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NEGOTIATING THE FOREST-FALLOW INTERFACE

Benzoin trees in the multifunctional shifting cultivation landscapes of Lao PDR

Simone Vongkhamho and Micah L. Ingalls[*]

Introduction

As the Lao People's Democratic Republic (Lao PDR, or Laos) strives to balance the demands of rural development, poverty alleviation and environmental sustainability, the fate of the Lao uplands – the largely rural, mountainous areas along Laos's north and east, comprising nearly 70% of the national territory – have been thrust on to centre stage. These uplands are generally poorer than lowland areas along the Mekong and its tributaries. This is due in large part to their steeply-sloping terrain and limited fertile flat land for cultivation, as well as their inaccessibility, which has hindered agricultural investment and the penetration of development assistance. Shifting cultivation remains a dominant livelihood strategy in these areas. As of the last agricultural census (2011), about 1.4 million people, or 29% of the agricultural population, are engaged in shifting cultivation. They are distributed across half of all villages in Laos (Epprecht et al., 2018). Shifting cultivation is not only a leading livelihood strategy in the Lao uplands, it is also the largest agricultural land use. About 212,000 hectares are planted annually with upland rice, or 17% of the country's total rice-production land. But when the associated fallow areas are added to this figure, the total area involved in shifting cultivation amounts to as much as 6.5 million ha (Messerli et al. 2009), more than six times the total production area of wet rice, the country's second-largest agricultural land use. Shifting cultivation has a long history in the Lao uplands, dating back centuries, if not millennia, resulting in a complex landscape of fields, fallows and forests. This mosaic of land uses, habitats and associated species produces a unique, multifunctional socioecological system (Fox et al., 2000; Ingalls and Dwyer, 2016).

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However, the persistence of shifting cultivation is perceived by many development agencies and policymakers as an obstacle to both development and environmental sustainability. Land-sparing models that emphasize intensification and commercialization within existing agricultural land, alongside enhanced forest and environmental conservation, have become increasingly dominant. Within the land-sparing concept, shifting cultivation is a misfit; it is a livelihood strategy that is neither apparently intensive nor considered compatible with forest conservation. As a consequence, development and conservation policies have long sought to eradicate or stabilize shifting cultivation. These efforts have recently redoubled as Laos strives to achieve the United Nations' Sustainable Development Goals; to lift itself from Least Developed Country status and to reach the government's target of achieving 70% forest cover by 2020.

Development practitioners, conservationists and state foresters have long sought viable alternatives to shifting cultivation in the Lao uplands, but these have generally remained elusive. Nevertheless, restrictive policies continue to diminish the land available for shifting cultivators, resulting in shorter fallow periods (Fujita and Phanvilay, 2008; Kenney-Lazar, 2010). The shortening of shifting cultivation fallows has made way for the expansion of large commercial plantations and land concessions, alongside increased forest areas, all to the detriment of poor shifting cultivation households. Declining yields, soil fertility and fallow health and the replacement of natural vegetation with non-native monocultures has, in the main, been disastrous for both shifting cultivators and, perhaps paradoxically, the natural environment (Foppes and Ketphanh, 2004; Rerkasem et al., 2009; Mertz et al., 2009). This has often undermined efforts to achieve either rural development or environmental sustainability.

Lao PDR is at a crossroads, faced with disparate possible futures. On one hand, it may follow a land-sparing development pathway that emphasizes intensification through commercialization, investment in commodity-oriented exports and increased foreign direct investment alongside the modernization of forest-conservation measures. On the other, there is the possibility of land-sharing for development and conservation, building on the unique strengths of its agricultural and ecological base and the indigenous cultural practices of the country's multifunctional uplands. Depending on the direction it follows, shifting cultivation faces an uncertain and increasingly threatened future in Lao PDR.

The success of the multifunctional, land-sharing development and conservation pathway depends on a number of inter-related factors. The most important of these is the ecological and socio-economic viability of shifting cultivation systems and the degree to which rural households are able to secure access to and control over their resources.

