TRANSLINKS

Promoting Transformations
by Linking Nature, Wealth and Power

Case Studies:

Bundling Agricultural Products with Ecosystem Services

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Bundling ecosystem services with agricultural products: Case Studies

1. Introduction

Increasing food prices, climate change, biodiversity loss, water stress, and other environmental problems has triggered a renewed concern about the interface between agricultural production and ecosystem management. The global demand for food and other agricultural products is projected to increase at least 50% over the next two decades, and doubling or more in many developing countries (UN Millennium Project 2005). Yet recent evidence suggests that by 2050 up to 25% of the world's food production will be threatened by and may be lost due to environmental breakdowns (UNEP 2009). These projections call for a reconciliation of agricultural production and production-dependent rural livelihoods with healthy ecosystems (Carpenter *et al.* 2005). And indeed, experience and research increasingly shows that farmers can produce ecosystem services not only by maintaining conservation areas in the farm and landscape, but also from production systems, if well designed and managed.

However, if such ecoagriculture systems are to be widely adopted, then incomes and other non-monetary benefits for farmers who provide ecosystem stewardship will be key (Scherr and McNeely 2008). In some cases, eco-friendly production practices are low-cost for farmers to adopt and maintain and have significant benefits for production in terms of yields, risk management or quality, so additional incentives may not be needed (see chapters on biodiversity-friendly crop, livestock and agroforestry production in Scherr and McNeely 2007). However most common agricultural systems today require additional investments or recurrent costs for farmers to make the shift to production systems that also protect ecosystem services, and without financial incentives that value these additional services farmers provide, they will be unable or unwilling to do so. Regulatory approaches have been widely established to reduce negative environmental impacts of farming, but for practical or political reasons, have had only limited impacts. There is thus increasing interest in exploring alternative approaches that provide positive financial incentives for farmers.

One approach is direct payments to farmers for provision of ecosystem services, where the specific beneficiaries of the service (say municipal water utilities, biodiversity conservation NGOs, real estate developers, or the general public, through government agencies) pay for those changes in land uses and management practices (Scherr *et al.* 2007; FAO 2007a). Such payments are unrelated to the marketing of agricultural products from the farm.

An alternative type of market-based incentive is bundling of ecosystem services into agricultural products (BESAP) which are sold to intermediate buyers or consumers who prefer (or are mandated) to purchase fresh or processed food, beverage, fuel, fiber, and other products that are ‘eco-friendly’. Most existing markets for BESAP are for agricultural products that are ‘eco-labelled’ at the field or farm level, assuring buyers through second or third party certification that ecological practices were indeed used by the farmers. Formal certification may not be needed if consumers have high trust in the organizations marketing the products, such as well-known conservation organizations. A small number of products are only or principally grown in production systems that are inherently ‘eco-friendly’, and can be marketed as such without the need for certification. New forms of eco-labeling are developing, such as landscape labeling and supply chain labeling. A companion paper to this one (Scherr, Andersson and Shames 2010 forthcoming) explores the evolution globally of various types of BESAP markets, and assesses their potential to have significant financial benefits for farmers at scale, and to produce significant conservation benefits.

This paper examines how BESAP markets are actually being set up on the ground, drawing lessons learned from six cases in Africa and Latin America. The cases have been prepared by leading innovators who are marketing ecosystem services bundled with agricultural products:

- Shaded coffee in Colombia (Ecoagriculture Partners and CIAT)
- Organic essential oils from lemongrass and rosemary in East Africa (AgroEco)
- Bamboo in Uganda (Nature Harness Initiative)
- Quality differentiated honeys in Southern Colombia (BioComercio Sostenible)
- Eco-certified coffee (Rainforest Alliance)
- *Allanblackia* nuts in tropical Africa (Ecoagriculture Partners)

The underlying business model for each example is described using a common template. We analyze the supply chains planned or being used to market the bundled services, the actors, governance structures, financial transactions and information flows, the expected livelihood impacts of each example, and lessons learned from that case about developing bundled products and ecosystem services. The type and scale of ecosystem services produced from the system are evaluated, as well as opportunities to market these products to buyers who would value the associated ecosystem services. The more general lessons learned from the case studies about developing and implementing BESAP initiatives are summarized below, following an overview of the cases and the ecosystem services they are seeking to conserve.

Overview of cases

Shaded coffee in Colombia. The first case, shade coffee production in southern Colombia, illustrates the model of farm-based eco-labeling. Colombian coffee farmers have grown coffee under shade for generations, long before eco-labels emerged. This is so because the supporting ecosystem services make this traditional approach a very resilient production system, which helps reduce risks and buffering the negative impacts of climate hazards and market price fluctuations. Farmers explain that potential monetary benefits from price premiums associated with ‘shade-grown’ and ‘organic’ certification are an important incentive for using these BESAP approaches. However, the non-monetary benefits obtained from the farm-level provision of supporting ecosystem services – in particular soil formation and nutrient cycling – are often of equal (or even greater) importance to them. The shade-grown coffee also provides diverse provisioning services besides coffee, including fruits and firewood from the shade trees.

Organic essential oils from lemongrass and rosemary in East Africa. The organic farming case study from East Africa is another example of farm-based eco-labeling with third-party (organic) certification. The case highlights the process of working with farmers to improve production practices and quality standards to produce higher-value products for the market. While 'organic' certification does not convey the provision of specific ecosystem services, in the future, this program might consider 'landscape labeling,' identifying the optimal zoning for locating rosemary and lemongrass plantations in such a way as to maximize conservation and livelihood benefits by reducing human-elephant conflicts. Depending on the conservation scale and the spatial dynamics needed to maintain biodiversity, Tamteco plantations could then be considered for example for certification under the Wildlife Conservation Society 'Certified Wildlife Friendly' label or a new "elephant-friendly" eco-label could be developed.

Bamboo in Uganda. The third case study describes the bamboo market chain in Uganda. Here, a provisioning service (i.e., bamboo) is intrinsically 'bundled' with regulating ecosystem services, due to the inherent characteristics of the crop itself which enhances land rehabilitation, and soil and water conservation. In addition, the production system can provide supporting ecosystem services of global importance such as biodiversity conservation and carbon storage, and potentially even contribute to landscape beauty. There is a rapidly growing demand for bamboo products, and overall marketing initiatives can accelerate this growth by emphasizing ecosystem benefits of source from bamboo relative to alternative building, furniture and fiber materials.

Quality differentiated honeys in Southern Colombia. The fourth case study illustrates a "landscape-specific eco-labeling" model. This case of differentiated honeys from the Huila region (Colombia) describes a rural territorial development project with a focus on goods and services from biodiversity, similar to the well-known Biodiversity and Wine Initiative from South Africa. Here, the price premium associated with the production of differentiated honeys from a region known for its rich biodiversity and numerous protected areas was the main incentive for honey producers from a commercial or marketing point of view. The training in better production practices also led to a sensitization and increased awareness about other associated benefits obtained from native species of apicultural flora, for example regulating services (erosion control), provisioning services (timber), and supporting services (pollination of other agricultural crops such as coffee).

Eco-certified coffee. The fifth case study describes a farm-based eco-labeling initiative developed by the Rainforest Alliance and the Sustainable Agriculture Network (SAN). Rainforest Alliance certified coffee farms provide a broad range of different ecosystem services, including provisioning services (coffee, fruits, timber, firewood and medicine from shade trees), supporting services (erosion control, nutrient cycling), regulating services (pollination, seed dispersal, pest regulation), and cultural services (bird diversity attracts eco-tourism). In addition, the Rainforest Alliance is currently working to add a carbon module to their certification scheme, which would allow coffee companies to buy carbon from farmers along with their coffee beans, paying farmers a small carbon premium. The RA certification scheme would then transition to a landscape basket eco-labeling BESAP scheme, involve multiple products and agricultural markets in a given landscape, thus reducing the risk of potential market failure for a single product.

***Allanblackia* nuts in tropical Africa**. The last case study describes an example of a trust-based BESAP scheme for a product whose inherent characteristics allow it to be harvested at any scale from a well-managed ecosystem. The case describes a private-public partnership in tropical Africa called the Novella Africa Partnership. The initiative was created by Unilever, IUCN, ICRAF and others to develop a market for *Allanblackia* nuts. *Allanblackia* is not grown as a monocrop; its nuts drop from trees and must be collected from the ground. On cacao plantations in tropical Africa, *Allanblackia* is grown as a shade tree inter-cropped with cacao and is valued for retaining soil moisture in dry areas. The fruits attract wildlife. No international market existed for these nuts when Unilever committed to buying a set quantity of them, but only from producers that followed certain ecological management guidelines. The partnership of Unilever with IUCN and ICRAF as trust brokers was key since consumers have confidence in these well-known international organizations to help Unilever assess and regulate the sustainability of harvests. Because Unilever is the only source buyer, other international market actors can trust that all *Allanblackia* nuts and oils they buy are sourced from these diversified agroforestry systems or sustainably managed natural forests. Therefore, no label or certification is necessary to differentiate one *Allanblackia* brand from another. However, if another company discovers a way to grow *Allanblackia* profitably as a monocrop, then Unilever may require a label certifying that its products meet certain sustainability criteria.

General conclusions from the case studies

The six field experiences described in this paper are very diverse in terms of the products and ecosystem services produced, underlying business models, actors involved, governance structures, financial transactions and information flows. In spite of these differences, some general conclusions and recommendations can be drawn for the development and implementation of field programs seeking to market bundled agricultural products and ecosystem services.

Marketing capacity

Local capacities in marketing are a key requisite for promoting bundled products with ecosystem services-- a common lesson learned across the six field experiences. In those cases where market analysis was an integral part of project development and implementation (bamboo from Uganda, differentiated honeys in Colombia, and *Allanblackia* oil from West Africa), this analysis was highlighted as one of the critical factors responsible for project success. In contrast, in those cases where market issues were not or not adequately addressed, problems encountered later down the road of project implementation were attributed to the lack of conducting thorough market analyses and defining clear marketing strategies for the respective ventures (see the case on organic herbs and essential oils from Uganda). Market skills are therefore an essential capacity that needs to be tapped by any initiative or alliance aimed at promoting bundled agricultural products and ecosystem services. At a minimum, one of the institutions involved should have a proven track-record in conducting high-quality market analyses. Ideally, project activities should include training of rural communities and producers to improve their marketing skills and thus increase the probability of the venture's economic sustainability in the long-term.

Realizing market benefits from bundling products and ecosystem services

In all six cases presented here, agricultural products are successfully sold in existing markets. However, only in two cases, the products are actually realizing market benefits from "bundling" their product together with the provision of certain ecosystem services. In the case of Rainforest Alliance certified coffee, consumers pay a price premium for Rainforest Alliance certified coffee to compensate producers for adhering to defined sustainable management practices that enhance ecosystem service provision. In the case of *Allanblackia* oil from W Africa, Unilever has committed to buying all *Allanblackia* nuts at a pre-set price from producers that follow certain ecological management guidelines. The price paid to the producer is linked to the world market price of *Allanblackia* oil, which is comparable with that of palm oil (about USD 650/t for refined oil in Europe).

However, in neither case were clear rules in place to determine the magnitude of the price premium or distinguish between different ecosystem services, nor is the price premium attached to a quantifiable rate or amount of ecosystem service provision (monitoring and verification). For example, coffee farms with a higher amount of leguminous trees are likely to be more beneficial for soil conservation, whereas farms with fruit trees may be more beneficial in terms of providing feed for birds and small mammals and thus contribute to the conservation of biodiversity. The questions arises of whether producers who contribute to water conservation <u>in addition</u> to biodiversity conservation and soil restoration receive higher price premiums than those who do not provide this ecosystem service.

In the other four cases, clear linkages were documented between generation of the agricultural product and the provision of specific ecosystem services, but marketing and selling of the product to consumers explicitly as bundled with ecosystem services has yet to be realized. This highlights the importance of undertaking parallel actions to mobilize buyer demand for products bundled with ecosystem services.

Spatial and temporal factors affecting distribution of benefits

As part of more in-depth market analyses, it is indispensable to conduct thorough socio-economic and cost-benefit analyses to better determine the production (for products) and provisioning (for ecosystem services) costs and understand the distribution of benefits (monetary and non-monetary) throughout the value chain. On both the supply side and the demand side, spatial and temporal scales need to be considered in estimating costs and benefits. The provision of and the demand for ecosystem services can be either local (farm or landscape scale), regional or global. Time lags are often experienced before the enhancement or deterioration of ecosystem services becomes measurable.

These scale issues have consequences for matching supply (of products and/or services) with demand and may create problems of equity in distributing related costs and benefits. Obtaining detailed cost-benefit measures is often difficult and time- and cost-intensive. However, projects should aim to conduct at least some basic cost-benefit assessments, since such information is key to realize negotiations with buyers, and settle fair agreements and commitments between the different actors of the value chain. It is recommended to establish from the beginning clear rules of commitments and agreements for all actors to assure the equitable distribution of benefits among all actors of the value chain.

Governance of markets

This issue relates directly to another aspect of importance: "good governance". Good governance refers to a transparent, participative process where groups of actors negotiate decisions and enforce their implementation. From the growing number of projects on markets for ecosystem services – including the six cases presented here – it becomes clear that trust-worthy, committed partnerships among third parties (i.e. brokers), buyers and sellers enable the promotion of bundled products and services. Multi-stakeholder processes such as the ones observed in cases of bamboo from Uganda, differentiated honeys in Colombia, and *Allanblackia* oil from W Africa are crucial for managing sellers' and buyers' risks for markets to function effectively and result in enhanced provision of ecosystem services. Here, third parties or intermediaries such as internationally recognized NGO's and research institutes play an increasingly important role as trust-brokers by monitoring and certifying compliance with production standards, brokering deals, and supporting activities that decrease pressure on ecosystems.

Summary

Transformation of agricultural production and marketing systems to become ecosystem-friendly requires considerable investment in technical and marketing support for farmers on the ground, even as policy and commercial efforts proceed to expand industry and consumer demand. These six cases provide valuable guidance on how to build these on-the-ground processes.

2. POTENTIAL MARKETS FOR ECOSYSTEM SERVICES FROM SHADED COFFEE IN COLOMBIA

Meike S. Andersson, German Escobar, Sandra Bolaños, Thomas Oberthür, James Cock

Background

Coffee is the most important commodity in the economy of many developing countries (Gresser and Tickell 2002) and is grown in the main biodiversity hotspots around the world (Clay 2004; Perfecto *et al.* 2005). Half of the world's coffee is produced in Central and S America. In Colombia – the world's third-largest coffee producer after Brazil and Vietnam – more than half a million smallholder farmers produce approximately 12.000 bags of coffee per year on 900.000 hectares. The on-farm production activities of Colombia's coffee sector provide 30% of rural employment (FNC 2009) with an additional 2 million people directly and indirectly dependent on the coffee industry.

Most Colombian coffee producers are smallholder farmers. Farm holdings of less than 1 ha account for over 60% of all coffee farmers, and 95% are five hectares or less (Fonseca 2002). For the 5% of Colombian farmers with land holdings greater than 5 ha, coffee is only one among many income sources, with about 20% of their farms planted to coffee. This contrasts with the typical coffee farm of only 1.5 ha with about 1 ha (75%) planted to coffee (Escobar 2007). Thus, the smaller farmers are more dependent on coffee than the larger farmers, and consequently are more vulnerable to price fluctuations on the coffee market. In fact, the percentage of households in coffee-growing areas of Colombia living under the poverty line is high, and has grown from 54.2% to 61% between 1997 and 2000 (ICO 2003).

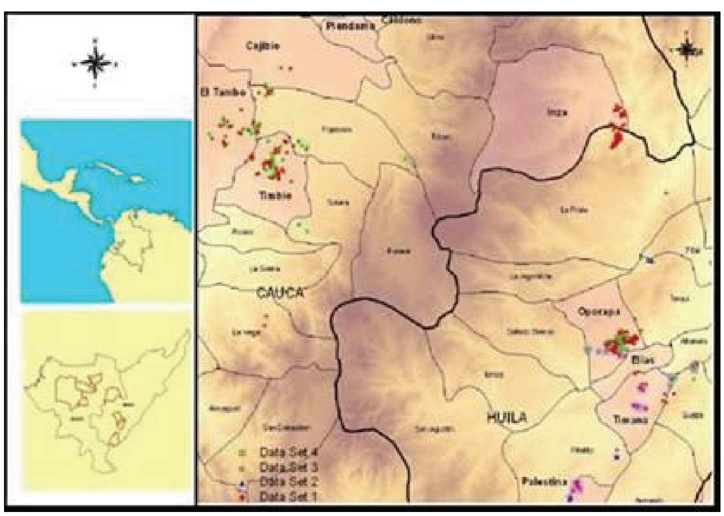

Figure 1. Location of the study area in Colombia, and distribution of the data sets used in this study

The coffee growing region in Colombia extends from N to S throughout the country, along the Andes mountain range in a north south direction, at altitudes between 1000 and 2000 m asl. The so-called "coffee region" comprises about 3 million hectares, with about a quarter of the total area planted to coffee; the remaining area is pastures for cattle grazing (33%), natural mountainous habitat (33%), and other agricultural crops (9%). Our study area covers approximately 461,500 ha and is located in Southern Colombia, in the Huila and Tolima departments between 1°45' and 2°37' N, and 75°50' and 76°50' E (Figure 1). The elevation ranges from 1330 to 2000 m asl, with average slopes of 17 degrees, and an average precipitation of close to 2000 mm per year. Historically, the natural vegetation in the area is sub Andean forest (Cuatrecasas 1958; Rangel and Velázquez 1997). Today however, we find a mosaic of heterogeneous vegetation patches, including agricultural land uses (predominantly coffee), secondary forest, shrubland, and grasslands.

Table 1. Summary of sample data

	Data set 1	***Data set 2***	***Data set 3***	***Data set 4***
Source	CINFO Database (Niederhauser *et al.* 1994)	(Rico 2006)	(Bolaños 2007)	(Escobar 2007)
No. of coffee farms sampled*	330	13	43	58
Shade tree diversity assessment				
Species richness	x	x	x	-
Frequency	x	-	-	-
Abundance	-	x	-	x
Species identification				
Farmer's knowledge	x	-	-	x
Herbarium identification	-	x	x	-
Cultural use of shade trees				
Farmer interviews	-	-	-	x

** Some farms were sampled in more than one study.*

This case study draws on a data set of 410 coffee farms (34 farms were used in more than one study), compiled from four different sources (Table 1). The coffee farms are located in the two S Colombian departments Cauca and Huila, over a range of 6 municipalities: El Tambo (144 samples), Inza (70 samples), and Timbio (10 samples) in Cauca department; Oporapa (150 samples), Timana (29 samples), and Palestina (7 samples) in Huila department. Data sets were tested for normality, randomness, and equality of variances, and subsequently log transformed to normalize them (Sneath and Sokal 1973). Rarefaction was applied to standardize sampling efforts for the different data sets, using Coleman's method (Coleman 1981; Brewer and Williamson 1994). Accumulation and rarefaction curves were computed with EstimateS®, running 100 randomizations (Colwell 2000). Refraction curves were smoothed following the procedure described in Gotelli and Colwell (2001) to obtain the average addition of species. Species richness, frequency, and abundance were then calculated (Magurran 1988). Species richness refers to the number of shade tree species per farm. Species frequency refers to the number of farms in which a certain species has been found at least once. The number of individuals per tree species was recorded in data set 4 and then used to calculate abundance. Using data set 4, the influence of socioeconomic factors (farmer's age, schooling, farm size, number of children and number of coffee plants) on the composition of shade diversity was evaluated, using principal component and regression analyses.

The innovation

In Colombia, as in much of Latin America, coffee was traditionally grown under shade. However, since the 1970's, most of the traditional shade-coffee systems have been converted to new varieties planted under full-sun or reduced-shade in order to counter decreasing coffee prices on the global market, low productivity and increasing pest and disease problems (Nestel 1995; Perfecto *et al.* 1996; Rice and Ward 1996). The process of intensification and "technification" is still on-going, and today traditional full-shade coffee systems account for less than 30% of Colombia's coffee cropping area, and the area under shade continues to decline (Fonseca 2002; Farfán V. and Mestre M. 2004).

Provision of ecosystem services

Traditional coffee production under shade in Latin America is generally believed to be less environmentally destructive than other, more intensified production systems such as sun or reduced-shade coffee cultivation. The biodiversity benefits of shade-coffee cultivation are well researched and documented (e.g., Pimentel *et al.* 1992; Perfecto *et al.* 1996; Rice and Ward 1996; Greenberg *et al.* 1997; Moguel and Toledo 1999; Botero and Baker 2001; Gillison *et al.* 2004; Mas and Dietsch 2004; Komar 2006; Gordon *et al.* 2007). Traditional coffee plantations enhance the species richness of a wide range of animal groups (e.g., birds, insects, amphibians, small mammals), and in a landscape-context they provide valuable stepping-stones connecting fragments of forest remnants and other natural habitats, and act as buffer zones around protected areas (reviewed by Moguel and Toledo 1999; Pagiola and Ruthenberg 2002; López-Gómez *et al.* 2008). Moreover, some of the taxonomic groups that are frequently found in traditional coffee plantations (in particular birds and ants) have been shown to provide other important ecosystem services such as soil aeration, pest control (Philpott and Armbrecht 2006; Williams-Guillen *et al.* 2008), pollination, increased fruit set and seed dispersal (Roubik 2002; Olschewski *et al.* 2006; Philpott *et al.* 2006; Perfecto *et al.* 2007; Klein *et al.* 2008).

Depending on the tree species used for shade cover, traditional coffee cultivation systems provide a range of other ecosystem services, including soil conservation and erosion protection, carbon sequestration, and provisioning services such as food, fodder, medicines, firewood and timber, both for subsistence and sale. In this case study, we analyze the services provided by shade trees used in traditional coffee production systems in Colombia, and we make suggestions of how they could be produced and marketed 'bundled' together with the principal product (coffee) to provide additional income and other benefits to small holder coffee producers and others who live in the coffee region.

Market opportunities

a) Certified and specialty coffees

An obvious market for shade-grown coffee is the certified sector, in particular organic certification and various eco-labels such as "bird-friendly" (Smithsonian Migratory Bird Center) and "shade-grown" (Rainforest Alliance, RA). The market for certified agricultural products has grown continuously over the last two decades, and currently retail sales are increasing by an average of 40% per year for organic products, and 10–15% for RA certified products. The expected medium term annual growth rates lie in the range of 15–20% for organic, and 8–15% for RA certification (Andersson and Oberthür 2008).

The market share of certified coffee in global coffee retail sales is relatively small (<5%), with shade-grown coffee representing only about 1% of total sales in the gourmet coffee market. In absolute numbers, however, this translates into a USD 30 million business in the US alone, and USD 300 million in the global coffee market. Organic coffee retail sales in the US amounted to USD 110 million in 2006 after an increase of 24% over the previous year (Willer and Yussefi 2007).

