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Negotiating the Forest-Fallow Interface: Benzoin Tree in the Multifunctional Landscapes of Lao PDR

KEY MESSAGES

- Upland agriculture systems are under **threat from competing land uses and development priorities that seek to intensify agricultural land uses while promoting strict forest conservation**, leading to shortened fallow systems and a large-scale shift toward commodity crop production
- Better alternatives are needed for the development of Lao PDR's uplands—**alternatives that build on traditional management regimes, local agrobiodiversity and traditional knowledge systems rather than replace them**, recognizing multiple uses of landscape systems and their substantial potential to contribute to sustainable socioeconomic development.
- Multifunctional landscapes depend on a complex mixture of croplands, forest, fallows and the diversity of endemic species used by local communities. **Long-fallow rotational systems are a key element in these complex uplands**, enhancing and supporting ecosystems services and the sustainability of upland systems
- **Benzoin tree is exemplary of similar local species adapted to long-rotational cultivation systems** and an integral part of upland diversity. Benzoin depends on long-fallowing and enhances economic returns from upland systems.
- Despite strong market demand and rising prices, **Benzoin production has decreased dramatically in recent years due to shortening rotations and loss of available land due** to forest conservation measures and the rapid expansion of commercial crops.
- Analysis indicates that for economic returns and production per unit of land and labour, benzoin production compares favourably with typical cash crop alternatives such as maize, while also delivering co-benefits for sustainability.
- Benzoin production represents an agro-forestry system with high sustainability. Benzoin should be regarded as an agricultural product, rather than a natural product with regard to quota systems and taxation.

Introduction

Lao PDR is at a crossroads, faced with disparate possible futures for the development of its upland, rural areas. One potential future is characterized by current development initiatives that emphasize agricultural intensification and commercialization, investment in commodity-oriented export sectors, and the promotion of concession-based land investments (most prominently, high-level policy frameworks relating to Turning Land Into Capital, TLIC) (see Kenney-Lazar et al. 2018). To balance intensification with environmental sustainability, this development pathway focuses attention on more rigorous protection of state forest areas, toward the overall goal of achieving 70 percent forest cover by 2020 (MAF, 2016). Quite simply, this development agenda promotes a bifurcation between used spaces and protected spaces, sometimes referred to 'land sparing' (where intensification on limited, 'used' land enables the achievement of socioeconomic development objectives and 'spares' forests and other natural habitats for nature conservation). There is an alternative approach, sometimes referred to as 'land sharing,' an approach that seeks rather to build on the historic social and environmental legacies that have produced the diverse, multifunctional land systems that have given rise to Lao PDR's impressive natural and agricultural biodiversity (or agrobiodiversity, ABD). This alternative vision for the Lao uplands provides a crucial counterpoint to the land sparing model of development by rejecting simplified 'use' and 'conservation' zones, emphasizing rather the close inter-relationship between humans and nature in working landscapes. While in practice, development in Lao PDR's uplands demonstrates a mix of these two approaches, the most contentious wrinkle relates to upland rotational agricultural systems and, in particular, their millions [1] of hectares of fallowed agricultural land. Fallows are commonly viewed as 'wasted', or underutilized areas, that meet neither the criteria of intensive, sedentary agricultural use nor protected forests.

The viability of upland multifunctional landscapes—their ability to contribute to socioeconomic development, nutrition-sensitive food security, and environmental sustainability, while also remaining resilient in the face of change and disturbance—depends in large part on the degree to which decision-makers and managers are able to balance multiple uses, ensure appropriate management regimes, and enable local rights of access

[1] Messerli et al. 2017 estimate rotational agricultural land uses—comprising of a small area of currently cultivated land and a much larger share of cyclically-fallowed land—to be around 6.5 million ha.

and use. Agricultural fallows are critical to these systems, due to (1) their ability to regenerate soil fertility and reduce pests and weed pressures during cropping stages (2) their abundance of wild, semi-domesticated and domesticated species including both Non-Timber Forest Products (NTFPs) and planted crops, and the role these play in household consumption and revenue generation, and (3) the various other ecosystem services that depend on these, including water provisioning, carbon sequestration, and wild biodiversity. In general, the value of fallows along these dimensions increase with fallow length (Mertz 2002, Xu et al. 2009). In addition to the direct benefits for agricultural production, fallow length is positively associated with other ecosystem service values relating to wild biodiversity (Rerkasem et al. 2009, Mertz et al. 2009), agrobiodiversity (Foppes and Ketphanh 2004) water provisioning services, and climate regulation (Hett et al. 2012, Fox et al. 2014, Ingalls and Dwyer 2016).

Without adequate security of upland resource tenure, local communities will fail to fully realize socioeconomic and environmental benefits. While formal tenure security in Lao PDR is low (Broegaard et al. 2017, Ingalls et al. 2018), rotational shifting cultivation areas—which are typically managed as communal commons—are particularly insecure, being generally ineligible for titling or other types of formal tenure recognition[2]. Innovations are needed to capitalize on the productive and economic potential of local agrobiodiversity within upland systems, to enhance the economic returns from upland fallows and fields, and ensure local tenure over these resources.