The viability of shifting cultivation relates in some measure to the management of fallows as an intermediate land use between cropped lands and forests. This is due to the importance of fallows for:

- their ability to regenerate soil fertility and reduce pests and weed pressures during the cropping stage;
- 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
- the various other ecosystem services that depend on them, including water provisioning, carbon sequestration and wild biodiversity.

In general, the value of fallows increases with fallow length (de Rouw, 1995; Mertz, 2002; Xu et al., 2009; Cramb et al., 2009). In addition to the direct benefits for agricultural production, fallow length is positively associated with the value of other ecosystem services relating to wild biodiversity, water provisioning and climate regulation (van Vliet et al., 2012; Fox et al., 2014; Ingalls and Dwyer, 2016).

Without adequate security of upland resources, local communities will fail to realize the benefits of long fallows. While formal tenure security in Laos is low (Broegaard et al., 2017; Ingalls et al., 2018), shifting cultivation areas – which are typically managed as communal commons – are particularly insecure and under current laws, are generally ineligible for titling or other types of formal tenure recognition.

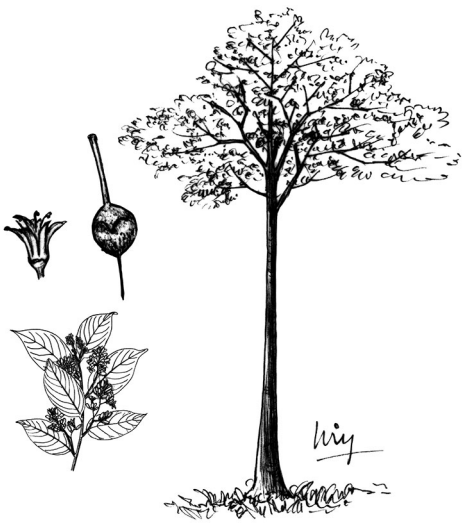
In the light of these threatening conditions, this chapter focuses on two inter-related innovations in the Lao uplands that provide some measure of hope. First, we highlight *Styrax tonkinensis*, a species that produces benzoin resin. It is highly adapted to long-fallow shifting cultivation systems and has enabled local communities to benefit from increased fallow lengths and enhanced overall system viability. Second, we examine the ways in which community-led land-use planning – best exemplified in the participatory approach to forest and agricultural land-use planning and management (FALUPAM) – has enabled benzoin producers to demonstrate customary-resource claims and negotiate a politically acceptable space for long fallows.

Stryrax tonkinensis (Lao Benzoin or, locally, *yarn*), is a tree species native to Laos and Vietnam. It is closely related to other species found throughout Southeast Asia, Asia Minor and South America. It produces a resin that has been used in and exported from Indochina since the 16th century. Benzoin resin is used in incense, cosmetics and inhalants, as well as in Chinese traditional medicine. The composition of Lao Benzoin – comprising about 65% Coniferyl benzoate, 10% Benzoic acid and other aromatic esters – is particularly suitable for producing high-value perfumes and cosmetic products in the European Union, especially in France, where benzoin from Laos claims about 70% of the market (FAO, 2014).

S. tonkinensis, which is a scarce species in global terms, but abundant locally, is emblematic of a group of endemic species and cultivars in Laos that are highly adapted to shifting cultivation systems. It is a pioneering species that occupies forest breaks and newly-cleared land. It also appears to be semi-pyrophilic, as burning seems to invigorate germination and promote seedling emergence. As a medium-term woody species, *S. tonkinensis* has specific agroecological needs that make it particularly suited

to long-fallow systems. It thrives across the entire spectrum of successional stages in the shifting cultivation landscape, from cropping to fallow, to forest.

In the uplands of Laos, *S. tonkinensis* is self-generated within rice fields and managed fallows, along with more than one thousand other NTFPs that together comprise the complex food-production systems of Laos's shifting cultivation landscapes. These NTFPs, which are integral to local livelihoods and the area's complex biotic interactions, play a fundamental role in the social-ecological systems of the Lao uplands, providing food and medicine, household income and regulatory benefits. These services are especially valuable for low-income households that rely on these resources most directly, and that also tend to lack other resources to buffer shocks and disturbances such as those resulting from climate change. In the uplands of Laos, benzoin and other NTFPs provide as much as 45% of cash incomes and nearly 50% of non-cash resources for upland families (Weyerhaeuser et al., 2010). However, these benefits are not restricted to upland communities. Nationally, trade in NTFPs comprises 19% of all exports from Laos (see Wiemann et al., 2009).



