conditions and formal contracts for workers** to overcome the often precarious situation of day labourers and their children is therefore an issue that should be given more attention by

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development projects. The Covid-19 pandemic has exacerbated the situation of child work on family-managed farms as well³⁴. Child labour seems to be less common in niche products. This may be because there is less pressure from a strong hierarchical labour system within a large sector, as is the case with mainstream commodities, while the production of niche products is usually controlled by the producers themselves without the need to meet quotas. Additional labour is recruited from the same village within a “healthier social structure”, where child labour could be prevented through social pressure. However, child labour may occur here as well, and should be addressed.

A low level of work safety is common for the whole agriculture sector and can be found in both, mainstream commodities and niche products. Usually there are best practices available for mainstream commodities, whereas **niche products** are often produced in a so-called “**traditional way**”, often using **very archaic methods while completely disobeying any western standards for labour safety and hygiene**. Drastic examples are the production of Peru balsam (*Myroxylon balsamum var. pereirae*) in El Salvador (a flavour ingredient for the food sector), where workers climb barefoot up to the crown of the tree and then set the tree on fire in order to stimulate gum flow³⁵, or the extraction of candelilla wax (*Euphorbia anti-syphilitica*) in the Mexican desert, which is obtained by boiling the plants in a mix of water and sulphuric acid under very basic conditions (Woda, 2016). Here, development projects can achieve high impacts by promoting research on **improved and safe production techniques** in partnership with research institutions and international clients.

Even though the use of state forests is described in the study as an advantage for poor people to participate in income-generating activities through wild harvest, it can become an issue since it often does not ensure **long-term access to forests and use rights**. This may prevent international companies from investing due to **uncertainties about the long-term supply** of the respective product. Furthermore, the absence of clear forest use rights often promotes **conversion into agricultural land** or other forms of land use. Here, development projects can contribute to support the extension of **land use certifications, usufruct contracts for community land and tree planting certifications**,

based on a mapping of production areas, a register of the families involved and documentation about the benefits for communities from the use of the wild harvested species. International partner companies can become a key success factor in this process by presenting climate- and biodiversity-friendly alternatives of income generation and the associated market opportunities that can be created once long-term land use security is achieved to the government. Promising in this respect are illipe butter and styrax gum, where state forests have been designated community forests. The information gained by mapping producers can also be used in traceability systems and as a baseline for certifications schemes.

5.3 Impacts on ecological sustainability

The initial hypothesis that niche products contribute more to biodiversity conservation and ecological sustainability than mainstream commodities has been confirmed. Climate change and the loss of biodiversity are considered today's biggest challenges (Sasaki, 2020). To assess the impact of the production systems, the impact of extraction on the related ecosystems, but also on the used species itself must be evaluated. Here, risks of negative impacts on the used species can be observed in the case of niche products.

Wild harvested species are likely to become **over-exploited**, especially when they are successfully promoted and demand increases, since there are often no regulations for sustainable production. **The costs of properly managing** wild-harvest species to ensure long-term production (e.g. forest thinning, tree planting) are **often overlooked** by producers and clients and not reflected in the price negotiations. Development projects should assist national stakeholders in the definition of easy-to-apply regulations for sustainable management based on best practices, as has been done for styrax gum in Honduras. However, care must be taken not to create regulations that are too stringent and impose **high additional costs** on collectors or **drive the business into illegality**. For mainstream commodities, the challenge is different and consists in preserving the **germoplasma of old land races** (e.g. criollo cocoa), which is often less productive and resistant, but adapted to locally specific site conditions.

³⁴ <https://www.unicef.org/press-releases/child-labour-rises-160-million-first-increase-two-decades>

³⁵ https://www.youtube.com/watch?v=_yARD4tZ4jg

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The **sustainable management** of wild harvested and **light-demanding tree species** in native forests (such as the gum producing trees *S. tonkinensis* and *L. styraciflua*) can become challenging. These species often require shade regulation, e.g. by cutting down other trees; otherwise they will not regenerate due to insufficient light conditions. Nevertheless, forestry agencies often **allow the extraction of gums and other NTFPs such as seeds, roots, and even small plants, but not the cutting of trees, ignoring the fact that the used species may need more light and a less dense canopy for successful re-generation**. Thus, **natural succession** takes place and the forests gradually change their vegetation composition, usually leading to a **decrease of the used light-demanding species**. This is the case for styrax gum production in Honduras and benzoin gum production in Vietnam; the situation there remains unresolved.

Overall, however, the production of niche products contributes significantly to conserve biodiversity, since the collectors are highly **motivated to keep the native forest or other ecosystem in which the used plant is growing**. The impact on biodiversity conservation depends on the quality of the respective ecosystem, which can vary from native old-growth forests (e.g. styrax gum) to secondary forests (benzoin gum) up to single free-standing trees (illipe and shea nuts) or other vegetation. Nevertheless, the use of wild harvest species does not automatically save forests from deforestation, since the **drivers of deforestation are often external groups, not the producers themselves**. In some cases, there are even violent conflicts between producers and third-party actors over land and forest use, for example conflicts over styrax forests in indigenous territory in Honduras. To effectively contribute to forest conservation, further action is needed, including **law enforcement** in close coordination with public institutions, in addition to empowering communities to use forests in a sustainable manner. In addition, the promotion of internationally networked monitoring systems that provide traceability within a deforestation-free supply chain seems promising.

Mainstream commodities, in contrast, are one of the **main causes for deforestation** in many regions (e.g. palm oil in Indonesia, coffee in Honduras). At the same time, they also have the **potential to recover degraded land**. Some examples for this are the coffee production in Lao where degraded maize fields are recovered and diversified cocoa plantations that “reforest” pastures in the Brazilian

Amazon. Coffee and cocoa are also sometimes cultivated under the native forest cover. This can be seen as good and bad: on the one hand, it ensures that at least a forest cover is kept, which has positive impacts on the soil and climate, but on the other it affects forest regeneration and species composition, which results in negative impacts on biodiversity. The assessment of whether mainstream commodities have **positive or negative impacts** on biodiversity and the environment is **relative and depends on the perspective and the initial given situation**: Mainstream commodities can contribute to restoring degraded lands and increasing biodiversity (e.g. establishment of agroforestry systems), but are causing significant negative impacts when replacing the native vegetation. **Development projects should therefore focus more on restoring degraded land** when it comes to promoting mainstream commodities.

Despite the high potential of niche products to conserve biodiversity, supply chain actors do not pay a lot of attention to this topic. Producers and clients (with exception of the company Natura in Brazil) do not consider this part of their responsibility since it does not affect their core business and is also not demanded by end consumers. This goes hand in hand with **little knowledge about the relationship between the wild harvested species and local wildlife** (e.g. its role as a food source and host species for wildlife, pollination, seed dissemination). In the few cases where forest- or species-based management plans are developed, the focus is often only on sustainable management of the species used, while biodiversity issues are not addressed (“everything is fine”). There is a need here for greater **promotion of biodiversity-related actions** in the form of specific biodiversity action plans or by integrating biodiversity elements into management plans (e.g. enrichment planting, creation of hedgerows or allowing more spontaneous vegetation). Promising experiences have been made by the GIZ/BMU project “Private Business Action for Biodiversity PBAB” in India, where guidelines for biodiversity-friendly production and marketing have been drawn up together with national companies and biodiversity action plans for various spice plants have been developed. Based on this experience, a manual was published that shows how to set measurable targets for biodiversity conservation in a production system and illustrates biodiversity management measures, agroecological practices and aspects to be considered in biodiversity-sensitive monitoring systems (GIZ, 2018). In Peru, the Ministry of Environment, with support from

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GIZ³⁶, has developed biodiversity-specific indicators as part of its proposal for a set of principles and criteria for “bio-commerce,” considering that biodiversity conservation is usually not the focus of producers and customers.

For mainstream commodities, in contrast, there is **more knowledge available** about their impact on biodiversity, and **best practices** are promoted by specific certification programmes (Gullison, 2003). Recent trends of reducing shade cover in coffee and cocoa plantations to increase production raise concerns about biodiversity losses. **Shade coffee certifications** are in place as a market-based conservation strategy. However, when promoting certification, it must be ensured that premiums are high enough to compensate for yield reductions and income losses due to biodiversity conservation measures as well as for the additional costs related to certification (Perfecto et al., 2005).

A further issue is the use of **agrochemicals** in the production of mainstream commodities, which affect surrounding ecosystems and groundwater quality (e.g. fertilisers in palm oil, pesticides in cotton). Agrochemicals are not widely used in niche products, especially when wild harvested. However, when used as a flavour ingredient in the food sector, they are required by international clients to be organically certified (e.g. benzoin gum and illipe nut). In these cases, **organic certification** has **no real effects** since the **production is already organic**, and important issues such as actions towards biodiversity conservation or promotion of sustainable harvest quotas for the used species (e.g. organic certified illipe butter) are not tackled. Here, there is still plenty room for improvement. Care should be given not to overload small farmers with strict certification regulations (e.g. prohibition of any type of irrigation in cotton production in Africa by CmiA³⁷, which makes it almost impossible for smallholders to adapt to climate change), while large agribusinesses continue to use the same conventional high input farming methods.

Overall, in the analysed supply chains **certifications have shown little additional positive impact on the environment. They also do not significantly improve producers' incomes, but are a prerequisite for access to the international market.** Ideally, certification costs are borne by the customer, but in practice they are often paid by the producers. In the case of mainstream commodities, the **fluctuating world market prices are frequently higher**

than the certification premiums. As described above, coffee producers in Laos prefer to apply for specialty coffee designations under a coffee quality rating system to avoid high certification fees, even though they could easily go through an organic certification process. Noor et al., 2017 concludes the following about the role of certification for the palm oil sector in Indonesia: “... *We argue that certification ... will not be able to deliver expected environmental and social benefits because of (1) an uneven distribution of incentives along the value chain, (2) traceability issues, (3) difficulties associated with an expanding market, and (4) alternative low standard markets ... We argue that the sustainability debate has actually failed to address the fact that oil palm landscape as a whole would be more sustainable if smallholders for whom palm oil is not an economic viable avenue would engage in other forms of land use. An important starting point for change is to move beyond narrow business interests of satisfying customers' and shareholders' interests ... Capitalising the [palm oils industries] expertise to develop value chains for alternative land-based products would make oil palm truly the “golden” crop*”. Based on this consideration, there is a clear need to increase private sector participation in building resilient landscapes. Development projects can contribute to this not only by pointing the finger at others, but also by creating attractive conditions for private sector investments (see conclusions).

Overall, **farm diversification** is expected to increase climate resilience (Seo, 2010) and food security (Wahe et al. 2018) and provide positive impacts on the environment and biodiversity. **Agroforestry systems** are promoted as a promising alternative (e.g. cocoa in Brazil). However, practice shows that the volumes of the alternative products produced on the farm are often too small for profitable marketing, and the large number of products requires dealing with different buyers which increases transaction costs, while the economic viability is low (e.g. coffee farm diversification in Honduras). This might put smallholder farmers into an even less competitive position compared to large specialised farm businesses. An alternative option here is to diversify production in the form of **various monocultures on the same farm but in different plots** as shown for coffee and up-land rice production on farms in Laos, or by implementing a **rotation system** (e.g. benzoin gum and rice). Positive effects on the environment may be smaller, but the benefits achieved are more balanced

³⁶ Project Biocomercio Andino (GEF-funded and implemented by GIZ) and project Perubiodiverso (supported by SECO and implemented by GIZ)

³⁷ <https://cottonmadeinafrica.org/>

5 Discussion: what is achieved by strengthening sustainable supply chains for niche products and mainstream commodities?

between farmers and the environment. Another valid option is to promote diversity at the landscape level, with different crops being cultivated by agribusinesses and smallholders, such as illipe production in a region dominated by palm oil plantations. Regardless the level of diversification, it is important that a market-based approach is applied to ensure economic feasibility, as shown by the lessons learned from diversified coffee production in Honduras.

The effects of intensive and extensive production systems on the environment can be discussed controversially. Intensive farming systems are known to have the highest productivity but have negative impacts on the environment, while extensive farming systems are low-input and an eco-friendly alternative (Novikova & Startiene, 2018). This is a clear argument for palm oil production, the most productive vegetable oil crop in the world, since its replace-

ment by other oil plants would require the use of a larger land area. However, it could also be an argument against styrax gum production, an extensive production system operated on several thousand hectares of land by only a few hundred producers with a low turnover per hectare – but this production system actively contributes to protect native old-growth forest. This demonstrates the need for combined evaluation criteria that take both aspects into account, i.e. the **expansion of the land used and the contribution to conserve highly valuable forests and biodiversity**. Many production systems for niche products have the potential to serve as **eco-corridors**, linking biodiverse areas of high value in a landscape approach. When produced in biomass rich natural forests, they also have a high potential to contribute to **carbon sequestration**. However, these potentials have not yet been exploited in any of the projects studied and could be a target topic in the future.