In this brief, we focus attention on *Styrax tonkinensis*, the Benzoin tree (or locally, yarn), a species highly-adapted to long-fallow rotational systems that has enabled local communities to extend and benefit from increased fallow-lengths and enhance overall system viability. We assess the current status of Styrax, its relation to some common alternatives, and the ways in which Styrax production relates to national development goals. We also examine the ways in which community-led land use planning—exemplified in the participatory Forest and Agricultural Land Use Planning and Management (pFALUPAM) approach—have enabled benzoin producers to demonstrate customary resource claims and negotiate a politically-acceptable space for long-fallowing.

Stryrax, found only in Lao PDR and Vietnam, produces a resin (benzoin) that has been used in and exported from Indochina since the 16th century during the reign of King Soulinhavongsa of the Lanxang Kingdom. Benzoin resin is used for a variety of purposes including the preparation of incense, inhalants and in Chinese traditional medicine, as well as high-value perfumes and cosmetic products in the European Union, especially France, where Lao benzoin dominates approximately 70 percent of the market.

Styrax—a globally-scarce but locally-abundant species—is emblematic of a variety of endemic species and cultivars highly-adapted to rotational shifting cultivation systems of Lao PDR. It is a pioneering species that colonizes forest breaks and newly-cleared land. It also appears to be semi-pyrophilic; burning seems to invigorate germination and promote seedling emergence. As a medium-term, woody species, Styrax has specific agroecological needs that make it particularly suited to long-fallow systems, serving as a cross-over species that thrives across successional stages in the rotational cultivation landscape, from cultivated fields, to fallow, to forest. In the uplands of Lao PDR, Styrax is managed within rice fields and fallows along with more than one thousand other NTFPs that together comprise the complex food production systems of Lao PDR's rotational shifting cultivation landscapes. But these are under threat. The unregulated expansion of commercial trade and the related boom in export-oriented commodity crops in the uplands, the reduction of rotational shifting cultivation area due to policy constraints, and poor management and overharvesting have had a significant impact on NTFP diversity and abundance. More than 15 percent of NTFP species are at risk of extinction, while 80 percent of all NTFP species have shown significant decline (NAFRI, NUoL, SNV, 2007). Styrax's obligate relationship with long-fallowing systems presents acute obstacles to its future as fallow periods continue to decline.

The Context of Benzoin Production in Lao PDR

There are at least 184 producing villages in Houaphan, Luang Prabang and Phongsaly Provinces, the main benzoin production region, involving 3,285 families (or approximately 19,700 individuals) with 5,307 ha currently under production (Table 1). Houaphanh province has the largest area of Styrax (2,432 ha), comprising 46 percent of all production area, involving 1,397 families in 69 villages, with an average of 1.74 ha/household. Within this province, Samneua District has the largest concentration. Luang Prabang has the second largest area of production, followed by Phongsaly. There are known but unquantified production areas in Oudomxay and Xieng Khouang Provinces. Benzoin-producing communities and households typically have low to very-low holdings of paddy rice, and are primarily dependent on rotational shifting cultivation of rice. In producing districts, the proportion of upland, annual rotational rice cultivation land ranges from just below 20 percent to more than 90 percent (Figure 1). Benzoin producing villages tend to be poorer and remote from urban centres. For all producing communities and households, benzoin supplements rice-dominated livelihood strategies, providing cash income for expenses and a safety-net during periods of shortfall.

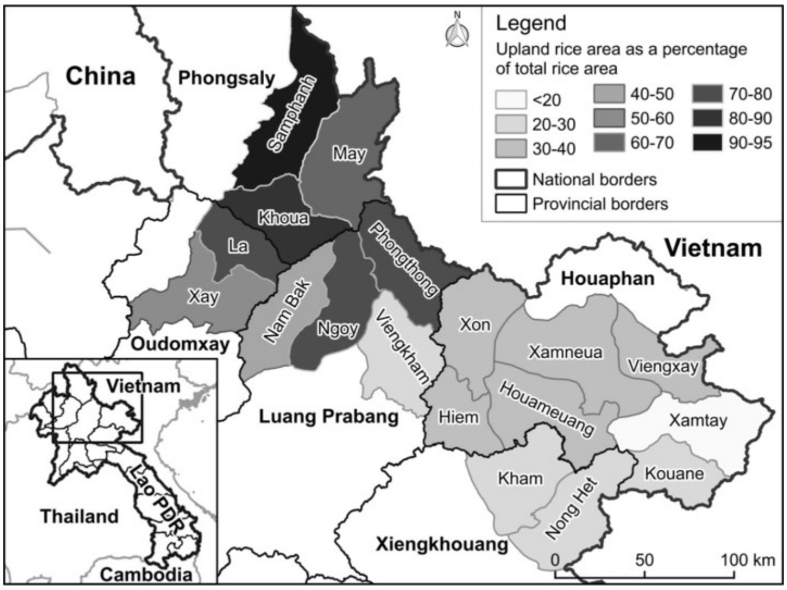
Table 1: Key benzoin production areas in Lao PDR