Styrax tonkinensis Craib ex Hartwich [Styracaceae]

A fast-growing, light-demanding tree that invades forest gaps and disturbed land. The resin tapped from its trunk is thick and brownish-yellow, with a sweet balsamic odour and a hint of vanilla. Its many uses range from medicinal – as an inhalant and an antiseptic; to culinary – as a food flavouring; and cosmetic – in creating fragrances. Elsewhere, the species is also an important pulpwood crop.

Despite their significance, NTFPs – and perhaps benzoin in particular – are under threat. The expansion of commercial markets and the related boom in export-oriented commodity crops in the uplands, the reduction in land available for shifting cultivation, poor management and overharvesting have had a significant impact on NTFP diversity and abundance. More than 15% of NTFP species are at risk of extinction, while 80% of all NTFP species have shown significant decline (NAFRI, NUoL and SNV, 2007; Ketphanh and Vongkhamho, 2008). The obligate relationship of *S. tonkinensis* with long-fallow systems presents acute obstacles to its future as fallow periods continue to decline. Despite this, many communities have used the benefits of benzoin to enhance returns from long-fallow systems.

Understanding of the agroecological, production and marketing needs of *S. tonkinensis* and its benzoin product is critically limited. Likewise, there is little

knowledge of the ways in which traditional *S. tonkinensis* cultivation intersects with national development and conservation policies and ongoing efforts to secure land tenure in Laos's uplands. Our research, which was carried out in partnership with producing communities, private-sector partners,[1] government agencies and The Agrobiodiversity Initiative of the Lao PDR (TABI), addresses this need. In the sections that follow, we provide some context of the benzoin-production landscape in the Lao PDR and describe key attributes of the benzoin-production system. We also offer a comparative analysis of alternative land uses and explore some ways in which participatory land-use planning has functioned to support both benzoin production and long fallowing, while providing a measure of tenure security for producing communities. We close by drawing out some implications relating to national policies on development and conservation.

Assessment of benzoin production practices and producing communities

The initial stages of the research process involved the collation and review of existing documentation, reports and market information relating to the agroecological dynamics of *S. tonkinensis* and the benzoin value chain, along with relevant policy domains that influence them. Published information was sourced through Internet and library resources, especially from the archival resources of the Lao National Agriculture and Forestry Research Institute (NAFRI), and through extensive canvassing of stakeholders involved in all stages of the benzoin supply chain, from producers to processors, exporting companies and government officials. The results of this review served as a baseline upon which structured field observations, participatory research and data collection were carried out between 2015 and 2018.

Research was conducted in five upland provinces of northeastern Laos, across the known range of benzoin: Xiengkhouang, Houaphan, Luang Prabang, Oudomxay and Phongsaly. In these provinces, the research team conducted extensive field studies and interviews of experts across 17 districts (Figure 34-1), aimed at investigating the distribution of *S. tonkinensis* trees. There was a greater in-depth analysis of key benzoin-producing areas in 11 focal districts (Table 34-1). In total, field interviews involved 128 individuals, including government authorities, and focused particularly on local experts in producing villages.

After completion of the surveys, the team mapped the distribution of *S. tonkinensis* and made an inventory of the current benzoin-production areas with their corresponding yields. Data was cross-analyzed with regard to agroecological conditions, production practices and local knowledge, as well as the effectiveness of community-led land-use planning, using the participatory forest and agricultural land-use planning and management approach. We also conducted a brief comparative analysis of costs and benefits associated with two common livelihood strategies in benzoin-producing areas: the production of rice and maize. Analysis of government programmes and policies was carried out in order to identify key gaps and potential leverage points.