6 Conclusions: what is needed to get the best of both approaches?

The analysis shows that there is no “good and bad” when it comes to mainstream and niche products – both have their own justification and can contribute to sustainable development. From the **macroeconomic perspective at the national level, mainstream products are undoubtedly more important.** However, from a **community or even regional perspective, niche products** can have much **greater impacts on socio-economic sustainability** and the **conservation of high value biodiversity (HVB) or high conservation value (HCV) areas.** The number of farmers that directly benefit by development projects does not differ between mainstream and niche commodities. The sectors of mainstream commodities are much larger; however, the number of producers directly reached by a project is not linear to the size of the sector, but varies according to the intensity of the technical assistance (between 100 and 5,400 producers).

Overall, niche products have been found to create more of a direct positive impact on biodiversity conservation in the study than mainstream commodities. This can be attributed to the fact that they are often **wild harvested in native ecosystems** that have to be conserved to ensure continuous production. Niche products often benefit **marginalised people** because they are produced in low-input systems, often in remote areas with still intact ecosystems, but with competitive disadvantages when it comes to marketing mainstream products due to poor infrastructure. However, niche product supply chains sometimes have **monopoly tendencies** and producers may experience a high degree of dependency on one single client due to an unbalanced distribution of power. When demand on the international market surges unexpectedly, **shortages** can occur at the local level, as in the case of argan oil³⁸.

In contrast, projects that strengthen the sustainability of mainstream commodities often target biodiversity conservation in a more indirect way. Mainstream commodities are grown on agricultural land, which has a direct negative impact on biodiversity, while **being an antagonist to native ecosystems.** Positive environmental impacts are sought by **reducing the negative impacts** of the production system, e.g. by promoting agroecological and organic farming or by improving land use planning. Here, the “impact chain” is longer and more likely to be influenced by other external factors. Farmers dependent on common

commodities are exposed to **fluctuating world market prices**, which often prevent them from overcoming poverty. On the other hand, the large number of market options provides farmers with a **variety of opportunities**, and the promotion of “**niche**” **products within mainstream commodities sectors**, such as high-value specialty coffee, has been quite successful in terms of direct benefits to producers, the environment and biodiversity.



³⁸ <https://ceepolicy2016.wordpress.com/2016/11/28/argan-oil-the-price-of-beauty/>

6 Conclusions: what is needed to get the best of both approaches?

The following conclusions can be drawn:

1 **Niche products and mainstream commodities** can be thought of as **complementary** (rather than opposing) elements within a landscape. Following the principle of **yin and yang**, both interact to form a dynamic system in which the whole is greater than the assembled parts. To achieve real sustainable development, both elements must be considered and strengthened within a certain region or landscape.

2 The promotion of alternative income options must always follow a **market approach**. Although this is not a “new” lesson learned, practice shows that this is still not always taken into account. In order to ensure a high degree of flexibility for development programmes to join existing market options, it is recommended to design the project’s **impact matrix indicators** in a way that allows for adapting to new options that present themselves during project implementation and for strengthening supply chains that were not identified during the planning phase.

3 The study shows that it is important for development projects to connect with national and international key players from the various niche product sectors, as failure of projects on the ground to reach major players from international companies in the respective cosmetics, food, pharmaceutical and chemical sectors means that the full potential of strengthening effective supply chains can no longer be exploited. A **closer and more target-orientated coordination by the head office to investigate options for cooperation** is recommended in order to identify options for alternative supply chains in different regions and landscapes even before project start.

4 **Crop diversification** is a key element in increasing resilience to climate change and absorbing economic shocks. However, this does not always have to be done only at the farm level, but also at the **landscape level**. Thus, **agribusinesses and small farms ideally will coexist while each serving a particular sector**. This would require that international companies assume responsibility for local communities by ensuring that their practices do not affect their production systems

(e.g. by pollution or deforestation) and by actively supporting them in the creation of market access for alternative products.

5 The **multi-sectoral and multi-level landscape approach** seems to be the most promising way to promote sustainable development while establishing and implementing sustainable and long-term land management plans that are consensually supported by all stakeholders. Practice shows that the **private sector** is often the key piece to get things moving (while having the power to influence local policies) – but does not always cooperate as expected. Therefore, **multinational companies** with a strong presence in the region should be strategically targeted and motivated to **invest beyond their supply chain**, not just in the form of donations, but also by promoting alternative income options (e.g. fostering a market demand for unknown products through the companies’ experience and marketing channels).

6 To get the private sector on board, the investment into the respective supply chain needs to be made attractive. Projects can be used here to help better visualise the impact of sustainability and make for easy storytelling. Despite the fact that the world’s attention is mainly focused on climate change and biodiversity loss, current certification schemes do not pick up on this, so there is a very high unexploited potential here. For many sustainability **certifications** farmers do not have to put in any additional effort to comply with the sustainability requirements, and the certifications have **no real effects**, besides high additional costs for administration and certification fees. Overall, compared to conventional products, the net benefit for certified products is often not significantly higher.

7 Companies can be supported in documenting **deforestation-free supply chains** as an option for further value-adding, based on the mapping of the producers’ production areas, the quantification of carbon mass and a solid traceability system. When combining these activities with actions to increase the **producers’ land use or forest use rights security** and promoting multi-year purchasing agreements with fair and stable prices and pre-financing schemes (if needed),

6 Conclusions: what is needed to get the best of both approaches?

this could have more benefits for the producer and the environment than a traditional certification. At the same time, the option to trace a deforestation-free supply chain and the impact on carbon storage may also be of interest to western companies as an option to **create own carbon credits** instead of buying them on the market.

8 When promoting deforestation-free supply chains, attention should be put not only on the volume of carbon stocks, but also on the quality of conserved ecosystems in terms of biodiversity. The study shows that addressing **biodiversity** is a real challenge as **companies do not see it as part of their responsibility** and **producers already have a number of other issues to deal with**, such as climate change, market requirements and ensuring their own living income. Here, development projects can play a key role in supporting the elaboration and implementation of **biodiversity action plans (BAP)**³⁹, which include baseline information about the biodiversity conservation status, a risk analysis and identification of actions to maintain or improve the given status quo. Care should be taken to use local and traditional knowledge as a starting point, and to integrate the BAP into other management plans – provided they exist. A BAP can be developed for a single supply chain or, more effectively, for an entire landscape, with the possibility of considering the landscape itself as an entity in any future certification (Tscharntke et al., 2015).

9 As discussed at UNCTAD's 6th BioTrade Congress⁴⁰, BioTrade initiatives are still highly fragmented and **difficult to understand for key decision makers**. Although the UNCTAD BioTrade standard provides a guiding orientation, this guidance is still at a very general, but complex level, and adapted standards need to be elaborated for each niche product. This might prevent a stronger engagement of the financial sector, and the creation of **clear rules for the financial sector to get involved in BioTrade** is urgently needed. It can be expected that once biodiversity is recognised as a business

model, the dynamic will become so strong that own rules will be established without considering existing best practices – as was the case with the “gold rush-like boom of carbon offsets in the agricultural market” (Dorning et al., 2021). This also brings the risk of **greenwashing** (e.g. Environmental, Social and Governance (ESG) funds at DWS Group Bank (Dörner & Rickens, 2021)). Here, development projects can contribute to create **clear indicators** and regulations for investing into resilient, biodiversity-friendly, deforestation-free and integral supply chains as part of a **global benchmarking effort**.

10 As shown, **supporting exporters can be an effective strategy** for promoting sustainability along the supply chain, as they connect international customers with producers. Exporters can assist to overcome bottlenecks at the producers' level and encourage their clients to assume responsibility for strengthening sustainability along the supply chain. However, exporters sometime feel like they are part of a hierarchical system in which the international customer is at the top. This can hinder effective communication, especially when “critical” issues come up, such as **land use conflicts, labour, environmental and biodiversity issues**. Here, development projects have an important role – they need to **push these topics** from the producers' perspective, as well as “translate” the sustainability requirements from western standards to stakeholders in the production country. Improved communication is a key aspect for a better understanding between actors and the functioning of international supply chains.

11 An ongoing challenge is to ensure long-term impacts when promoting sustainability along a supply chain. Buyers tend to concentrate on sustainability criteria that are directly linked to their business, such as prices, pre-financing, purchasing agreements, quality control and sometimes labour safety. To keep attention on other important criteria, especially environmental ones, **independent monitoring** is indispensable. Here, development projects can support the

³⁹ See: GIZ, 2018: Manual on biodiversity action plan for pepper, cinnamon, cardamom and nutmeg, <https://www.giz.de/de/downloads/BAP%20Spices.pdf>

⁴⁰ <https://unctad.org/es/node/36023>

6 Conclusions: what is needed to get the best of both approaches?

creation of the **required institutional framework conditions** and contribute to **capacity building** among national or local NGOs, public and academic institutions that can assess the performance of the private sector. Furthermore, **law enforcement** might be needed to tackle deforestation and environmental conflicts and **to relieve the first line of defence at the community level**, including a budget line to support marginalised groups in **legal disputes about their land use rights**. Law enforcement is often not very popular as it may affect the poorest (e.g. expansion of palm oil into forests and peatland by small holders, Schneider et al., 2019). Here, alternative conflict management is needed, as well as a strengthening of the dialogue between civil society, government and private actors in order to create locally adapted solutions by supporting a national **multi-stakeholder platform** for a single supply chain or in a regional landscape approach. Multi-stakeholder platforms at the regional level with direct coordination to the national level are particularly important in countries with high levels of violence and corruption (e.g. deforestation in Honduras by drug traffickers), as they provide a space where sensitive information can be quickly disseminated to a large number of actors and institutions, promoting transparency between sectors while reducing opportunities for corruption and the risk to individuals as sole holders of knowledge. At the same time, they create the opportunity to respond effectively to the threat at hand through cross-sector coordination.

transparency along the supply chain, and in some cases can be helpful in proving the region or even country of origin for products whose actual origins are disputed (e.g. some stakeholders in Laos are convinced that all benzoin gum marketed in Vietnam is produced in Laos – this could be disproved with the help of traceability). **Nevertheless, the main benefit of traceability is achieved when it is used as a tool to review best practices, or to highlight where improvements are needed.** It is **not necessary to choose a highly sophisticated, digital traceability system**, but the system should be **adapted to the local context** and match the technical means available on the ground. In any case, care must be taken to ensure that sustainability standards for biodiversity-based products are not set too high to avoid discouraging nature-rich countries and making it too costly and difficult for smallholders to meet these standards, while mainstream commodities are allowed to be traded without further requirements.

- 12 Development initiatives should take care to **create real impacts for producers**. The current hype about high-tech blockchain traceability systems and tokenisation to promote sustainable supply chains brings questions about the benefits for the local people. **Traceability alone should never be the goal**, although it can help to improve producers' land use rights by providing basic information not only to private, but also to public entities about where production is taking place and can then be used as a basis for promoting improved use rights. It also facilitates

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I. Additional information on selected commodities

1. Illipe butter (*Shorea stenoptera*) production in Kalimantan

a) Economic characteristics of illipe nut production in Kalimantan

1. **Number of benefited families:** It is estimated that illipe butter is produced by about 15,000 families in 73 villages of 8 districts in West Kalimantan in Indonesia (ITTO tengkawang project document; Project for Forests (P4F), 2020).
2. **Turnover and contribution to the GDP:** According to P4F (2020), production in West Kalimantan was between 2,000 and 6,000 tons in 2017. Prices paid to producers for the fresh nut were about IDR 1,000 to 3,000/kg (EUR 0.06/kg = EUR 60/t), with an overall value of the commercialised nuts at the community level between EUR 120,000 to EUR 360,000. Retail prices for pure illipe butter in small quantities are very high on the western online market with EUR 114/kg (e.g. at www.etsy.com or <https://soulobjects.de>). Even when the high waste rate that occurs when fresh nuts are turned into pure butter is considered, the large difference of the retail price compared to the price paid to the producers demonstrates the producers' limited participation in the benefits created along the value chain. Between 1985–1989, the export of 10,667 tons of illipe seeds generated an income of USD 7,500,000 (Statistical Year Book of Indonesia, 1989). Export price were about USD 700/ton.
3. **Alternative income options:** The communities involved in the production of illipe butter use mostly shifting agriculture methods in subsistence systems. Some families also cultivate rice and sell what is not needed for their own consumption to local traders. Other opportunities to generate cash are very limited.
4. **Work load and farmers' resilience:** Illipe nuts are wild harvested and collected from single trees or forest gardens. So far, no management activities to improve or maintain the tree population have been carried out, besides some producers planting illipe trees in their own gardens. Production activities are limited to nut collection and the post-harvest period. The short time frame of illipe production allows the families to engage in

other economic activities within the subsistence system or employment, and contributes to increased income diversity and economic resilience.