Province	District	No. of villages	Households	Styrax Area (ha)	Average (Ha/HH)
Houaphanh		**69**	**1,397**	**2,432**	**1.74**
	Houamouang	3	13	9	0.69
	Samneu	39	794	1,541	1.94
	Viengxay	7	150	379	2.53
	Samtai	11	219	423	1.93
	Kouane	9	221	80	0.36
Luangprabang		**34**	**730**	**1,528**	**2.09**
	Nambark	12	285	536	1.88
	Ngoy	15	271	578	2.13
	Phonthong	7	174	414	2.38
Phongsaly		**81**	**1,158**	**1,347**	**1.16**
	Khoa	41	623	350	0.56
	Mai	9	167	120	0.72
	Samphanh	31	368	877	2.38
Total		**184 villages**	**3,285 hh**	**5,307 ha**	**1.62 ha**

Source: Agroforex co., 2015. DAFO, 2016, TABI 2018

[2] Land titling is currently applicable primarily for individual parcels, except for communal titling which has been piloted on a limited basis. Further, current interpretation of law suggests that titling cannot occur on state forest lands (DoF 2018), areas that encompass 61 percent of the territory of Lao PDR.

Figure 1: Benzoin producing districts and rotational shifting rice cultivation in Lao PDR



Data source: MAF and LSB, 2011

Styrax Silvicultural Techniques

Generally growing above 1000 m asl, S. *tonkinensis* is a pioneering species that establishes in upland fields following vegetation clearance and burning. Most cultivated trees occur naturally, emerging from seeds and rootstocks within newly-cleared fields. However, some farmers systematize the silviculture of Styrax by the supplementary planting of seeds between February and early March. About 15 days after clearing the fallow vegetation and leaving it to dry, farmers who plant supplementary Styrax push small holes in the ground with a dibble stick and place five to eight seeds in each hole. Spacing is 5 m by 10 to 15 m, resulting in between 130 and 200 holes per hectare. The cut vegetation is left to dry for about one month. Then, depending on weather conditions, it is burnt to clear the field for planting rice and other vegetables and herbs, and to trigger the germination of the Styrax seeds. When the rains begin (between late April and May), the farmers plant rice by dropping seeds into holes spaced about 25 cm by 25 cm apart. The rice and tree seeds usually germinate together in late May, although some Styrax seedlings emerge later.

Over the following year, the farmers cultivate rice while managing the emerging Styrax seedlings. Depending on the length of the previous fallow, the field is weeded two or three times, first in June or July and then again in September or October. During the first weeding, the Styrax saplings are handled carefully. They may be about 20 cm tall, and at this stage the farmers select the strongest seedlings with the highest potential for future resin production. Preferred characteristics include dark green bark and dark green, curling leaves. Farmers report that saplings with straight trunks, light green bark and straight leaves yield lower quantities of resin. Selected seedlings are retained, while crowded and weaker seedlings are weeded out. The farmers generally prefer to keep one or two seedlings per clump during this initial thinning, leaving between 130 and 200 seedlings per hectare or, in fields where they prefer a denser stand, as many as 400 seedlings per ha. In some cases, healthy seedlings found in dense clumps are transplanted for spacing, but these have a high casualty rate. Seedlings are maintained and tended during the second year of rice cultivation, when healthy saplings reach a height of two to three metres. Farmers then cut off the leader, or top shoot to promote lateral branching, a practice that enhances future tapping potential and overall resin yield.

Rice and other indigenous species and perennials such as broom grass (*Thysanolaena latifolia*) are commonly intercropped with Syrax saplings through the second cropping year, after which time canopy closure precludes rice cultivation. Shade-tolerant species such as galangal (*Alpinia* spp.), mushrooms (*Russula* spp., *Lentinus* spp., *Termitomyces* spp., etc.), cardamom (*Amomum villosum*), and bamboo (*Bambusa* spp., *Indosasa* spp., *Phyllostachys* spp. etc.) continue to be grown within the maturing stands of Styrax.

Tapping and Harvesting

Benzoin producers generally begin tapping Styrax trees when they are about eight years old, by which time the bark is thick enough to produce a large volume of high-quality resin while ensuring the longevity of the tree (Figure 3). Producers continue to tap until resin yield declines and tree death-rates increase, normally sometime after the 15th year, although some trees continue to provide resin until after their 20th year. Ideally, tapping begins between May and June, when the trees are in flower and there is a higher volume of resin. However, the availability of labour is lowest during these months, when households are commonly involved in rice planting and weeding. Consequently, many households do not begin tapping until after August (after the second weeding of the rice field), up until November (prior to rice harvest). Field surveys across all producing areas indicate that August is the most intensive tapping period on average, involving 38 percent of producers.