In practice, the high transaction costs and initial investments required for certification are often an obstacle for smallholders wanting to access these markets. However, there are alternatives that do not require certification. High-quality specialty coffees, including single origin coffees, and gourmet coffees do not require formal certifications, but they do command price premiums in the national and international markets. In the US – home to the largest coffee market in the world – the segment of specialty coffees is the fastest growing of all coffee market segments (Packaged Facts 2008). Today, specialty coffees comprise roughly 30% of the US market.

b) Agro-ecotourism

In addition to tapping into certified or specialty coffee market niches, farmers in some areas could also benefit by combining shade-grown coffee production with ecotourism. Shade-coffee production areas attract increased numbers of birds and wildlife, and many coffee-growing areas in Colombia and other Latin American countries border with or are close to national parks (Varangis *et al.* 2003). Diversified and well-managed coffee farms in these areas lend themselves to the agro-ecotourism concept and could be prime tourism destinations. In some rural areas, ecotourism may even become as economically important as agriculture. In fact, the "*zona cafetera*" (coffee-zone) of Colombia is already one of the most important touristic regions of the country, with accommodation facilities on coffee farms, and two major tourist attractions. The National Coffee Park founded by the National Coffee Federation is a non-profit organization dedicated to the preservation of culture and heritage of coffee in Colombia and the promotion of cultural, recreational and ecological activities that promote ecotourism in the region. A private company established PANACA (the National Park for Agriculture and Livestock Culture) in the region in 1999 with the philosophy "with no countryside there is no city". It was only feasible to establish these two major tourist attractions in the region due to the extremely attractive landscape and pleasant climate of the region. Since then, a whole series of smaller tourist attractions, almost all based on ecological themes, have sprung up in the region. For example a small hotel complex Bosques del Saman, bundled with a productive coffee farm describes itself as "*surrounded by luxuriant coffee plantations and cool bamboo groves, with paths that allow the visitor to become familiar with nature*". The PANACA experience has been so successful that PANACAS are now being established in Costa Rica and Mexico. A similar trend towards agro-ecotourism can be observed in other coffee-growing regions in Latin America, including El Salvador, Costa Rica and Nicaragua (Bacon *et al.* 2005; Méndez *et al.* 2007).

It is noteworthy that these trends to increased importance of ecotourism in the coffee regions depend on the natural beauty of the eco-agricultural mosaic which reflects the way that coffee producers manage the landscape. At the same time, the coffee producers exploit this image of a beautiful and natural production environment. This is well illustrated by the Jamaican propaganda for their Blue Mountain Coffee *"Toward the eastern end of the beautiful island of Jamaica runs the majestic range of hills known as the Blue Mountains…………..the terrain, the rainfall pattern, the Blue Mountain mist, and the overall conditions are blessed by God to be perfectly suited for the cultivation of the world's most distinguished and delicious coffee*" or more mundanely for Colombia "*Juan Valdez …..who explained, as he walked down through shaded hillsides with his donkey, that the best coffee is mountain grown.*"

The actions

As a response to the fluctuations of (conventional) coffee prices on the global market and the increasing incidence of pests and diseases such as *broca* (coffee berry borer) and *roya* (rust) in Colombia, the National Association of Coffee Producers (Federación Nacional de Cafeteros, FNC) together with their research branch, the National Center for Coffee Research (Cenicafé), has promoted -and subsidized- the intensification and "technification" of coffee plantations in Colombia since the 1970s. The technological package offered to farmers includes:

1) The introduction of improved varieties that are higher-yielding, disease resistant (particularly rust) and tolerant to full-sun exposition (such as *Caturra* and *Colombia*),
2) Use of inorganic fertilizers and agrochemicals for weed control,
3) Full-sun cultivation with higher coffee planting densities (7.500 to 10.000 plants/ha instead of 2000 – 3000 plants/ha under traditional shade cultivation), and
4) Biological control of pests, particularly broca.

Due to these efforts, today 75% of the coffee area in Colombia is planted to the high-yielding, disease-resistant varieties *Caturra* and *Colombia* (Cenicafe 2009). These improved varieties are cultivated mainly in full-sun or low-shade systems (usually “shaded monocultures” with only one or two species of shade trees) and require significantly higher input of fertilizers and agrochemicals than the traditional, lower-yielding shade-tolerant varieties.

Nevertheless, about 20% of Colombian coffee producers have not intensified their production methods and continue to cultivate coffee the traditional way, under a diversified shade cover using a mix of native and exotic shade species. These farmers prefer shade cultivation as a sustainable strategy for minimizing risks and confronting economic uncertainty (mainly coffee prices) as well as ecological instability (Fonseca 2002; Escobar 2007).

Economically and socially, when global coffee prices fall or harvests are poor, shade trees act as “insurance” to the grower providing firewood, timber, and fruit. Another factor influencing the decision as to whether to convert to full-sun coffee systems or not, is that smallholder producers often cannot afford the expensive chemical inputs required for full-sun production systems. On the contrary, farmers who use the more labor-intensive shade systems are better off when it comes to confronting price crises. They are usually better able to stay in the coffee business since they can a) rely on family labor as input, and b) complement reduced incomes from coffee with additional income obtained from multi-purpose shade trees. Another important characteristic of the shade systems is their greater ecological sustainability, thus reducing problems of soil fertility degradation and erosion that are frequently encountered in full-sun systems. Furthermore, if they wish to diversify into activities such as ecotourism, their farms with more abundant and varied wildlife are easier to convert or to integrate with these activities.

Impact

Coffee farmers in this case study (four data sets from Southern Colombia) prefer traditional shade systems over full-sun coffee production because of the direct monetary **AND** the non-monetary benefits that they derive from the ecosystem services provided by these production systems. These ecosystem services are many-fold, and several of them have a direct economic impact on the farmers’ livelihoods.

Biodiversity

Coffee farmers cultivate a great diversity of shade trees in their coffee plantations (Figure 2). In a study of 58 coffee farms in Southern Colombia, Escobar (2007) identified a total of 114 different shade species. The fifteen tree species most frequently used for transitory and permanent shade are shown in Table 2. Other shade species found with less frequency in the study area include *Acacia* sp., *Albizzia carbonaria*, *Bactris gasipaes*, *Bambusa guadua*, *Cassia grandis*, *Cassia spectabilis*, *Cyphomandra betacea*, *Fraxinus chinensis*, *Gliricidia sepium*, *Leucaena leucocephala*, *Myrsine coriaceae*, *Psidium* sp., *Tababuia chrysantha*, *Tephrosia candida* and *Tetrorchidium* sp.

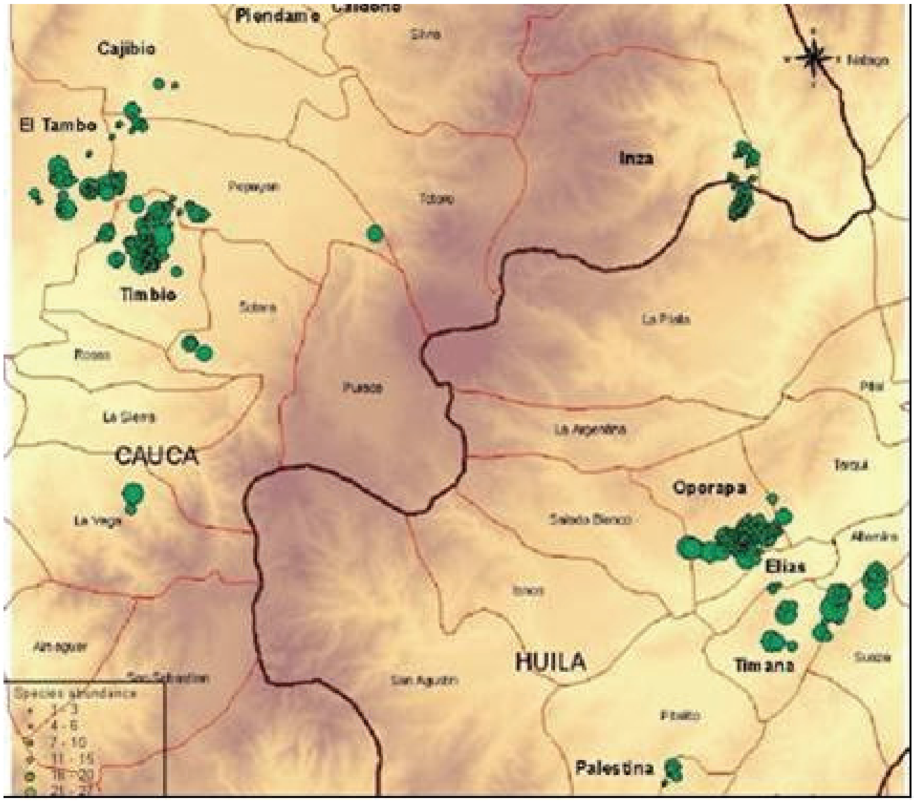

Figure 2. Shade tree species abundance on 58 coffee farms in Southern Colombia.

Table 2. The most common shade trees on coffee farms in Southern Colombia.

Common Name (Spanish)	*Scientific Name*	*Family*	*Presence (%)*	*No. of Individuals*	*Shade type**
Guamos	*Inga* spp.	Mimosaceae (Leg.)	85	3561	P
Cítricos	*Citrus* spp.	Rutaceae	71	647	P
Plátano, banano	*Musa* spp.	Musaceae	69	10760	T
Cachimbo, cámbulo	*Erythrina* spp.	Fabaceae (Leg.)	68	1360	P
Aguacate	*Persea americana*	Lauraceae	49	483	P
Nogal cafetero	*Cordia alliodora*	Boraginaceae	34	328	P
Nacedero	*Trichanthera gigantea*	Acanthaceae	32	1328	P
Mango	*Mangifera indica*	Anacardiaceae	22	114	P
Guayabos	*Psidium guajava*	Myrtaceae	20	326	P
Yarumo	*Cecropia peltata*	Cecropiaceae	19	150	P
Cedro	*Cedrela angustifolia*	Meliaceae	15	139	P
Cucharo	*Myrsine guianensis*	Myrsinaceae	15	95	T
Higuerilla	*Ricinus communis*	Euphorbiaceae	15	347	T
Eucalipto	*Eucalyptus grandis*	Myrtaceae	12	359	P
Tambor, Balso	*Ochroma pyramidale*	Bombacaceae	10	17	P

* T = temporal shade, P = permanent shade.

The species most frequently used for permanent shade are nitrogen-fixing tree species that belong to the family of the legumes (Fabaceae or Leguminosae). Escobar (2007) identified a total of 19 different legume species used in Southern Colombia (11 Mimosoideae, 6 Faboideae and 2 Caesalpinioideae). Of these, 17 are used for permanent shade and two for green manure. He found on average two different legume tree species per coffee farm, usually belonging to the genera *Inga* and *Erythrina*, and 85% of the 58 coffee farms had at least one variety of *Inga* with a relatively large number of trees (average 61 individual trees per farm). Leguminous trees have a positive effect on soil fertility due to their ability to fix air-borne nitrogen.

Shade as a secondary source of income

Coffee farmers derive a wide range of products from shaded coffee systems, including fruits (oranges, mandarin oranges, bananas, plantains, mangos, avocados, guavas), medicines (eucalyptus, rhicinus), firewood and timber for construction of houses and fences. Most of these products are not readily marketed, and the majority of smallholders utilize them for home-consumption and subsistence. Thus, coffee farmers benefit from access to the products produced by shade trees rather than through income generated by marketing them. However, access to these products probably improves their diet and hence their health, and also reduces their expenditure thus increasing their disposable which they can spend for other needs such as schooling and health care.

In some circumstances, products from shade trees contribute significantly to household income in some areas. For example, in the surroundings of the small village of Timaná in Southern Colombia, intermediaries buy bananas, mandarin oranges and oranges directly from nearby coffee farms and re-sell them in the local market. This generates an income stream equal to that derived from coffee, which is considered to be their principal crop. In other cases, the revenues derived from shade tree products (especially fruits and firewood) can account for up to 60% of farm income (Lagemann and Heuveldop 1983; Escalante *et al.* 1987; Rice 2008). Diversification of farm income from these by-products is an important strategy not only in Latin American coffee systems, but also in other coffee regions around the world. For example, in Sumatra, Indonesia, more than 15 other products are grown alongside coffee including spices, fruits and timber (Philpott *et al.* 2008).

Even though - generally speaking - farmers in Southern Colombia obtain relatively small direct profits from their shade trees, they see the greatest economic benefit in the access to a highly nutritious diet, food security and environmental services that shade trees provide to them.

Environmental services provided by shade systems

Escobar (2007) interviewed 58 coffee farmers in South Colombia to find out why they prefer shaded over full-sun coffee systems. Nearly 80% of the coffee farmers replied that they maintain shade trees on their farms because they improve the nutrient availability in the soil, 64% have shade to improve the coffee bean quality, and 48% value it for soil conservation

(Table 3). The presence of litter from the shade trees increases the organic matter content, which in turn improves other soil characteristics such as humidity, porosity, less compactness, lower specific gravity and lower temperature that favor coffee growth. Every third farmer perceives that shade trees protect the coffee bushes and soil against extreme climatic events (excessive sun exposure, high temperatures in drought periods, storms, frost or strong winds), and stabilize the microclimate in the plantation. Also, one out of three farmers benefit from an economic income generated from shade trees or use them as additional source of food, thus improving the quality and the security of their food supply.

Furthermore, 28% of the producers have shade to control weeds, thus reducing the labor cost for crop maintenance. In non-shade systems, weed control represents between 30 and 40% of the production costs. Moreover, weeds in coffee systems are the one of the main causes for coffee yield losses, due to their efficiency to absorb nutrients. Weeds in coffee systems are the one of the main cause of coffee yield lost. In Kenya, Brazil, Ethiopia and Colombia weeds are responsible for 50, 60, 65% and 66.5% of yield losses, respectively (Escobar 2007).

Table 3. Reasons why farmers in Southern Colombia prefer shaded over full-sun coffee systems

Perceived benefits of having shade	*%*	*Negative impacts of NOT having shade*	*%*
Nutrients	78	Coffee bushes do not thrive	62
Coffee bean quality	64	Declining soil fertility	53
Good soil characteristics	48	Decreasing coffee yields	38
Better microclimate	36	Reduced coffee bean quality	38
Protection against extreme climatic events	34	Weed increase	24
Non-timber products (fruits)	34	Environmental problems	9
Weed control	28	Agrochemicals (contamination)	9
Crop health	21	Absence of non-timber forest products	3
Biodiversity	21		
Reduction of agrochemicals	16		

Another positive effect of shade trees for 21% of the coffee farmers is that they improve the health of the coffee plants. Also, 21% consider shade trees as important to preserve the diversity of plants and birds, 5% perceive that shade trees are beneficial for pest and disease control, and 3% have shade because they undergo a certification process for organic production.

As much as 62% of the producers believe that their coffee plantation will suffer damage without the protection of shade trees against extreme climatic events, such as storms or droughts. 53% of the coffee farmers perceive their system without shade as eroding, with the fragile soils being exposed and quickly becoming sterile. Another effect of primary importance is that coffee plants lose vigor and age quicker under full sun, requiring costly renovation of the coffee plants after only a few years. 38% of the coffee farmers claim that without shade productivity diminishes, because of the damage and reduced quality of coffee beans (irregular shapes, smaller beans). Also, 38% of the producers claim that coffee production under full sun strongly relies on fertilizers and agrochemicals for sustained production. They affirm that at the same time the plants age faster because of the use of those agrochemicals. They perceive a higher risk when the fertilizers have to be used under adverse climatic conditions, because of leaching due to rains or soil crystallization due to extreme sun exposure.

Coffee: Reduced yields, improved bean quality

Even though farmers admit that coffee yields under shade are about 30% less than in full-sun systems (0.5-1 t dry beans/ha under shade as compared to 2.5-4 t/ha without shade), they consider coffee production in full-sun systems unsustainable in the long term due to declining soil fertility and increased soil erosion. This leads to the decline of coffee yields, and the system becoming dependent on costly external inputs. Furthermore, farmers claim that with appropriate shade management the yield loss can be minimized (e.g., according to the interviewees, the pruning of shade trees avoids the loss of flowers in coffee plants).

They also affirm that the costs in terms of foregone (coffee) production and income are compensated or even outweighed by the longer productive life of the coffee plants, better coffee quality (bigger and heavier beans, less faulty grains, better organoleptic characteristics), and reduced production costs in terms of less labor, fertilizer and agrochemical input. They confirm that in shade systems, they save about 50% of fertilizer and labor input as compared to full-sun systems, thus constituting an important economic advantage. Another positive effect of shade trees mentioned by the farmers is the more homogenous distribution of coffee harvest: In traditional coffee systems the two main harvests in a year are distributed 60% and 40%, while in full-sun systems the proportion is approximately 24% to 76% (Farfán V. and Mestre M. 2004). The optimum amount of shade is when environmental benefits and quantity/quality of coffee production are balanced.

As in our case study, coffee farmers in Mexico value shade trees mainly for improving the quality of their coffee and for the ecological services they provide (weed control mentioned by 90% of the farmers, as well as soil fertilization and impact on pest and disease incidence). The role of shade trees for domestic purposes and additional goods such as food, firewood, medicine is only secondary (Soto-Pinto *et al.* 2007). Positive effects of shade on the physical (uniformity, hardness, weight, health) and organoleptic (aroma, body, acidity, texture, viscosity of the beverage) characteristics of coffee beans have been documented in several studies (Boulay *et al.* 2000; Muschler 2001; Wintgens 2004; Vaast *et al.* 2006; Bosselmann *et al.* 2009).

Another important factor for maintaining shade is the economic benefit associated with the production of specialty coffees: Shaded coffee systems are more likely to be certified, and this represents an attractive economic factor especially for small farmers who cannot compete with volume of production. The higher the number of species in a shaded system, the higher the probability of being certified.

Carbon sequestration

There is another important ecosystem service provided by traditional coffee production systems, which is only recently receiving more detailed attention: carbon sequestration in agricultural production systems (see e.g., Kursten and Burschel 1993; Montagnini and Nair 2004). Already more than two decades ago, Dixon estimated that one hectare of sustainable agroforestry in the tropics can provide goods and services which potentially offset 5-20 ha of deforestation (Dixon 1995). In another early study, Dejong *et al.* (1995) estimated that the total potential carbon sequestration of shade-coffee plantations in Mexico ranged from 47-237 t carbon/ha.

In the last years, several new studies have had a closer look at the potential benefits that agroforestry systems can provide with respect to carbon sequestration and emissions reductions – both directly (by sequestering carbon in trees) and indirectly (by inducing lower applications of nitrogen fertilizers). In particular coffee and cacao agroforestry systems represent promising platforms for carbon trading. Increasing tree cover on-farm and in border and buffer areas can increase carbon stocks – while besides diversifying farmer income, providing better habitat for biodiversity, and improving long-term agricultural sustainability. For example, Noordwijk *et al.* (2002) found that that soil carbon stocks in shade-coffee plantations in Indonesia were 60% of that expected in primary forests, versus 45% for full-sun coffee systems. Polzot (2004) calculated that aerial (above ground) carbon stocks in Costa Rican coffee farms range from 11 t/ha for simple shade (one heavily pruned shade species) to nearly 32 t/ha for diverse shade. Depending on the value of carbon in the global market place and the return rates paid to farmers, this could provide coffee farmers with an additional net income between from 500-3000 USD/ha.

So far however, few – if any – agroforestry carbon credit initiatives have gone to market. This is most likely due to a variety of factors, including additionality (low marginal values of additional carbon sequestration), production trade-offs, cost barriers, the lack of proved, broadly accepted methodologies for quantification and monitoring, issues related to permanence and volume of carbon storage, and unclear land titles and policy environments in some countries.

Enabling conditions

Environmental context

Shade or biodiversity-friendly coffee cultivation is not a viable option under any given environmental circumstances. For example in lowland areas of Africa and Asia, the elevation, climate, and soil conditions do not allow the cultivation of shade tolerant *arabica* coffees. In most of Latin America, however, coffee cultivation under shade is an economically viable and environmentally sustainable option. In El Salvador for example, Gobbi (2000) found that shade-grown coffee cultivation is economically viable across a range of production systems, from intensive monoculture to traditional polyculture. Colombia's National Center for Coffee Research, Cenicafé, found that in certain parts of Colombia – for example those with insufficient luminosity due to misty or cloudy conditions – shade production systems are not viable, while in other highly productive areas shade protection is necessary (Giovannucci and Koekoek 2003). So a critical factor for bundling of coffee production with ecosystem services provided by shade trees is that the environmental and climatic conditions have to be appropriate for this type of production system.

Market trends

The coffee industry has been a pioneer in piloting sustainability measures, and already a decade ago more than two-thirds of the North American specialty coffee industry believed that certification of sustainable coffees would be important to their business in the future (Giovannucci 2001, 2003). This proved to hold true, as seen by the continuous growth of the certified coffee sector, with annual increases of 10–15% in retail sales over the last years, and most recently the entry of large multi-national roasting companies into the certified coffee market (e.g. Sara Lee, Kraft). Furthermore, the Rainforest Alliance is currently executing a 7-year project supported by the GEF through UNDP with the aim to certify 10% of the world's coffee supply by 2013 (Leif Pedersen, RA, personal communication). Taking all this together, it is very likely that by 2015 all major actors in the coffee world will have some sort of sustainability standards and policies in place.

The current sector growth of differentiated coffees is driven to a large extent by increasing consumer awareness about the health and environmental effects of the products they consume. Another determining factor is the growing popularity of specialty and gourmet coffees. This is reflected in the emergence of a "coffee culture" and the rise of global coffee chains like Starbucks all over the globe, including in the producer countries themselves.

External support

Access to these markets does not necessarily require third-party certification, but certification surely facilitates it. For smallholders this can be an obstacle difficult to overcome. When organized in farmer associations, however, smallholders can benefit from support offered by NGO's, development organizations and social for-profit enterprises such as Sustainable Harvest (www.sustainableharvest.com) who train farmers, provide micro-credits, build direct market linkages, and help construct transparent and equitable supply chains that are governed jointly by all actors involved.

Critical factors: The role of bundling

Ideally, the extent of shade and the composition of shade species should balance environmental benefits and the quantity/quality of coffee production. Here – as pointed out by Soto-Pinto *et al.* (2007) for Mexico – the role of local knowledge is critical to achieve the observed synergies between production and environmental objectives.

The “bundling” of coffee production with the ecosystem services provided by associated shade trees, is a necessary condition for obtaining benefits on multiple scales. On the one hand, farmers obtain the following personal benefits:

- Minimization of production costs through pesticide substitution and natural weed control,
- Risk prevention by natural control of pests,
- Maintenance of soil fertility and avoidance of soil erosion through litter decomposition and nitrogen fixation,
- Minimization of economic uncertainty caused by commodity price fluctuations,
- Better coffee quality

At the same time, this type of bundling provides important benefits to the global public, in terms of:

- Contribution to landscape connectivity at regional scale,
- Conservation of biodiversity of global importance, and
- Mitigation of climate change through carbon sequestration.

So far, farmers are not fully compensated for these benefits to the global public. Eco-certification is one possible option for farmers to receive price premiums for using biodiversity-friendly production practices. However, a more explicit marketing effort for “bundling” coffee production with the environmental services provided by accompanying shade trees may provide an additional incentive for farmers to maintain these traditional systems instead of following the trend and converting their coffee production systems to full-sun plantations.

For example, an exciting idea is developing a system that would allow coffee companies to buy carbon from farmers along with their coffee beans – through the existing supply chains. Companies would pay farmers a small carbon premium. The Rainforest Alliance is already making a step into this direction: they are currently working on the addition of a carbon module to their certification scheme (see also case study 6).

Lessons learned about bundling

Due to the higher costs of full-sun coffee systems and volatile coffee prices, accompanying tree species in shaded coffee systems provide a means for ecological and economic sustainability. Important factors considered by smallholders at the moment of choosing shade species include:

a) The provision of fruits (e.g., citrics, bananas and plantains),
b) Litter production and nutrient recycling (e.g., *Inga* and other legume tree species), and
c) The provision of timber or firewood (e.g., eucalyptus, *Cedrela* and *Cordia*).

The greatest benefits from shaded coffee systems perceived by farmers are soil protection and conservation through the production of organic matter (litter), nitrogen fixation, and the creation of mulch. This in turn favors soil temperature, water retention, weed and erosion control, as well as nutrient assimilation. It also helps to control sediments, avoids nutrient leaching by reducing runoff, and minimizes the cost of agrochemical inputs and labor. Furthermore, producers gain a comparative advantage by producing better-quality beans, protecting the environment, and minimizing external risks. Therefore, shaded coffee systems have the potential of being competitive and profitable, as compared with “technified” monoculture coffee production systems.