5. **Economic relevance in consideration of the given infrastructure:** Illipe nut production takes place under varying conditions in a more or less remote area. The lack of proper drying and storage facilities has made it difficult to process larger quantities (nuts germinate quickly and then lose their market value). In the past, communities have been more interested in cutting the trees for timber, obtaining prices between IDR 300,000 to 600,000 (EUR 18 to 36) per cubic metre. Nevertheless, the production of illipe butter has been described by Winarni et al., 2017 as an important source of income for Dayak communities.
6. **Stable prices for producers:** In the past, producers had no direct market access. Monopolistic trading structures and middlemen systems have contributed to low prices, which were often lowered even more at the end of the harvest season.
7. **Pre-financing and economic dependency:** In some communities, mortgage systems for illipe nuts are common, where middlemen provide prepayment for the nuts in the pre-harvest period. This is highly attractive for producers as it allows them to get cash, but the amount paid by the middlemen gives producers only a minimal profit margin.
8. **Market potential:** Basic information about illipe butter properties and chemical components is available in scientific studies (Banerji et al., 1984; Blicher-Mathiesen, 1994; Lykke et al., 2001; Naik & Kumar, 2014; Bahari & Akoh, 2018; Muhammad et al., 2019). According to a market study (Dataintel, 2019), the main international demand comes from cosmetic companies based in Europe and the USA, with an increasing demand for organic butter. Illipe butter is suitable to replace synthetic emolliency enhancers, and is promoted to be free of allergens, bovine spongiform encephalopathy (BSE), transmissible spongiform encephalopathies (TSE) and genetically modified organisms (GMO) (see Technical Datasheet Illipe Butter, OQEMA). Furthermore, there is a high potential to make use of illipe butter in the food sector, where it can contribute to reducing greenhouse

gases by increasing vegan foods and strengthening local/regional value chains. However, illipe butter is still quite unknown among end consumers and needs targeted promotion. Further investments are needed to define best processing techniques and to establish a quality standard (Ramadhani et al., 2021).

9. Long-term sustainability of volumes: A critical factor for clients at the industrial level may be the geographic limitation of illipe trees – an endemic species – to Borneo. On the one hand, the high fluctuation of illipe nut volumes based on natural mast years is already a major challenge. On the other, the long-term existence of rainforests and trees is uncertain given the ongoing pressure on natural forests by timber logging and conversion to palm oil plantations. These factors negatively affect the attractiveness for international customers to join the value chain, as they rely on stable volumes.

10. Options for direct market access (B2B): Five companies from Europe that are involved in illipe butter production have been identified. Despite the small number of companies, there are strong players involved, such as BASF, and other companies with a focus on research and/or eco-friendly ingredients represent a high potential to create partnerships and promote B2B with a commitment to sustainability. Recently, the Dutch company Forestwise opened a locally-based company to collect, store and process the nuts while adhering to sustainability criteria (see below).

The identified European companies involved in illipe butter production are as follows:

- AAK (formerly AarhusKarlshamn): a global Sweden-based company and producer of vegetable oils and fats for food, pharmaceutical, cosmetic, chemical and animal feed industries;
- A&A Fratelli Parodi, est. 1955: an Italian company who processes vegetable oils, esters, waxes, butters and vegetable-based products for cosmetic and industrial use (lubricants, metalworking fluids, plasticisers, natural solvents);
- BASF, Germany: offers illipe butter under the brand of “Cegesoft” SH as “an exotic, waxy emollient with consistency-giving properties, suitable for all skin care formulations”;

- OQEMA: a chemical distribution company for commodities and specialties in Germany. Illipe butter is offered as an emollient for stable emulsions due to its uniform triglyceride composition for skin care and make-up products;
- ICSC (International Cosmetic Science Centre), Denmark, founded in 1990. Producer of natural ingredients such as exotic butters, oils and antioxidants for the cosmetic industry. It has a strong focus on research to innovate, produce and deliver high quality oils, lipids, antioxidants and preservatives. Manages its own research and development centre, sponsors PhD students and guest professors.

In addition, there are at least four trading companies based in the USA that distribute illipe butter products on the western market: 1) BioOrganic Concepts (Ross organics/Azelis Company), est. 1997: a trader of natural ingredients to the cosmetic industry with a focus on eco-friendly, natural, mild and value-added specialty products. Main supplier: BASF, HallStar, Floratech and Schulke; 2) Protameen Chemicals, a trader for chemical specialties since 1960, now with a new focus on broadening its range of products to include innovative specialty ingredients such as natural exotic butters based on market demand; 3) Lush Cosmetics North America, a business partner of Forestwise, linked to UEBT; 4) Thornley Company: trader, no further information found.

11. Role of certification: Since illipe butter is still quite an unknown product from the tropical rainforest, a certification with focus on ecological and socio-economic sustainability might be useful to develop the market while providing more information and knowledge about production conditions to end customers. However, the current market demands organic certification, which in fact does not have any positive effects on increasing the sustainability of wild harvest-management systems, since production is already done without the use of chemicals.

b) Social sustainability of illipe butter production in Kalimantan

1. Empowerment of the poorest (LNOB): Illipe production is done in Seberuang-Dayak communities, as well as by Malay people. “Malay” and “Dayak” are terms used for several hundreds of different ethnolinguistic groups

in Indonesia. The Dayak communities have been historically marginalised by the government in terms of lack of respect for culture and traditions, socio-economic development and political participation. Since the 1970ies, Dayak territory has been affected by government colonisation and settlement. Their traditional forest land, the base for their traditional shifting rotation system, is threatened by timber concessions and rubber and palm oil plantations that are expanded without respecting traditional use rights (Minority Rights Group International, 2018). Violent conflicts are still ongoing. Illipe butter from Dayak people is therefore produced by a socio-economically and politically marginalised ethnic group. Malay people in West Kalimantan tend to live more closely to river streams, where illipe trees can be found in forest gardens.

- 2. Traditional/ancestral knowledge:** Use of the illipe nut is probably based on traditional Dayak knowledge. Illipe trees and nuts are still used on a daily basis, e.g. in customary ceremonies or as oil for lamps. The illipe tree is sacred, and some illipe trees that grow in religious areas are excluded from use.

Indonesia is party to the Nagoya protocol and has extended the “Regulation of the Minister of Environment No. 34/MenLHK/Setjen/Kum.1/2017” to recognise and protect local wisdom in the management of natural resources and the environment, including provisions for the utilisation of traditional knowledge and genetic resources. However, there is no mechanism to put ABS into practice as of yet (CBD, 2021).

- 3. Gender equality/participation of women:** The natural occurrence of mast years and the seasonality of illipe seed production, which is limited to just a few weeks per year, facilitate women’s participation in the collection of nuts. This is due to the fact that it is easier for women to organise child care for only a specific period than it would be for a longer period of time. The post-harvest processing activities done in the villages, such as roasting (old production system) and sun drying, also permit a high participation rate of women, as these activities can be performed in short distance to the home, allowing the women to also take care of family members. Traditionally, men have taken the lead role when it comes to carrying the sacks of nuts and cleaning the nuts in river streams. Women are involved in collecting the nuts from the forest floor and in drying. Transport and selling of the nuts to traders is generally done by men.

- 4. Land security:** Dayak communities are lacking land access security and secure forest use rights. Within their territory, the community members have established customary rules about ownership of the trees, and for harvesting and processing illipe nuts (when to harvest, who is involved, division of labour and distribution of benefits). There are at least four illipe tree management systems used by Dayak people: 1: Public management: the trees belong to a single village. Anyone from the village can harvest the nuts as long as they do not stay overnight; 2: Hereditary: trees are owned by around 3–6 generations of a family from the same bloodline. The family manages the trees according to their own rules; 3: New heir: trees are owned by up to 2 generations. One large family is responsible for their management and gets the benefits from the harvest; 4: Individual: trees are owned by an individual person. Family members help with the harvest activities.

- 5. Work safety:** At present, seeds are collected in forest gardens close to the villages. Once the production volume increases, people might go into the forest to collect seeds and thus will be exposed to risks such as snake and insect bites. The traditional smoke-drying of the seeds on open fire can affect the respiratory system of the people involved (mainly women).

- 6. Child work:** Child work does not seem to be a major issue in illipe nut production due to the limited time frame of production activities.

- 7. Social working conditions:** Illipe nuts are harvested by family members for their own benefit. Generally, there are no additional external paid workers involved. Producers take care of themselves, as much as they can.

- 8. Contribution to technological improvement:** There is a high need for technical improvement in order to standardise operation procedures in accordance with quality requirements from the international market. The main issue for the communities is to improve the drying process and to avoid seed germination during the drying process.

- 9. Contribution to local development:** Illipe nut production is a valuable option for sustainable and climate-friendly land use, especially when done in the form of forest gardens, galleries and in remaining forest stands, and contributes to sustainable landscapes within a region that is dominated by large palm oil plantations.

The processing facilities for storage, drying, grinding and extraction could be used for other purposes too, for example charcoal and electricity production or for the drying of other agricultural products, such as rice, fruits and timber.

c) Ecological sustainability in illipe nut production in Kalimantan

1. **Impact on the used species:** *Shorea stenoptera* is classified as a nearly threatened tree species (NT) (Rendi et al., 2019) on IUCN's red list. The impact of seed collection has not been properly studied yet. The collection of the seeds interferes directly with the tree's regeneration, since a significant amount of seeds is extracted during collection. On the other hand, the natural mortality of the seeds and sapling is high anyway, as many seeds are eaten up by animals or get affected by fungi or insect infection (Curran & Webb, 2000). ITTO reports the threat of genetic erosion of the species due to an increasing isolation of the tree population. At present, no specific measures have been established to regulate the amount of seeds that can be extracted. At least, some Dayak communities have delimited sacred areas with illipe trees that are excluded from seed collection, which might contribute to conserve the population. The species is described to be able to restore degraded land (Kartawinata & Satjapradja, 1983).
2. **Maintenance of native forest cover:** The pressure on Borneo's native forests is very high. Despite its rich biodiversity and importance as a carbon sink, half of the forest cover has been lost to agricultural expansion, encroachment and logging over the past 50 years. The sustainable use of illipe seeds under improved conditions for the local communities might motivate the local people to keep the trees and forests instead of making use of the short term benefits provided by the cutting of timber. However, it must be mentioned that most of the trees harvested for illipe butter production are not growing as intact forests, but as forest gardens, as single trees on degraded forest land or in small forest strips along watersheds. Illipe trees in old-growing forest stands are not harvested yet, as the current demand can be covered by harvesting trees near the villages.
3. **Contribution to biodiversity conservation:** *Shorea stenoptera* is a key species of the tropical rainforests on Borneo. Its nut-like big seeds are eaten up and dispersed

by vertebrate animals such as rodents and pigs (Curran & Webb, 2000) and form part of the food pyramid base for wildlife, with endangered predators on the top. Although the collection of seeds reduces the amount of nuts available for wildlife, the overall impact of illipe nut production can be seen as positive as it raises the motivation to keep the illipe trees. It can be assumed that animals still get sufficient nuts as food even though the seeds are collected by humans, e.g. through seed consumption during the night when people are not collecting. Furthermore, since the seed production takes place in mast circles it can be assumed that there is an "overproduction" with respect to the seed demand by wildlife.

Even though illipe trees for nut production are located in forest gardens and open forest landscapes, their contribution to biodiversity can be described as very high. The tree crown and stem form a micro-habitat for biodiversity as a host species for numerous plants and animals, such as epiphytes, invertebrates, reptiles and others; more studies are needed in this area.

4. **Potential for eco-corridors:** Natural forests used for illipe nut production are very suitable for linking highly valuable biodiverse areas as eco-corridors. Illipe nut production in forest gardens or small-scale plantations can still contribute positively to connect higher biodiversity areas, considering the microhabitat and the food source they represent for many vertebrates. Promising experiences from the community-based management of illipe nut trees are reported from Malaysia as they represent an entry point for integrated landscapes in Labian-Leboyan watershed management (Heri et al., 2020).
5. **Biodiversity conservation actions (e.g. biodiversity action plans):** At present, no specific actions to conserve biodiversity are in place with regard to illipe nut production. The contribution to biodiversity conservation happens indirectly through maintaining the native forest and illipe trees as part of the natural vegetation.
6. **Impact on soil health & fertility:** Illipe trees form strong roots that effectively contribute to prevent soil erosion. As the illipe tree is an old-growing species with increasing seed production as it ages, areas with illipe trees are kept and not used for shifting cultivation agriculture. Illipe nut production therefore contributes to retaining soil fertility and maintaining interactions between soil, plants and soil organisms.

7. Contribution to the CO₂ sink: Illipe nut production, with old-growing trees, contributes to preserving and maintaining long-term CO₂ sinks. As illipe trees can regenerate in shady conditions, the ecosystem can remain in a steady state for long periods without losing biomass and CO₂. At present, many producers still roast the nuts over an open fire during the drying process which results in a high rate of fuel wood consumption. Forest-wise recently (re-)introduced the sun-based drying system in an attempt to reduce the use of fuel wood.