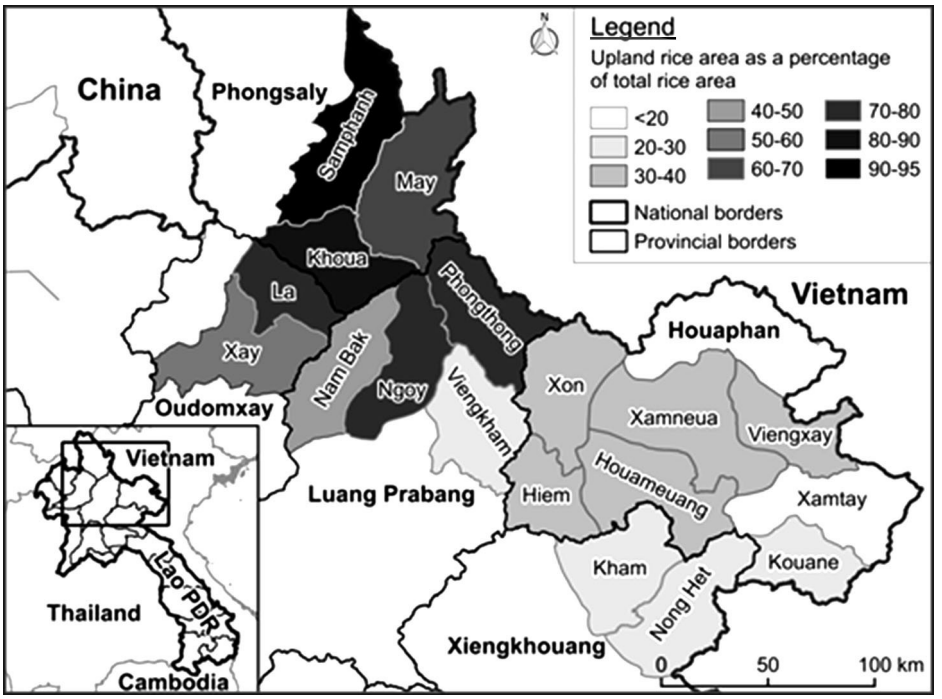


FIGURE 34-1: Benzoin-producing districts and shifting cultivation of rice in Lao PDR.

Data source: Epprecht et al., 2018.

TABLE 34-1: Key benzoin-production areas in Lao PDR.

Province	*District*	*No. of villages*	*Households (hh)*	*Area (ha)*	*Average (ha/hh)*
Houaphan		**69**	**1397**	**2432**	**1.74**
	Houameuang	3	13	9	0.69
	Xamneua	39	794	1541	1.94
	Viengxay	7	150	379	2.53
	Xamtay	11	219	423	1.93
	Kouane	9	221	80	0.36
Luang Prabang		**34**	**730**	**1528**	**2.09**
	Nam Bak	12	285	536	1.88
	Ngoy	15	271	578	2.13
	Phonthong	7	174	414	2.38
Phongsaly		**81**	**1158**	**1347**	**1.16**
	Khoua	41	623	350	0.56
	May	9	167	120	0.72
	Samphanh	31	368	877	2.38
Total		**184 villages**	**3285 hh**	**5307 ha**	**1.62 ha**

Sources: Field surveys, 2015, 2016 and 2018.

The context of benzoin production in Lao PDR

As mentioned earlier, benzoin production has a long history in the uplands of Laos and is rooted in traditional practices and local socioecological systems. In the recent past, exports of benzoin resin amounted to about 50 tons per year, but records were not systematically maintained nor were production areas officially registered. Between 1996 and 1998, the Food and Agriculture Organization of the United Nations (FAO) carried out a survey of benzoin production areas in Luang Prabang, covering about 1200 ha. At that time, there was no information about *S. tonkinensis* production in other provinces. According to the data collected by the FAO, benzoin production was generally on the decline. Key causal factors in this decline were identified as (1) livelihood transitions away from benzoin and shifting cultivation towards maize production, livestock raising, cardamom cultivation and others, and (2) the migration of young people to urban areas, leading to a reduction in the rural workforce. Similar dynamics remain relevant today, but have intensified due to policy measures promoting agricultural intensification and the restriction of shifting cultivation within state forests.