The sustainability of shaded coffee systems is neither a function of shade tree density and species diversity, nor a result of the complexity of the system. Beyond that, it is a function of the internal entropy of the system: the ecological relationships between the accompanying shade species, and the specific economic and environmental needs of each individual coffee farm. Due to the wide range of climatic and topographic conditions, different perceptions and producers’ needs, the b system and accompanying species will vary from one area to another and between producers of the same area. This capacity for adaptation illustrates the importance of traditional coffee agroforestry systems in providing multiple strategies to farmers for profitable and sustainable management, while minimizing external risks.

Thus, farmers obtain significant benefits in terms of better livelihoods, reduced risk and greater resilience from the ecosystem services that come along with coffee production under traditional shade. However, so far they are not fully compensated for the ecosystem services they provide to the global public such as biodiversity conservation and carbon sequestration.

Eco-certification would be one possible option for farmers to gain additional benefits such as price premiums, and access to new and more stable markets. In the BESAP (Bundled ecosystem services and agricultural products) typology developed by Scherr, Andersson and Shames (2010, forthcoming), such a marketing strategy would fall under Type 1: Farm scale eco-labeling, where ecosystem services are tied to specific on-farm eco-management practices (traditional shade systems) and sold along with the product (coffee). Third-party certification would increase credibility and help producers gain access to market niches linked to specific brands that are already established and recognized in the market, such as “bird-friendly coffee” and Rainforest Alliance certified “shade-coffee”. These products sell quicker in international markets and often fetch considerable price premiums.

However, there are two main problem with these certification approaches. First, the high transaction costs involved with certification and annual renovation are an obstacle for individual smallholder farmers who do not have the economic means to afford this. Thus certification often is a viable option only for farmers who are organized in associations that can leverage these transaction costs.

Second, shade coffee certification programs have emerged primarily from concerns about conservation, rather than integration of conservation and production – and this bias is reflected in the certification criteria. In practice, a variety of shade regimes exist in coffee agroecosystems. The extent of shade on individual farms is a complex function of ecological relationships, eco-geographical conditions, economic and productivity considerations, and individual farmer perceptions and needs. The balance between environmental benefits and coffee yields plays a key role here, and coffee yields are usually maximized between 35 and 65% shade cover (Staver *et al.* 2001). Therefore, programs that only certify plantations with more than 70% shade are only attractive to producers if the price premium offered compensates for coffee yield losses. Hence, for eco-labeling programs to be widely adopted by producers, they must incorporate economic goals in addition to the broader environmental goals.

Carbon sequestration may provide a complementary income to leverage a transition to more sustainable production practices. From an entrepreneurial perspective, existing coffee marketing channels and organizations could provide a strong framework for aggregating and commercializing small volumes of carbon credits from many farmers. This could be especially attractive for smallholder coffee producers interested in obtaining environmental-friendly certifications.

Furthermore, promotion of coffee landscapes for eco-tourism as in Colombia's "coffee-zone" would fall under the BESAP category Type 4: Landscape basket eco-labeling, which relies on more than one product (meaning also more than one market) from a given landscape, thus reducing the risk of potential market failure for a single product. So if coffee markets plummet, the ecosystem services from shaded coffee production would still continue to be provided via the market for eco-tourism to shaded coffee farms.

3. ORGANIC ESSENTIAL OILS FROM LEMONGRASS AND ROSEMARY IN EAST AFRICA

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Background

Uganda is an East African country, with an area of 241,038 km^2. The population is estimated to be 31.9 million, the majority of which belongs to the Bantu ethnic group. Uganda is divided into small units of administration, the district being the biggest sub division. Divisions are governed under a decentralized governance system, where the leaders are democratically elected by the masses. Natural resources are also decentralized and the district leadership is responsible for their management and revenue collection from the goods and services obtained. However, there are some natural resources, like the central forest reserves, national parks, game reserves, and wetlands that are still managed by national authorities set up by the central government, like the National Forestry Authority (NFA), Uganda Wildlife Authority (UWA) and National Environment Management Authority (NEMA).

Tamteco fragrant herbs is an organic project initiated in 2005 as a secondary enterprise by Toro Mityana Tea Company (Tamteco) in order to diversify the company's business. Tamteco is the successor of the East African Tea Estates, a wholly owned subsidiary of the Uganda Tea Company that was incorporated in 1903, whose core business is to produce and export tea. It has vast estate lands in Mityana (formerly Mubende) and Kabarole districts, in the central and western parts of Uganda respectively, where the operations of the fragrant herbs project's are also located.

Geographical context and natural resources

Mityana district lies at 31˚50' E 32˚10' E longitudes and 0˚40' N and 0˚10' N latitudes, 69 km west of the capital city of Uganda, along Kampala-Mubende road. Kabarole district is located in western Uganda between 0˚15' N and 1˚00' N latitudes and 30˚00' S and 31˚15' S longitudes, with a road distance of 320 km via Mubende to Kampala capital city. Both districts cover an area of ~2000 km^2 each, with a total populations of 279,900 people in Mityana and 375,500 people in Kabarole, belonging mainly to the Bantu ethnic group[1].

Both districts have bimodal rainfall schemes, with peak periods in March to June and August to November and relatively cool temperatures varying from 15˚ C to 28˚ C. Mityana lies close to the Lake Victoria climate zone of high rainfall (between 1279 mm and 1524 mm per annum).

[1] Uganda District Information Handbook, expanded edition 2007-2008.

Kabarole district has varied climate and topography due to its proximity with the Rwenzori Mountains. Its altitude ranges from 915 m at Lake George to about 3556 m above sea level with a rainfall range of 750-1000 mm/year. The soils in Mityana district are dense loam in most parts of the district, and are relatively fertile, although they are susceptible to leaching and erosion in sloping areas. Kabarole soils are red sandy clay, black loam and volcanic, and are very fertile.

The natural vegetation is highly varied in both districts, including savannas, shrubland, tropical moist broad-leaf forests and tropical rain forests – both under reserve and private land -, and (in Kabarole) afro-alpine vegetation. Forest reserves in Mityana district cover a total of 33.85 km^2 (about 1.7% of the total district area) and are protected and managed by the National Forestry Authority (NFA). In Kabarole district, 84% of total land is under agriculture, 2% under forestry, 11% under national parks, 1% under built areas, and 2% under open waters and wetlands. In both districts there are also private forests under the private owner's scheme and public forestlands managed by the district local authority, under the act of decentralized natural resources management. The tea factories also have plantation forests of Eucalyptus which is used for heating and drying the tea.

Livelihoods

Generally, about 80% of the Ugandan population is engaged in farming. In Mityana district, 87% of the population are engaged in subsistence agriculture, with the rest undertaking various income generating activities.[2] The average farm size is 1.8 hectares,[18] where farmers grow food crops such as maize, beans, cassava, and bananas in a mixed cropping pattern. Coffee and tea are the perennial cash crops grown in the area. In Kabarole, the majority of the population is engaged in subsistence agriculture with 75% of the total agriculture land rated at subsistence agriculture, 20% at small-scale and 5% at large-scale commercial agriculture. The average farm size is 1.2 ha.[18] The smallholder growers produce a variety of food crops like bananas, Irish potatoes, beans, maize, cassava, millet and assorted fruits, including avocadoes, pineapples, passion fruits and vegetables such as cabbages, carrots, peas, tomatoes and onions. They also keep animals, mainly for home food needs, with some surplus being sold in local markets.

Households derive income from farm gate sales of surplus food, and from coffee and tea. Both Mityana and Kabarole districts are major tea growing areas in Uganda. The tea is sold to any of the tea processing companies operating in Mityana (three companies) and Kabarole (six companies). Tamteco is the biggest producer, with expansive tea plantations and a factory. Although the majority of the population are farmers, the tea estates also provide a source of employment opportunity for many locals in the district, as laborers for planting, weeding and plucking tea, as well as in the transport service industry to the tea companies.

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[2] Baseline report for Tamteco Fragrant herbs project 2006. EPOPA publication.

The innovation

The innovation in this project is the production of herbal teas and essentials oils from lemon grass and rosemary grown following organic agriculture farming practices at the estate lands as well as involving smallholder outgrowers (Figure 3). Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of external inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. The production and processing are independently audited and certified against standards and regulation for organic agriculture set by the International Federation of Organic Agriculture Movement (IFOAM) and the EU organic agriculture regulation. The focus market for the products is the EU.

World interest in organic essential oils continues to grow along with the overall market of organic food and beverages (ITC 2006). Interest in organically produced products in the international markets is gaining more interest from eco-conscious buyers and consumers, due to the environmental sustainability that is linked with organic production practices. Organic production practices have been shown to contribute to direct and indirect ecosystem services, thus enhancing sustainable livelihoods locally and regionally.

Some of the ecosystems services accruing form organic agriculture practices include: nutrient recycling that supports improved soil fertility for food production, improved organic matter dynamics in the soil for better maintenance of soil structures (thus reducing soil erosion), natural suppression of pests due to higher biodiversity, contribution to the preservation of biodiversity because it favors the development of a diverse and active community of organisms, and mitigation of effects of climate change. In the Tamteco case, farmers utilize various soil and water conservation technologies, like terracing and mulching to manage erosion on their farms, they plant trees to increase tree cover and timber and firewood availability, they use green manure to improve fallows and soil fertility on-farm, they recycle biodegradable materials to make compost that is added to soil and improves soil structure, and they do not use synthetic chemicals in pest management that have high potential to contaminate the environment. All these practices contribute to improved health of the farm environment and soil fertility, which in turn improves food yields and environmental resilience.

Tamteco has vast estate lands, some of which have been lying fallow for over ten years, and are suitable for growing a variety of herbs and essential oil crops. Tamteco was motivated to start this project because there is a growing demand for organic herbal teas and essential oils, whose main outlets include: aromatherapy/ natural medicines, cosmetics, fragrance and flavorings/food ingredient markets. The main demand for organic essential oils is from the fragrance and cosmetic industry, while for spices and herbs it is the food service/catering sector that offers good potential for increased demand for organic herbs. Most essential oil crops are produced in the tropics, due to availability of cheaper labor, but also due to the favorable climatic conditions. As such, producing organic herbs and essential oils provides a promising export and marketing opportunity for smallholder producers in developing countries whose production systems are easily convertible to organic.

Figure 3. Rosemary plantation on a hilly slope in Kabarole district.

Lemongrass (*Cymbopogon citrates* DC.) and rosemary (*Rosmarinus officinalis* L.) are both aromatic plants, which easily grow in both tropical and subtropical climates.

Lemongrass, a perennial grass, has a life span of about seven years, and originated from Southeast Asia, before spreading to other parts of the world. It is a popular herb tea, ranking third behind peppermint and chamomile in usage. It is also a rich essential oil crop. Lemongrass grows as a crown spreading with many suckers, providing sufficient cover of the ground. It has fibrous roots which form a network that has a strong soil particle holding capacity, making it a good soil conservation grass - protecting the soil from leaching, desiccation and erosion. Lemongrass is locally known for use in tea, and many smallholder households have one or two plants near their kitchens to provide leaves that are used in tea. Before the intervention of the project, the crop was never grown at commercial scale in Uganda, despite its market potential and its ability to protect and conserve soils.

Rosemary is a woody perennial herb, recognized as a medicinal herb for many years, for use as a circulatory tonic. It is also very popular in the culinary industry. Rosemary is also a high value essential oil crop. The plant is native to the Mediterranean coast and exotic in Uganda. Rosemary takes over a year to attain a size that is big enough for the first harvest. After the first harvest, the crop grows with vigor and develops into a large bush that covers the ground (Figure 1). From then on, branches and leaves can be harvested twice a year.

Bundling of product and ecosystem services throughout the market chain

Tamteco started producing herbal teas and essential oils in September 2005 without being certified organic yet. At that time, Tamteco established market contacts with an intermediary based in the UK, to whom the herbal teas were sold as bulk conventional produce, with no price premium.

Traditionally, essential oils used in aromatherapy were seen as “natural” and more or less organic anyway, and this has limited the uptake of organic certified oils by this market. Today however, many aromatherapy companies offer full organic essential oil ranges, in all major markets. For Tamteco, organic certification was required as a means of gaining easier market access, given that this was a new product for the company and the country at large. Organic certification offered an audit trail, often perceived by intermediate buyers as having reduced risk of adulteration. Also, they often prefer having direct links to the producers and thus more influence on product quality.[3] With financial and technical support from EPOPA (Export Promotion of Organic Products from Africa Program)[4], the project obtained organic certification according to EU organic regulation 2091/92 (843/2007) in September 2008. Although certified, the products are still being bought at a conventional price, through the same intermediary who sells them in the EU markets, mainly in Britain and Germany. Organic market linkages are yet to be established.

The actions

In 2005, Tamteco initiated a plan for the production of lemongrass and rosemary crops on its estate lands in Mityana and Kabarole, involving neighboring farmers as outgrowers. The main objective of the action was to set up a commercially viable and sustainable production and export of organic herbal teas and essential oils.

The main trigger for starting the project was largely internal, although influenced by the external trigger of increased demand for organic herbal teas and essential oils in the world market. Internally, Tamteco identified the opportunity to produce herbal teas and essential oil crops on its vast estate lands, involving the surrounding communities as outgrowers, because it would be easy to meet the requirements for conversion to certifiable organic production. Secondly, the company has many squatters on its lands, for which it desired to obtain a benefit where the squatters produced a crop that would be marketable by the company, but would in turn provide an income to these squatters. The company was also interested in diversifying its business from only tea to other products. Herbal teas and essential oils were identified as most promising

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[3] International Trade Centre UNCTAD/WTO Organic Trade October 2004. Marketing and Web Directory for Organic Spices, Herbs and Essential Oils October 2004.

[4] EPOPA was a “development through trade” program with the objective of improving the livelihoods of rural communities through exports of organic products. The program was funded by the Swedish International Development Cooperation Agency (SIDA).

products as they fitted well with the existing business. Lastly, the environmental conditions in the project's areas were conducive to producing these crops.

Thus, while the company would meet its business objective, through this project the livelihoods of rural communities living on and adjacent to the Tamteco tea estates in Mityana and Kabarole districts would improve: Through their involvement in production and sale of the products to Tamteco, and through hired labor activities for both estate production and processing of the products; activities that bring in extra income for those involved.

Actions undertaken to set up the project

a) Institutional involvement

The Managing Director of Tamteco approached the Country Manager of EPOPA to support a number of activities to enable this project to be established. The following activities were directly and indirectly supported by EPOPA consultants: Technical and financial support to sensitize and mobilize farmers to join the project, training workshops for Tamteco staff involved in the implementation of the organic project to impart the required skills necessary for setting up a smallholder organic project using the internal control system approach (ICS), [5] monitoring and evaluation of project activities through follow-up field visits to project areas, and meetings with project staff and management to discuss difficulties and strategies to streamline project operations.

b) Collection and multiplication of planting material

Initially, there was a lack of planting material. Tamteco then invested in collecting lemongrass suckers and rosemary cuttings from the surrounding communities who had a few plants growing in their courtyards. Materials were transplanted to mother gardens at Tamteco estates for multiplication and subsequent distribution to the contracted outgrowers (Figure 4).

c) Outgrower organization and contracting

The outgrowers were recruited and organized as individual producers accepting to be part of the outgrower scheme. The process involved the company staff conducting community sensitization seminars with the potential outgrowers about what the project is about, the production practices required, the organic production practices based on the IFOAM organic standards and adapted EU organic production regulation, the direct and indirect potential benefits of going organic, and the potential livelihood benefits for the growers being part of the project.

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[5] Internal control system (ICS) is a documented quality management system where all actors involved in the production and processing chain of an organic product are identified and all are aware of their roles and responsibilities in guarding the integrity of the organic product.

Following the sensitization seminars, interested outgrowers signed a contract with Tamteco, accepting to be part of the organic project that is managed by an ICS. Once contracted, outgrowers were given a special identification number (a code), received training in organic production practices and the general standards for organic agriculture for which they were audited before certification, and started active implementation of the recommended organic production practices on the farm.

Figure 4. Rosemary cuttings growing in a nursery, ready for transfer to the field.

d) Capacity building and extension support to outgrowers

For the outgrowers to adapt organic farming practices, extension and training support was provided by the project. Tamteco offered extension support to outgrowers about crop agronomy and organic agriculture practices; for example, how to conserve soil and water using different practical technologies, how to improve soil fertility, and alternatives to the use of agrochemicals for general pest control on the farm.

e) Investment in processing technology

Tamteco invested in constructing drying barns for the herbal teas, and a stainless still distillery for the essential oils extraction (Figure 5). The company used its internally generated capital to set up these processing facilities.

f) Organic certification

In collaboration with EPOPA consultants, Tamteco organized the process of organic certification, where an internationally recognized certification body, the Swiss Institute for Marketecology (IMO), was contracted to provide the certification services. A certification body with international reputation is required to do the certification because the buyers in the market where the products are intended to be sold must have trust and need to recognize the certification body. EPOPA provided the initial funding for the project to be inspected in the first year of its operation. In the second year, EPOPA provided 50% of the certification costs, while the other 50% were provided by Tamteco.

g) Marketing of the organic products

Generally, conventional as well as organic markets for essential oils and herbal teas still remain a niche market. In order to establish organic markets, Tamteco was supported by EPOPA to attend two international organic fairs: The Natural Expo Fair in Dubai in December 2006, and the BIOFACH in Nuremberg, Germany, in February 2008. Here, Tamteco presented samples of their products and met potential organic herbs and essential oil buyers.

Figure 5. Technicians undertaking a trial run of the newly constructed essential oil distillery.

Difficulties faced during the program development and how they were solved

Major difficulties included: Insufficient planting materials to meet the needs of the recruited outgrowers, lack of technical expertise to set up systems that qualify for international organic certification, production of products that meet the required quality and can compete and sell in the international organic markets, and lack of an established organic market for the products.

These hurdles were overcome by: Tamteco setting up extensive nurseries from which planting materials were distributed to all recruited outgrowers, getting technical and financial support from EPOPA consultants to set up certifiable systems, and Tamteco investing own resources in construction of drying barns for herbal teas and stainless still distillery for the production of high-quality essential oils. To address the marketing issues, EPOPA supported Tamteco to attend an international conference on essential oil production and marketing in Rwanda in 2007, as a capacity building. In addition, EPOPA supported the project's participation in two international organic trade fairs, in Dubai and Germany. Product samples were presented to the public, and many contacts with potential organic buyers were made from these shows, though actual business transactions are yet to take place.

Impact

The project impact assessment revealed that 96% (baseline 2007: 90%) of the interviewed farmers were eager to continue to plant and produce more lemongrass and rosemary following organic practices. Continued practice of organic farming in the community is expected to continue contributing positive impacts to environmental sustainability in the project area. So far, the project provided the following direct benefits to the associated rural communities:

Livelihoods

a) Employment / income

Since the start of the project, more than 1500 people have benefited from casual employment at different stages of production: in the production of planting material, planting, weeding and other agronomic requirements (Figure 6), and harvesting and processing of the products (Figure 7). Casual laborers generally earn at least 1.1 USD/day, which is the tea sector's standard daily wage for casual laborers. Each year, at least 300 women and over 200 men benefited from temporary employment. Three hundred thirty (330) outgrowers benefit from additional income obtained from direct sales of lemongrass and rosemary raw products to Tamteco. A kilo of fresh lemon grass earns them 0.04 USD, while rosemary is yet to be harvested.

b) Gender equity

Women are particularly targeted for employment in the processing stage of the herbal teas in the organic project at the estate, leading to an economic empowerment of women. Of the over

1500 people who gained direct employment at the estates due to the project's activities, 70% are women, providing weeding, harvesting, nursery management and processing labor. Spouses and relatives of company employees – especially women who were not employed by the estate before the set up of the project – are now provided with employment and therefore generate additional income for their families.

Figure 6. Tamteco field agronomist inspecting a rosemary plantation.

Figure 7. Laborers harvesting lemongrass for processing into essential oils and herbal teas.

c) Infrastructure and other livelihood assets

Social amenities, like feeder roads within the community, are improving as the company increases its interaction with neighboring communities through the field organization, extension system and buying of the outgrower crops.

d) Health

Increased awareness of HIV/AIDS prevention and care among outgrowers due to the seminars on HIV/AIDS issues that were organized for outgrowers as part of the organic sensitization seminars that were conducted during the trainings. At the company level, Tamteco initiated a corporate HIV/AIDS workplace policy following the training.

e) Benefits to the country

The project has added diversity to the agriculture products exported from Uganda as this is one of the first commercial organic herbs and essential oils projects operating in the country. With an increase in export volumes of value added products, i.e. herbal teas and essential oils, there will be increased foreign revenue coming into the country.

Environmental impacts

a) Enhanced ecosystem services provision

The project has both direct and indirect positive impacts on the environment, when farmers implement the skills learned of organic farming practices. Organic farming practices emphasize preventative pest and disease management, and the use of natural systems like biological control, paying due diligence to manage soil erosion, preservation of natural bushes and planting and conservation of trees, water bodies and catchments areas on certified farms. These practices, once adopted, provide direct and indirect avenues that enhance provisioning and regulating services of ecosystems, for example increased firewood, biological control of pests, erosion control, better water quality and climate regulation among others. From these impacts, households practicing organic agriculture enjoy a cleaner and more sustainable environment for the present and future generations.

b) Less tree cutting and encroachment on forests for firewood

Another activity of the project included the planting of beneficial agroforestry trees, including *Grevelia*, *Mysopsis* and *Calliandra* for firewood. Over 10,000 trees were planted by the participating farmers, from tree nurseries that were established by the project. It is expected in the future that community members' access to trees for firewood will improve, but also the trees will contribute to carbon sequestration among other environmental services like soil conservation and fertility improvement.

c) Soil conservation

Crop residues and lemongrass off-cuts rejected due to low quality and waste from distillery are used as mulch in the gardens, a practice that facilitates soil conservation.

Enabling conditions

There are several enabling conditions that have played an important role in facilitating the development of this venture. These have included:

a) Market demand

Tamteco provided a ready market for the organic lemon grass and rosemary produced by the farmers. On the other hand, Tamteco was motivated by the increasing demand for organically produced herbs and essential oils in the international market. Because Tamteco offered a guarantee to buy 100% of raw materials, it was relatively easy for the outgrowers to take up growing these crops within their farming systems as they required little external input in terms of crop protection and production. Farmers were provided an opportunity to diversify their incomes rather than earning an extra income through price premiums normally associated with bundled products. This is especially true because these crops were not commercial before the project started.

b) Business atmosphere

Processing of the crops into essential oils was possible as the company had the capital to invest in constructing a stainless still distillery. Technical and financial support from EPOPA played a critical role in setting up of this project. Tamteco's management was responsive to the technical advice given by the EPOPA consultants and had a lot of internal initiative. Even before organic certification was attained, the company had established a market – though conventional.

c) Environmental conditions

Growing of organic lemon grass and rosemary on the tea estate lands and at the outgrower level was identified to be easy for several reasons. On the one hand, the tropical climate in the project areas was favorable for growing both crops. On the other hand, the farming practices of the smallholders were predominantly traditional, with no or minimal use of agrochemicals on their farms. These practices can be classified as "organic by default". This made conversion to organic production practices easier. In addition, opening up of the estate lands that had been left fallow for over ten years to organic production was also easy.

d) Social issues

Most smallholder farmers surrounding the estates were already growing one or two of the selected crops, so the producers were already relatively familiar with them. Tamteco established a field organization by utilizing effectively its existing staff working in tea to take on added roles in the organic project. The project worked hard to recruit outgrowers for the project. Tamteco field staff mobilized the communities to join the outgrower scheme and provided extension support. Receiving training and extension support was an important incentive for farmers to get involved.