8. Resilience to climate change: No specific information about the susceptibility of *Shorea stenoptera* to the effects of climate change has been found. It can be assumed that, compared to plantations, nut production in an intact forest ecosystem is less vulnerable to climate change effects as the microclimate is supposed to be more balanced in the forest.

2. Indonesia – palm oil (*Elaeis guineensis*) production in Borneo (Kalimantan)

a) Economic characteristics of palm oil production

1. Involved families: In Indonesia, over 8 million people are directly employed by the palm oil industry, mainly in rural areas such as on plantations, by the processing, trade and transportation sector and by the chemical industry (PASPI 2017). Smallholder oil palm farmers manage almost half of the Indonesian oil plantations (Nasha et al., 2021). It is estimated that more than 2 million people are involved in palm oil production in Kalimantan. Nevertheless, it has also been argued that there is a need to quantify of how many alternative jobs and income opportunities have been lost due the expansion of palm oil plantations and processing sites (Murray Li, 2015).

2. Trading volumes: Global demand for vegetable oils has rapidly increased over the last 50 years. Being the most productive oil crop, palm oil has become the leading vegetable oil (70 million t), and 41 million t of it are produced in Indonesia (Ritchie & Roser, 2021).

3. Alternative income options: Smallholder shifting cultivation farmers and indigenous communities in Kalimantan are affected by the rapidly spreading estate crops of palm oil and rubber plantations, while their traditionally used land for subsistence farming is exposed

to land speculation by larger agribusinesses. Thus, families have to give up the shifting cultivation, or they expand their activities into protected forest areas. Conservation values are declining and the future of community-managed forests is uncertain since poor communities are often attracted to larger oil palm (or rubber) mono-crop farms with the expectation of improving their livelihoods (Langston et al., 2019).

4. Farmers' resilience: Prior to focusing on just oil palm, most farmers produced a combination of subsistence and plantation crops, with little off-farm diversification. Some smallholder farmers also manage a combined system of rubber and oil palm (Schleicher et al., 2019; Schonveld et al, 2019).

5. Economic relevance in consideration of the given infrastructure: Palm oil production is the most important cash crop in the region, and specialised infrastructure and logistics for transportation and processing (palm oil mills) are in place.

6. Payment and price level for producers: Labour costs are the largest expense in palm oil production on the plantations (about 60% of the overall costs) and there is a lot of pressure to reduce them. In Indonesia, official minimum wages are set by the government; however, these are often not respected in palm oil production, including on certified farms (John, 2020). Instead, it is also common that workers are paid by harvest volume, for which daily volume targets are set. In some cases, it is almost impossible for workers to reach these targets and they need their families to support them, basically forcing child labour (Schneider et al., 2019).

Independent smallholder farmers, in contrast, live on the revenues gained by selling fruits and branches and depend on locally paid prices. Prices are determined weekly by the Ministry of Agriculture based on yields, world market prices, material balance and the dollar exchange rate. A decreasing world market price has a direct impact on the income of small-scale oil palm farming. To the present day, none of the certification schemes in Indonesia include a minimum price (Schneider et al., 2019).

The small land sizes of these farmers combined with low yields and their inability to reinvest in land trap the farmers into reinforcing cycles of unsustainable management and incomes (McCarthy, 2010; Molenaar

et al., 2013). Palm oil price depressions have a severe effect on the livelihoods of these farmers and their ability to maintain their plantations (Noor et al., 2017).

- 7. Strong need for financing:** Palm trees need 4 to 5 years to become fully productive, and plantations have to be renewed after 20–25 years. Smallholders are faced with a revenue gap during the first years of the plantation (Schneider et al., 2019). Furthermore, they need the necessary investment to gain access to high quality germoplasma and to properly manage the plantations (fertiliser), otherwise productivity remains low, and so does the revenue (Rainforest Alliance, 2016). There are public funds to support smallholders in replanting older plantations with decreased productivity.
- 8. Market options:** Although palm oil has faced some criticism by end consumers in western countries, the overall market demand is increasing. Palm oil is mainly used in the food sector (68%) and for industrial applications, as well as in soaps, detergents, cosmetics and cleaning agents (27%), while 5% are used in the bio-energy sector (transport, electricity or heat), with an increasing demand in western countries. The main consumer countries of palm oil are India, China and Pakistan, followed by the Netherlands, Spain and Italy (Ritchie & Roser, 2021).
- 9. Long-term sustainability of volumes:** Reduced volumes of palm oil from Malaysia and a crop disaster affecting canola oil production in Canada coincided with pent-up demand when economies reopened in 2021. Bloomberg warned of a “palm oil shortage” and a “supply chain crunch” (Raghu, 2021). The low volumes in Malaysia can be directly attributed to high price volatility at the international level and a lack of (migrant) workers that are willing to work in undesirable social conditions.
- 10. Options for direct market access (B2B):** Due to pressure from civil society and consumers in western countries, the western industry has become engaged in national and international initiatives that aim to strengthen sustainability in the palm oil sector. The “Forum Nachhaltiges Palmöl” from Germany, for example, has more than 50 members from the private and the public sector and from civil society. Among its members are processing companies and retailers such as BASF, Beiersdorf, Alfred Rittersport, Dirk Rossmann, DM-Drogerie-Markt, Edeka, Ferrero, Griesson, Henkel, Kaufland, Kneipp, Lidl, Rewe, Thyssen-Trupp and Weleda

among others. Some of them have been chosen as best practices (e.g. Weleda, see Vidya, 2019). However, the impact achieved to date is debatable since companies from the biggest consumer countries (India, China and Pakistan) are poorly represented in sustainability activities.

- 11. Role of certification:** Certification has been strongly promoted across the palm oil sector in order to strengthen sustainability. Examples are the Indonesian Sustainable Palm Oil (ISPO) programme by the Indonesian government or the standard from the Roundtable on Sustainable Palm Oil (RSPO). RSPO is the world's leading palm oil sustainability certification scheme. It requires compliance with all applicable national laws and regulations including, for Indonesia, not to operate in a forest area. Nevertheless, Greenpeace (2021) reports that RSPO member plantation companies are operating in nearly 300,000 ha of forest areas. Furthermore, labour abuse and child work has been seen on certified oil palm plantations in Indonesia, including exposure to hazardous chemicals, a reliance on temporary workers, below minimum-wage payments and suppression of independent unions (Amnesty International, 2016; Auerbeck, 2017; John, 2020).

The impact of the financial benefits on palm oil producers is ambivalent. Schleicher et al. (2019) report that some palm oil producers in Indonesia get financial benefits by better sales prices, but mainly through the reduction of production costs while implementing better agricultural practices (less fertiliser and pesticide use). Palm oil companies report that higher revenues through certification are passed on to workers in the form of improved safety measures, health checks and child care services. Salary increases or premiums are not very common. However, other producers reported that they do not see a significant financial benefit, but are motivated by the fact that they may achieve better market access with certified palm oil. Smallholder cooperatives express that they do not feel sufficiently valued considering the effort of certification.

b) Social sustainability of palm oil production in Kalimantan

- 1. Empowerment of the poorest (LNOB):** Smallholders are the fastest growing producer group in Indonesia's oil palm sector. The palm oil area managed by smallholders is expected to grow from approximately 40% of the total

national area in 2016 (11.9 million ha) to over 60% by 2030 (Saragih, 2017). Smallholders are not always poor farmers, but are a quite heterogeneous group. Schoenveld et al. (2019a) have identified five different groups of smallholder palm oil farmers in Kalimantan: 1) *Subsistence farmers*, with palm oil (< 5 ha) as the only cash crop; 2) *Migrant labourers*: mostly first-generation migrants of Javanese origin with a poor level of education and a plantation size of about 4 ha; 3) *Early adopters*: small farmers (> 5 ha) with commercial oil palm farms, mostly indigenous or second-generation migrants specialised in rubber and experienced as workers on corporate plantations; 4) *Entrepreneurs*: medium-sized plantations (7 ha), more educated, but comparatively inexperienced in farming activities, fairly engaged in small businesses; 5) *Local elite*: with a median area of 15 ha, an ethnically diverse group, politically influential, the most educated group with income from civil service, many of them reside far away from their oil palm plots. This shows that working with smallholder farmers does not necessarily mean that the poorest people are reached.

2. Traditional/ancestral knowledge: *Elaeis guineensis* is a species that was introduced to Indonesia and production is done based on “foreign” knowledge. Palm oil plantations may affect the traditional life of nearby native communities, as pesticides and fertilisers may pollute local streams and drinking water, causing negative impacts on health, food production and income (Murray Li, 2015).

3. Gender equality/participation of women: Although often invisible, female workers are common on palm oil plantations. Whereas men are more likely to get full-time permanent positions, women are often hired by subcontractors on a day-to-day basis without benefits. Or they are contracted by companies as casual workers for the same jobs, but without an employment guarantee or even the assurance to get paid. Women are generally paid less than men, and often it is impossible for women to meet the daily harvest quota they are required to meet for full payment. In addition to the unequal treatment of men and women, systematic unequal treatment of migrants and ‘locals’, young and old has been seen as well (Murray Li, 2015). According to an investigation of the Associated Press, women in some commercial palm plantations are also exposed to sexual abuse, ranging from verbal harassment to brutal aggressions in the form of rape (Mason & McDowell, 2020).

4. Land security: Land conflicts experienced by several stakeholders are one of the most prominent problems of palm oil production in Indonesia (Schoenveld et al., 2019b). Nearly a third of all palm oil companies in Indonesia are illegally operating inside forest areas (Greenpeace 2021). However, there is also a large portion of smallholders that contributes to the illegal conversion of forest and peatland, especially indigenous farmers (Schoenveld et al., 2019b). At the same time, the lack of written land use permits and varying maps at different political levels threatens the rights of indigenous people. Communities with customary land use rights are suddenly told that they live in protected forest areas or on land that was officially released for palm oil production without getting any compensation (Murray Li, 2015). According to John (2021), authorities tend to not enforce the law on companies but take a harder line on community members protesting against the companies. The potential to complain on the violation of human or land use rights and to solve the situation in collaboration with certification bodies like the RSPO remains underutilised because of complicated procedures and a lack of trust in institutions (Yuliana et al., 2020). This situation shows the urgent need for consensus land use planning with all stakeholders following a landscape approach in order to avoid further conflicts.

5. Work safety: Work on palm plantations in Indonesia is mainly done by hand, including the cutting and carrying of heavy braches and fruits. Studies show frequent musculoskeletal disorders in workers (neck, back and knees). Furthermore, infectious diseases transmitted by insects are common, such as malaria and leptospirosis. Workers may also experience stress due to poor living conditions, low wages and long working hours. This is especially the case for migrant workers, who may not have a supportive social network. Workers are also exposed to pesticides, such as paraquat and herbicides, but impacts on health are difficult to proof and poorly documented (Myzabella et al., 2019).

All certification standards for palm oil in Indonesia require the use of suitable personal protection equipment (PPE) for workers, so it can be assumed that conditions in those companies are better. However, several companies report difficulties in convincing workers to use PPE such as breathing masks and protective clothing, as they cause discomfort in the high temperatures and humidity encountered in the tropics (Schleicher et al., 2019).

6. Child labour: Child labour is widespread in the sector, particularly among smallholder farms that supply to larger companies (UNICEF, 2016). Child labour often happens when collection targets are set too high, and parents order their children to support them (International Labour Organization 2019). Child labour has been reported in Indonesia as well as on RSPO-certified palm oil plantations (Amnesty International 2016; Averbeck, R., 2017; Schleicher et al., 2019). UNICEF (2016) has documented other critical issues related to children's rights, such as precarious hygienic conditions on the farms, exposure of children to hazardous chemicals and pollution, lack of paid time off for pre- and post-natal care for women, especially for casual female workers, and challenges in access to education for children of migrant workers.

7. Social working conditions: Informal working conditions are a critical issue here – even after having worked for the same company for years, payments are often below the minimum wage and daily production targets are set too high. Furthermore, sexual abuse of women is reported as well as poor housing and hygienic conditions on farms and exposure to hazardous chemicals (Murray Li, 2015; Sinaga, 2021).

8. Contribution to technological improvement: At the small farmers' level, there is still a high need for training on best agricultural practices to optimise production processes in order to increase yields, lower costs and reduce the use of agrochemicals. However, the main issue here is to facilitate access for smallholders to certified germoplasma when establishing new plantations, as this is the decisive factor for high productivity. Access to high quality seedlings is often restricted to commercial and state-owned companies, or small-scale farmers lack capital to purchase them (Schleicher et al., 2019).