Our benzoin survey results indicate that there are at least 184 producing villages across the three focal provinces of Houaphan, Luang Prabang and Phongsaly, involving 3285 families (or about 19,700 individuals) and 5307 ha currently under production. Average smallholding stands of *S. tonkinensis* cover about 1.62 ha per family (Table 34-1). Of the three provinces, Houaphan has the largest area of benzoin resin production (2432 ha), amounting to 46% of the three-province production area, involving 1397 families in 69 villages, with an average of 1.74 ha/household. Within this province, Xamneua district has the largest concentration. Luang Prabang province has the second-largest area of production, followed by Phongsaly. There are known but unmeasured production areas in Oudomxay and Xiengkhouang provinces. Benzoin-producing communities and households typically have low to very-low harvests of wet rice and are instead primarily dependent on shifting cultivation of upland rice. In benzoin-producing districts, the area of upland-rice production, as a percentage of total rice-production areas, ranges from just below 20% to more than 90% (Figure 34-1). Households engaged in benzoin production tend to be poorer and more remote from urban centres.

Benzoin production has a long historical association with the ethnic Khmu,[2] who cultivate around 90% of all *S. tonkinensis*. For many Khmu communities, benzoin production is an integral element of traditional practices and beliefs that are highly-adapted to remote areas. By providing a product that has a low volume-to-value ratio, a long shelf-life, and a strong market demand, benzoin production is suited to the dynamic, mobile livelihoods of the remote Lao uplands (cf. Scott, 2009). While the Lao ethnic majority comprises only 1% of benzoin-producing households, they are disproportionately involved in processing and exports, thus capturing an outsized portion of the total value of the benzoin trade. For all producing communities and households, benzoin supplements livelihood strategies that are dominated by rice, providing cash income for expenses and a safety-net during periods of shortfall.

Silvicultural techniques for cultivating *Styrax tonkinensis*

S. tonkinensis grows well in acidic soil with a pH level lower than 4.5 and organic matter content higher than 2%. Higher resin yields generally come from areas with higher potassium (K) soil content, and where clay loam soils predominate in the upper soil layers – with good drainage, as the trees are intolerant of waterlogging. While *S. tonkinensis* plantations are found as low as 750 m above sea-level (masl) within the research area, the majority of high-yielding stands occur above 1000 masl.

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 *S. tonkinensis* by planting seeds in freshly cleared swiddens between February and early March. About 15 days after slashing the fallow vegetation and leaving it to dry, farmers who plant supplementary *S. tonkinensis* 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 *S. tonkinensis* seeds. When the rains begin (in late April or 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 *S. tonkinensis* seedlings emerge later.

Over the following year, the farmers cultivate the rice while managing the emerging *S. tonkinensis* seedlings. Depending on the length of the previous fallow, the field is weeded two or three times, first in June and July and then again in September and October. During the first weeding, the *S. tonkinensis* 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. The farmers say 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. The 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 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 the growing *S. tonkinensis* trees through the second cropping year, after which canopy closure precludes rice cultivation. Shade-tolerant species and NTFPs 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 *S. tonkinensis*.

Tapping and harvesting

Benzoin producers generally begin tapping *S. tonkinensis* trees when they are about eight years old, when the bark is thick enough to produce a large volume of high-quality resin while ensuring the longevity of the tree. Producers continue to tap until the tree dies, 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, when the second weeding has been done, 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% 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 (Figure 34-2). 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 (Figure 34-3). 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 (Figure 34-4). 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

FIGURE 34-2: Tappers cut away the bark to reach the xylem, then make a shape to receive the resin.

FIGURE 34-3: Lower tappings are up to one metre from the base of the tree.

Photos: Simone Vongkhamho.

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 (Figure 34-5). 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.

FIGURE 34-4: Tapping the trees at higher levels requires ropes and a pole to stand on.

Photo: Simone Vongkhamho.