Critical factors: the role of bundling

The venture is now three years old. Organic certification, which adds value to the products to attract buyers of bundled products, was attained in September 2008. So far however, marketing is still through the conventional channels where no regard for the value added through bundling is recognized. The venture is yet to break through in terms of access to premium organic markets. Thus, the producers do not yet receive a better price for their produce, but it is expected that this will be the case once the products are sold by Tamteco with a premium.

Bundling through organic certification was absolutely necessary in this case, as organic certification means easier market access, given that this is a new product for the company and the country at large. Organic certification offers an audit trail, often perceived by buyers as having reduced risk of adulteration. Besides, buyers in niche markets sometimes like to have a more direct link to the producers in order to have more influence on the quality. Organic certification easily provides for that. At the moment, it is still to debate whether bundling through organic certification is sufficient for the venture to meet its goals. The volumes targeted earlier to make the production and export of herbal teas and essential oils a commercially viable and sustainable enterprise were 109 tons of organic lemon grass herbal teas, 2606 liters of lemongrass oil, and 237 liters of rosemary oil. It is likely that the project will start attracting established organic herbs and essential oil buyers once substantial commercial volumes with a constant supply are attained.

In the meantime, farmers benefit from having knowledge and practice of new sustainable farming practices which bring them direct and indirect benefits from ecosystem services accruing from practicing organic farming practices.

Lessons learned about bundling

Bundling of the product with the ecosystems services it offers through the means it is produced should normally provide an attractive selling point in markets which demand for clean production and development. Obtaining organic certification for any product automatically qualifies it into a “sustainable product”, which should attract a price premium that trickles down to the primary producer. The price premium has proved to be an important incentive for smallholders to produce organic produce in many other projects, as they are remunerated for with the additional efforts and costs that go with organic production. Unfortunately, this expectation does not always come out right as shown in the lessons learned below.

Quantity, quality and price

Although bundled products – such as organically certified products – are expected to fetch a price premium and are regarded as a high-value product, with the increasing competition in the market even "sustainable products" must compete with other similar, but not sustainably produced, products in terms of price, quality and quantity to attract buyers. As such, these dimensions should never be ignored even with sustainably produced products.

Need for a production history and story

Herbs and essential oils are niche market products, and will remain so in the foreseeable future (ITC 2006). Yet the economies of production for start ups, like in this case, are far higher than those in already established supply chains of herbs and essential oils. So, far cheaper products can be easily obtained from recently expanded certified big farms, for example from China, India and Indonesia, countries with a longer history in trade of herbs and essential oils. Many bigger buyers prefer to buy from such well-known sources. The lack of Uganda's trade history with herbs and essential oils in the international market poses a disadvantage to the products. This can however be improved by proper product identification at the crop selection stage, and a rich product story associated with the origin and production practices, emphasizing the concept of bundling, which has so far not been the case in marketing of these products.

Starting a venture with a marketing strategy

For this venture where penetration of trade in the organic markets is still under way, the emphasis of sustainability of the process under which the products are produced is one of the main selling points that will attract the market. A proper marketing strategy for the bundled products is needed and is yet to be formulated. Efforts to establish organic markets that appreciate the bundled product are yet underway.

There are promising opportunities for attaching a marketable story and presenting a colorful picture about the product to highlight the importance of bundling and raise awareness about the conservation benefits that are supported by the consumer when buying the product. For example, in this concrete case there are location-specific benefits of producing organic herbs and essential oils in Africa that could be highlighted. Similar to tea, ginger and chili peppers, plantations of organic herbs can reduce elephant-human conflicts due to elephant crop raiding. Food and cash crops commonly cultivated on this type of soils and under these agro-climatic conditions include maize, sorghum and millets. Elephants target and feed on these staple food crops, and damage cash crops such as cotton and cocoa through trampling. Crop damage not only affects farmers' ability to feed their families, it also reduces cash income and has repercussions for health, nutrition and education. In contrast, certain high-value crops that are not eaten by elephants (such as lemongrass, rosemary, ginger, chili peppers and tea) can serve as effective buffer zones to separate protected areas (e.g., national parks and wildlife reserves) from crop fields, hence preventing elephants from crop raiding and thus reducing human-elephant conflicts.

So far, this organic farming case study would fall into the category of “Farm-based eco-labeling” with third-party – organic – certification (type 1). However, it could be “up-graded” to the landscape-level category if a broader land use planning approach was taken, e.g. by identifying the optimal zoning for locating rosemary and lemongrass plantations in such a way as to maximize conservation and livelihood benefits by reducing human-elephant conflicts. Depending on the conservation scale and the spatial dynamics needed to maintain biodiversity, Tamteco plantations could then be considered for example for certification under the WCS ‘Certified Wildlife Friendly’ label (type 2) or a new “elephant-friendly” eco-label could be developed (type 3).

4. The market opportunity for bundling bamboo and ecosystem services in Uganda

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Introduction

This case study is based on a market opportunity assessment for ecoagriculture products and services from landscapes in East Africa, conducted in 2008 in collaboration between Ecoagriculture Partners (EP) and the Nature Harness Initiative. In this case study, we report the findings for landscapes in the Kabale and Kisoro districts in South Western Uganda. Here, based on household surveys, participatory community workshops and scoping studies of eco-agriculture practices, bamboo was identified as one of the most promising market opportunities, and was frequently ranked as the second or third most important source of income by rural communities (after Irish potatoes and casual labor). Bamboo has enormous potential for alleviating environmental and socio-economic hardships due to its multi-use characteristics and environmental benefits. It is used in a number of applications which include construction, fencing, weaving, and other activities that are integral to the livelihood systems practiced by these rural households in the district. Its rapid growth rate enables bamboo to reach maturity within three to five years and hence makes it a very reliable source of raw material. Its biological characteristics contribute to preventing soil erosion on steep slopes, and its qualities of strength, light weight and flexibility make it a versatile input in the furniture, crafts and construction industries. Last but not least, processing of bamboo is done at household level with low capital input, thus offering tremendous employment opportunities.

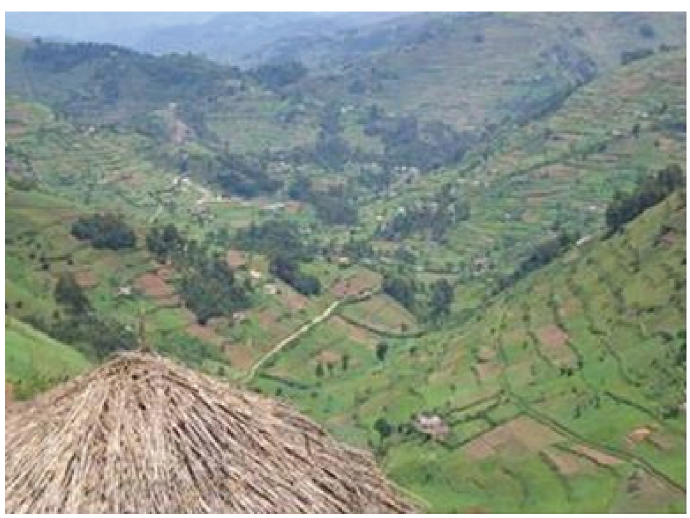

Figure 8. Kabale landscape (Source: Edirisa, Wikimedia Commons 2009, http://commons.wikimedia.org/wiki/File:Kabale_landscape.jpg**)**

Background

Geographical context and natural resources

South Western Uganda lies on the southern edge of the Western Rift Valley (or 'Albertine Rift'). Its altitudinal range varies from about 1000 to 2600 m asl, with an annual temperature range from 7 to 20 °C, and annual precipitations between 1130 mm and 2390 mm. The rainfall pattern is bimodal, with peaks in March/April and September/November.

The region is an important biodiversity hotspot that was once covered by continuous tropical rainforest across what is now SW Uganda, the western parts of Rwanda and Burundi and eastern Zaire. Today, these areas have been largely cleared for agriculture, and only residual forest fragments remain, made up mainly by montane forest (*Hagenia-Hypericum*) and extensive bamboo forests (*Arundinaria alpina*). The majority of these are on private farmland, with some protected areas in the form of forest and wildlife reserves, and national parks (e.g., Echuya Forest Reserve, Mgahinga and Bwindi Impenetrable National Parks in Kabale and Kisoro districts). More than 300 tree species have been recorded in these afro-montane forests, 10 of which occur nowhere else in Uganda. About 360 bird species, over 200 species of butterflies, and 120 species of mammals have been reported, including about 30 elephants and eleven primate species. Among the primates, the most notably are the mountain gorilla (*Gorilla gorilla beringei*) and the golden monkey (*Cercopithecus mitis* sp.). The gorillas mainly use the bamboo zone, particularly in the months February-April and September-December. In the national parks gorilla tracking and bird watching are important tourism attractions.

The eco-agriculture landscapes outside protected areas are very heterogeneous and are comprised by a patchwork of natural resources. Its primary assets include long-stretching wetlands, water resources, low-lying lands, and a wide range of hills. Almost all available land has been cleared for agriculture, which is diverse and extensive, and is practiced for both subsistence and commercial purposes.

Livelihoods and land use

Kabale and Kisoro districts are among the most densely populated of Uganda, with up to 226 persons/km^2 in Kabale and 323 persons/km^2 in Kisoro. Of these, over 96% live in rural areas and depend mainly on low input/output agriculture for subsistence (Figure 8). The average annual household income is USD 27, with the poorest households earning as little as USD 2.08/month. Agriculture contributes close to 50% to rural livelihoods, followed by forest products. Irish potatoes and wheat are the main crops in the hillsides, while Irish potatoes, sorghum and vegetables (mainly cabbages) are the dominant crops at lower altitudes. Other crops include sweet potatoes, maize, beans, peas, millet, egg plants, tomatoes, groundnuts, rice and yams.

Forests and woodlands are vital to the people's livelihoods (and critical to the protection of the Ugandan landscape). On average, households derive 20-30% of their overall income – monetary and non-monetary – from forests. The very poor rely even heavier on forest resources, which contribute up to 38% to their subsistence and cash income. They depend on a wide range of products and ecological services, including gathering honey, wild meat, root-tubers and fruits to meet their food security needs.

The high population densities in the area constitute a high pressure on resources, particularly agricultural land. As a consequence, the conversion of land for agriculture – together with policy failures and a lack of alternative energy sources – has led to over-harvesting of trees and forest loss, especially on private farmland. This is reflected by the forest area/capita (ha), which is considerably lower in the region than the national average (Figure 9), while the energy dependency on firewood (96%) is higher. Community rights to access forests are regulated by community forest management agreements and 'multiple use' pacts, allowing consumptive use of renewable resources by local people (e.g., collection of bamboo rhizomes and establishment of beehives). Still, population pressure is strong and households cultivate to the margins of the reserves (Buyinza *et al.* 2007).

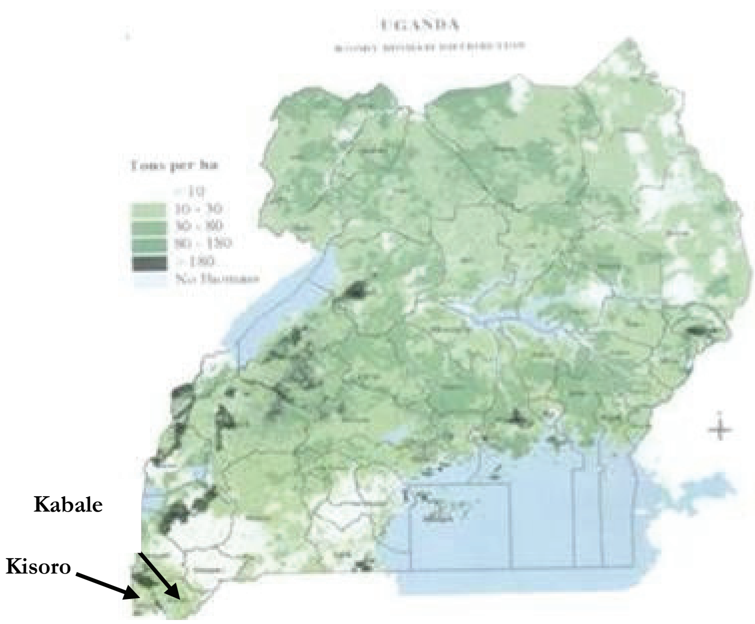

Figure 9. Woody biomass distribution in Uganda (Source: Kazoora *et al.* 2008)

The innovation: Bamboo

There is a need to curb the forest degradation and deforestation described above. On the other hand, the contribution that forests and woodlands can make to the livelihoods and transformation of households and the economy in general is recognized. Therefore, strategies need to be identified that allow the sustainable use of forest and woodland resources –

contributing to improved livelihoods while at the same time protecting the remaining forest resources.

One of these strategies can be bamboo. Bamboo plays an important role for rural local communities in Uganda (Esegu *et al.* 2000; Banana and Tweheyo 2001). Household surveys, participatory community workshops and scoping studies of eco-agriculture practices have identified bamboo as one of the most promising market opportunities for Kisoro and Kabale districts in SW Uganda, due to the following reasons: First, bamboo is frequently ranked as the second or third most important source of income by rural communities (after Irish potatoes and casual labor). Second, due to its multi-use characteristics and environmental benefits, bamboo has enormous potential for alleviating environmental and socio-economic hardships.

Distribution and biological characteristics

Bamboos belong to the grass family *Poaceae* and are also commonly called ‘giant grass’. Globally, there are over 1,200 bamboo species in more than 90 genera. Bamboo species grow naturally in tropical regions all around the globe, but also extend into temperate climates (Figure 10). They are adapted to a wide variety of ecosystems and climatic conditions (Banana and Tweheyo 2001). It is estimated that bamboo covers between 1-3% of the tropical and subtropical forest area - over 22 million ha worldwide. For Africa, a total of over 2.7 million ha of bamboo forest is reported by six countries (Ethiopia, Kenya, Nigeria, Uganda, Tanzania and Zimbabwe).

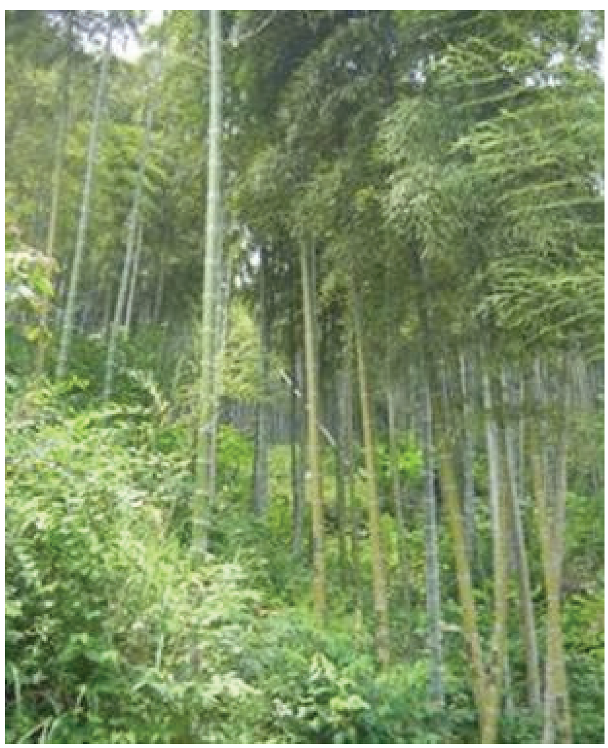

Figure 10. Bamboo forest in Anji, Zhejiang, China (Source: Tina, Wikimedia Commons 2009, http://commons.wikimedia.org/wiki/File:Anji_bamboo_forest.jpg)

Bamboos are characterized by the special structure of their stems (also ‘culms’ or ‘canes’) and their rapid growth rate. Like most grasses, they have underground rhizome buds that resprout and produce new shoots when the above-ground stems are harvested. Growth rates of up to three feet/day have been reported in mature stands. When the culm has reached full height, branches start to appear. Depending on the species, new shoots can be fully developed within less than three months. During the shooting stage, new culms consist of approximately 85% water. Bamboo is therefore often found along watercourses. With increasing age, the water content in stems diminishes and tensile strength increases. Mature bamboo has a cellulose content of about 48% when air dried.

Bamboo uses

Bamboo is a highly versatile plant with over 1500 documented uses. In principle, it can be used to produce anything that can be made from timber, competing directly with wood products in price, performance, and product diversity. Important bamboo product categories include furniture and handicrafts; housing, scaffolding and flooring; mats, boards and veneer; pulp and paper; charcoal (fuel, absorption); fiber and textiles; food and beverage (shoots); fodder (leaves and culms); medicine; composite materials; etc.

Bamboo is widely known as the “poor man’s timber” since it is harvested, processed and used mainly by the rural poor. Processing of bamboo is mostly done at household level with low capital input, and offers tremendous employment opportunities. Bamboo thus provides an excellent means of income generation for both men and women. At the same time, bamboo plantations are beneficial for erosion control, land rehabilitation, and wastewater treatment. Their rhizomatous root system helps retain the soil, while the evergreen forest-like stands provide valuable habitat for wildlife.

More than 100 bamboo species are being used commercially worldwide, and bamboo related industries already provide income, food, and housing to over 2.2 billion people. The value of bamboo products traded globally approached USD 6.5 billion in 2007 (INBAR 2009). Today, the world demand for bamboo products is estimated at more than USD 11 billion/yr, and the market is projected to grow to USD 15-20 billion/yr by 2018 (PI 2008).

With natural forests worldwide under strong deforestation pressure, bamboo is considered a sustainable substitute for timber due to its fast growth (3-4 years until harvesting and consequently annual harvests - as compared to 5-10 years for e.g. eucalyptus). A key challenge is the development of economically and environmentally sustainable supply chains and fair trading systems that return benefits back into local communities.

Status of current markets for bamboo products

It has been shown for other regions of Africa, Asia, and Latin America that the development of bamboo resources and industries promotes economic and environmental growth, mitigates deforestation and illegal logging, prevents soil degradation and restores degraded lands. This potential has yet to be realized for SW Uganda. Explicitly marketing traditional bamboo products 'bundled' together with the ecosystem services provided by the crop (e.g., biodiversity and eco-tourism) can help rural farmers in buffer zones of forest reserves and National Parks in SW Uganda to access new markets and improve their livelihoods. A supply chain analysis was conducted to identify gaps and constraints that need to be addressed when aiming at increasing the value derived from bamboo products in Kisoro and Kabale districts.

The bamboo supply chain in Uganda is relatively short and consists mainly of farmers, weavers, traders and consumers. Value is added to the bamboo right from harvesting. The roles played by the different chain actors in the bamboo supply chain include:

Farmers / collectors:

- Grow and manage the crop, or harvest it from wild stands
- Sell bamboo planting materials and edible shoots
- Add value, e.g. by weaving
- Market bamboo products locally

Processors / weavers:

- Grow bamboo
- Add value to bamboo, e.g. by weaving
- Transport and market bamboo products locally or regionally

Traders:

- Collect bamboo products from farmers and weavers in rural areas, transport and market them in urban markets

On-farm production and wild harvesting

Farmers in Kisoro district plant bamboo on their farms as an alternative source of raw materials, and because on-farm bamboo growing contributes to soil and water conservation. Planting materials are obtained from wild stands during the rainy season (March and September), when new shoots are sprouting. The main problems encountered by bamboo farmers are transportation of planting material from the source, and poor management and rotting of the young plants.

Harvesting of wild bamboo in Uganda is concentrated in Rwenzori, Echuya Central Forest Reserve, Mhahinga and Bwindi Impenetrable National Parks in Kabale district in SW Uganda (about 11,000 ha), and in the mountain forests of Elgon in the Mbale district in E Uganda (about 7,000 ha). Wild bamboo harvesting is an individual undertaking, and the harvesters usually do not own the land from which the bamboo is collected. For harvesting from forest reserves, the collectors have to purchase annual permits from the Forest Department and make an additional payment to the market ‘masters’. Harvesting is permitted one day per week only. Bamboo collectors move into the forests on foot, cut the stems down, remove the branches, and transport the poles out of the forest on foot.

Bamboo is collected for both commercial and subsistence (food) purposes. The amounts collected depend on the availability of capital, transport and seasonality of the bamboo shoots. Dry bamboo stems for construction are harvested all-year-round. The peak harvest seasons for green bamboo (for weaving baskets and for food) are from February to May, and from August to November. Young shoots for consumption are dried over a fire made with wood gathered from the forest (Buyinza 2009).

Processing and manufacturing

There are many indigenous and traditional uses of bamboo in the region, but these are of low value addition and are usually for subsistence use by the producers. Different parts of the plants, both green and dry, are used for different products. The processing generally involves two stages and differs depending on the end use. Most processors are also farmers and earn most of their income from activities other than processing bamboo.

In the primary processing stage, all side branches are removed and the bamboo is cut to size. It is then split, slivered and bundled. The secondary stage of processing involves the manufacture of handicrafts and furniture. Secondary processing of bamboo occurs in many households and can be done during spare time. Most processing takes place when crop activities such as planting, weeding and harvesting are low. Producers can add value to bamboo even with limited technical knowledge. Time and labor investment, the number of processing stages and economic returns depend on the end product.

There are a multitude of different products that are made from bamboo (Figure 11). In Kisoro and Kabale bamboo stems are mainly used for:

- Handicrafts: Baskets (green stems), beehives, granaries, stretchers, mats, trays and toys.
- Furniture: Several products such as beds, doors, tables, shelves, chairs, lamp shades.
- Construction: Houses, granaries, fencing, ceilings, gutters and wall panels.
- Others: Firewood, stakes, tube-containers, drinking vessels, stands, medicine, rivets and walking sticks.

The most common bamboo products in Kisoro are different types of baskets (traditional wedding baskets, harvesting baskets, storage baskets), winnowing trays, bean stakes to support climbing beans, brooms, and stretchers. Men are mainly involved in weaving baskets and construction of granaries for storage purposes, while women dominate marketing activities. Children sometimes weave winnowing trays which are then sold to pay schooling fees.

Figure 11. Baskets and table mats made from bamboo.

Shortage of raw materials and inadequate skills were reported to be the major constraints encountered by processors. Participants ranked the constraints staring with the most serious ones as follows:

> Shortage of raw materials; inadequate skills due to lack of training; inadequate working capital; lack of markets; lack of storage facilities to store finished products to maintain quality; lack of equipment and hand tools; lack of joint marketing facilities such as show rooms; high government taxes on finished products in the markets; lack of transport to markets; and poor value addition.

Marketing and trading

There are no established trading arrangements for bamboo in Kisoro and Kabale. Marketing is usually done on individual basis, except for granaries which are marketed as a group because producing them requires a lot of time and combined labor. Seasonal markets in the district are the main outlets for bamboo products. The size and design of products depend on special orders and market preferences. It is common for buyers to order products, and deposit part of the payment in advance. Sometimes traders travel to collect the products directly from the processors/farmers. Bamboo traders in Kabale pay taxes, and when selling on the local market they have to pay daily market fees.

The ten bamboo products most commonly marketed in Kisoro are shown in Table 4 (ranked). There is great seasonal variation in the average volumes of the main bamboo products sold during the year. For example, sales of harvesting baskets are highest between June and

August, when households are preparing for harvesting season. Marketed volumes of all products have increased during the past years due to increased harvests of other crops.