9. Contribution to local development: Within the context of certification, the establishment of schools and kindergartens is mentioned as a good example (Schleicher et al., 2019). However, there are critical voices who argue that the high level of poverty common among small-scale palm oil farmers is simply ignored. Noop et al. (2017) conclude that “the sustainability debate has ... failed to address the fact that oil palm landscape as a whole would be more sustainable if smallholders for whom palm oil is not an economic viable avenue would engage in other forms of land use”.

c) Ecological sustainability in palm oil production in Indonesia

1. Impact on the used species: *Elaeis guineensis* is native to Africa, thus the assessment of the use of the species on the native species population does not apply in this case.

2. Conservation of native forest: Palm oil production and timber harvest are the main drivers of deforestation in Indonesia. Forest conversion for palm oil has taken place based on formal concessions, but also illegally (Ritchie & Roser, 2021). In 2019, a moratorium was put in place by the government to ban the clearance of primary forest and peatland. Nevertheless, palm oil plantations are also established on degraded forest land that has been subject to timber exploitation in a planned sequence (Corley & Tinker, 2016; Margono et al., 2014; Rival & Levang, 2014). In Kalimantan, oil palm plantations have caused at least 23% of the overall deforestation in 2001–2016. Deforestation by large-scale plantations reached its peak in 2009 – today it is mostly smallholder plantations that contribute to deforestation, especially in peat forests (GIZ Indonesia). In areas classified as production forest, industrial plantations cover a wider area than smallholder plantings, but in protected forests and other conservation areas, smallholder plantings cover twice the area of industrial plantations (Greenpeace, 2021). Smallholder entrepreneurs and local elites often establish palm oil plots on peatland, since they have the political connections required to invest in peat infrastructure (Schoenveld et al., 2019b). This is due to the fact that smallholders are living in more remote areas where they often determine the tipping point of the ecological integrity of the highly fragmented oil palm landscapes (Fitzherbert et al., 2008; Dawson et al., 2013).

However, it should be mentioned that palm oil is the most productive vegetable plant crop at the global level. Replacing it with another vegetable oil crop might lead to an even larger area of land use for oil production (Ritchie & Roser, 2021).

3. Contribution to biodiversity conservation: Studies in Asia have revealed severe declines in abundance and species richness in oil palm plantations compared to forests (Edwards et al., 2010; Yue et al., 2015). 20% of oil palm plantations in Indonesia are illegally located inside forest areas, including protected areas such as national parks and UNESCO World Heritage Sites

(Greenpeace, 2021). These forests are hotspots for biodiversity, providing habitat for flagship species such as orang-utans, tigers and the endemic Bornean elephant, in addition to other endemic or rare species of flora and fauna. Forest loss in Kalimantan caused by palm oil plantations is therefore classified as very critical in terms of biodiversity conservation.

4. Potential for eco-corridors: Palm oil plantations have the potential to contribute to link fragmented higher value forests. Mammals, including large ones such as tigers and orang-utans, are reported to disperse into mature plantations as long as they are close to well-conserved forest (Ancrenaz et al., 2015). Small plantations are viable refuges for small and medium mammals, and small plantations close to well-conserved forest may sustain high biodiversity. Here, the implementation of land use planning to create a mosaic of plantations, riparian forests and other smaller forest patches is a key factor for maintaining the existing fauna in fragmented landscapes (Azhar et al., 2014, 2015).

5. Biodiversity conservation actions: The Roundtable for Sustainable Palm Oil (RSPO) standard contains recommendations to contribute to biodiversity conservation, such as the conservation of water bodies and forests to ensure connectivity and refuge for sensitive mammal species, the creation of higher structural complexity by complex understory and enrichment planting, manual harvest, as well as avoiding night-time work hours so that mammals can adapt to circadian activity rhythms. Drainage canals should have crossing structures for land animals and low angle borders for water dwelling ones, and stakeholders should ensure that no hunting takes place (Payán & Boron, 2019). However, there are doubts about the effectiveness of RSPO since non-certified smallholders in Asia have been recognised as more biodiversity-friendly than certified large ones (Azhar et al., 2017). At the same time, environmental law enforcement is low despite reports from NGOs and local communities demanding legal action against companies operating illegally inside forest estates (Greenpeace, 2021).

6. Contribution to the CO₂ sink: Deforestation and especially the conversion of peat forest are a major source of global greenhouse gas emissions and are directly linked to the extension of palm oil plantations. It is estimated that illegal palm oil plantations generate 104 million metric tons of carbon emissions annually,

or 60% of what the global aviation industry churns out in a year (Greenpeace, 2021). UNFCCC estimates that in 2010 the land use change of forests in Indonesia was responsible for 821 MT-CO₂ (around 60% of the national GHG emissions), making Indonesia one of the biggest emitters of GHG. With palm oil production, there are additional GHG emissions arising from the use of fossil fuels for transport and machinery on plantations and in the oil mill (Brinkmann Consultancy, 2009).

7. Impact on soil health & fertility: Oil palm needs a lot of mineral fertiliser to form its leaves and fruit clusters, which is usually applied in the form of ammonium sulphate and potassium chloride (FAO, 1990). Both fertilisers can affect soil health and the quality of drinking water (health problems for humans and flavour). Over the 20-year lifetime of a plantation, on average around 850 kg/ha of fertiliser is used in Indonesia (Rival & Levang 2014). Good agricultural practices include the use of organic compost from oil mills (e.g. empty fruit bunches) to reduce the amount of inorganic fertiliser. Palm oil plantations are relative robust against diseases, so the use of pesticides is less common and mainly limited to herbicides during the first years of establishment and rat poison to reduce the loss of fruits to animals (Rival & Levang 2014).

8. Resilience to climate change: The roles of palm oil plantations and climate change are ambivalent. On the one hand, palm oil plantations contribute significantly to forest and peatland destruction and GHG emissions. However, when established on grassland, they also contribute to carbon sequestration. At the same time, productivity of palm oil plantations is increasingly affected by the effects of climate change (Paterson & Lima, 2018). Smallholders, in particular, are affected by the climate change effects. According to Irham et al. (2021), 60% of palm oil smallholders are facing reduced resilience due to climate change, production uncertainty and bargaining position in Bengkulu Province, Indonesia. Furthermore, the practices of commercial and illegally established palm oil plantations affect the resilience of indigenous and rural communities by accelerating the negative effects of climate change at the local level in the form of floods, heat waves, low humidity and increased forest fires (Greenpeace, 2021).

3. Siam benzoin gum (*Styrax tonkinensis*) production in Laos

a) Economic characteristics of siam benzoin gum production in Laos

1. Involved families: Siam benzoin gum production in Lao PDR is mainly done in the Northern Provinces of Luang Prabang, Phongsaly and Houaphan. The total number of families involved in benzoin gum production is estimated to be 4,000 (Helvetas, 2021).

2. Trading volumes: The annual export volume from Laos is estimated to be 50 tons (Kashio & Johnson, 2001; GIVAUDAN, 2009). Despite relatively stable trading volumes over the last two decades, export prices (free on board, FOB) have increased from USD 7.70/kg in 1993–1995 to up to more than USD 70/kg in 2017 (pers. communication MANE company). Today, export prices oscillate around USD 40–60/kg. The overall annual export value is estimated to be at about USD 2.5 million.

3. Alternative income options: Most of the benzoin producers cultivate upland rice as a staple food, maize and job's tears (*Coix lacryma-jobi*) as cash crops, and also grow styrax trees during the fallow period. The producers generally cultivate additional plants for own consumption, and sometime manage small forest timber plantations, cardamom, prickly ash (*Zanthoxylum rhetsa*) or cattle/buffalo to create savings. In remote areas, opium can also play a role in benzoin producer economics (Yokoyama, 2004).

4. Work load and farmers' resilience: The benzoin gum production period lasts up to 7 months, with the harvest taking place 7 months later after tree tapping. The number of days spent by producers on tapping, controlling and collecting the gum varies between 60 to 90 days per season (Woda, 2019). This relatively low work load allows farmers to engage in additional income activities that contribute to the families' economic resilience. In fact, benzoin gum matches up perfectly with the upland rice cycle and thus allows for rice cultivation during its fallow period.

5. Economic relevance in consideration of the given infrastructure: The north of Laos is increasingly influenced by infrastructure development from China. The growing commerce and construction sites are offering

new income opportunities for traditional gum producers. It is likely that young people prefer these new job opportunities over the dangerous and hard work associated with benzoin production, such as tree climbing. Many of today's producers are over 60 years old, and the change of generations might become critical for the sector.

6. Price level for producers: In recent years, most of the benzoin producers in Luang Prabang have depended on Chinese buyers that were offering about EUR 8/kg, whereas producers expected to get at least double the price. Some producers also sell to smaller local middlemen that charge a service fee of Kip 20,000/kg (about EUR 1.62). According to own studies (Woda, 2019), a tapping couple (2 producers) taps between 150 and up to more than 1,000 trees per season. The overall harvest volume of a couple varies according to the number of trees and the trees' age and productivity and can be between 10 and 100 kg/year. The annual income for a couple is equivalent to EUR 80 to 800. Assuming an average of 75 labour days, income per labour day is between EUR 1 and 10. Laos minimum wage for rural work is currently EUR 4.60, but should be higher for benzoin gum which is classified as dangerous work. Farmers complain that prices are too low for a strategic, long-term land use planning that would ensure steady gum production volumes within the agricultural rotation system.

7. Limited financing options: The time between tapping (the most labour-intensive activity for the producer), harvest and selling of the gum is about 7 months. Producers have to pre-finance their work with their own funds since middlemen rarely offer credit. This tempts growers to sell to the first middleman who shows up, even if the prices are low. Producers are further tempted to harvest the gum as early as possible to get money quickly, even if the gum is not completely dry. This affects the gum's quality as impurities stick to it. Therefore, access to pre-financing under fair terms is an urgent matter to be attended to.

8. Market options: Market demand by western companies has been quite stable around 50 tons per year during the last 20 years (Kashio & Johnson, 2001; GIVAUDAN, 2009; Woda, 2019). The gum is used in floral-oriental perfume compositions which have been very successful (e.g. "La vie est belle", one of the top ten perfumes of the world). Furthermore, there is increasing market potential in the food sector (pers. comm. BioTrade team), in

addition to the incense market in the Middle East, India and North Africa (Yokoyama, 2004). Overall, the challenge is not market development, but maintaining production volumes.

9. Long-term sustainability of volumes: Despite the fact that the overall production volume on the international market is stable, at the household level, production volumes vary quite dynamically. Many households earn high incomes from gum production for a few years, but are then forced to reduce or stop production because the trees become too old or the land is needed for agriculture. Often producers are then without gum income for years because they do not implement systematic land use planning that allows constant tree growing in a rotational system. This situation makes it difficult for clients/traders to establish long-term relationships with producers as they are constantly changing. The frequent source/origin changes also make traceability, quality control and reaching all of the producers to implement training sessions and other measures to improve production conditions difficult.

Another challenge is the recent trend to restore fallow land to active cultivation more quickly, before the benzoin trees are ready for gum production. As a result, the overall production area may decrease. This is because of increased land pressure and population growth. Furthermore, the sector, which requires hard and dangerous work, is losing its attractiveness for young people.

10. Options for direct market access (B2B): The fragrance and flavour sector is quite small, and so is the number of aromatic gum traders. The industry is concentrated in the surroundings of the historical centre of perfumes in Grasse (France) and the south of Spain. There are also relevant companies in Germany, the U.S. and England. Some of them are members of the Union for Ethical Bio Trade (UEBT) and thus committed to ethical sourcing, such as Symrise, Firmenich, Givenchy, Christian Dior, Cosmo International Fragrance, Drom Fragrances and Kenzo. Other companies have joined a similar initiative, the “Natural Resource Stewardship Circle”, that has promoted the voluntary application of sustainability standards. Although the NRSC does not exist anymore, some of these companies

have saved the spirit of NRSC and implemented its principle within their B2B processes in order to strengthen sustainability along their supply chains (e.g. MANE Fragrance and Flavor, Payan Bertran, Goup Mul).

11. Role of certification: The sustainable management of styrax tree stands and fair trade by producers are critical aspects that require special attention. However, at present the focus of the certification activities is on organic (EU) certification. This may facilitate access to new markets within the food sector, but does not bring benefits for the producer with respect to improving their production conditions, as production is done organically anyway. However, at least the certification supports transparency along the supply chain through the implementation of a traceability system.

b) Social sustainability of siam benzoin gum production in Laos

1. Empowerment of the poorest (LNOB): Most benzoin producers in Lao PDR belong to the Khmu and Hmong ethnic groups (Yokoyama, 2004, SD FORES 2020). The Khmu people are one of the largest ethnic groups in Lao PDR. Due to their geographic isolation in a mountainous area, they have maintained their cultural traditions, but also have been marginalised by the government⁴¹. The Hmong people are the third largest ethnic group in Lao PDR and also live in the mountainous north. Many Hmong have collaborated with the foreign army during the Indochina and the Vietnam war, and have later faced repressions by the Lao government (UNDPO, 2017). According to the UN Special Rapporteur on extreme poverty and human rights (UNHR, 2019), structural barriers for ethnic minorities to enjoy human rights still persist. Minority groups in Lao PDR face higher rates of poverty and limited access to public services.