FIGURE 34-5: After some months, the dried resin is picked off the trees into baskets.

Photo: Keooudone Souvannakhoummane.

Yield and tree death

According to participants in the study, resin yield per tree varies considerably, depending on the health and age of the tree and the experience and technique of the tapper. Lower yields range around 270 grams/tree to higher-level yields of around 540 g/tree. Younger trees – those between five and seven years old – produce substantially less. In Houaphan, for example, younger trees produced 36% less than trees eight years old and over, and 47% 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 it was observed that 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 shifting cultivation cycle, with most farmers clearing and burning their stands of *S. tonkinensis* at a relatively young age (a point we return to below).

The benzoin value chain: Processing and pricing

Benzoin is commonly sold to agents of exporting companies in producing villages. These agents usually transport the resin to the Laotian capital, Vientiane, for processing, during which around 11.4% 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 benzoin market in Lao PDR is dominated by two companies, which together command nearly 90% of formal trade. As well as the registered companies, there is a large but unregulated trade carried out by independent traders from China and Vietnam, who purchase raw benzoin at village level and export it 'unofficially'. Administrative practices relating to quotas, taxation and exports are highly variable and weakly regulated, creating market uncertainties for producer villages and companies throughout the value chain.

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 then (Figure 34-6). The reasons are numerous. Recent years have seen a reduction in production area as *S. tonkinensis* forests have 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 shifting cultivation in the Lao uplands (see below). However, anecdotal evidence suggests that there has also been a rise in informal trading, chiefly through

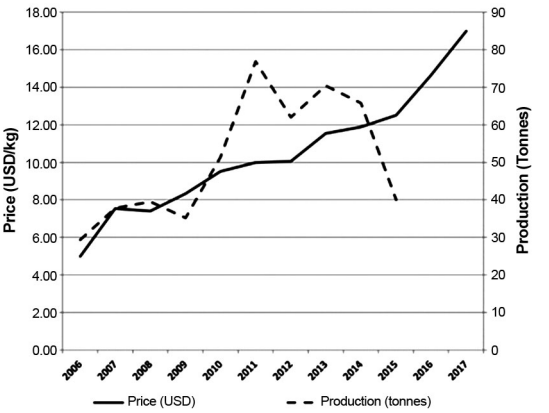


FIGURE 34-6: Benzoin pricing and production in the Lao PDR, 2006-2017.

Source: Field surveys, 2015 and 2016.

Vietnamese and Chinese middlemen, and a growing illicit cross-border trade in benzoin. It is unclear to what degree this informal trade affects production statistics, as these record only formal production and trade.

Benzoin in the short(ening) fallow

As mentioned above, the annual and total yield of benzoin is considerably higher in long-fallow shifting cultivation regimes. Figure 34-7 shows the observed relationship between tree age and bark thickness (the most predictive factors for yield rates) over time, compared with harvesting periods under short- and long-fallow swidden systems. Historically, producers did not tap trees younger than eight years old, due to low rates of yield and higher risks of premature tree death. However, fallow lengths have recently decreased considerably, as has the total area of upland-rice production. This largely accounts for the drop in overall production and per-household benefits from benzoin production, despite rising prices. Many producer communities now tap trees at year five, and continue to tap for only one or two years more before the field is cleared for fresh rice production. Moreover, many farmers tap trees annually, rather than in alternating years, due to the limited time available for tapping under short-fallow regimes. In 2015, for example, 88% of trees that were tapped were younger than 10 years old.