The main tool used in tapping is a sharp knife; farmers cut the bark deeply to reach a small portion of the xylem and then push down about 8 to 10 cm to make the shape of a valve to receive the resin. Tapping is divided into portions, depending on the health of the tree and the skill of the tapper. Lower tappings are done within the first two metres of the trunk, from 20 cm to 1 m from the base of the tree. The second set of tappings is done between two and four metres above the base, and a third set of tappings is done between four and six metres up the trunk. In each group, the tree is tapped on two to four faces, with about three tappings per face (thus there are six to 12 taps in each set of tappings). The tapper lashes a wooden step to the tree with rope, and stands on this to reach the higher tapping positions. In traditional practice, an individual tree will be tapped only in alternating years, to maintain yields and prevent premature tree die-off. In cases where trees are tapped only in the lower position, one tapper can handle six to eight trees per day, but difficulties in accessing the second and third positions limits the worker to about four trees per day, on average. The trees are left for some months, allowing the resin to collect and dry at each tap position. The main harvesting period is from November to April, outside of the rice season when labour is available. The most intensive month of harvesting is December, following the rice harvest. During the harvesting of the resin, farmers use a knife or another sharp tool to cut off the bark and carefully pick the hardened resin off the tapped trees. As in the tapping procedure, rope and wooden steps are used to reach the higher tapping positions. The resin is kept in baskets until it is sold to traders.

Yield and Tree Death

Resin yield per tree varies considerably, depending on the health and age of the tree and the experience and technique of the tapper. Yields range from around 270 grams/tree to around 540 g/tree. Younger trees – those between five and seven years old – produce substantially less. In Houaphan, for example, younger trees produced 36 percent less than trees eight years old and over, and 47 percent less than trees older than 11 years. In other areas, where tree stand densities are greater, yield variations between age classes are less pronounced, possibly due to crowding. Total annual yield per family also varies significantly, depending on the availability of labour, tree numbers and stand age, ranging from 12.54 kg to 24.23 kg. Wide variations in yield suggest the need for further assessment.

While tree mortality rates increase considerably following 15 years of age, many trees survive for more than 20 years. However, the main constraint on the tapping age of trees is the length of the rotational cultivation cycle, with most farmers clearing and burning their stands of Styrax at a relatively young age (a point we return to below).

The Benzoin Value Chain: Quotas, Processing and Pricing

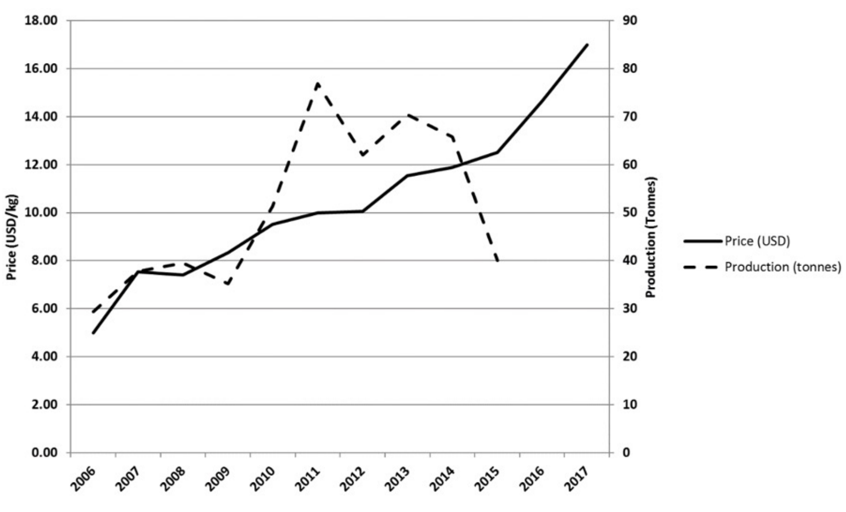
Companies seeking to purchase benzoin from producing communities submit annual requests to the District Agriculture and Forestry Office (DAFO), which then summarizes these and submits to the Provincial Agriculture and Forestry Office (PAFO). Because benzoin is considered a natural product, PAFOs requests for the issuance of quotas are submitted to the Department of Forestry at the Ministry of Agriculture and Forestry (MAF) which, in turn, submits these to the Government for the issuance of the annual quota. As DAFOs capacities are insufficient to annually assess the available harvest volume of benzoin, quotas very little from year to year and are typically in response to private sector demands.