The prices of bamboo products are set based on seasonal market trends, and the cost of the raw material (Table 4). The price for green bamboo stems (= young, 5 months old) used for weaving is Ush 500 each, while dry stems (2 to 3 years old) which are mainly used for making beehives cost Ush 700 to 1,000. Prices are higher towards the end of the harvesting seasons when most households are selling crop produce (i.e., June/July and December/ January). Grading is based on size, and not quality. In general, prices have been on the increase during the past three years, which is partly attributed to the increase in prices of the raw materials used – unlike before, when bamboo was obtained free from the forests.

The approximate profits obtained for four representative bamboo products are illustrated in Table 5. Based on the average volumes marketed annually, traditional wedding baskets are the most profitable product, even although their production is seasonal only during weddings. Storage baskets and serving trays are the second-most profitable products. The final margins, however, are less than the values given here since the following cross-cutting costs still need to be deducted:

- Transport costs to the local market (estimated at Ush 3,000 per trip)
- Market taxes (estimated at Ush 200 per product per market day)
- Trading license (Ush 7,500 per month for busy traders)

Table 4. Estimated volumes and farm gate prices of the main bamboo products in Kisoro.

Bamboo products	***Average volumes marketed (pcs./year)***	***Current farm gate prices (Ush/pcs.)***		
		Small	***Medium***	***Big***
Baskets	40	5,000	6,000	8,000
Stakes to support climbing beans (bundles of 100 sticks)	200	-	7,000	-
Storage baskets	50	10,000	13,000	15,000
Building materials (bundles of 30)	30	-	7,000	-
Harvesting baskets	10	50,000	70,000	100,000
Serving trays / plates (plain)	80	2,000	2,000	2,000
Serving trays / plates (colored)	80	10,000	10,000	10,000
Chairs	-	150,000	150,000	150,000
Winnowing trays	60	4,000	4,000	4,000
Bee hives	60	5,000	6,000	8,000
Traditional wedding baskets	4	15,000	20,000	25,000

Table 5. Profitability of selected bamboo handicrafts.

Cost of inputs and labor	*Total production costs (Ush)*	*Average market price (Ush)*	*Gross margins (Ush)/pcs.*	*Annual profits*
Baskets (medium-sized) *Inputs:* 2 bamboo old stems @ Ush 500 = 1,000 2 bamboo young stems @ Ush 700 = 1,400 *Labor:* 1 person (adult) for one day = Ush 3,000	5,400	6,000	600	24,000
Serving trays / plates *Inputs:* 1 bamboo old stem @ Ush 500 = 500 1 bamboo young stem @ Ush 700 = 700 *Labor:* 1 person (child) for one day = Ush 2,000	3,200	4,000	800	40,000
Storage baskets *Inputs:* 10 bamboo old stem @ Ush 500 = 5,000 *Labor:* cutting bamboo: 1 person, 1 day = Ush 3,000 preparing bamboo: ½ day = Ush 1,500 weaving: 1 person, 1 day = Ush 3,000	12,500	13,000	500	40,000
Traditional wedding baskets *Inputs:* 2 bamboo young stems @ Ush 700 = 1,400 3 bamboo old stems @ Ush 500 = 1,500 *Labor:* 1 person for three days = Ush 9,000	11,900	20,000	8,100	32,400

Constraints faced for marketing bamboo products are (ranked):

- Unreliable markets: Sometimes products are carried to markets and not sold, hence they have to be carried back home, incurring transport costs.
- Drastic price changes
- Lack of marketing information
- Low prices compared to time input and cost of raw materials
- No collection center for marketing the products
- High transport costs, especially to distant markets such as Bunagana (bordering Congo and Rwanda)

Other marketing constraints reported were lack of storage facilities for the finished products, which are usually affected by rain reducing their quality; the high taxes on the end products; and the middlemen who confuse the farmers and end up offering them low prices.

Ecosystem services provision by bamboo

Bamboo in Uganda has the potential to provide a wide range of ecosystem services. The most important ones include:

Hydrological and watershed management functions

Bamboo is a natural agent for erosion control, thanks to its widespread root system and exuberant foliage that creates a dense litter on the forest floor. Bamboo greatly reduces rain run-off, facilitates infiltration, prevents soil erosion, and keeps twice as much water in the watershed (as compared to watersheds without bamboo). Its root system stabilizes slopes and fragile riverbanks, and retains the soil in deforested areas, places prone to earthquakes and mud slides.

Furthermore, bamboo plays an important role in pollution management due to its dual function of filtration and purification. It helps mitigate water pollution by absorbing and nitrogen, phosphorus and heavy metals, and fixing them into its biomass. This ability makes bamboo a powerful agent for ecological wastewater treatment from manufacturing, livestock farming and sewage. There are several examples in Africa where bamboo is already implemented with this purpose, e.g. to filter wastewater from the United Nations complex where ICRAF is based (Kenya), for treatment of polluted Lake Victoria waters in Kisumu (Kenya), and for wastewater treatment at Murchison Bay prison in Luzira (Uganda) to help clean up the heavily polluted Nakivubo swamp near the prison (Kirunda 2005).

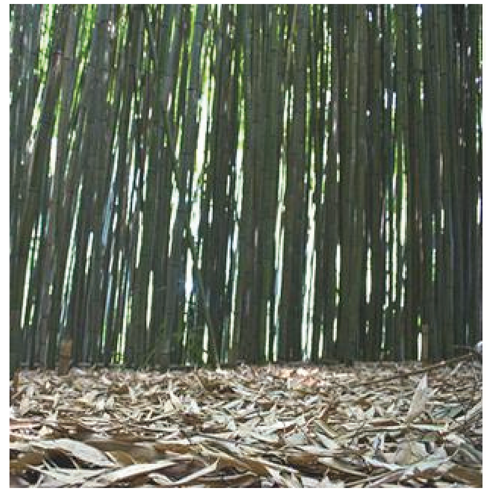

Figure 12. Leaf litter on the forest floor of a bamboo forest (Source: flickr commons, www.flickr.com/photos/fleur-design/2751764267/)

Land rehabilitation and soil conservation

Bamboo is a pioneer plant that can grow on and even help restore marginal and degraded lands with low soil fertility. Its extensive root system with exceptionally high fine-root biomass holds the topsoil in place and contributes to soil water retention and soil nutrient enrichment (Arunachalam and Arunachalam 2002). The extensive foliage produces a dense litter cover on the forest floor (Figure 12), contributing to the build-up of organic matter, nurturing the topsoil, restoring soil fertility, and preventing or reversing acidification (Takamatsu *et al.* 1997, Singh and Singh 1999). Studies of different forestry ecosystems in China have shown that the amount of litter in bamboo stands (Maozhu and *Indosasa sinica*) is five times higher than in stands of mixed broad-leaf conifer, *Cunninghamia lanceolata*, and ever-green broad-leaf stands (Maoyi 2007). In the Javanese “bamboo talun-kebun” rotation systems, increases of approximately 7 Mg/ha of soil organic matter in the top 25 cm of soil have been reported after the 4-year bamboo fallow (Christanty *et al.* 1996, 1997). It is thought that bamboo recovers much of the nutrients leached deeper into the soil profile during the interim cropping years via its extensive root system, depositing them at or near the soil surface.

Biodiversity function

Although bamboo stands are essentially monocultures, they are important for biodiversity. In different geographical regions, they provide habitat, food, shelter, and sites for reproduction to a variety of endangered species.

In Africa, the Eastern Mountain Gorilla (*Gorilla beringei beringei*) inhabits bamboo forests in SW Uganda, Rwanda, and the Democratic Republic of Congo. These endangered gorillas feed on bamboo shoots, which can make up to 90% of their diet, corresponding to approximately 35 kg/day for a male gorilla. Another African animal dependent on bamboo is the endangered Mountain Bongo (*Tragelaphus euryceros isaaci*) – a type of antelope from Kenya – that hides in bamboo thickets from predators during the dry season (Figure 13).

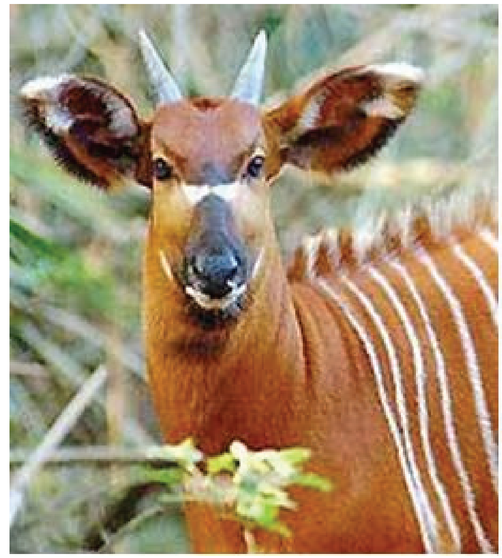

Figure 13. A Mountain Bongo in Kenya (*Tragelaphus euryceros isaaci*) (Source: Dept. Veterinary Services, Malaysia)

On other continents, bamboo forests provide a habitat for other endangered species, including the emblematic Giant Panda (*Ailuropda melanoleuca*), different species of Bamboo Rats and Bats in Asia. In Madagascar, bamboo forests are the home of the world's rarest and most endangered tortoise, the Ploughshare Tortoise (*Geochelone yniphora*), the Madagascan Climbing Poisonous Mantella Frog (*Mantella laevigata*), and several endemic, critically endangered Lemur species (IUCN 2009). In South America, the Spectacled Bear (*Tremarctos oranatus*) and the Mountain Tapir (*Tapirus pinchaque*) depend on bamboo for food, and 4-5% of Amazonian birds are reported to live exclusively in bamboo thickets (IUCN 2009).

Carbon storage

Bamboo is also considered as one of the most promising plants for incorporation into the Clean Development Mechanism (CDM), the main vehicle promoted by the Kyoto Protocol for reducing greenhouse gases (GHG) and combating global warming. This is due to the fact that bamboo is one of the most productive and fastest growing plants on the planet. The fastest-growing species may grow up to 1.2 m a day. This unique capacity makes bamboo a valuable sink for carbon storage, competing easily with the most effective wood species in terms of carbon sequestration capacities. Comparative studies have shown that bamboo biomass and carbon production may be 7-30% higher compared to the fastest growing wood species (INBAR 2009).

Some bamboo species can absorb as much 12 t/CO_2/ha (ICRAF 2005). With a carbon percentage of up to 45%, nearly half of their total biomass is carbon (e.g., Nath *et al.* 2009). Below ground bamboo biomass makes up 25-50% of the total stock, and it is estimated that about one-quarter of the biomass in tropical regions and one-fifth in subtropical regions comes from bamboo.

In general, tropical sympodial bamboo species are more productive than the subtropical, monopodial species. For example, monopodial Moso bamboo (*Phyllostachys pubescens*) produces a total above ground biomass of 120-140 t/ha, while the tropical sympodial *Bambusa* *bambos* may produce twice as much (280-290 t/ha). The total biomass of *Bambusa bambos* after 6 years (149 t C/ha) is higher than that of teak after 40 years (126 t C/ha), and its mean annual production (~47.8 t/ha/yr) is almost twice that of the Eucalyptus clones. The subtropical Moso bamboo produces at least 86 t/ha biomass and sequesters 43 t/C/ha every 5 years – almost twice as much as teak under the same conditions.

Potential market development for bundling products and ecosystem services from bamboo in Uganda

The development of bamboo resources and industries worldwide promotes economic and environmental growth. Numerous studies and analyses in Asia, Africa and Latin America have shown that bamboo (and rattan) from sustainable forest harvesting has a high potential of contributing towards local and regional development, mitigating deforestation and illegal logging, preventing soil degradation and restoring degraded lands. These qualities of bamboo have been well studied and are widely known (see e.g., Ruiz Pérez *et al.* 2004; Zhu 2005; Marsh and Smith 2007).

When looking for evidence on the potential of bamboo production for rural livelihoods, one does not need to go far. In Uganda, a local project in Mt. Elgon National Park (in the neighboring district Mbale) that supported the formation of a marketing group has led to a 6-fold increase in village incomes from selling edible bamboo shoots (Buyinza 2009). For other parts of SW Uganda, where bamboo traditionally is an integral part of rural livelihoods, this potential has yet to be realized.

Constraints in the bamboo value chain

The following main constraints of the bamboo value chain were identified in Kisoro and Kabale. First, there is no management of bamboo resources or control of harvesting. Most of the bamboo resources are located in protected areas under government control. Due to restrictions on these areas, not all bamboo forests are accessible to the harvesters. Still, the natural stocks of bamboo are being extensively harvested in many forests, even in reserves that are not legally accessible. Subsequently, the rapid spread of activities in the sector and the low level of conversion skills have led to the degradation and local shortages of the resource.

Second, the high productivity and economic potential of the bamboo sector in Uganda have not yet been realized. There is no proper treatment of the raw material due to inadequate processing skills, and only little awareness on the potential of bamboo for industrial use. The bamboo industry has not yet received policy support, and remains a minor production commodity whose potential role as economic development strategy is undervalued and not significantly appreciated.

Opportunities in the bamboo value chain

Although the bamboo supply chain in SW Uganda faces several constraints, there are also significant opportunities to develop the chain. The most promising include:

- Handcraft making is traditionally an integral part of the local culture
- A lot of potential products have not yet been developed
- Most of the products on the market are of low quality and are produced in small volumes only – there is scope for increasing production volumes and adding value through improved processing
- There is an expanding local market due to different uses of products
- Kisoro is a tourist destination, which provides a unique marketing opportunity for "eco-friendly" bamboo products
- Presence of organizations and initiatives to help developing the sector (e.g. URP)
- Export market availability in neighboring countries

The fact that a wide range of institutions have come together to support activities for developing the bamboo sector in Kisoro and Kabale districts in SW Uganda, has been critical for the sustained success observed today. Important actors involved in the endeavor include: The local and national governments (Environment Office of Kisoro district, National Forest Authority NFA), the "PRIME/West – Uganda Productive Resource Investments for Managing the Environment, Western Region" program, local and international NGOs (including the Albertine Rift Conservation Society ARCOS and Nature Uganda), and local Community Based Organizations such as the Ugandan URP ("Uplift the Rural Poor").

In particular the URP is addressing several of the challenges identified above. They have chosen to focus on the following specific objectives for Kisoro and Kabale districts:

- Increase household incomes through sustainable use of bamboo resources,
- Enhance opportunities of the marginalized groups to improve their living standards,
- Conserve the environment through awareness and adoption of efficient methods, and
- Promote bamboo eco-tourism in the districts of Kisoro and Kabale.

To reach these goals, the URP has developed a collaborative partnership with the Uganda Industrial Research Institute (UIRI), which facilitated the training of URP staff in bamboo technology and utilization in China in 2006, where URP staff attained diplomas in Bamboo Technology. UIRI also provided travel support to Chinese Professors in Bamboo Technology for visiting URP activities in Kisoro.

Furthermore, the URP has implemented the planting of bamboo as a future source of raw materials for handcrafts. In an collaborative effort and with support from the USAID-supported PRIME/West-Programme, and the African Wildlife Foundation (AWF), at least 200 farmers have planted bamboo on their farms in areas adjacent to Echuya Forest Reserve and Mgahinga

National Park. URP has also supported farmers through community programs, providing training on bamboo growing practices and bamboo product development. The incomes of farmers have increased steadily over the last years, mainly through the sale of bamboo shoots as planting materials and bamboo stems for handcraft, construction and agriculture.

URP is also implementing conservation programs around the protected areas of Kisoro district, in collaboration with the National Forest Authority (NFA), Nature Uganda, PRIME/West, and the Environment Office of Kisoro district. Their aim is to create awareness of the ecosystem services provided by bamboo, and of the importance to use wild bamboo resources in a sustainable manner. Emphasis is placed on educating farmers about the environmental services provided by bamboo.

The global carbon market – potential for bamboo?

For tapping into the market of "eco-friendly" bamboo products, the carbon storage capacity of bamboo is surely a powerful asset. Although botanically a grass and thus a non-wood plant, bamboo is considered a part of the world's forests and thus qualifies for forest carbon credits under the CDM.

As outlined above, bamboo has several advantages over wood plants that make it one of the most promising candidates for carbon trading schemes. These are in particular: high growth rates, continuously high productivity throughout its life cycle (after 30-40 years, at the age of teak or eucalyptus harvesting, bamboo biomass will still be as high as when it was 5-8 years old), and low-emission processing techniques (harvesting and processing is mostly carried out locally and by hand, requiring little to zero fossil fuel input).

However, when planning on how to best implement a carbon trading scheme for bamboo, the processing and longevity of the bamboo products is a key factor that will determine the carbon sink function to a great degree. Depending on the length of growing time of the bamboo stems and the processing of the final end product, the extent of net GHG removal (and release after consumption) will vary.

According to their longevity, bamboo products can be classified into "short-term" and "medium-term" products (Maoyi 2007). For example, bamboo fuel and paper pulp are short-term products that may emit the carbon stored in as little as one (fuel) to five (paper) years. In change, carbon storage in medium-term products such as bamboo boards and furniture may last up to 100 years. The longevity of bamboo can be further enhanced by prior treatment and the application of modern engineering techniques (Liese and Kumar 2003) to slow down the emission of GHG fixed in bamboo biomass.

Recommendations for developing the bamboo value chain in Uganda

During the process of participatory market analysis, the local communities in Kisoro and Kabale – supported by local and national institutions – have identified bamboo as the most promising crop for improving productivity, economic returns and rural livelihoods. Several opportunities were identified to enhance and upgrade the bamboo value chain in order to realize this potential. Concretely, the following recommendations are given to improve and further develop the bamboo value chain in SW Uganda:

- Creation of awareness on potential uses of bamboo in economic development,
- Improvement of bamboo technologies and marketing opportunities,
- Dissemination of available information and guidelines on management,
- Development of on-farm bamboo farming,
- Value addition through improved small-scale processing of bamboo raw materials,
- Training and capacity building in bamboo utilization,
- Dissemination of information on markets to the manufacturers,
- Marketing of bamboo as a "green product", 'bundled' with the ecosystem services provided by the crop (e.g., biodiversity or eco-tourism).

Particularly promising is the marketing of "eco-friendly" bamboo products that are harvested and produced in a sustainable manner and contribute to the conservation of the remaining afro-montane forests and their unique biodiversity. Marketing can be destined for export and/or targeted to tourists visiting the National Parks and bamboo forests for gorilla tracking and bird-watching. Despite growing demand for eco-certified products, international markets are practically inaccessible for local communities since obtaining export licenses involves a very complicated and costly process, and overcoming numerous other bureaucratic hurdles. Institutional support from local entities such as URP is critical for developing marketing plans and establishing direct contacts with international wholesalers.

Another promising strategy is the implementation of a carbon trading scheme under the Kyoto CDM. In both cases, the market value of bamboo products would be enhanced due to a 'bundling' of the (bamboo) product together with the ecosystem services provided by producing it (biodiversity, carbon storage, environmentally-friendly production).

Neither the linking ('bundling') of the bamboo products to biodiversity conservation or carbon credits is critical for enhancing the bamboo value chain in Kisoro and Kabale. There are several other opportunities along the supply chain to improve bamboo production and marketing, all of which are likely to make a significant contribution to rural livelihoods.

However, the local context of rural communities that depend on agricultural and forest products, in a scenario of high population pressure threatening the few remaining forest patches that harbor biodiversity of global importance, provides a unique opportunity to take advantage of market-based mechanisms for 'bundling' bamboo products with ecosystem services to achieve eco-agricultural livelihoods.

Lessons for bundling products and ecosystem services from bamboo

The unique biological and ecological characteristics of bamboo result in the provision of a number of ecosystem services that are important for the environment and human activities, both locally (land rehabilitation, soil and water conservation) and globally (biodiversity, carbon storage). At the same time, promoting the sustainable management and utilization of bamboo as a substitute for timber contributes to reducing pressure on the remaining forests and thus mitigating deforestation and illegal logging.

Furthermore, bamboo can play a significant role in linking climate change mitigation to sustainable economic development of rural communities in the developing world. Carbon credits may trigger the enhancement and sustainable utilization of bamboo resources (wild and in plantations) for processing, employment and income generation. Unlike tree crop plantations which often lack a pro-poor focus, bamboo production systems are highly suitable specifically for pro-poor development.

In this case study the ‘bundling’ of an agricultural product (here bamboo) with ecosystem services is already happening on a local scale, due to the intrinsic characteristics of the crop that enhance land rehabilitation, and soil and water conservation. However, awareness of the farmers about these services is low, and they are thus not actively utilized or promoted. Local communities can be educated to value and utilize these ecosystem services to a greater extent. However, non-monetary incentives alone are not always efficient, especially when other factors such as high population pressure on land and natural resources call for short-term solutions.

In the case of bamboo, ecosystem services of global importance such as biodiversity conservation and carbon storage are an added value that can help tipping the balance. Marketing these ecosystem services in a ‘bundle’ together with the bamboo product, can provide a monetary incentive for farmers to implement more sustainable harvesting and production methods. Experience has shown that when rural producers are aware of exciting alternatives they can seize these opportunities and add value to their traditional crops or diversify into totally new enterprises. Their current knowledge base and the lack of access to information sources, however, provide them with limited scope for improving livelihoods using more market-oriented mechanisms. Support from local and external institutions is therefore likely to be required for realizing these marketing opportunities.

A promising option would be to market bamboo products - together with the ecosystem services mentioned above - under a “landscape basket eco-label” (type 4 of the categories proposed in Scherr *et al.* forthcoming). This would:

a) increase awareness among producers about the values they are providing,
b) provide additional income through price premiums, and
c) minimize risks of market failures by selling the bundled products in different markets: local, regional (ecotourism), and global (carbon credits, biodiversity offsets).

5. Apiculture for quality differentiated honeys in Southern Colombia

Adriana Lucía Arcos D., José Antonio Gómez

Introduction

This project was conducted between 2005 and 2007 with small beekeepers and coffee producers in the Andean hillsides of Colombia (Arcos 2009). Activities were carried out by a strategic alliance including a rural cooperative of beekeepers (Coapi), the regional environmental authority (CAM), a biodiversity research institution (Humboldt Institute), an international agricultural research center (CIAT) and the academic sector (National University of Colombia and District University Francisco José de Caldas). The main purpose of the project was to assess mechanisms for value adding and quality improvement in the product chain of artisanal honey production (Figure 14), starting from the environmental offer, with the aim of accessing new, differentiated markets and thus contributing to increased incomes for the beekeepers involved in the project. The supply of nectar and pollen from the regional flora is identified as an environmental service to improve the beekeeping potential of a region.

Figure 14. Coffee landscape in Gigante, Huila department, Colombia, with beekeeping and honey production in bordering patches of secondary forest.

The justification of the project is based on the fact that different vegetation covers associated with the apiaries of the region (shaded coffee systems, shrub- and grasslands, secondary forest and primary forest remnants) and the diversity of flora that they support provide special quality attributes to the honeys produced from them (Garnica *et al.* 2006). These quality attributes manifest themselves as distinct flavors and aromas, antimicrobial potential, and multifloral or monofloral (“coffee honey”) honey features. Such attributes are of special interest for marketing efforts, and are relevant when considering honey differentiation via appellation of origin or geographical indication.

The novelty of the project, developed in the coffee region of Colombia, is the concern for searching comparative and competitive advantages in artisanal honey production to add value to the final product. Another innovative aspect is the multi-stakeholder approach, which allowed different stakeholders to articulate and consider their interests.

Background

The project was conceived as a learning experience on value chains, with the goal of contributing to improved competitiveness of the apicultural sector, by identifying mechanisms for product differentiation based on the botanical and geographic origin of bee honeys produced by small artisanal beekeepers in the region.

Project activities focused on the Andean region of Colombia, specifically the coffee zone of the Huila department, in the municipalities of Argentina, Paicol, Gigante, Garzon, Pitalito and Palestina, between 2005 and 2007 (Figure 15). The study zone is part of the Magdalena river basin, with a bimodal precipitation scheme, characterized by two wet and two dry seasons per year – an important characteristic of apicultural production in the country.