Short-fallow 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 that is largely rooted in lowland Lao cultural values (Baird and Shoemaker, 2007). Policies and state programmes have endeavoured to eradicate or stabilize shifting cultivation through semi-voluntary and involuntary resettlement (primarily before the early 2000s), various shifting cultivation bans, subsidization and promotion of alternatives (such as growing maize, cassava, rubber and other commodity crops produced primarily for export markets) and forest-conservation measures (Fujita and Phanvilay, 2008, Ingalls

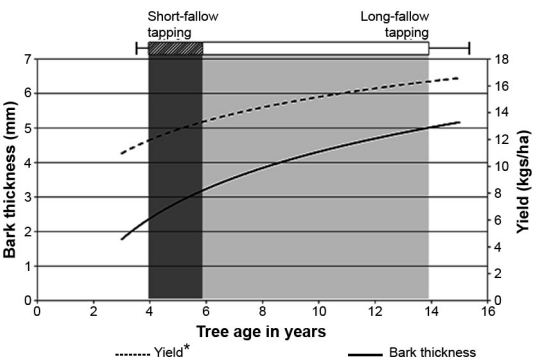
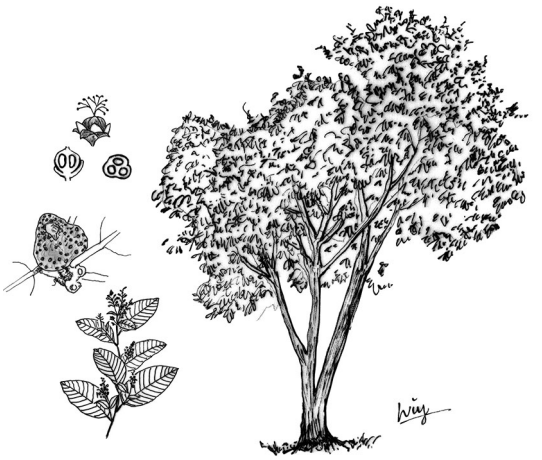


FIGURE 34-7: *S. tonkinensis* bark thickness and yield, over time, in short- and long-fallow systems.

Note: * 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 surveys, 2016.

and Dwyer 2016). These drivers intersect with national policies focused on the concept of 'turning land into capital', a policy direction that seeks to use Laos's large land-resource base to attract (principally foreign) investments, principally (but not solely) through the granting of large-scale land concessions and commercial operations. As of 2017, land concessions covered 1.1 million ha of land (Hett et al., 2019), creating a leading driver of land-use change in the Lao uplands. While population growth in the uplands is commonly blamed for the reduction of land available for shifting cultivation, this is largely untrue. Between 2005 and 2015, the rural population of Laos generally remained stable, at around 4 million people. The agricultural censuses of 1999 and 2011 – the only systematic sources of data specifically on the shifting cultivator population – indicate that the number of households involved in these rice-production systems actually declined, from around 260,000 households to 240,000.



Croton cascarilloides Raeusch. [Euphorbiaceae]

A shrub growing up to two metres, this species is called *pao ngern* in the benzoin-producing forests, and is harvested in the wild for its medicinal properties. The bark and roots are antipyretic, and are used to prevent or reduce fever. It flowers and bears fruit all year round.

Assessing the alternatives: A comparative analysis

Land-sparing approaches to development and conservation in Laos have focused not only on restricting access to forest areas and reducing shifting cultivation, but also on the promotion of alternatives. To assess the implications of these alternatives we carried out a limited comparative analysis between the production of benzoin with shifting cultivation of rice and the production of maize, a common alternative. Systematic assessment was carried out with participating farmers within the research area to quantify and compare the costs and benefits associated with these alternatives. An analysis then focused on returns per labour and per hectare, 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 comparisons. Yield rates under each scenario were averaged across production years for simplification (Table 34-2).

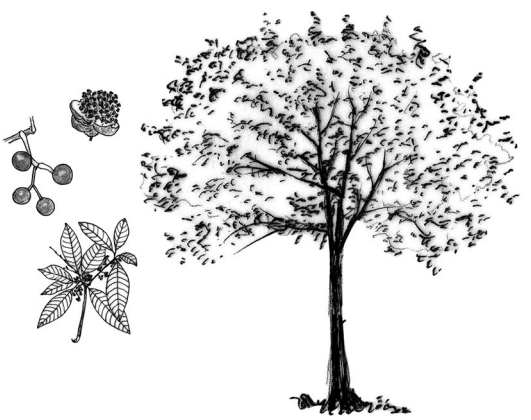
TABLE 34-2: Comparison of cost benefits between benzoin resin and shifting cultivation of rice and maize.