Benzoin is commonly sold to agents of exporting companies in producing villages. While some companies liaise with DAFO officers at the district, many companies work directly with producers, sometimes without direct reference to official harvest quotas, limiting the effectiveness of regulatory systems. Agents usually transport the resin to Vientiane for processing, during which around 11 percent of the purchase weight is lost in cleaning. Processed benzoin is exported to several countries, although the formal market is dominated by exports to European Union countries and the United States. The formal benzoin market in Lao PDR is dominated by two companies, which together command nearly 90 percent of formal trade. In addition to registered companies, there is a large but unregulated trade carried out by independent traders from China and Vietnam, who purchase raw benzoin at the village level and export it through unofficial border trade. This informal trade, weak regulation and other challenges create market uncertainties for producer villages and companies throughout the value chain (Ketphanh and Vongkhamho 2008).

While Fischer et al. (2007) observed that the price of benzoin had declined considerably from historic levels, systematic production and trade data was generally lacking at that time. They reported that low and uncertain benzoin pricing had led to overall reductions in benzoin production across the country. However, since that time the price of benzoin has increased considerably, with average farm-gate prices currently at around US$17/kg. Despite consistent increases in the market price of benzoin, available data indicates that production rates have been variable; there was a sharp increase between 2009 and 2011, but production has fallen considerably since (Figure 2). The reasons are numerous. One issue is that the production area of Styrax has been squeezed by the expansion of boom crops – the success of which are partly attributable to favourable policies and promotion by state agencies – alongside enhanced forest conservation efforts that have restricted rotational shifting cultivation in the Lao uplands, thus reducing fallow periods (see below). However, informal trade of benzoin (above) has not been quantified; anecdotal evidence suggests that it is large and growing, confusing the picture presented by official production and trade statistics.

Benzoin resin is currently taxed at 10 percent of sale value, as a natural forest product. It is unclear whether benzoin should more appropriately be considered an agricultural product, given the management of seedlings and trees on the part of producing households, typically within upland agricultural fields.

Figure 2: Benzoin pricing and production, 2006-2017



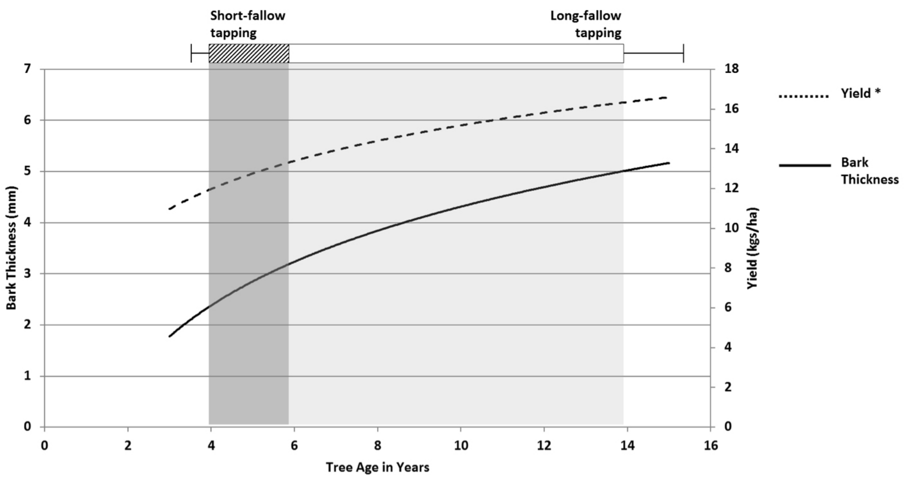
Sources: DAFO, 2016; Agroforex, 2017

Benzoin in the Short(ening) Fallow

The annual and total yield of benzoin is considerably higher in long-fallow rotational regimes. Figure 3 below shows the observed relationship between tree age and bark thickness (the most predictable correlate of yield rates) over time, compared with harvesting periods under short- and long-fallow rotation. Historically, producers did not tap trees younger than 8 years old, due to low rates of yield and higher risks of premature tree death. In recent times, however, fallow lengths have decreased considerably as has the total area of upland rice production, largely accounting for the drop in overall production and per-household benefits from benzoin production despite rising prices. Many producer communities now tap trees by year 5, and continue tapping only for 1-2 years before the field is cleared for rice production. Further, many farmers tap trees annually rather than in alternating years, due to the limited time available for tapping under short-fallow rotation regimes. In 2015, for example, 88 percent of trees tapped were younger than 10 years.

Short-fallow rotational shifting cultivation systems have become the norm in the uplands of Lao PDR. Crucial to this transition has been the perception that shifting cultivation is unsustainable, environmentally-destructive and, fundamentally, a 'backward' agricultural practice inconsistent with a vision of modernization, economic development and national identity largely rooted in lowland Lao cultural values (Baird and Shoemaker, 2007). Policies and state programmes have endeavored to eradicate or stabilize shifting cultivation through semi-voluntary and involuntary resettlement programmes (primarily before the early 2000s), various shifting cultivation bans, subsidization and promotion of alternatives (such as maize, cassava, rubber and other commodity crops produced primarily for export markets) and forest-conservation measures (Fujita and Phanvilay 2008, Ingalls and Dwyer 2016). These drivers intersect with national policies revolving around TLIC, a policy direction that seeks to leverage Lao PDR's large land resource base to attract (typically foreign) investments, principally (but not only) through the granting of large-scale land concessions and commercial operations. As of 2017, land concessions covered more than 1 million ha of land (Hett et al. 2020), constituting a leading driver of land use change in the Lao uplands.