The landscape is characterized by a varied topography, ranging from hilly slopes to steep canyons, with fertile soils of volcanic origin. The principal activity in the six municipalities is agriculture, mainly coffee production under traditional shade, with some fruit trees like citrics and granadilla. Honey production is a traditional activity in the region, especially in the municipalities of the south, although only secondary in terms of economic importance. Honey production is maintained to a large extent by the vegetation bordering the beekeeping places, and is characterized by great floral diversity with a variety of different vegetation covers including primary and secondary forest relicts, crops, grass- and shrublands (Figure 16).

The native vegetation consists of pre-montane dry and humid tropical forests, but these have now largely disappeared and were replaced by a mosaic of agricultural land uses. Some fragments of primary forest remain in the protected areas of the region such as the National Park “Cerro Páramo Miraflores”, the forest reserve “Serranía de las Minas” and the biological corridor “Guácharos Puracé”, all of which form part of the Regional System of Protected Areas (SIRAP) of the regional environmental authority.[6]

[6] Corporación Autónoma Regional del Alto Magdalena (Spanish acronym for the Independent Regional Corporation of the Magdalena Uplands)

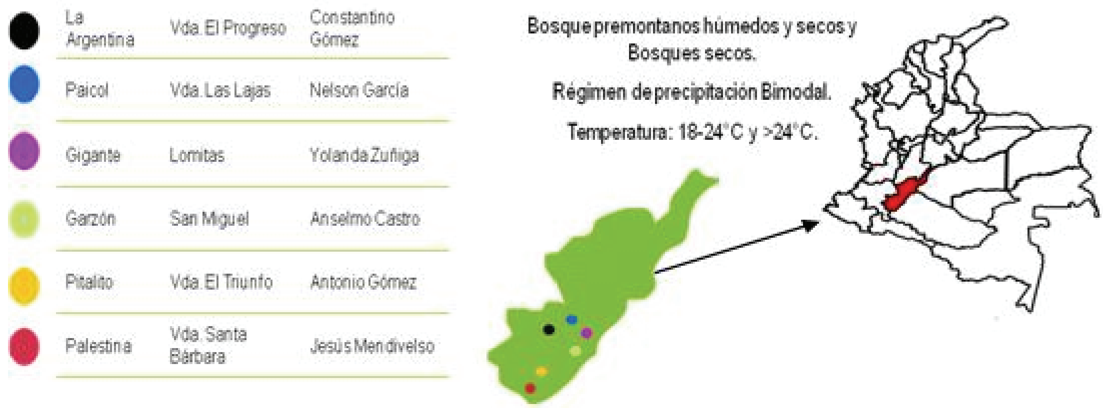

Figure 15. Area of influence of the systematized experience (adapted from Chamorro 2006).

Figure 16. Landscape with secondary forest relicts and open grass- and shrublands, associated with beekeeping and honey production in Gigante, Huila department, Colombia.

Most honey producers in the study area are at the same time smallholder coffee producers, who place beehives near their coffee plantations or in the neighborhood of other crops such as citrics and granadilla, or pastures (Figure 17). For coffee producers, honey production has two important advantages. On the one hand, it constitutes an important strategy of “crop diversification” as risk insurance and for additional income generation at times of coffee crisis.

On the other hand, bees are important for the pollination of coffee plants and contribute to improved coffee yields (Garnica *et al.* 2006; Martínez 2006).

The producers involved in the project are between 40 and 60 years of age, live in rural communities, and are primarily coffee producers who produce honey as a secondary economic activity. They have only recently associated themselves in a producers association called "Coapi" (Cooperativa Integral de Apicultores del Huila, Spanish acronym for Integral Cooperative of Beekeepers in the Huila). Some of them have only recently started to produce honey, while others have more than 20 years of experience with beekeeping and alternate this activity with coffee production. All are small-scale, artisanal honey producers who market the end product locally. The strategic alliance established with public and private research institutes and the academy in the frame of this project allowed all actors involved to analyze the importance of the work on value chains and biotrade enterprise initiatives as a conceptual and methodological tool that can provide an important contribution to territorial approaches of rural development.

The innovation

The territorial approach of rural development aims at integrating the components of a territory based on a common objective, normally oriented toward fortifying a productive sector through the identification of competitive and comparative advantages. In this sense, the biophysical (environmental and geographic), economic, institutional, cultural and political components of a territory play an important role for the fortification of biotrade value chains conformed by small and medium enterprises that offer goods and services derived from local biodiversity.

The ecosystem component of the project aimed specifically at identifying and characterizing the relationship between flora, bees and honey production in the region. Activities were carried out to identify the honey attributes generated by the diversity of apicultural flora (nectar and pollen), and to use them as differentiating elements based on botanical or geographic origin in the search of new markets. Certain physical, chemical, microbiological and organoleptic (color, scent and flavor) honey characteristics could be traced back directly to the supply of pollen and nectar from the flora associated with the location of the beehives.

Beehives associated with different types of vegetation – such as crops, pastures, secondary vegetation and forests – were selected and the local vegetation characterized and identified (Figure 17). Jointly with the beekeepers floral calendars were elaborated, the frequency of bee visits and foraging patterns were recorded, and pollen and nectar samples were taken and evaluated for the pollen and nectar contribution of the associated vegetation and sugar content (degrees brix). The value of the ecosystem service "pollination" was inferred by evaluating the diversity of bee species associated with different types of crops such as coffee and fruit trees (citrics).

Figure 17. Analysis of vegetation cover near beehives as a means of supply for nectar and pollen production from apicultural activity, Huila department, Colombia (adapted from Chamorro 2006).

Engaging different value chain actors (academy, productive and political sector) in a participatory manner plays an important role in developing innovative strategies for improving the use potential of underutilized local resources. For example, in the case of the apicultural chain in the Huila department, the vegetation associated with the beehive locations can be seen as an underutilized local resource. Beekeepers did not appropriately value the vegetation as a means of innovation, with the potential to generate added value. No importance was given to the identification of attributes for differentiating their products (honey). The results of the organoleptic analyses clearly showed that certain plant species provide the honey with special colors, aromas and other physical characteristics. Furthermore, the importance of shaded coffee plantations as a floral resource and supply of nectar and pollen for honey production was revealed.

The actions

In an earlier effort to strengthen the apicultural product chain in the region (years 2003 to 2004), several key challenges and limitations for honey production and commercialization had already been identified. These issues were taken into consideration for the intervention realized between 2005 and 2007.

The principal limitations identified were low honey volumes and productivity, low prices obtained on the local market, lack of knowledge of honey attributes for product differentiation, lack of knowledge about the apicultural flora supporting honey production in the region, lack of knowledge of good practices for honey production and processing, lack of promotion and commercialization strategies for apicultural products, lack of product information associated with the final product at the moment of sale (technical information product charts), high transportation and production costs, and lack of innovative strategies to add value to the honey (Figure 18).

Based on these preliminary findings, an in-depth value chain analysis was conducted and research was undertaken to identify the actions for strengthening the value chain. The most promising actions identified included among others: the elaboration of technical product charts for honey commercialization, identification and characterization of the regional honey attributes based on botanical and geographic origin, increasing sales volumes by identifying new commercialization channels, development of innovative strategies for commercialization and promotion (Table 6).

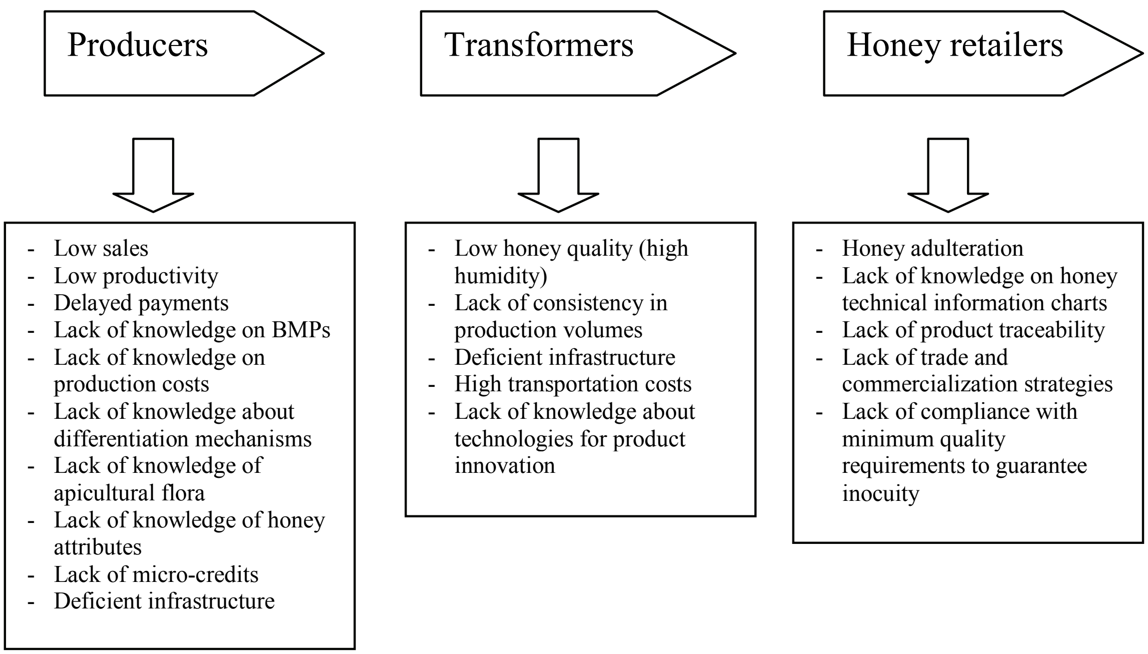

Figure 18. Key limitation of the apicultural value chain in the Huila department, Colombia (2003/2004).

Table 6. Key value chain limitations and actions taken to address them.

Key limitations	Actions conducted during the process of fortification of the apicultural chain
Lack of knowledge about honey characteristics and attributes	Elaboration of technical charts of the honeys, according to their physical-chemical, microbiological and organoleptic characteristics
Lack of knowledge about apicultural flora	Elaboration of apicultural floral calendars (flowering, nectar, frequency of bee visits and forage patterns)
Lack of product traceability throughout the product chain	Documentation of information on honey production, storage and sales
Lack of knowledge about good practices for product processing	Capacity-building and implementation of better production and processing practices
Lack of knowledge on honey attributes for differentiation and adding value	Identification of differentiating honey attributes (color, aroma, flavor, antimicrobial properties, etc.) based on botanical and geographic origin
Low production of honey of bees	Management of location of beehives according to flowering times
Lack of knowledge on trade and commercialization strategies	Market study on apicultural opportunities in Huila (consumer profiles, market requirements)

The actions undertaken were a joint effort of different value chain actors, involving actors from the productive, environmental and academic sector. Collaboratively, a route of intervention for strengthening the value chain was developed, and an integral vision of expectations from the project and from the value chain in the long run was created, based on the opportunities provided by the territory. Thus, the interests of all value chain actors were projected towards the same objective, namely improving the competitiveness of the regional apicultural chain.

Impact

The high value of honey from Huila was demonstrated, not only in terms of economic value but also in terms of intangible production values such as the traditional production system on hillsides, associated with coffee plantations, the importance of honey production as additional source of income for coffee growers, the importance of the conservation of biodiversity and its characteristics according to the flora associated with the apicultural production sites in the region.

More equitable governance of the honey value chain

The value chain approach facilitated the development of new interactions between the different actors and generated an impact along the chain, from production to commercialization. New linkages, flows and relationships developed in terms of inputs (consumables), information and transactions (honey sales), thus positively affecting and enhancing the competitiveness of the supply chain overall. The evolution of the linkages and networks from year to year (2004 to 2007) is illustrated in Figure 19.

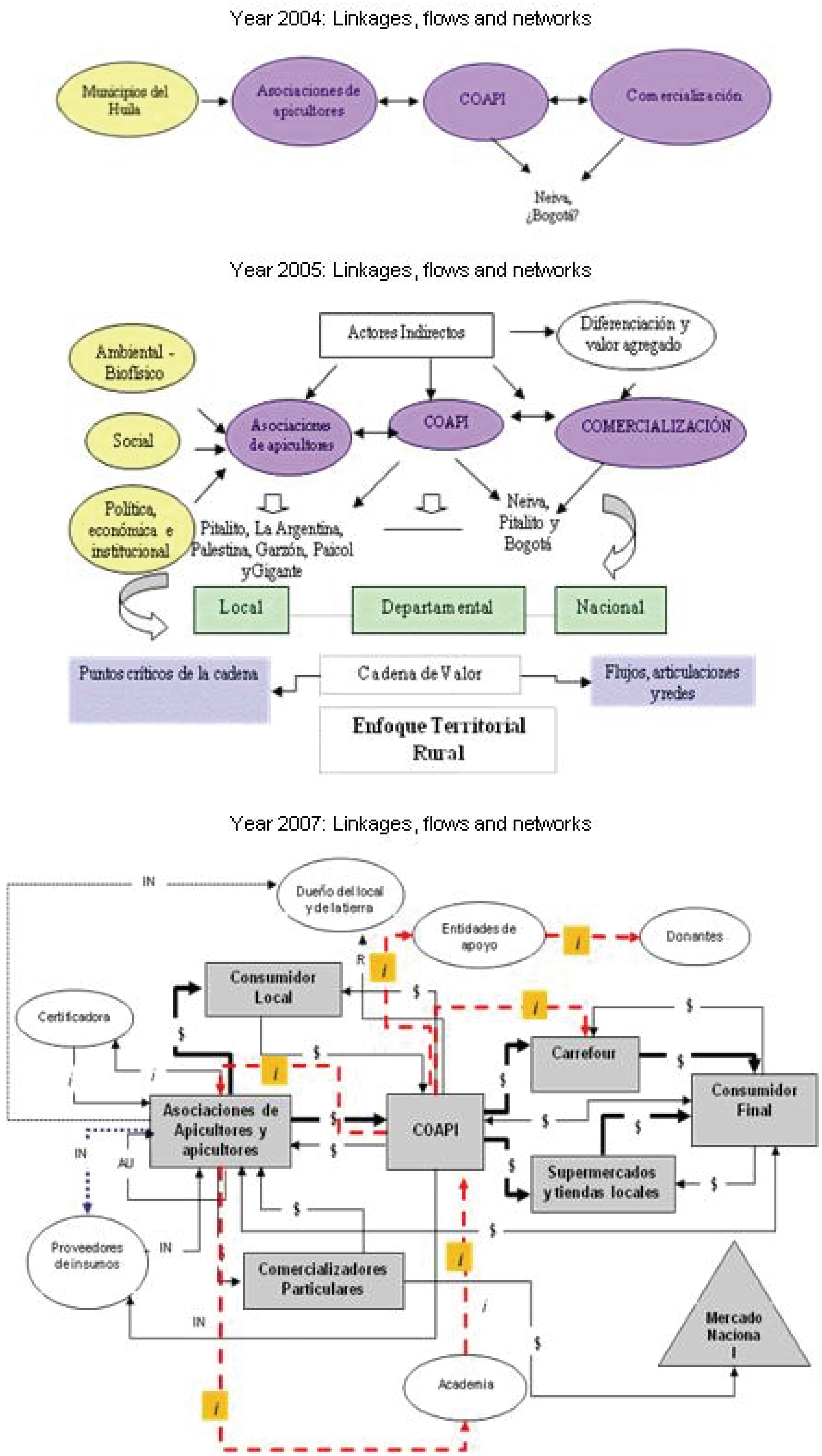

Figure 19. Flows, interactions and networks evolving along the apicultural supply chain in Huila department, Colombia, during years 2004 to 2007.

Market transformation: Access to new markets

The number of contractual alliances between individual beekeepers of the Coapi Cooperative, local stores, supermarkets, and market chains increased as a result of the efforts undertaken by the cooperative to supply better-quality, differentiated honey products, supported by technical charts. In total, 80 members of the Coapi beekeeper cooperative benefited from the project interventions by gaining access to new markets, new information and knowledge from research investigations, capacity-building, and access to financial resources to continue the process of fortification of their productive systems.

The Huila region as a whole has a great potential for the production of differentiated apicultural products (honey, pollen and nectar), due its environmental supply basis, great diversity of vegetation (shaded coffee, pastures, shrubland and forests), and the presence of honeys with antimicrobial potential, multifloral and monofloral honeys with differentiated flavors and aromas (coffee honey, guava honey, among others). New research projects were included within the policy action plans of the Ministry of Agriculture and Rural Development, and new markets were identified in accordance with the local and regional realities and opportunities.

Biodiversity

With respect to the ecosystem component, the importance of the vegetation used as supply basis for honey production was demonstrated. By the end of 2007, 47 plant families and 135 plant species were identified, belonging to nine different plant communities. Of these, 31 species were cultivated by farmers in the region (Montoya 2007). The most dominant plant families were the *Asteraceae* and *Fabaceae*. Pollen was identified belonging to 65 different plant species, and nectar of 51 plants. The paleontological study of pollen identified 30 families and 76 species. 121 units of native bees were reported, of which 37 could be identified to species level. The bees belonged to three different bee families (*Apidae*, *Halictidae* and *Colletidae*), with *Apidae* representing 74% of the individuals (Parra 2006).

Pollination

Although this project did not measure the ecosystem service “(crop-)pollination” directly, it did infer its value by assessing the diversity of bee species associated with different types of crops such as coffee and fruit trees (citrics). 121 different bee morphotypes, 37 bee species in three bee families (*Apidae*, *Halictidae* and *Colletidae*) were identified (Parra 2006). Although estimating the economic value of pollination services is problematic, they are likely worth billions of dollars per year globally (Southwick and Southwick 1992; Nabhan and Buchmann 1997). Studies in all major coffee growing regions around the world have shown that fruit set and coffee yields are positively related with pollinator species richness and diversity (e.g., Raw and Free 1977 for Jamaica; Badilla and Ramírez 1991 for Costa Rica; Roubik 2002 for Panama; Klein *et al.* 2003a, b for Indonesia; Vergara and Badano 2009 for Mexico). Roubik (2002) estimated that honeybees can augment pollination and boost coffee yields by over 50%.

Ricketts *et al.* (2004) calculated that pollination services from forests patches in Costa Rica contributed an average of 42 USD/ha to annual incomes from coffee production. In a similar exercise, Olschewski *et al.* (2006) calculated the economic value of pollination by using the distance to forest patches as a proxy measure for pollination services. In the worst-case scenario, complete deforestation within an area of 100 ha around coffee plantations would lead to a pollination service loss (i.e., net income foregone due to reduced coffee yields) of 47 USD/ha of forest in Indonesia and 49 USD/ha in Ecuador.

Enabling conditions

Institutional support and integration of value chain actors

The participation of value chain actors from the productive, environmental and academic sector in the development of an intervention route allowed integrating the visions and expectations that different actors had of the project and of the value chain in the long term, based on the territorial supply basis:

1) The direct participation of the producers (beekeepers) in activities of rural diagnosis and field work led to an increased awareness of the conservation value of biodiversity (apicultural flora and wild bees), of the services obtained from biodiversity in terms of honey production and differentiating attributes, and of the importance of applying this knowledge to their productive systems for improvement and access to new markets.

2) The regional environmental authority participated in the project, which guaranteed that the analyses of vegetation covers and apicultural flora were conducted in accordance with national policies and standards. Accordingly, the studies about diversity of native bee species associated with apiaries facilitated the development of a scoping study on the potential of honey production from wild bees, and the provision of other ecosystem services such as crop pollination, for future efforts to diversify the supply of services and products in the apicultural value chain.

3) Other indirect actors such as the research institutes and universities are key partners in initiatives aimed at strengthening biotrade enterprises, due to the high costs involved with conducting research on the attributes of goods and services from biodiversity. Usually, this kind of research is unaffordable and thus inaccessible for small rural enterprises whose productive systems are immersed in areas rich in biodiversity.

Jointly, the different visions of producers, environmental authorities, academy, market analysts and connoisseurs of honey commercialization, allowed focusing the intervention efforts towards the identification of differentiation mechanisms and value aggregation for apicultural products, based on the environmental supply of the territory.

Critical factors: The role of bundling

Colombia's coffee region has a high potential for beekeeping thanks to the environmental supply represented by its diversity of vegetation covers. Coffee flowers attract bees that in return contribute to the pollination of the crop. The honeys obtained in this region have special characteristics, including monofloral honeys produced almost exclusively of nectar from coffee flowers ("coffee honey"). Although this project has not evaluated the pollination component in depth, it has assessed the diversity of bees in the region and their potential for providing pollination services. 121 different bee morphotypes, 37 bee species and 3 bee families (*Apidae*, *Halictidae* and *Colletidae*) were identified (Parra 2006). Thus, "bundling" in this case is beneficial in two directions: On the one hand, the honey gains from the coffee flavor, while on the other hand the coffee gains from pollination by the bees.

Research proved the high value of the honey product chain in the Andean region of Colombia. Its significance is represented not only by its economic value but by other intangible values related to the tradition of artisanal honey production, in areas associated with coffee and fruit trees, its importance as an additional source of income for coffee producers in times of coffee crisis, and last but not least its importance for the conservation of biodiversity and its specific characteristics according to the flora associated with the apiaries.

A market study led by the Humboldt Institute identified the typical profile of the honey consumer in Colombia as 31 to 50 year-old female adults (60%), from households with 1 or 2 children, in the majority (57%) with university education (Rodríguez 2004). Honey is mostly bought in natural products shops since honey is considered more a health/medical product than a foodstuff in Colombia. Honey can also be found in supermarkets, but the frequency of purchase is rather occasional. Although the market study showed that Colombian consumers are unwilling to pay a special price for a differentiated product, it was useful in providing guidelines on regulation for special honeys and highlighted the need to promote, in the medium term, differentiated honeys and punishment for honey forgery and adulteration.

For the success of projects aiming at the development of value chains and the construction of competitive territories on a local supply basis, a regional atmosphere of willingness to cooperate is necessary, along with geographically-linked institutional clusters that integrate companies, suppliers and associated institutions operating in a particular enterprise field, and tied by common and complementary characteristics.

Furthermore, in the case of the Huila department, it is important to mention the following factors that favored success of the project:

a) The existence of a cooperative of beekeepers (Coapi) which embraces almost 50% of the beekeepers of the region,
b) A regional system of protected areas (National Parks and natural reserves) of approximately 310,000 hectares[7] that provides special conditions for the supply of nectar and pollen for the apicultural activity, among others, and
c) The existence of a regional environmental authority (–CAM) whose mission besides guarding by the preservation of the natural resources of its area of influence, also is to contribute to generate processes of sustainable advantage of the resources of biodiversity, through a program for green markets and biotrade, and who are in commitment with the apicultural chain in the region.

The joint effort of the productive sector, the environmental authority and the academic sector in support of the cooperative's search for mechanisms of differentiation (from the environmental supply) and for improving and maintaining quality in honey production for accessing new markets, were key factors for success of the project.

Lessons learned about bundling

Small rural beekeepers do not have the necessary resources to invest in research – which in this case was necessary to identify the extent to which environmental services such as biodiversity contribute to differentiated characteristics of the product of interest (honey). Therefore, the inclusion of the academic sector and research institutes as strategic partners in the intervention process was key for achieving fortification of the honey value chain and the associated beekeepers cooperative in Huila.

So far, no monetary impacts have been obtained in terms of better prices for the differentiated honeys. More work is needed on the subject of production costs and distribution of benefits (monetary and non-monetary) throughout the value chain. Such information would be key to realize negotiations with buyers, and agreements and commitments between the different links of the value chain. For future projects, it is recommended to establish from the beginning clear rules of commitments and agreements for the different actors to assure that the new wealth is distributed equitably among all actors (Albanesi and Preda 2007).