2. Traditional/ancestral knowledge: Siam benzoin gum has been traded on the western market for at least 100 years, and therefore is not subject to the Nagoya protocol. Lao PDR has ratified the Nagoya protocol in 2012, but no mechanisms for ABS have been put into practice yet (CBD, 2021).

⁴¹ <http://www.khmuoc.org/Default.aspx>

3. **Gender equality/participation of women:** Benzoin gum production is generally carried out by two persons, one of whom is climbing the tree for tapping or harvest, and the other person is assisting. In many cases it is a husband and wife team doing the work together, or father and son(s). The tree climbing is generally done by men, whereas the carrying of goods is typically done by women with help of traditional baskets.
4. **Land security:** Land in Lao PDR belongs to the national community according to the constitution, but land use rights can be granted to an individual or a legal entity. The majority of land is still untitled (GIZ/LIWG (2017)). People in rural areas often have customary land tenure, which is not documented. Benzoin gum production is mainly done on land with temporary land use rights for agriculture activities, issued by the district or municipal Land Management Authority ("village chief"). In any case, the state has the faculty to expropriate the rights of use.
5. **Work safety:** Tree climbing, tapping and harvest is done in the traditional way, and all of the equipment is made by the tappers without any support by the middlemen through the provision of tools. The thin tree trunks are climbed barefoot without any safety equipment up to a height of 10 m. Every 2 metres, the climber horizontally ties a bamboo stick to the trunk using a rope, which then serves as a step. The most common accidents are cuts to the feet during preparation of the tapping cuts or during harvest. Access to medical assistance is very limited. There are no first aid materials available in the villages, and wounds are traditionally treated with plant compresses.
6. **Child work:** Benzoin producers are generally aware that gum production is hard and dangerous work. No cases of child labour are reported; however, no systematic attention has been paid to this issue yet.
7. **Social working conditions:** Benzoin gum is produced by the families for their own benefit. Generally, there are no external workers involved. Producers take care of themselves, as much as they can.
8. **Contribution to technological improvement:** There is a high potential to increase productivity through optimising gum collection by introducing adequate equipment.

Some of the gum gets lost during harvest, as it just falls down to the ground. This could be avoided by the use of adequate collection vessels. Furthermore, the gum is often harvested too soon by producers in need of cash. At that point it is still sticky, meaning that cleaning becomes difficult and waste rates are high. Here, better coordination between producers and buyers is needed to optimise the harvest time and payment schedule. Overall, producers and traders only have little information about quality requirements by the market. The gum is classified according to its size, not its degree of purity, despite the fact that fragrance processors have confirmed that the size is not relevant for quality. Quality differences based on the growing regions have been reported by producers, but have not been analysed yet. Better coordination among the supply chain actors is needed to establish a commonly shared quality standard based on real needs and practical methods.

9. **Contribution to local development:** Benzoin gum production takes place in rural areas that are poorly connected to the capital and characterised by limited access to public services. Many producers belong to historically marginalised ethnic people. The strengthening of sustainable supply chains for benzoin gum with shared responsibilities among stakeholders could have a major positive impact on local development.

c) Ecological sustainability in Siam benzoin gum production in Laos

1. **Impact on the used species:** Benzoin gum originates from the cambium cells between the bark and wood as a reaction to external damages. FAO has evaluated eight different tapping methods and best practices are available (Kaisho & Johnson 2001), but not all producers are trained accordingly. If tapping cuts are not properly made, the wounds will not heal and trees become exposed to fungi or insect attacks. If too many tapping cuts are placed, the phloem flow can be interrupted and trees dry out (Woda, 2017). *Styrax* trees used for benzoin gum production in a shifting cultivation system are often cut at the age of about 10 years, as the area will be used for agriculture. Therefore, the negative impact of tapping can be neglected there. However, respecting correct tapping methods is of high relevance if production takes place in timber plantations (Matuso et al., 2016) and natural

forests since trees there reach higher ages. Best techniques should always be applied to maintain the trees' vitality and high productivity.

In order to ensure continuous gum production, producers have to plan their land use and let styrax trees grow spontaneously on fallow land or plant them from seeds. Optimally, three plots are managed with different ages up to 15 years. A two-area system with shorter rotation circles reduces the possibility that the styrax trees reach their full productive age. A three-area rotation system is feasible for producers as long as there is long-term market security and gum prices are stable.

2. Conservation of native forest: *S. tonkinensis* is a native pioneer species that does not grow well in shady conditions. If natural succession occurs, the trees' abundance decreases. Therefore, in natural forests a thinning of the canopy is needed in order to regulate shade for the styrax trees. This forestry treatment is currently not feasible in Lao PDR and Vietnam due to "logging bans" issued by the government to protect native forests.

3. Contribution to biodiversity conservation: Information about the ecological functions of *S. tonkinensis* is quite poor. Producers from Vietnam report that pollination is done by insects (Woda, 2017), and Les (2017) describes that the species of the styrax genus are mostly pollinated by insects. For benzoin production, chemicals are not generally used, so it can be described as insect-friendly. The seed capsules are a food source for wildlife, such as squirrels, rodents and birds. Rodents are part of the food pyramid for prey animals, and some producers have reported the existence of small wild cats, dog-like species and small bears in the surroundings of styrax forests (Wilson 2019)

4. Potential for eco-corridors: Benzoin gum production takes place mainly in middle range altitudes between 800 and 1,600 m asl (Kwaschik, 2011), since lowland is used for intensive agriculture and higher altitudes are too humid and cold for gum production. Well managed *S. tonkinensis* stands can serve as "buffer-zones" for mountainous forests of high ecological value or connect them as green corridors. Even if gum production takes place in shifting rotating systems with clear cutting, the small-scale pattern of land use still contributes to enrich habitat biodiversity compared to monoculture landscapes.

5. Biodiversity conservation actions: Awareness about the need and options to contribute to biodiversity conservation is very poor within the benzoin gum production sector, and no specific actions have been implemented. Nevertheless, producers have in-depth knowledge of the local biodiversity and many households mix their plantations to diversify their income options. However, best local practices are poorly documented and not considered in "official" conservation strategies. Furthermore, illegal hunting and uncontrolled use of forest resources by producers is common, as economic needs are high. Overall, there is a high potential to increase efforts to improve biodiversity, especially if they are coordinated jointly by clients and producers.

6. Contribution to the CO₂ sink: Styrax trees in rotation systems are clear-cut every 10 to 15 years. The wood is used for "short-term" products, such as matches, chopsticks, pencils or firewood, but sometimes is also just cut and burnt on site. Therefore, the contribution to the CO₂ sink is only temporary.

7. Impact on soil health & fertility: The shifting rotation system is a traditional way to regenerate soil fertility through the improvement of biomass and soil activity. After a couple of years, the trees are cut and the area is burnt. As benzoin production takes place in a mountainous area, the clear cutting and burning often occurs on steep slopes, causing high erosion rates. Skidding is done by buffalos, but also by machines, and soil gets compacted. Contribution to soil health is therefore ambivalent. Permanent Styrax stands are promoted (e.g. GIZ CLIPAD project), but in the producers' view are difficult to implement.

8. Resilience to climate change: Styrax as a tree species is more resilient to weather extremes compared to annual crops and may contribute to the producers' economic resilience in years with abnormal weather conditions.

4. Styrax gum (*Liquidambar styraciflua*) production in Honduras

a) Economic characteristics of styrax gum production

1. **Involved families:** The number of families involved in Styrax production who manage their own Styrax trees is about 300. Many producers contract additional workers for tapping and harvest, so the total number of people involved is estimated to be 450.
2. **Trading volumes:** For the last decade, the Honduras Government has not registered Styrax gum separately in the export statistics. It is mixed in with pine resin and, as a result, no solid data are available. According to information provided by the supply chain actors, the annual trading volume is about 40 tons. Assuming an average export price (FOB) of USD 40/kg, the annual income for Honduras is more than USD 1.6 million.
3. **Alternative income options:** For most of the styrax producers, Liquidambar represents the main or even the only cash crop. Further income is generated by maize and bean production and smaller coffee plantations. Some producers also have cows to create savings. Production volumes vary based on rainfall. The average income from styrax gum per family is between USD 625 and USD 1,715, which represents up 70% of the total annual family income.
4. **Work load and farmers' resilience:** The main work period in styrax production is at the beginning of the rainy season, which matches perfectly with the farming production calendar as there are only a few other productive activities this time of the year. However, the tapping needs to be planned carefully, as the producer has to go into the forest for up to 10 days – far from home and without any communication.
5. **Economic relevance in consideration of the given infrastructure:** Styrax gum production takes place in a quiet, remote and rural area that is characterised by cattle raising for both milk and meat production. It can be said that cattle raising, which is destructive to forests, is a direct – and pretty much the only – income alternative to styrax gum production, whereby styrax gum is the more accessible option for families with less capital as it is managed as an extraction system. Coffee production is another alternative, but the altitude is too low for quality coffee (700 m asl). Recently, cacao has been

promoted as another income alternative, but plantations are few and still young, and require much more attention and labour than gum production in an extraction system.

6. **Prices for producers and financing options:** The volatile price behaviour has been the main problem for styrax gum producers. Clean gum can be stored in properly closed drums for years without affecting the quality. Middlemen and traders have used this to their advantage and have stored gum for several years to wait for better prices. Once their storage becomes full, they offer very low prices to producers. The producers, however, have no other option but to sell, since there are only a very limit number of traders. Furthermore, many producers are dependent on the middlemen due to loans. Pre-financing is needed by the producers to buy the food needed to stay in the forest and to pay the day workers during tapping and harvest. It is common that pre-financing is given with the promise of high prices by middlemen, but prices are then lowered during harvest time, and the producers have no choice but to accept.
8. **Market options:** Market demand at the international level has been pretty stable for a long time, although recently there have been some years with less demand. However, perfume formulas usually do not change quickly, and once the gum has been integrated as an ingredient it will stay for a while. Therefore, demand should not be a major challenge, but better communication between clients and producers about volume forecasts in order to avoid overproduction and price declines is a real need.
9. **Long-term sustainability of volumes:** Long-term supply security is a risk in the sector since the native forests where benzoin gum production takes place are exposed to massive destruction driven by the demand for new pasture areas for cattle. The issue is quite critical since the government usually does not legally persecute ambient crimes. In many cases, upper-class political actors are involved in forest destruction, and conflicts often turn violent.
10. **Options for direct market access (B2B):** The small number of clients, international brokers, national exporters, collectors and production villages facilitates the establishment of direct business relations, or at least the promotion of transparency along the supply chain with improved communication. Due to strong market disturbances in 2010, some international

companies started to pay closer attention to the situation in Honduras in order to understand what was happening in the sector, and then decided to get actively involved in promoting sustainability together with GIZ under a PPP with the Natural Resource Stewardship Circle (NRSC).

11. **Role of certification:** There has been demand from some end clients (perfume companies) for styrax that is certified in accordance with the UEBT standard for ethical sourcing, but so far none of the producers are certified.

b) Social sustainability of Styrax gum production in Honduras

1. **Empowerment of the poorest (LNOB):** Styrax production is done by poorest people in rural, remote areas who depend on extraction activities. Styrax producers who “own trees” at least have informal access to forest land, whereas the daily workers involved in tapping and harvest have ever fewer resources and depend on daily payments as rural workers. Altogether, there are two indigenous villages involved that have been the collective knowledge carriers for styrax gum production for centuries.
2. **Traditional/ancestral knowledge:** The use of styrax is based on the ancestral knowledge of indigenous people from Central America (Pardal, 1937; Peterson & Peterson, 1992). Europeans were introduced to styrax by Hernán Cortes’ encounter with the Aztec Emperor Moctezuma II, who smoked styrax mixed with tobacco after dinner (Gómez de Avellaneda, 1873; Tiedemann, 1854). The use of styrax is also documented for Maya people who used the gum to sculpt ceremonial objects (Pardal, 1937; Torre Montes, 1967; Navarrete, 1968) or in incense (Cano, 2008). The indigenous people are no longer the main actors in styrax gum production; as of today, they are only responsible for about 15% of the overall annual production volume. Middlemen and national exporters are mestizo. At the beginning of the PPP, no specific actions were in place to recognise the use of traditional knowledge.
3. **Gender equality/Participation of women:** Styrax gum production is generally done by men. The preparation of the “huacas” by axe is hard physical work. Furthermore, the producers have to stay in the forest for several days which is difficult for women due to their re-

sponsibilities at home. While the men stay in the forest, the women take care of the family and other farming activities.