Figure 3: Bark thickness and yield, over time, in short-fallow and long-fallow systems



** Yield varied greatly in sampled fields. Yield values here are based on Luang Prabang, where an average of 167 trees were tapped per hectare. The figure depicts the logarithmic trend of averaged values per age-class.*

Source: Field samples, 2016.

Assessing the Alternatives: A Comparative Analysis

Land-sparing approaches to development and conservation in Lao PDR have focused not only on restricting access to forest areas and reducing rotational shifting cultivation, but also on the promotion alternatives. To assess the implications of these alternatives we carried out a limited comparative analysis between the production of benzoin, rotational shifting rice cultivation and the production of maize, a common alternative. Systematic assessment with participating farmers within the research area was carried out to quantify and compare the costs and benefits associated with these alternatives, analysed with regard to per-labour and per-hectare returns, both of which are limiting input factors in upland cultivation systems. Costs associated with purchased inputs were deducted from revenue under each scenario to allow for direct comparison. Yield rates under each scenario were averaged across production years for simplification.

Table 2: Compared cost benefit between benzoin resin with rice and maize

Product Type	Labour Costs	Yield	Unit Value	Input Costs	Benefit (land)	Benefit (labour)
	Pax days/ha	**Kg/ha**	**USD/Kg**	**USD/ha**	**USD/ha**	**USD/pax/day**
Benzoin resin	35	41.8	18	6.96	745	21
Upland rice	271	2,090	0.36	19.92	732	3
Maize	113	4,200	0.144	59.16	546	5

Source: Field survey, 2016.

Labour requirements for benzoin, rice and maize vary considerably (Table 2). Benzoin tapping represents the lowest labour requirements (35 person days/ha/yr), followed by maize (113 person days/ha/yr) and upland rice (271 person days/ha/yr). While the volume of yield for benzoin is much lower, high price-per-volume ratios mean that benzoin compares favourably with maize and rice, particularly with regard to returns per unit of labour, where return differential is 4- and 7-fold higher, respectively. Returns per unit of land are also enhanced under traditional systems of rice and benzoin co-production. Maize is not suitable for intercropping with benzoin due to the latter's shade-intolerance during early seedling stages. Benzoin production thus shows particular potential for lower-income families with limited labour resources and capital inputs.

The comparative analysis above does not include revenue generated from intercropped cultivars and NTFPs. In the Lao uplands, numerous vegetables and other products are produced within cultivated fields and fallows, including benzoin stands, constituting a significant proportion of household consumption and income. While NTFPs are commonly thought to be primarily associated with forests, this is not typically the case; the abundance and diversity of such cultivars and species is by far the highest in fallows. An assessment of the contribution of NTFPs to household income across 300 villages in Lao PDR's northern uplands under the TABI project indicated that 48 percent of NTFP values were derived from rotational shifting cultivation fields and fallows, versus only 10 percent from mature forest areas. In the surveyed villages, NTFPs contributed as much as 33 percent of total household income (Ingalls and Roth 2018).

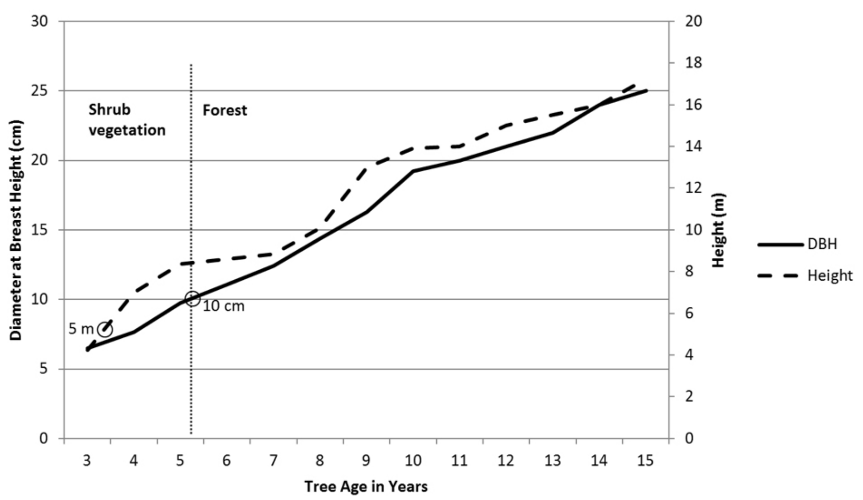
The comparison of costs and benefits above also excludes key values not easily captured, such as those producing non-monetary environmental and social values. Maize cultivation is representative of the kinds of alternative land use systems promoted for intensification under the land-sparing paradigm. Maize cultivation entails high-levels of external inputs, including herbicide and insecticide applications and inorganic fertilizers, as well as modern technical expertise. The short-cycle annual production system of maize also presents particular risks related to soil erosion. While no systematic comparative assessment was done in this study with regard to these factors, some reasonable inferences can be made. The known impacts of pesticide application and intensive fertilizer regimes are well-documented, particularly in the Lao context where poor regulation of such inputs and inadequate management measures have been shown to present substantial and far-reaching risks to local communities[3] and natural ecosystems (Wentworth et al. 2016, Rassapong et al. 2018, Shattuck 2019). These, together with the typically-low biodiversity of monocultural plantations of non-native species like maize, suggest that Styrax cultivation—which employs local knowledge and long-rotation systems wherein chemical inputs are not typical—compares even more favourably.