Analyzing the territory from its environmental, social, economic and institutional dimension was important to generate strategies for integral and sustainable value chain fortification in the long term. Furthermore, we would like to emphasize that rural territorial development projects with focus on goods and services from biodiversity need to go hand-in-hand with national policies of

[7] Declared as "protected areas" by the Environmental Authority of the region (CAM) and the Ministry for Enviroment, Housing and Territorial Development, due to teir importance as hotspots of biological diversity, reserves for hydric resources, and their representativeness in terms of national ecological characteristics.

promotion to these processes; otherwise, efforts will most likely be restricted to the local and regional level and cannot be extended to national scale.

Although the main incentive for the honey producers was from a commercial or marketing point of view, the training in better production practices also led to a sensitization and increased awareness about how through the better beekeeping practices biodiversity conservation can be implemented in a very practical way (for example by protecting the flora associated to apicultural production). As part of this process, the environmental authority supports and implements programs of reforestation and planting of native species of apicultural flora which at the same time offer other services such as erosion control, timber, and habitats for endangered fauna, among others.

Furthermore, the beekeepers better understood the advantage of knowing the surrounding flora in the zones of production, to guarantee the efficiency in the productivity and added value to their honeys. This knowledge is also useful for identifying new areas for the establishment of beehives, considering the environmental supply.

Similar to the Biodiversity and Wine Initiative (BWI) from South Africa, this case of differentiated honeys from the Huila region (Colombia) falls into the category of “Landscape-specific eco-labeling” (type 3). The conservation aspect of producing differentiated honeys based on the associated flora could be made even more explicit by emphasizing the importance of the protected areas in the region, which constitute a significant supply basis for the production of mono-floral honeys from wild plant species.

6. BUNDLED ECOSYSTEM SERVICES ON CERTIFIED COFFEE FARMS: THE CASE OF RAINFOREST ALLIANCE CERTIFIED™

Leif Pedersen, Rainforest Alliance, Sustainable Coffee Program

Sustainably managed coffee farms provide a long list of services in the productive landscape and to people in local communities. The farms are havens for biodiversity; farmers protect forests and water resources and provide livelihood for numerous workers. Producers generally contribute to the common good in their area without receiving a particular compensation for their efforts.

Once farms are certified to the rigorous standards of Rainforest Alliance certification, however, products can be traded on international markets with the certification seal for a premium price and other market benefits. The premiums and preferential treatment a certified farmer receives from buyers can be regarded as a compensation for the services the farmer provides in terms of environmental stewardship on his farm and ethical treatment of his workers. But certification is very different from a traditional payment for ecosystems services arrangement between a provider and a recipient of services, like a downstream water user paying for watershed conservation measures upstream. The strength of certification is that it allows ecosystems services and corresponding payments to be exchanged across continents and between hundreds of thousands of actors who are unknown to each other. Services flow from farmers who most often don't know who is the final consumer of their coffee, and payments flow from consumers who have never seen a coffee farm, have little idea of the challenges and the hardship of the coffee farmer, and the threats confronting fragile ecosystems in the South. Undoubtedly many of these consumers are only marginally committed to the cause of ecosystem conservation.

Nevertheless, certification drives significant change processes in coffee landscapes. Certification has overwhelming potential for scale up across the coffee sector, bypassing usual problems of pairing an ecosystem service provider with someone who is willing to pay to enjoy the direct benefits of these services, and the considerable institutional and financial obstacles of setting up and managing a payment for ecosystem services program.

What is Rainforest Alliance Certified™?

Rainforest Alliance is an international conservation organization with operations in more than 60 countries. It works to conserve biodiversity and ensure sustainable livelihoods by transforming land-use practices, business practices and consumer behavior. Along with its partners in the Sustainable Agriculture Network (SAN), a group of leading conservation and development organizations in Latin America, it has developed detailed and rigorous standards for best practice in tropical agriculture. The standards have been defined over several decades in rigorous multi-stakeholder processes involving producers, industry, conservation groups, academia and governments.

SAN auditors inspect farms once a year to evaluate the farms' compliance with the standards. Certified producers can sell the products that are produced on certified farms with a certification seal that follows the product through the supply-chain and eventually ends up on product packaging in the retail outlet.

The certification seal allows markets to recognize a product that has been grown under sustainable conditions. It empowers consumers to give preference for products grown under conditions that resonate with their values. It provides incentives to companies to make voluntary efforts for the common good, as a part of a viable business model. And it rewards farmers for implementing sustainable production practices on their farms.

Voluntary certification schemes work essentially as environmental and social governance systems in developing countries and emerging economies where agricultural practices are often very damaging to people and the environment, and where governments frequently lack capacity to enforce regulation.

As global awareness of sustainability issues increases, so does the need for solutions to common sustainability problems in many commodity sectors. As a result, certification systems experience staggering growth rates. The 2009 sales estimate for Rainforest Alliance Certified coffee is 100,000 metric tons, up from approximately 12,000 tons four years earlier.

What do Rainforest Alliance Certified farmers do right?

Rainforest Alliance Certification drives implementation of best management practices on coffee farms. Certified producers conserve ecosystems and protect wildlife and water resources on their farms. They treat workers fairly and provide them with good working conditions. Larger farms provide housing for workers, schooling for children and access to health care. Farmers implement occupational health and safety programs and work to improve community relations. They minimize the use of agrochemicals and find alternatives where possible. They manage soils, including maintaining a biodiversity-friendly and carbon-storing shade cover, and manage wastes. Finally, they professionalize their farm practices by establishing a social and environmental management system on farms.

Coffee experts use Rainforest Alliance's standards because "it is the way coffee should be produced." In other words, a win-win situation which simultaneously secures improved environmental stewardship and allows increased farmer efficiency.

From an ecosystems conservation standpoint, the hard work of certified coffee farmers is very valuable. Virtually all coffee is grown within 13 of the world's biodiversity hotspots. According to FAO, coffee production occupies slightly more than 10 million hectares globally, all of it grown in conjunction with or in place of tropical forests, except for large coffee areas in the highly biodiverse Cerrado in Brazil.

The coffee plant, *Coffea arabica*, evolved in the rainforests of Eastern Africa as a thin understory tree. As coffee was introduced into new origins, it was mostly planted in forested areas as an agro-forestry production system under an existing canopy. Coffee growth gradually replaced much of the old-growth humid and wet premontane forest in middle elevations (400-1600 meters above sea level). Shade was often provided to the coffee plants by old-growth majestic tree species now scarce or locally threatened.

As logging, cattle grazing, and more intensive agricultural production gradually ate up most of the original forests, many shade-coffee plantations have remained virtually intact for many decades and, together with relatively few natural protected areas, now represent sanctuaries of habitat containing important parts of original ecosystems. It is well recognized that remaining protected areas are too fragmented and too small to ensure survival of ecosystems and species. Sustainable coffee plantations offer valuable contributions to conservation efforts in some of the most biologically diverse and most threatened ecosystems, by linking remaining natural areas with productive lands with biodiversity-friendly production methods.

What motivates farmers to provide ecosystems services?

Through the process of implementing the better practices required for certification the farmer often achieves a series of benefits on his farm. The producer will often improve his general management of the farm. Small farmers learn to manage their farm like a small business, and larger farms strengthen their management systems through the requirements of record-keeping and documentation. Improved management practices lead to efficiency gains in production, such as reduced agrochemical input. As the farmer improves practices throughout the farm, it often influences his ability to improve coffee quality. The farmer becomes a better coffee farmer, so to speak. Improved conditions for workers help attract necessary labor (a growing problem in many origins), lead to lower worker turnover and increased productivity as skilled and seasoned workers stay on the farm.

These benefits are gradually recognized by the farmer, but they are rarely the initial driver of certification. Most producers get certified because they want improved market access and a better price for their products. In the market, the farmer can use the certification seal to distinguish his product from the ordinary anonymous commodity. The initiative can also begin with the buyer suggesting certification to the farmer in exchange for better price and/or better conditions. As buyers need a stable supply of certified coffee for their seal-carrying brands, they often build mutually advantageous, long-term relationship with "their" certified farmers, and show a willingness to compensate the farmer for their efforts. While the "sustainability premium" varies, buyers often pay 10-12 cents or more on the pound of green coffee, or about 10% of the farm-gate value.

Buyers are willing to pay higher prices to certified coffee farmers because their stewardship of ecosystems has a value to coffee companies and consumers. As we shall see, however, the bundled ecosystems services provided by certified producers satisfy needs that in character are often quite different from the services the producers actually provide.

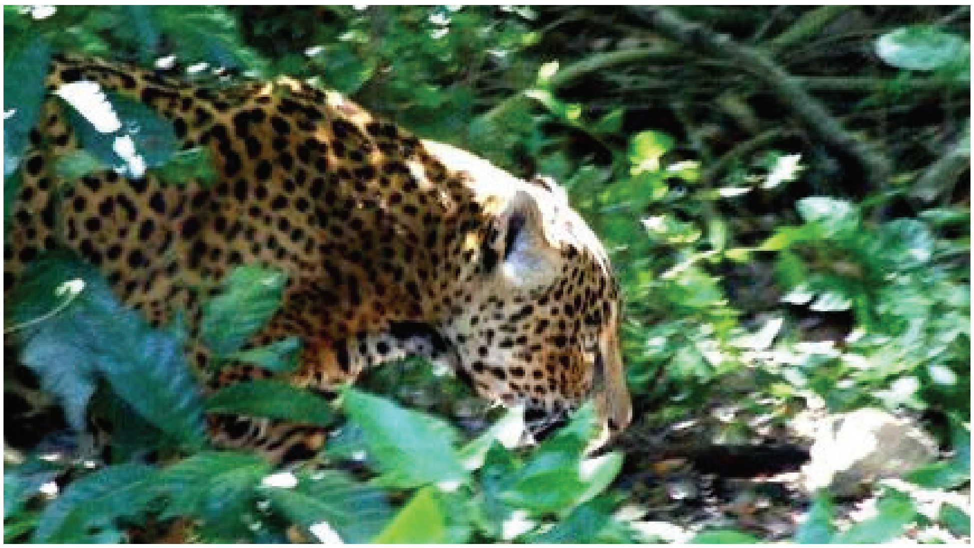

Figure 20. Jaguar on Patrol on Rainforest Alliance Certified Finca Arroyo Negro, Chiapas, Mexico.

Consumer demand for ecosystem services

The traditional consumer chooses a product based on parameters such as price, taste, quality and so on, but increasingly other factors influence consumers' choice as well. The ethically minded consumer has added a number of values or concerns to the list of factors that can determine the choice of product, such as concerns about environmental problems and related health concerns. Have dangerous pesticides been used? Did production contribute to deforestation of the rainforest? The consumer wants to know where products come from and how they were produced. Or rather, they want to know that it was produced in a safe and responsible way. The ethical consumer is sensitive to social and community issues and generally doesn't want the products she buys to be a negative force in local people's lives. Was the product produced discriminating against women/ethnic groups/the poor/children? Was child labor used?

It would not be accurate to say that these concerns mean consumers diligently investigate if products meet their ideals, instead they hold companies responsible for ethical or sustainable sourcing. The power of a certification seal is that it can easily communicate to the consumer that the product is produced in a responsible, sustainable way.

The consumers who are aware of the weight ethical shopping has on companies are still the minority, but the minority is growing fast. It is also trend-setting, and at times even activist, and therefore very visible to companies. But the segment is also profitable as the ethical consumer is often willing to pay more for a product produced under sustainable conditions. Paying more for a sustainably produced product is not for everyone, though. Particularly on mainstream markets price elasticity is minimal and some companies find they cannot raise their prices even if their raw materials cost more.

While some consumers are passionate about these concerns, many ethically aware consumers are not necessarily deeply committed to ecosystems conservation or even know what it means. Many seek “guilt-free” consumption, and want to “do the right thing” without it being overly complicated – or expensive. These consumers are not necessarily bothered with the finer nuances in Rainforest Alliance’s certification standards. However, even if the motives of the consumer are sometimes a bit fuzzy, the impact on farmers, workers, and the ecosystems where they live is very real.

Company demand for ecosystem services

Companies increasingly buy certified coffee and other certified sustainable products. In 2008, companies bought 65,000 tons of Rainforest Alliance Certified coffee at an estimated price premium of USD 10 cent per pound of green coffee at the farm gate, or equivalent to USD 13.6 million paid in premium prices. That is on average 680 USD per certified farmer.

In a situation where consumer demand for certified products is still modest, albeit growing, it is often companies who are the real drivers of sustainability certification. The buying companies typically have a series of concerns that drive them towards a certified product.

Like other commodity companies, coffee roasters most often purchase an anonymous raw material – green coffee – on an international market, with only general knowledge about its origin. Most often the company cannot know from which farm the product comes from and how it was grown. But if a product is certified sustainable, the buyer gains knowledge of the producer through the certification program’s traceability system. He will not only know the name of the farm or cooperative, but also know that the producer was certified against very strict standards for best practice in tropical agriculture.

This knowledge gives a company the opportunity to assure consumers that they know their product better, know its origin and how it was produced, and that ultimately they can stand by it in a more confident way than had they just bought anonymous beans on the international market. This is ever-more important in a world where consumers hold companies responsible for their sourcing practices, and activist groups campaign against companies who are perceived as capitalizing on social injustice and environmental degradation in the third world. Such negative publicity can severely tarnish the company's name or their brands.

Buying certified sustainable raw materials enables the company to signal that they are aware of the problems and are doing something to address them. Thus, certification can have a risk-mitigating function for the company.

The most successful companies don't stop with risk mitigation, though, but make sustainable sourcing a pillar of their CSR strategy and their corporate branding. By embracing sustainability they can improve company image and build awareness and brand loyalty with their consumers. It allows them to tell stories about how their sourcing practices help change people's lives and save the environment. The message is that consumers can be a part of the cause, just by buying the product. Consumers don't have to sacrifice the things they like about their coffee, except – perhaps – paying a modest premium price for it.

Another driver for companies is that they hope to win over new market segments for their certified products, consumers who care about the issues and the stories from the field. Not that potential consumers need to have a burning passion for social justice or ecosystem conservation, they only need to care enough to choose a sustainably sourced brand over another. As the coffee sector is enormous, the largest agricultural commodity in the world with a retail value of USD 70 billion annually, small shifts in consumer preferences can mean big shifts in market share for individual brands.

Of course, many coffee companies care deeply about social and environmental problems in growing regions, but as can be seen from the above, they are also motivated by pure business concerns (traceability, risk mitigation, image improvement, brand loyalty, market access among others), which is only indirectly related to the ecosystems services that the farmer actually provides.

There are fundamentalists who deplore companies' lack of altruistic motives, as if altruistic motives are more important than ensuring real impact in tropical production ecosystems. These skeptics have utterly misunderstood the logic behind certification, which aims to create a win-win situation where companies can derive a benefit from engaging with sustainability and build a healthy business case on it, while at the same time reward farmers for their efforts to conserve and sustainably manage their production ecosystems. Sustainability certification is built on the belief that ecosystem conservation in productive landscapes can only be successful if the actors who exploit the ecosystem can make a better living by exploiting the resources sustainably, in a way that makes business sense.

Carbon

There's another kind of ecosystem service that coffee farmers provide to the global community, namely the storage of carbon in coffee plantations' shade trees and forest fragments. This service is still provided without compensation, though many are looking into the potential for carbon credits and other compensation to coffee farmers. Rainforest Alliance is developing carbon verification methodologies as voluntary snap-on modules to certification audits.

For some coffee companies, the notion of “carbon-friendly coffee” is interesting and would contribute to their willingness to pay a premium price for the product, but for the global community the carbon storage service is essentially unrelated to the specific crop. For the farmer to take advantage of voluntary carbon markets it would have to be demonstrated that the farmer re-forests his farm and thereby stores additional carbon, or that a carbon payment would help avoid deforestation of the coffee farm, such as under a future coffee crisis. Rainforest Alliance hopes carbon storage services – along with benefits derived from sustainability certification – will help struggling coffee farmers stay in business so they can continue to provide ecosystems services to coffee companies, consumers, and the world at large.

In the BESAP (Bundled ecosystem services and agricultural products) typology developed by Scherr *et al.* (2010, forthcoming), the Rainforest Alliance certification system falls under Type 1: Farm scale eco-labeling. Ecosystem services are tied to specific better management practices and sold along with the product (coffee). The individual ecosystem services are not “spelled-out” or quantified explicitly, but instead they are marketed and sold as a “package” of services, including the conservation of ecosystems, and the protection of wildlife, soil and water resources on coffee farms.

7. *ALLANBLACKIA* NUTS IN TROPICAL AFRICA: A NEW SOURCE FOR FOOD, OIL AND ECOSYSTEM SERVICES

Meike S. Andersson, Ecoagriculture Partners

Background

Agriculture is the basic sector of Africa's economy on which the majority of people depend for their livelihood. This is especially true for Sub-Saharan Africa (SSA), with a combined population of about 200 million people and with highly variable domestic production, limited tradability of food staples, and foreign exchange constraints in meeting their food needs through imports (World Bank 2007).

High rural population growth, escalating poverty (rural poverty rates of more than 50%), perverse policies and bad governance have led to the steady expansion of cropping areas into forested lands. In only 15 years (between 1990 and 2005), Africa has lost nearly 10% of its forest area (FAO 2007b). This is of great concern particularly in tropical Africa, an ecoregion that covers an area of approximately 20 million km² across a dozen West, Central, and East African countries. 3.6 million km² of this area are covered by rainforests, representing 18% of the world's closed tropical forests (FAO 2003).

The African tropical rainforests are evergreen forests, characterized by high humidity and annual rainfalls of >2500 mm. They contain most of the region's biological diversity, both in terms of quantity (species numbers) and quality (endemic species). Their carbon stocks per hectare are higher than that of any other terrestrial ecosystem in SSA (FAO 2003). The dense rainforest types cover nearly 86.5 million hectare and are concentrated in the rich Guineo-Congolean belt in West and Central Africa. This belt holds over half of all the species in the Afro-tropical realm, including 8,000 plants, 80% of which are endemic. Although 20% of the remaining forests in West Africa and 7% in Central Africa are now in protected areas, important gaps have been identified in the existing protected area system, especially within the Guinea-Congolean belt.

These last remaining African rainforests are depleted and degraded at alarming rates for the economic benefits of unsustainable logging, excessive firewood extraction and irrational conversion to arable land, ranching and settlements (Figure 21). Forests are converted without consideration of the capability and limitations of the land, which in turn has led to soil depletion, declines in food production, and increased poverty in many countries.

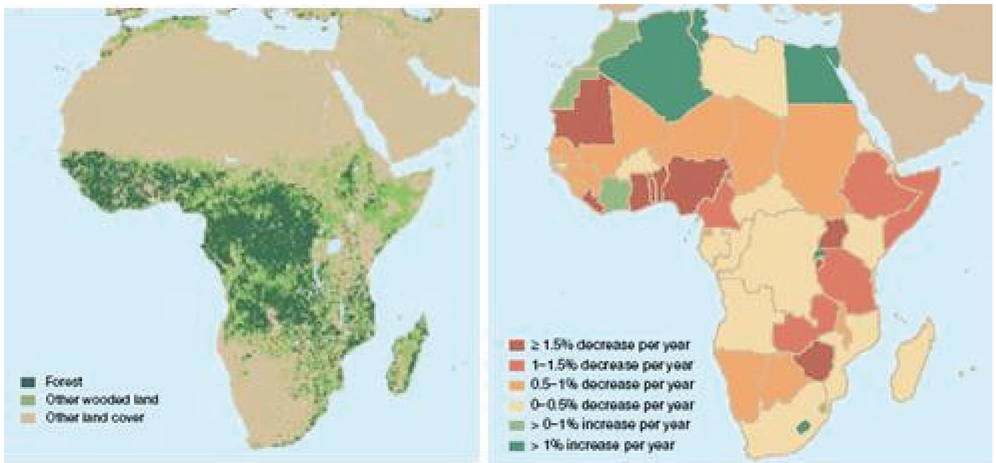

Figure 21. Forest resources in Africa: Extent of forested areas (left) and forest change rates by country or area between 2000 and 2005 (right). Source: FAO 2007b.

The innovation

The Allanblackia *tree and its uses*

Allanblackia (Clusiaceae) is an evergreen forest tree native to the African tropical rainforests, and can be found all across tropical Africa, from Liberia to Tanzania (Hall and Swaine 1981). *Allanblackia* trees are especially abundant in African wet forests, which are important biodiversity hotspots threatened by deforestation and land conversion (Hawthorne 1995; Figure 21).

Allanblackia fruits (nuts) are a valuable non-timber forest product (NTFP) ((Hawthorne 1996). The seeds (Figure 22) have a high content of edible fat and are traditionally harvested on a subsistence basis for domestic use as cooking oil and for soap-making (Abbiw 1990). The pods can only be collected when they are ripe and have fallen to the ground, so harvesters have to compete with rodents and other animals that feed on the seeds. In areas where *Allanblackia* is frequent on farmland, the fruits are therefore preferably harvested from wild trees within the farm, and to a lesser extent from forests or reserves.

Allanblackia trees are common on farms, albeit not in high densities. Wild *Allanblackia* stands are usually maintained after forest clearing and farmers appreciate them, since they do not have a large canopy and integrate well with agricultural crops. They are used as shade trees on cacao plantations, and are valued for keeping the soil moist in drier areas. The fruits attract wildlife, and farmers often lay traps around the trees to capture bush meat, mainly small rodents and Bush Tailed Porcupine (Nkyi 1989).

Figure 22. *Allanblackia* fruits, on the tree (left) and split open, with seeds cut in half (right) (Source: Novella Africa Initiative)

The traditional use of *Allanblackia* seeds as cooking oil and for soap-making has decreased in most parts of Africa over the last decades, in favor of other, mostly liquid oils and industrial soaps. In Tanzania there was some small-scale commercial use of *Allanblackia* nuts over 50 years ago, as a cocoa butter substitute (Lovett 1983). However, the fat was considered of low value at that time because it is solid at ambient temperatures, and in consequence the market never developed to a profitable size.

Precisely these characteristics have recently attracted the attention of international food companies and led to an increasing popularity of the *Allanblackia* tree in the last years: The fat from *Allanblackia* seeds has a relatively high melting point, making it congeal easily at room temperature. The special fat composition (about 60% stearin and 35% olein acids) results in unique physical and nutritional properties, and a great potential for use in novel consumer products on the basis of edible fats. *Allanblackia* fat is especially efficient as a substitute for palm oil and has the right properties for use in high quality spreads (margarine) and soaps. Production of these products on commercial scale enables access to markets of considerable sizes.

Due to the characteristics of its seeds, *Allanblackia* is of high potential interest to the development of rural communities in tropical Africa, where the trees occur naturally in the wild (wet forests, often protected areas) as well as scattered on smallholder farms and commonly-owned lands of rural communities. One mature female tree produces about 50 kg of seeds per year, and approximately 3 kg of seeds are needed to produce 1 kg of *Allanblackia* oil (i.e., ~15 kg of oil/tree). The market price of *Allanblackia* is comparable with palm oil, being sold for about USD 650/t for refined oil in Europe.

The Novella Africa Partnership

In 2002, the international food company Unilever co-founded the Novella Africa Partnership (www.allanblackia.info, Figure 23) to scale up the production of *Allanblackia* oil in Africa and at the same time reduce poverty and promote sustainable enterprise. The public-private partnership operates in five target countries (Liberia, Ghana, Nigeria, Cameroon, and Tanzania) and brings together Unilever, the World Conservation Union (IUCN), the World Agroforestry Centre (ICRAF), the United States Agency for International Development (USAID), the Netherlands Development Organization (SNV), the Swiss State Secretariat for Economic Affairs (SECO), a number of African governmental agencies, civil society organizations and local communities.