4. **Land security:** The lack of forest use rights and constant pressure from cattle farmers to clear-cut forests are the biggest challenge with respect to the long-term sustainability of styrax gum production and the livelihoods of gum producers. In Honduras, forest land is generally state property, and land titles are only granted to farmers for deforested areas. This setup has become the main reason for deforestation. Although the forest land is state property by law, almost all of the forest land is “occupied” by “owners”. Until the implementation of the PPP, all styrax gum traded on the world market came from these illegally occupied forests. The indigenous Pech people, who traditionally inhabited a vast area as semi-nomads, are particularly affected by the ongoing expansion of the agriculture frontier and deforestation, and the uncontrolled forest fires that are set to maintain pasture land. In the remote areas of styrax production, rural conflicts are often violent and involve the use of firearms.
5. **Work safety:** Rubber production takes place in remote forests, and accidents such as snakebites (including from the deadly *Bothrops asper*), broken bones and cuts are common. Limited access to medical care and transportation is problematic, and patients must be carried out of the forest by men or mules and then transported by public transportation. Therefore, wounds or snakebites are often not treated in time and in an appropriate manner.
6. **Child work:** Producers are aware that gum production in the forest is hard and dangerous work. Therefore, no cases of child work are known.
7. **Social working conditions:** Styrax gum production is generally done by producers for their own benefit. Nevertheless, producers also contract help for tapping and harvesting. These workers are paid on a daily basis and receive meals while working in the forest. In the forest, everybody takes care of themselves. For the overnight stays, simple roof structures are built out of palm leaves as a shelter for rain.
8. **Contribution to technological improvement:** Despite the long tradition of styrax gum production and its high relevance for the perfumery sector, *L. styraciflua* is

mainly known for timber (Shimizu, 2005) and for its ornamental value with respect to the colourful painting of the leaves in autumn (Santamour & McArdle, 1984). There have not been any scientific studies on styrax gum extraction, apart from an attempt to develop best harvest techniques by the Honduran Forest Administration AFE-COHDEFOR in 1970 and a study conducted by Gerry in 1921. However, it was not possible to find and access these works.

9. **Contribution to local development:** Styrax gum production takes place in very remote areas and villages that are poorly supported by the government (lack of adequate school buildings, health centres etc.). Donations from international customers to social projects as part of their corporate social responsibility activities can have a very big impact.

c) Ecological sustainability in Styrax gum production in Honduras

1. **Impact on the used species:** If the trees are tapped appropriately – one circle of tapping holes (“huacas”) per stem per year, with adequate distance between the “huacas” – the wounds heal and the trees survive and maintain their productivity for a long time. However, to avoid having to climb the trees, many producers prefer to reopen the same huaca year after year, which prevents the healing and closing of the wound, and the vitality of the trees becomes affected. The more huacas are placed on a tree, the more the tree is affected. The critical number is 70 huacas/tree. At that point, more than half of the trees are weakened, regardless of their diameter and age (Woda et al., 2017). Despite the negative impacts of styrax tapping on the trees’ vitality, the Pech people have been harvesting styrax for centuries in their territory, and the species is still common. This is probably due to the fact that *L. styraciflua* regenerates easily as a pioneer species. Shimizu (2005) describes it as an invasive species that requires measures to avoid uncontrolled regeneration. *L. styraciflua* also has the ability to resprout from stumps and adhesive roots (Kormanik & Brown, 1967), although this has not been observed in the study area.
2. **Conservation of native forest:** Until the implementation of the PPP, effective regulations for the use of styrax trees were not in place, and the Forest Authorities did not have a register with information on production

areas and producers involved. The authorities accepted “freely designed” forest management plans that were presented by middlemen without any solid base. As long as the middlemen and exporters were paying taxes for the gum, its transportation and exportation got authorised. In short, styrax forests have been maintained by styrax producers on their own and without much interference for decades.

3. **Contribution to biodiversity conservation:** The tree trunks need a diameter of at least 30 to 40 cm to be tapped. The larger the tree, the more huacas can be placed and it becomes more productive. This is a strong argument for producers to carry out styrax gum production in old-growth native forests where large styrax trees can be found. Productive styrax forests are highly biodiverse and provide habitat to threatened species such as tapirs, jaguars and others. Styrax production often takes place in the buffer zones of protected areas, or (illegally) even in the core zones.
4. **Potential for eco-corridors:** The productive Styrax forests belong to protected areas and their buffer zones in Rio Tinto, Montana del Botadero and Sierra de Agalta, which are part of the officially declared Mesoamerican eco-corridor.
5. **Biodiversity conservation actions:** Styrax producers are committed to defend and protect “their forests”. This has a significant impact on preventing the conversion of these old-growth native forests to agricultural land. No additional biodiversity conservation measures have been implemented.
6. **Contribution to the CO₂ sink:** Styrax gum is produced in old-growth forests that are protected from destruction. This represents a significant contribution to the conservation of carbon storage in biomass-rich old-growth forests.
7. **Impact on soil health & fertility:** Styrax gum is produced in permanent forests with positive effects on soil health. The surrounding areas are characterised by degraded pasture land, frequent bush and forest fires, landslides and eroded soils. The wind-dispersed seeds of *L. styraciflua* are very small and require leaf litter-free soils for germination. Given the challenges created by soil erosion, *L. styraciflua* is an important native pioneer species that can restore the forest cover of surrounding areas.

8. Resilience to climate change: Honduras is one of the most affected countries by climate change. Subsistence farmers are severely affected when their annual harvests suffer/are lost due to abnormal rainfall patterns. Styragum, as a tree product, is more resilient to extreme weather conditions and can help to improve farmers' resilience. However, a decline in gum production has also been observed in unusually dry years, so gum producers are not completely protected from the negative impacts of climate change.

5. Coffee production in Honduras (and Lao PDR)

a) Economic characteristics of coffee production in Honduras

1. Involved families: According to IHCAFE, there are about 120,000 coffee producing families in Honduras, of which 95% are classified as small producers with a production of less than 2,300 kg⁴². The number of producer families involved in Laos coffee production is estimated to be between 20,000 and 40,000 families. Most of the coffee production takes place in the Bolaven plateau, but recently also in the Northern Provinces (Phommavong et al., 2019).

2. Trading volumes: Coffee got introduced to Honduras in the 18th century. Honduras has increased its export volume to 5 to 6 million tons in 2021/2022, and today is the 5th largest coffee producing country. Coffee production in Honduras constitutes one third of the agricultural GDP and is the second largest export product.

Coffee got introduced to Laos in the 1920ies, and today is one of the country's three main agricultural exports. Total coffee exports from Laos generated USD 97 million in 2018, representing 1.7% of the value of all Lao exports. At the international level, Lao PDR is only a small exporter, ranking 32nd among the world's coffee producing countries in 2018, but with increasing production (INTRACEN, 2021).

3. Alternative income options: Half of the 120,000 coffee producing families in Honduras live in extreme poverty. Depending on the ecological zone and market access, fruits and vegetables are alternative income options, but the lack of technical assistance is a barrier

to profitable production. Most of the smallholder farmers grow corn, beans and sorghum, mainly for self-consumption.

4. Farmers' resilience: The high poverty level among Honduran coffee farmers is accompanied by low economic resilience. Farmers are exposed to coffee price instabilities that become even more critical due to the fact that intermediary systems are very common and low quality coffee is often offered due to limited access to processing facilities. Furthermore, farmers are exposed to the effects of climate change, in particular because Honduras is listed among the top ten countries most vulnerable to climate change in the world (Climate Risk Index). Overall, the indigenous tradition to grow maize and beans in subsistence agriculture in addition to cash crops has been a key factor for resilience (Caswell et al., 2016). However, farms are increasingly affected by droughts, pests and diseases; this not only affects the coffee production, but also maize and beans and has serious implications for the families' food security. In the drought year of 2014, the government froze prices for basic food products, such as maize, beans and rice, to avert price spikes. Coffee farmers who diversified their farms with these commodities were affected in more than one way: by the decreased coffee yield, and also by artificially low prices.

5. Economic relevance in consideration of the given infrastructure: In the rural, mountainous areas of Honduras, coffee is the most important cash crop, and there is poor access to processing capacities (bean washing and drying), transportation and commercialisation resources. There are several private initiatives and NGOs providing technical assistance to coffee farmers since there is no public agriculture extension service. Assistance here focuses exclusively on coffee, without making use of the potential to grow other products such as vegetables and fruits.

6. Payment and price level for producers: 74% of Honduran coffee growers do not belong to a producer organisation and market their coffee on their own. Thus, they often depend on an intermediary. There are about 1,000 officially registered coffee intermediaries, with a low degree of integration into the value chain and a lack of formal contracts (Alvarez, 2018). This setup increases the vulnerability of coffee farmers and their

⁴² <https://www.revistaforumcafe.com/cafe-de-honduras>

exposure to fluctuating coffee prices on the world market. During the last decade, prices peaked in 2010–2011 with USD 3/pound, followed by a price decrease down to USD 0.80/per pound, and a slight rebound in 2014–2015 (Fairtrade, 2019). On the other hand, there are more than 100 cooperatives with successful marketing experience that provide various services to their members, such as loans, storage, access to farming input and infrastructure for wet processing and drying (Alvarez 2018). A regional analysis of coffee production in Honduras in 2016/2017 concluded that, on average, the production costs of a sack of coffee are around EUR 181, not taking into account costs for compliance (or lack thereof) with social standards. On average, smallholders received an export selling price of EUR 120 per sack – a loss of approximately EUR 61 per sack (PROMECAFE/IICA, 2018). The official minimum wage for agricultural activities in Honduras is USD 8.30 per day; however, coffee farm workers earn much less (Dietz, Grabs, & Chong, 2019).

7. Financing: Loans have been controversial in the sector since, on the one hand, they help farmers through economic hardships in the moment, but often leave them worse off in the long run (Caswell et al., 2016). The financial limitations of the coffee sector include high interest rates and few credit lines for drying infrastructure and equipment (Alvarez 2018).

8. Market options: Honduras has been “discovered” in the last decade as a new sourcing area for high quality coffees due to the exclusive growing of *C. arabica* at high altitudes. Currently, there are about 50 established exporters who mainly focus on the European and the U.S. market. For more than ten years now, the most important customer has been Germany, purchasing at least 25% of the export volume. Honduras is one of the most important coffee suppliers in Germany, even ahead of Colombia and Ethiopia. 25% of the coffee exported to Germany is certified. Critical issues are the high price volatility, lack of accurate purchasing forecasts, low supply of differentiated coffee and poor promotion of coffee in the domestic market (Alvarez 2018).

9. Long-term sustainability of volumes: The high price volatility has a direct impact on the extension or reduction of coffee growing areas, with delayed effects based on the coffee plant’s growing period. After a price

depression, international clients have to deal with low coffee volumes from producer organisations and sometimes even non-compliance with deliveries. Furthermore, technology and infrastructure for drying and storage need to be improved in order to meet international quality standards. The lack of public safety in Honduras and the low level of education and entrepreneurial skills among farmers are additional problems affecting market supply.

10. Options for direct market access (B2B): In addition to the negative balance between production costs and selling prices, the economic sustainability of small-scale producers is further affected by unbalanced supply chain governance, which is strongly dominated by multinational companies such as Nestlé, Neumann Gruppe, Starbucks and other trade giants in the region (Grabs & Ponte, 2019). Likewise, climate change has tremendously affected coffee production and adaptation strategies are urgently needed (Bunn et al., 2018). Overall, coffee production is not a valuable livelihood strategy for many smallholders anymore, and many have even sold their farms to acquire some immediate cash to illegally migrate to the USA (REUTERS, 2021⁴³).

11. Role of certification: Some Honduran coffee producer groups offer their customers a certificate that guarantees the origin of the coffee (Protected Designation of Origin, PDO, for the Marcala region). The motivation behind this is to achieve higher selling prices. However, even here, economic profitability is low. Smallholders barely manage to cover their operational costs and are not able to accumulate further earnings. At the same time, producer groups make large investments to maintain the PDO standard and some groups also comply with other private certification standards. Overall, the additional price mark-up resulting from compliance with the certification scheme only serves as a financial incentive that assures that the PDO continues to function. Certainly, mutually recognised quality PDO facilitates product differentiation on the foreign trade market, but the coffee is exported as a raw material and basically just becomes part of a roasted coffee brand – the origin and PDO-established name tend to become invisible (Campos 2021). Dietz & Grabs (2021) have analysed the impacts of voluntary sustainability standards in the Honduran coffee sector

43 <https://www.reuters.com/markets/commodities/coffee-crisis-central-america-fuels-record-exodus-north-2021-12-08/>

(4C, Fairtrade, Fairtrade/Organic, UTZ Certified and Rainforest Alliance) on 160,000 ha of coffee plantations in 2016. According to them, recent mainstreaming efforts have increased competition between standards and driven down price premiums. It was found that “no scheme has managed to grow substantially while maintaining strong additionality: commercially successful standards show little impact, while stricter schemes create high entry barriers and unresolved opportunity costs. Successful mainstreaming would require better cost coverage of sustainability improvements by value chain actors”. Mixap (2009) also found that participating in Fairtrade does not reduce the level of farmers’ vulnerability to and dependency on the global food market.

b) Social sustainability of coffee production in Honduras

1. Empowerment of the poorest (LNOB): Rural households make up about half of the population in Honduras, and between 50 to 60% of them live in extreme poverty (World Bank, 2014). The majority of Honduran coffee producers are smallholders (95%), with an average farm size of 7 ha. 28% of the coffee farmers work on an area of 1.4 ha or less. Smallholders manage 81% of the country’s coffee growing area and 81% of the national production (IEH, 2013). The Honduran Institute IHCAFE estimates that approximately 1.2 million people out of a population of 9 million depend on work in the coffee sector. Medium-sized and large companies hire additional workers during the labour-intensive harvest period, of which 70% are seasonal workers. About 55,000 harvesters come from neighbouring countries such as Guatemala, El Salvador and Nicaragua.