Benzoin at the Forest-Fallow Interface

Upland rotational cultivation systems are a difficult fit within current policy directions that emphasize land-sparing (intensification of agriculture within limited areas alongside strict forest protection and environmental conservation) over land-sharing (extensive integration of human-environment systems across multiple land uses). Yet these systems—and particularly those with long-fallows—are a critical precondition for the benzoin production cycle as well as numerous other environment services that characterize Lao PDR's multifunctional uplands. This places benzoin production in a precarious position vis-à-vis national development and conservation directions. A very practical issue relates to the ways in which forest and agricultural land are defined, and the ways in which these definitions intersect with applicable legislation. Lao PDR's official definition of forest—thus areas to which forest protection measures ostensibly apply—includes areas larger than 0.5 ha wherein canopy closure is 20 percent or greater, tree height is 5 m or more and tree diameter at breast height (DBH) is 10 cm or more. Detailed above, the success of benzoin production depends on fallow length, relating to tree maturation and thus yields. Ideally, Stryax trees are not tapped until they have reached 8 years of growth. By age 15, resin production declines while rates of tree death increase rapidly, requiring clearance and burning and thus the second stage of the rotational cycle. However, even by the 5th year of growth, Styrax stands may have already reached applicable thresholds of the forest definition (Figure 4). Seen in this way, the cultivation of Styrax is directly comparable to long-rotation plantation systems, such as are typical for eucalypts (*Eucalyptus spp.*), acacia (*Acacia magnium*) and teak (*Tectona grandis*).

In practice, the enforcement of forest conservation law with regard to rotational shifting cultivation and Styrax cultivation has been mixed. Lack of clarity with regard to legal provisions, contradictory policies, and the local political ramifications of implementation have often chilled enthusiasm for strict enforcement. Until now, this has resulted in the tenuous persistence of rotational shifting cultivation, albeit under increasingly-restrictive conditions. Nevertheless, research participants identified forest conservation policies as a leading reason for the reduction in fallow periods and the abandonment of Stryax cultivation, consistent with what is widely known across the country (Fujita and Phanvilay 2008, Schmidt-Vogt et al. 2009).

Figure 4: Benzoin growth rates along the gradient of upland fallow-forest age.



Source: Field data 2016

Despite the historic ambiguity that has allowed for the persistence of rotational shifting cultivation and benzoin production systems, recent policy shifts and a renewed intensification of forest conservation efforts provide ample reason for concern with regard to the fate of shifting cultivation in general, and long-fallow systems in particular. The Politburo's (2017) *Resolution On the Enhancement of Land Management and Development in New Period* recently reiterated the Government's long-standing goal of achieving 70 percent forest cover (currently around 53 percent, DoF 2018) by 2020, also a precondition

[3] Rassapong et al. (2018) found that 96 percent of participants in their study of blood samples from 916 farmers, civil servants and school children tested positive for pesticide contamination. Among consumers specifically, 47 percent were determined to have risky or unsafe levels of contamination.

for Lao PDR's bid to graduate from Least Developed Country Status by 2024. The eradication of shifting cultivation and the succession of fallows to forest is widely viewed as low-hanging fruit for the achievement national forest cover goals (Dwyer and Ingalls 2016, *cf* DoF 2018). High-level endorsements (such as the Politburo Resolution) have galvanized those forest conservation advocates who are opposed to shifting cultivation, reflected in recent revisions of the Forestry Law and the national Master Plan for Land Use Allocation, each of which envisions the near-term replacement of shifting cultivation with intensive, sedentary alternatives.