The broad aim of the partnership is to scale up the production of *Allanblackia* oil by developing a socially acceptable, environmentally sustainable and financially viable supply chain for a novel product – from seed collection by local communities through processing to international marketing. Developing this new NTFP of African tropical forests sustainably will ensure economic long-term viability of the endeavor. Crucial to the success is "bundling" of the product (*Allanblackia* oil) with the environmental service of biodiversity conservation and marketing it as such, so that the final product is internationally recognized to be of sustainable origin. Such a market-based financing mechanism contributes to safeguarding both local livelihoods and biodiversity in the tropical forest belt in Africa.

Figure 23. Web portal of the *Allanblackia* Novella Africa Initiative (www.allanblackia.info)

By “bundling” a new commodity product (*Allanblackia* oil) with the environmental service of biodiversity conservation (plus rural development and poverty alleviation), the undertaking contributes to a set of interdependent objectives:

1. ***Preservation of natural habitats and global biodiversity***

   Developing the sustainable use of a hitherto hardly used but abundantly available NTFP promotes the environmentally-friendly and small-scale use of tropical forests by local communities. It raises the awareness of the importance of caring for the environment in local communities and provides an incentive to maintain and enhance the integrity of the resource – especially if the buyers demand good practice.

2. ***Long-term alleviation of poverty in poor rural communities***

   Providing rural communities with a new, additional and sustainable source of income, improves their livelihoods and alleviates rural poverty. The price paid for *Allanblackia* nuts makes the work of gathering them at least as rewarding as other current activities. Prices are increasing steadily over the last years, and are currently clearly above that level. The communities involved in the partnership benefit from other activities carried out by the partners in the project, including education, health care and community development.

3. ***Development of local economies***

   The value of the product is increased locally/nationally as much as possible before being exported. This provides existing local small businesses with the opportunity to benefit from a variety of activities along the supply chain: transport of nuts and/or oil, extraction of oils from nuts, refining of oils. The businesses involved also benefit in terms of training, through the transfer of technical knowledge and capacity building in sound business practices and planning.

4. ***Guaranteed market for specified quantities at a pre-set price***

   Unilever guarantees long-term demand and buys all *Allanblackia* nuts that are being collected at a price that is fair to the partners and on the other hand reflects the value that this new raw material has in the products where it will be used (connected to the world market price of palm oil). This guarantee enables the whole supply chain to work with confidence towards growing the business. Furthermore, Unilever commits to buy nuts only from those communities that implement the recommendations towards sustainable use of the forest.

The long-term vision of the initiative is to set up a sustainable sourcing system of *Allanblackia* nuts. The commercial use of the nuts should generate enough income to enable the wild gathering to continue after start-up project activities have ended, and thus make a lasting impact on the development of rural communities, income levels and the environment. By that time, the communities involved should have learned to value the sustainable use of their forests and have come to realize that repeated knowledgeable use is more profitable for all than a one-off logging.

Furthermore, farmers are encouraged to incorporate *Allanblackia* trees into their farming systems and plant new *Allanblackia* trees in areas where land has been cleared or abandoned. This form of smallholder agroforestry production contributes to better landscape connectivity and can help enhance the integrity of forest landscapes. Other activities during the start-up phase of the Novella Africa Partnership include the promotion of community forest reserves and the establishment of alternative income generating activities such as beekeeping, snail rearing etc.

The actions

The idea came initially from Unilever who were looking for opportunities to expand their choice of edible fats from sustainable sources. When researching alternative sources of unprocessed, hard fats in Ghana, they came across the fat made from *Allanblackia* seeds – a tree that had never been commercially exploited in Western Africa and less so traded internationally. The opportunity is therefore entrepreneurial from the core: to establish a new industry in Africa.

To develop a supply chain for a novel commodity product, the Novella Africa Partnership faced a number of serious challenges:

- Lack of knowledge on how a robust supply chain for *Allanblackia* oil could be developed in a manner that is economically viable, socially equitable and environmentally sustainable
- Uncertainty about the supply potential of the resource, and how its collection and marketing could operate in practice
- To trade and use *Allanblackia* oil internationally, the product had to be legally granted “food grade” status
- Uncertainty about how to ensure that *Allanblackia* oil development becomes a long-term incentive for forest conservation and not just a short-lived initiative

During the first five years of the partnership, the following activities were carried out:

1. ***Conduct pilot studies to explore the supply base***

   Detailed pilot studies were conducted at different field sites in the five target countries to improve knowledge about the local supply base, and identify strategies of how to best develop an economically viable, socially equitable and environmentally sustainable supply chain for the production of *Allanblackia* oil.

2. ***Establish ecological, economical and sociological foundations***

   To establish the ecological, economical and sociological foundations of the program, scientific investigations were conducted assessing the socio-ecological status of the

Allanblackia tree and socio-economic relations and indigenous knowledge within forest communities. Based on this understanding, the strategies were improved for establishing a sustainable wild gathering system of *Allanblackia* nuts under biodiversity guidelines. At the same time, the partners involved raised the knowledge required to set up small-scale community-based plantation systems. Research activities focused on the following aspects:

- *Ecological sustainability*: What is the role of *Allanblackia* in the ecosystem, how abundant are the trees, where do they grow, when do they flower and fruit?
- *Sociological sustainability*: Who gathers the nuts, when and how is it done, what is a reasonable price, how to best make the money available, what is the impact on local communities, how to involve various levels of government?
- *Economical sustainability*: What are the most effective incentives for the various actors in the supply chain, how to ensure equitable benefit-sharing in the long term, how to link the supply chain with world market prices?

3. ***Develop best-practice guidelines for wild harvesting of* Allanblackia *seeds***

An independent standard setting process was initiated, guided by the IUCN as a neutral body. Best-practice guidelines for the wild harvest and small-scale on-farm production of *Allanblackia* were developed and pilot-tested to put in place basic safeguards needed to prevent negative social and environmental impacts. The guidelines were shared with other companies and trading partners and will be used to set industry standards in the future.

4. ***Setting up collecting systems of* Allanblackia *seeds at the community levels***

Building on the knowledge gained from activities 1 to 3, several projects were initiated to scale up *Allanblackia* production in partnership with non-profit organizations and local governments. Farmers were trained on how to collect, dry and sell the seeds, boosting local incomes and creating a completely new source of supply for export.

5. ***Establish biodiversity programs in areas where* Allanblackia *is found***

The initiative promotes the commercial exploitation of a nut that is collected mainly from wild stands on farms and in forest reserves. This means that the safeguarding of the natural resource base is crucial to the sustainability of the endeavor. Community-based work therefore centered on the sustainable use of the forest. The wild harvesting of *Allanblackia* nuts is promoted as the main example, but – depending on local conditions – other activities such as beekeeping and snail rearing are also advocated. The awareness of the value of the habitat was raised and best practices to protect and restore endangered habitats were shared. Special efforts were made to ensure that the benefits of the program are transparent and shared by all involved.

6. ***Promote the incorporation of* Allanblackia *into traditional agroforestry systems***

   New trees were planted on farms, and farmers were encouraged to include *Allanblackia* as shade trees in existing cacao plantations, or develop new agroforestry systems incorporating *Allanblackia* with various combinations of fruit trees and cacao. ICRAF provided the know-how required to multiply, plant and grow the *Allanblackia* trees, and tree nurseries were established at several project sites. It has to be annotated here that widespread maturity and common fruiting cannot be expected until 15-20 years after planting saplings. Grafted material and a minority of small wildlings can fruit sooner, but diameter increments are likely to be similar whether grafted or not, and it remains to be seen how rapidly the productivity of grafted trees can develop.

7. ***Setting up marketing systems at the community levels***

   Supply chain stakeholder analyses were conducted and Business Development Services (BDS) trainings were organized for a selected group of stakeholders. Partners were assisted to set up commercial businesses in a way that supports the local communities and is in harmony with local customs. In most villages, focal persons were recruited to run local buying centers where the *Allanblackia* seeds can be brought, weighed and sold. Local business partners were sought to help with the buying of the seeds, the transport and the crushing. The resulting oil is used to make consumer goods, both within the countries and abroad. The sub-regional spread of this new commodity opens possibilities for developing pan-African trade in the continent, including the development of African local markets for different products based on *Allanblackia* oil thus providing a mixture of local markets and international export for the oil. Unilever is already present in Ghana, Nigeria and Tanzania, and helps in developing such markets at the first stage.

8. ***Monitoring and evaluation***

   Methods were developed for the biological monitoring of *Allanblackia* and associated vegetation as well as for tracking socio-economic outcomes and market developments (Hawthorne 2008). Periodic evaluations serve as guides to assure that no negative impacts are being registered, or to remedy and correct them in case they should occur.

Impact

Baseline

At project start in 2002, there was no known trade of *Allanblackia* seeds in West and Central Africa (Liberia, Ghana, Nigeria, and Cameroon), and only limited national trade in East Africa (Tanzania). *Allanblackia* played a minimal role in livelihoods in all target countries, since the income generated by *Allanblackia* was low in comparison to other produce.

Allanblackia oil had never been traded internationally, and at project start the product was not approved internationally for use in food products.

Although measurable impacts on livelihoods and ecosystems are not to be expected before 2015, some benefits are already obtained by stakeholders participating in the *Allanblackia* initiative. These are especially visible in Ghana and Tanzania where most project activities were focused during the first five years of activities:

Poverty alleviation: **Allanblackia** *seeds as a new source of income*

a) Opening of new markets

Unilever has invested considerable research and financial resources to obtain the food grade status for *Allanblackia* oil. An important milestone was reached in 2008, when the European Commission formally approved the use of *Allanblackia* oil in spreads. By acquiring Novel Food clearance, the European market has been opened and first *Allanblackia* products should soon be available for sales.

b) Scaling up of Allanblackia *production*

In Ghana, a gradual increase in the volume of *Allanblackia* seeds collected can be observed in the first years of project activities. From a modest 9 tons in 2004, the volumes increased to 42 tons in 2005, to 110 tons in 2006, went down to 70 tons in 2007 (due to a low fruiting season of the trees), and up again in 2008 to 100 tons. This could also have been enhanced by the gradual price increases.

These seed volumes collected are far from the projected goals (1000 t of seed or 250 t of refined oil after year 1 for Tanzania, and 4500 t seed/y for Ghana by 2007), since their estimation was based on assumptions that were not correct (the amount of seeds available from the wild was overestimated).

c) Income generation for nut collectors and farmers

In Ghana, a total of 200 communities are engaged seriously in the collection of *Allanblackia* seeds. More than 3200 people are active collectors, and a cumulative total of 10,000 community members have participated in village campaigns. When summing Ghana and Tanzania together, in total around 10,500 people are taking part as collectors of seed from *Allanblackia* trees growing in the wild and on farms (Figure 24).

The price obtained by collectors per kilogram of *Allanblackia* seeds has increased more than three-fold in Ghana between 2002 and 2007 (from ~0,40 to ~1,50 USD/kg). Although the income gained from *Allanblackia* can still be described as meager, it constitutes now an important supplement to the total household income (ICA 2003). Some collectors are still dissatisfied with the price paid, and the amount of time and energy spent on gathering and processing - yet they still engage in the collection, likely due to the steady increase in the price over the last years and the constant education programs. Village focal persons earn more than double of what they received at project start (~25 USD/month). Half of this is fixed income, the other half is depending on volume. In total, farmer incomes have been boosted by an estimated USD 120,000.

Figure 24. Farmer drying *Allanblackia* seeds on improvised drying mat (IUCN 2008a,b)

d) Tree nurseries for further scaling-up of Allanblackia *production*

Six new nurseries have been established in Tanzania producing and selling *Allanblackia* trees. Several existing nurseries have been given an additional tree to add to their assortment. All nurseries have received technical assistance and some support for the initial required investment (seeds, material). In total, around 40,000 *Allanblackia* seedlings have been raised for planting in farmers' fields in Tanzania and Ghana.

e) Business and employment opportunities for processors and other supply chain actors

A number of nurseries, transport firms, crushers and export firms are actively involved in the *Allanblackia* supply chain and earn normal charges for their services.

Transfer of technology and skills, infrastructure

Local communities have not only diversified their income sources and increased their income levels, but also gained more stability over time. Capacity-building has provided farmers with the ability to produce better quality products, make better informed choices for their agri-businesses, and increased their knowledge on how access to markets can be obtained. The fact that the *Allanblackia* chain has to be sustainable from an environmentally point of view also contributes to the long-term competitiveness.

All actors in the supply chain have benefited from the exchange of knowledge and expertise provided by the project activities. They obtained essential selling and marketing skills and working knowledge of record keeping, business planning, financial management, entrepreneurship, safety and quality. For example, crushers have been able to improve the operations and technical outfit of their plants. They can also use this knowledge and standards to produce better local oils and thus improve the profitability of their operations. Rural storage (warehousing) facilities have been improved, and a rural banking/payment system has been installed.

To a lesser extent, schooling of girls and boys, health care and HIV/AIDS awareness has been promoted.

Biodiversity conservation

It should be emphasized that the aim of the Novella Africa Initiative is not to encourage the establishment of large monoculture *Allanblackia* plantations, but a mixed system based on forest restoration (wild harvesting) and agroforestry. Project activities therefore will result in diverse agroforestry systems that are managed in a sustainable way and do not require the use of pesticides or chemical fertilizers. At the same time, natural forests in areas that are threatened or already seriously damaged by logging (since *Allanblackia* was not considered as useful, it mainly served as firewood) will be restored.

After the first three years, the knowledge and understanding of local communities of the need to conserve trees on farms as well as in their natural habitat has increased tremendously. Most farmers participating in the Novella Africa Partnership now leave trees and especially *Allanblackia* wildlings on their farms, and the demand for planting materials from nurseries has increased significantly. In several communities, the Chiefs and elders are planning to establish *Allanblackia* nurseries within the communities. This is a very positive development and shows the general acceptance of the project.

The additional trees planted reduce erosion, and contribute to CO_2 sequestration and the conservation of local biodiversity. African forests and the landscape in general benefit as the supply chain has to be sustainable (i.e., no deforestation, no monocultures, etc.). The initiative has also added value to government policies on participatory forest management.

Carbon

In the context of carbon sequestration, no quantitative assessments have been conducted so far, but it is likely that the situation is similar to cacao, with some shade beneficial in the early phases of establishment, but a more open canopy promoting fruit production at more advance stages.

Enabling conditions

The following opportunities were determinant in facilitating the successful adoption and up-scaling of the endeavor:

a) Market demand

Allanblackia has the ideal composition as a fat for margarine and soap, but has not yet been exploited on commercial scale for any application with a high added value. There are two markets of considerable size which enables the commercialization of *Allanblackia* on a large scale and therefore offers the opportunity for a profitable involvement of a great number of local and international supply chain actors: 1) The market for spreads and cooking products in Europe (~USD 1.8 billion), and 2) The market for soaps in Africa (>USD 770 million).

b) Profitability

Compared to common crops like maize and tea, *Allanblackia* trees have a relatively high profitability. Other advantages are that *Allanblackia* trees do not need a lot of maintenance, and that the harvest season is in a relatively quiet period. It does not compete with other principal crops (such as cacao), so in general farmers will have time available for earning an extra income. Also, commercializing *Allanblackia* at international scale will not have a negative impact on local livelihoods or food safety since currently the nut is hardly being used.

c) Sustainable harvesting

The fact that *Allanblackia* trees are not yet domesticated and are harvested from the wild (from forests or wild trees on farms) provided the opportunity to market the product together with the additional asset “sustainable”. By “bundling” the product (*Allanblackia* oil) with environmental services, the undertaking would promote the environmentally-friendly and small-scale use of tropical forests by local communities, thus contribute to the conservation of biodiversity. The planting of new *Allanblackia* trees would contribute to the restoration of damaged forests and degraded lands, and to landscape integrity and forest connectivity.

Critical factors: The role of bundling

As mentioned above, the role of “bundling” a new commodity product (*Allanblackia* oil) with the environmental service of biodiversity conservation – and marketing it as such – is crucial to the success of the initiative. If the final product was internationally recognized to be of sustainable origin, then this would be the first case of marketing where a crop itself would become a “brand” or “eco-label”, standing for sustainable production that safeguards both local livelihoods and biodiversity in the tropical forest belt of Africa.

At the same time this opportunity constitutes a risk, since it is crucial for the credibility of the final product that “Best Management Practices” for sustainable harvesting are established by a neutral body, accepted by the consumer, and applied consequently by the producers and other actors in the supply chain. Non-compliance at any level within the supply chain can endanger the credibility of the final product and hence success of the endeavor as a whole.

Lessons learned about bundling

Biodiversity conservation

The whole approach of marketing *Allanblackia* oil as a sustainable product is based on the assumption that wild harvesting from forests and farms promotes the sustainable use of tropical forests and thus contributes to the conservation of biodiversity.

However, preliminary results of biological baseline studies have brought up the need to study some of the underlying assumptions more in depth (Hawthorne *et al.* 2002). It has been found, for example, that *Allanblackia* resources are fairly common and robust in some countries and therefore promotion of *Allanblackia* planting will not necessarily result in an enhanced diverse forest landscape in these regions. On the contrary there is a risk that it may result in the replacement of more diverse and scarce forest trees currently found in farms and fallows by *Allanblackia*. In other countries in change, the wild harvesting of *Allanblackia* seeds from forest reserves would not be a sound basis for the development of a viable *Allanblackia* trade since it is not sustainable. For example, in Ghana the number of *Allanblackia* trees is limited, resulting in limited volumes of seeds. Here, ways need to be found to avoid that excessive wild picking of *Allanblackia* nuts endangers natural regeneration.

Ultimately, *Allanblackia* tree planting initiatives could lead to the creation of new hybrid varieties utilized on large estates or plantations, which would replace the diversity of existing agro-ecosystems by monocultures based on narrow improved genetic materials. To counteract these types of developments, it is recommended to integrate *Allanblackia* planting into a program of landscape-level restoration that encourages conservation and preservation of a range of forest products in agro-ecosystems.

Improved livelihoods and poverty alleviation

Socio-economic baseline studies and a detailed pricing study in Ghana have concluded that currently, collecting *Allanblackia* in addition to cacao production does not produce as much impact as when other NTFPs such as “Abesebuo” and “Atooto” are added. The current purchasing price of *Allanblackia* may therefore not be incentive enough to collectors of wild *Allanblackia* trees because large quantities of seeds may not be collected and processed (Friends of the Nation 2003). Furthermore, in Ghana the *Allanblackia* harvest season coincides with large labor demands on the farm and the harvest season for a number of other forest products that frequently have a better price on the market than *Allanblackia*. Here, concentrating on *Allanblackia* during the cacao “off-harvest” season would be most beneficial. In order to be sustainable in the long run, *Allanblackia* planting strategies in Ghana need to be integrated with existing farming strategies (Technoserve 2006). Concrete suggestions include the integration of *Allanblackia* into existing cacao farming systems, and the development of new agroforestry systems that incorporate various combinations of fruit trees with cacao.

Legal aspects

Allanblackia is a non-timber forest product (NTFP), hence legal and institutional challenges associated with its development must be resolved in the context of national NTFP development regimes.

a) Wild harvesting from forest reserves

In Ghana, the 1992 Constitution and the 1994 Forest and Wildlife Policy have established an adequate policy basis for *Allanblackia* harvesting from forest reserves. However, there have been instances when collectors wanted to enter forest reserves to collect *Allanblackia* seeds but forest guards denied them the access because they were not aware of the legal permission of NTFP collection from reserves. In any case, a dialogue is needed with the regulatory bodies concerned with harvesting natural resources from the wild (such as the Forest Services Divisions) to allow some amount of wild picking of *Allanblackia* nuts while ensuring natural regeneration. Efforts should be undertaken to include *Allanblackia* into national afforestation programs and plantation development plans (van Rompaey 2003).

b) Wild harvesting outside of forest reserves and land tenure

In Ghana, there are currently no national laws regulating NTFPs other than wildlife outside of forest reserves. *Allanblackia* collection from farms and from wild trees outside of forest reserves is therefore regulated by customary laws, which follow social consensus and are in a state of flux as contending interests compete for control over land resources. For example, many communities adhere to the traditional system of sharing (*abonu* or *abusa*) where the land owner takes half or one third of the proceeds collected. Such arrangements might become complicated and lead to conflicts over land rents in communities when the crop goes fully commercial and prices increase significantly.

In the BESAP (Bundled ecosystem services and agricultural products) typology developed in Scherr *et al.* (2010, forthcoming), the *Allanblackia* case would fall under the “trust-based” Type 7 of “Products from well-managed ecosystems”. So far, Unilever is the only buyer of *Allanblackia* seeds, and Unilever only buys from producers that follow certain ecological management guidelines. Thus, other international market actors can have trust that all *Allanblackia* nuts and oils are sourced either from diversified agroforestry systems or from sustainably managed natural forests. Therefore, no label or certification is necessary to differentiate one *Allanblackia* brand from another. However, if another company would enter the market and start growing the crop profitably as a monocrop, then Unilever might require a label to maintain consumer-trust in the sustainability of their *Allanblackia* products.

APPENDIX 1. REFERENCES

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APPENDIX 2: ACRONYMS AND ABBREVIATIONS

CIAT	International Center for Tropical Agriculture
EP	Ecoagriculture Partners
EPOPA	Export Promotion of Organic Products from Africa Program
FAO	Food and Agriculture Organization of the United Nations, Italy
FNC	Federación Nacional de Cafeteros (National Association of Coffee Producers), Colombia
GEF	Global Environment Facility
ICS	Internal Control System
IFOAM	International Federation of Organic Agriculture Movement
IMO	Institute for Marketecology, Switzerland
IUCN	World Conservation Union
NFA	National Forestry Authority, Uganda
NGO	Non-governmental organization
PES	Payments for environmental services
RA	Rainforest Alliance
UN	United Nations
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
US	United States (of America)

TRANSLINKS

TransLinks is a 5-year Leader with Associates cooperative agreement that has been funded by the United States Agency for International Development (USAID) to further the objective of increasing social, economic and environmental benefits through sustainable natural resource management. This new partnership of the Wildlife Conservation Society (lead organization), the Earth Institute of Columbia University, Enterprise Works/VITA, Forest Trends, the Land Tenure Center of the University of Wisconsin, and USAID is designed to support income growth of the rural poor through conservation and sustainable use of the natural resource base upon which their livelihoods depend.

The program is organized around four core activities that will be implemented in overlapping phases over the life of the program. These are:

1. Knowledge building including an initial review, synthesis and dissemination of current knowledge, and applied comparative research in a number of different field locations to help fill gaps in our knowledge;
2. Identification and development of diagnostic and decision support tools that will help us better understand the positive, negative or neutral relationships among natural resource conservation, natural resource governance and alleviation of rural poverty;
3. Cross-partner skill exchange to better enable planning, implementing and adaptively managing projects and programs in ways that maximize synergies among good governance, conservation and wealth creation; and
4. Global dissemination of knowledge, tools and best practices for promoting wealth creation of the rural poor, environmental governance and resource conservation.

Over the 5-year life of the program, TransLinks aims to develop a coherent, compelling and, most importantly, useful corpus of information about the value of, and approaches to, integrating Nature, Wealth and Power. To do this, TransLinks is structuring the work around two core issues – 1) payments for ecosystem services and 2) property rights and resource tenure.

TRANSLINKS

A partnership of NGOs, Universities and USAID led by The Wildlife Conservation Society, dedicated to finding and sharing practical ways to generate benefits from conserving natural resources that are of global importance, and that serve as the supermarkets, bank accounts and insurance for many of the poorest people on earth.

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For more information please visit our website at www.translinks.org or contact Dr. David Wilkie, the program director, at dwilkie@wcs.org.

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