2. Traditional/ancestral knowledge: *Coffee* was introduced to Honduras and Laos, and production is done based on “foreign” knowledge.

3. Gender equality/participation of women: It is predominantly men (70%) who find employment in the coffee sector except for harvesting. At harvest, almost two-thirds of the workers are women. Most of them have no work opportunities on the farm outside of harvest season, so they are only seasonal workers. Since the coffee cherries have to be processed the same day they are

harvested, overtime work is common but usually not adequately compensated. The long working hours are particularly problematic for women who report difficulties in balancing harvest work with their household and caretaking obligations (CIR, 2018).

4. Land security: Land security in Honduras is very poor, and conflicts about land use, even violent ones, are common. One of the reasons is that there are several public institutions extending land titles, which has led to overlapping titles. All forest land is national property; however, many consider it to be freehold. As by law land titles can only be issued for land under agricultural use, rural families are likely to cut down existing forests and convert them into fields, pastures or coffee plantations. In recent years, there has been a coffee boom in Honduras, which has been actively promoted by the government and international cooperation. As a result, coffee farms were extended to higher areas into intact forests, where land titles have been issued by public institutions, including for coffee plantations in protected areas. This process is still ongoing.

5. Work safety: Coffee farm workers are exposed to various health risks on the plantations, e.g. exposure to strong sunlight, heavy rains and agrochemical substances. The work often takes place on steep slopes on slippery ground, and workers have to watch out for insects (and associated infectious diseases such as malaria) and snakes. Usually there are no adequate safety and support measures in place for seasonal workers. First aid kits and protective clothing are generally not available. A further problem is the lack of adequate sanitary infrastructure and drinking water on many

6. Child labour: Child labour is a serious problem on Honduran coffee plantations. Although it is officially banned by the leading Honduran institute for coffee promotion (IHCAFE), it still occurs. Children are paid the same as adults, based on harvest weight. Children in rural areas often only complete the first six years of school, or even less, before starting to work on a farm. The analphabetism rate is about 11%. Child labour has increased during COVID-19 since public schools were closed for 2 years and the possibility of receiving online classes is pretty much zero for children in mountainous regions. Under these circumstances, working on coffee plantations or performing other farm

activities has become extremely common for rural children⁴⁴. Overall, child labour in Honduras is estimated to affect 400,000 children and 50% of the child labour performed is related to agriculture activities⁴⁵.

7. Social working conditions: There are about 2 million people employed by the coffee industry in Honduras, most of whom are day labourers. These are seasonal workers hired to pick coffee for a couple of months during harvest season (Knox, 2016). One of the main problems is wages since harvesters are paid by piecework. In a study by CIR (2018), 32% of male and 57% of female workers stated that they do not receive the minimum wage for rural regions (220 euros/month) or the agreed premium. Seasonal workers are further affected by precarious employment conditions and have to stay in small huts, often without electricity and sanitary facilities. They generally do not have written contracts which makes it difficult for them to enforce their rights and usually are not registered in the social security system.

8. Contribution to technological improvement: Financial credits for equipment are in high demand, especially for post-harvesting infrastructure. Capacities for the development of blends and coffee product lines are still low, and training is needed for tasters. The domestic market has not been fully explored yet since there is little product development and presentation of processed products, in addition to an underdeveloped packaging industry (Álvarez, 2018).

9. Contribution to local development: A study carried out by CIR (2018) shows that big companies such as Aldi Nord and Süd, Deutsche Extrakt Kaffee (DEK) and Neumann Kaffee Gruppe (NKG) purchase from supply chains with working conditions that violate national laws and the Baseline Common Code of the Global Coffee Platform, despite being members of the Global Coffee Platform. The irregularities detected include violations of statutory minimum wage requirements, the absence of adequate health and safety conditions and failure to provide drinking water for all workers.

c) Ecological sustainability of coffee production in Honduras

1. Impact on the used species: *Coffee Arabica* and *robusta* are native to Africa. Their cultivation in Honduras does not cause any negative impacts on the native species population.

2. Conservation of native forest: Honduras has one of the highest deforestation rates in the world, and the establishment of coffee plantations is an important driver. Since 1990, approximately 45% of natural forests have disappeared and been converted to other land uses. In 2015, forests covered about 40% of Honduran territory, compared to more than 70% in 1990. An additional 20% (or 1.1 million hectares of forests) was affected by canopy reduction, another symptom of coffee expansion. In some regions, 50% of the land use after deforestation is devoted to coffee cultivation. All land above 1,800 m a.s.l. is protected and should not be used for agricultural production. However, Honduras' marketing strategy is to promote "gourmet coffee from high altitudes" and thus producers push increasingly into higher, protected areas. Furthermore, growing regions in higher altitudes are believed to be more robust to the effects of climate change and, as a result, farmers are looking there for better production sites in intact forests (Bunn et al., 2018).

3. Contribution to biodiversity conservation: Arabica coffee is a shade-grown plant that needs to be protected from excessive sunlight. Agroforestry systems with banana trees and some taller shade trees are common. Several studies have documented biodiversity losses in the case of intensively managed coffee plantations due to a reduction of canopy richness and complexity; this especially affects birds and invertebrates. Coffee grown under native forest canopies leads to equal, and sometimes even greater, ant and bird richness than that seen in nearby forests (Philpott et al., 2008), but many coffee farmers remove the shade trees in order to increase productivity (Jha et al., 2014).

4. Potential for eco-corridors: The more rustic the coffee plantation, e.g. coffee is grown under native forest cover or in an agroforestry system, the higher the potential to form buffer zones or to connect highly valuable biodiversity areas. However, recent trends in coffee production lean towards intensifying coffee management with higher

⁴⁴ <https://contracorriente.red/2021/03/06/el-trabajo-infantil-que-cosecha-el-cafe-de-exportacion/>

⁴⁵ https://www.ilo.org/sanjose/sala-de-prensa/WCMS_672438/lang--es/index.htm

planting densities, a greater use of agrochemicals and less shade; unfortunately, this severely limits any contribution to native forest protection (Harvey et al., 2021).

5. Biodiversity conservation actions: Intensively managed coffee farms can be “improved” with respect to biodiversity by simple measures such as augmenting the native tree, shrub and herb presence and richness and allowing the growth of epiphytes (Philpott et al., 2008); this is promoted by several certification standards.

6. Contribution to the CO₂ sink: The removal of shade trees in coffee agroforestry systems can be described as a consequence of fluctuating international markets, controversial government-supported agricultural policies, and climate change. There is currently no widespread policy incentive that encourages the maintenance of shade trees for the benefit of carbon sequestration, and data about the capacity of coffee agroforestry systems to store carbon are very sparse. Schmitt-Harsh (2012) believes that the carbon stocks in agroforestry systems are higher than in mixed dry forests.

7. Impact on soil health & fertility: The use of agrochemicals depends on the economic means of the coffee farmers, i.e. whether funds for purchasing them are

available. Overdosing of pesticides and inadequate handling of toxic substances occurs quite often on smallholder farms. The use of glyphosate to control weeds is common, and so is the use of other pesticides to control pests and diseases. Fertilisers are sometimes donated by the government and are then used without carrying out a specific analysis about the soil’s needs.

8. Resilience to climate change: A study carried out by CIAT (Bunn et al., 2018) estimates that 45% of today’s coffee areas in Honduras will no longer be suitable for coffee production in the future without adaptation measures to address heavy storms, irregular rainfall, increasing temperatures, draughts and strong winds. It is expected that adverse weather conditions will negatively affect productivity through an increase of pests and diseases and abnormal flowering, in addition to soil erosion. In 2012/13, the Honduran coffee sector was already heavily affected by a disease resulting from high temperatures and rainfall; this reduced the national productivity of coffee by 15%. Irrigation systems are among the most frequent adaptation measures promoted at the moment, whereas ideas on how to deal with increased pests include recommendations for conventional treatment using agrochemicals in addition to ecological approaches.

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III. List of interview partners

Interview partner	Organization/Project/Position	Date
Andiroba (<i>Carapa guianensis</i>), Brazil		
Dr. Benno Pokorny; Benno.Pokorny@giz.de	Director do Projeto do Bioeconomia, Brazil	20.12.2021
Katharina Bohl; Katharina.Bohl@giz.de	Projeto DeveloPPP Symrise, Programa Biodiversidade, Florestas e Clima, Brazil	20.01.2022
Arabica Coffee (<i>Coffea Arabica</i>), Laos and Honduras		
Andrew Bartlett; Andrew.Bartlett@helvetas.org	Director of the project Lao Upland Rural Advisory Service (LURAS), funded by SDC, Laos	27.12.2021
Barbara Judith Heck; Judith.Heck@giz.de	Entwicklungshelferin ProCambio II Honduras	27.12.2021
Cacao (<i>Theobroma cacao</i>), Brazil		
Dr. Benno Pokorny; Benno.Pokorny@giz.de	Director do Projeto do Bioeconomia, Brazil	20.12.2021
Pedro Zanetti; Pedro.Zanetti@giz.de	Projeto DeveloPPP Mondelez. Assessor Técnico, Brazil	07.01.2021
Cotton (<i>Gossypium hirsutum subsp. latifolium</i>), Uganda		
Heike Ostermann; Heike.Ostermann@giz.de	Formerly at INA's focal point for cotton production, germany	30.12.2021
Illipe butter (<i>Shorea stenoptera</i>), Indonesia		
Reinhard Hilliger; reinhard.hilliger@giz.de	Entwicklungshelfer (EH) at Agricultural Supply Chains in Indonesia Project (SASCI+), Indonesia	17.11.2021
Valentinus Heri; herivalens@gmail.com	Riak Bumi Foundation, Pontianak, Kalimantan, Indonesia	24.11.2021
Palm oil (<i>Elaeis guinensis</i>), Indonesia		
Ade Cahyat; ade.cahyat@giz.de	Low-Emissions Oil Palm Development in Berau District, East Kalimantan (LEOPALD), Indonesia	17.12.2021
Shea butter (<i>Vitellaria paradoxa subsp. nilotica</i>), Uganda		
Agnes Gerold; amgerold@aol.com	Consultant for GIZ Uganda, Promoting Rural Development Programme Uganda, Germany	19.01.2022
Ines Wiedemann; Ines.Wiedemann@giz.de	Head of Component II Promoting Rural Development Programme (PRUDEV), Uganda	03.02.2022

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Interview partner	Organization/Project/Position	Date
Siam Benzoin gum (<i>Styrax tonkinensis</i>), Laos		
Phonexay Sengsoulichanh; Phonexay.Sengsoulichanh@helvetas.org	Value chain officer at Helvetas/Regional BioTrade Project South East Asia, Laos	30.11.2021
Sisavan Phimmasan; Sisavan.Phimmasan@helvetas.org	Country team leader Laos at Helvetas/Regional BioTrade Project South East Asia, Laos	30.11.2021
Dr. Jane Carter; Jane.Carter@helvetas.org	Senior Adviser in Natural Resource Governance, Switzerland	30.11.2021
Mrs. Somphavanh Chanthaphonh; mimi.sdfei@gmail.com	Vice-director and Purchasing Manager, SD Fores, Vientiane, Laos	30.11.2021
Styrax gum (<i>Liquidambar styraciflua</i>), Honduras		
Kenia Crozier; k.crozier@hotmail.com	CEO at Crozier Green Business, Honduras	16.12.2021
Michel Mane; Michel.Mane@mane.com	President, MANE & fils, USA	19.11.2021, 17.12.2021
David Morenon; David.MORENON@MANE.com	Purchasing director at MANE, France	17.12.2021
Julien Coron; Julien.CORON@MANE.com	Responsible Purchasing Coordinator at MANE, France	17.12.2021
General concept and review		
Roberto Duarte Preuss and Dr. Gerhard Langenberger, INA, GIZ Roberto.Duarte@giz.de; Gerhard.Langenberger@giz.de		

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