As mentioned above, there may be another way to achieve these national development and forest-conservation goals, one that builds on (rather than undermines) indigenous livelihood systems rooted in Lao PDR's multifunctional landscapes and agroecological diversity. Styrax cultivation in the long-fallow system is consistent with such an alternative option. Benzoin production within long-fallow rotational systems has all the hallmarks of the plantation forestry alternatives proposed by forest conservation advocates. Like rubber (*Hevea brazilinsis*)—an oft-touted alternative for upland systems—Styrax is a fast-growth tree species that rapidly matures to forest, produces a high(er) value resin with a strong global market demand and a low labour-to-area ratio suited to the low labour density of the Lao uplands. Similar to pulpwood species such as eucalypts and acacia—other proposed alternatives for reforesting the Lao uplands[4]—old Styrax trees whose resin-yields have declined have shown some promise as pulp and plywood in Vietnam (Fischer et al. 2007). Unlike rubber and eucalyptus, benzoin has three distinct advantages: (1) it is suited to intercropping with rice and other cultivars (2) it has deep biocultural associations with upland communities, employing local agroecological knowledge (versus external knowledge and resources) in its cultivation and use; and (3) it is an endemic species embedded within local agroecosystems, constituting an integral element in upland multifunctional landscapes.

While policies to protect and promote Stryax and other endemic fallow species and the shifting cultivation landscape more generally are a necessary precondition to leverage their livelihood and ecosystems potentials, these are not sufficient absent secure local tenure of these resources. Without adequate recognition of customary use and tenure over these resources, local producers will fail to realize their benefits. As we have said, tenure security within Lao PDR's uplands is weak, particularly for communally-managed rotational cultivation fallows. In recent years, innovative approaches such as pFALUPAM have emerged that embrace indigenous land use systems and traditional livelihood practices and act to demonstrate and defend customary land use claims within these areas. In so doing, such approaches create the enabling conditions for multifunctional, long-rotation shifting cultivation systems and sustainable benzoin production. Through pFALUPAM, local communities have been able to document customary land uses and demonstrate tenure claims in a way that has proven largely acceptable to government authorities. Participatory planning through pFALUPAM for collective rotational shifting cultivation within existing fallows has been used by more than 200 communities to both increase fallow-lengths and forest cover[5] under village management, while also functioning to secure a measure of formal recognition of customary claims over land and forest resources.

Conclusion

The complex mixture of agricultural fields, fallows and forests constitute the foundation of Lao PDR's multifunctional landscapes, providing ecosystem services essential to the sustainable development of rural areas. While often characterized as under-utilized or wasted, fallows are instead an essential element in these systems, not only with respect to their role in enhancing fertility and the productivity of cropping phases, but also for the diverse values derived from the species that comprise them. The value of fallows areas can be enhanced through the promotion of endemic species and cultivars with high-market potential that also support system-wide processes. Benzoin tree represents one such species, being closely adapted to long-fallowing systems while delivering high values for local communities. The sustainability of Lao PDR's uplands and rural areas depends on the degree to which decision-makers and managers are able to harness the value of such species, promote their protection, and ensure the tenure security of smallholders who manage them.

While 'win-win' is certainly a fraught term, we cautiously suggests that benzoin cultivation within long-fallow systems enabled through community-led land use planning may be just that: local innovations that enable both enhanced forest cover during the long return interval of mature tree stand management and tapping, and also create space for the return of long-fallow rice production, together with the numerous environmental and social benefits that accompany them. Achieving such a win-win would, however, require a more enabling policy environment grounded in land-sharing (rather than land-sparing) paradigms in multifunctional landscape systems wherein long-term tenure security is ensured. At present, despite the partial-security afforded by land use plans, Styrax stands in rotational shifting cultivation fallows remain largely insecure with regard to local tenure claims as these have yet to receive official validation similar to that of the alternative sedentary crops actively promoted by state agencies. While tree plantations of eucalypts, rubber and other commercial crops receive such protections, benzoin continues to be seen as part and parcel of the rotational shifting cultivation system and thus restricted by many forest conservation advocates.

Formal recognition of customary tenure and culturally-embedded management regimes is essential to ensure the sustainable future of Lao PDR's upland multifunctional landscapes. This is currently lacking. While formal collective land titling has been piloted on a limited basis in Lao PDR, it is unclear whether it will be systematically employed and, if it is, national coverage remains a long way off. Enhanced formal recognition of participatory land use plans as documentation of local tenure claims is a practical and proven innovation to address this gap.

[4] We note here that Lao PDR's forest definition, consistent with that of the FAO, includes monocultural plantations of non-native species as 'forest,' despite the obvious and substantial differences with regard to ecological functions
[5] On average, allocation for forest areas has increased by 9.6 percent in villages that have carried out pFALUPAM

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Contact address:

Dr. Simone Vongkhamho
National Agriculture and Forestry Research Institute (NAFRI)
Ministry of Agriculture and Forestry (MAF)
Email: simonevkh@gmail.com
Tel: +856 20 55924948
Office: P.O. Box: 10896

Dr. Micah Ingalls
Centre for Development and Environment (CDE)
University of Bern
Email: micah.ingalls@cde.unibe.ch
Tel: +856 20 59921728

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