Product	*Labour costs (Person days/ ha)*	*Yield (kg/ha)*	*Unit value (US$/kg)*	*Input costs (US$/ha)*	*Benefit (land) (US$/ha)*	*Benefit (labour) (US$/person/ day)*
Benzoin resin	35	41.8	18	6.96	745	21
Upland rice	271	2090	0.36	19.92	732	3
Maize	113	4200	0.144	59.16	546	5

Sources: Field surveys, 2016.

Labour requirements for benzoin, rice and maize vary considerably. Benzoin tapping has 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, a high price-per-volume ratio means that benzoin compares favourably with maize and rice, particularly with regard to returns per unit of labour, where return differential is four- and seven-times higher, respectively. Returns per unit of land are also enhanced under traditional co-production of rice and benzoin. Maize is not suitable for intercropping with benzoin due to the shade-intolerance of *S. tonkinensis* during its 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 species and NTFPs. In the Lao uplands, numerous vegetables and other products are grown within cultivated fields and fallows, including *S. tonkinensis* fallows, contributing 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 species are far higher in fallows. An assessment of the contribution of NTFPs to household income across 225 villages in Laos's northern



Litsea glutinosa (Lour.) C.B.Rob. [Lauraceae]

Called *mee tho* in northern Laos, this evergreen tree has multiple uses. The fruit has a sweet creamy edible pulp; the roots, bark and leaves are used medicinally to reduce fever or swelling and to treat diarrhoea; the timber can be used to make furniture; and the roots yield a fibre that is used to make rope.

uplands under the TABI project indicated that 48% of the value of NTFPs was derived from shifting cultivation fields and fallows, versus only 10% from mature forests. In the surveyed villages, NTFPs contributed as much as 33% 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 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 drawn. The known impacts of pesticide application and intensive fertilizer regimes are well-documented, particularly within the context of the Lao PDR, where poor regulation of such inputs and inadequate management have been shown to present substantial and far-reaching risks to local communities and natural ecosystems. These, together with the typically low biodiversity of monocultural plantations of non-native species like maize, suggest that *S. tonkinensis* cultivation – which employs local knowledge and a long-fallow system in which chemical inputs are not typical – compares favourably beyond economic returns alone.

Benzoin at the fallow-forest interface

Upland shifting cultivation systems are a poor fit within current policies 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 the latter 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 the multifunctional uplands of Lao PDR. This places benzoin production in a precarious position vis-à-vis the directions of national development and conservation. 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. The official definition of forest in Lao PDR – the areas to which forest-protection measures ostensibly apply - includes areas larger than half a hectare, wherein canopy closure is 20% or greater, tree height is 5 m or more and tree diameter at breast height (dbh) is 10 cm or more. As stated above, the success of benzoin production depends on fallow length, relating to tree maturation and thus yields. Ideally, *S. tonkinensis* trees are not tapped until they reach eight years old. By age 15, resin production declines while rates of tree death increase rapidly, requiring clearance and burning to begin the swiddening cycle anew. However, even by the fifth year of growth, *S. tonkinensis* stands may already have reached the thresholds of the forest definition

(Figure 34-8). The clearance and burning of *S. tonkinensis* stands, which is necessary to ensure continued production, is in conflict with forest-protection legislation and is thus forbidden, particularly under recently-enhanced regulatory approaches to conservation.

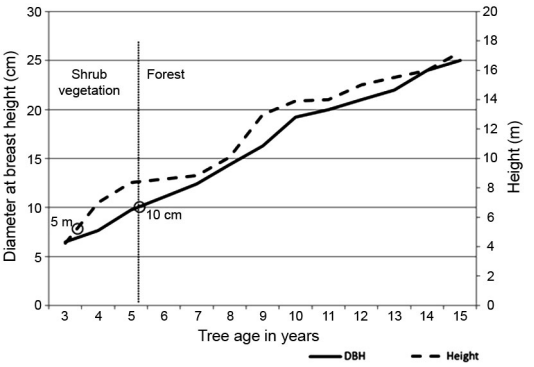


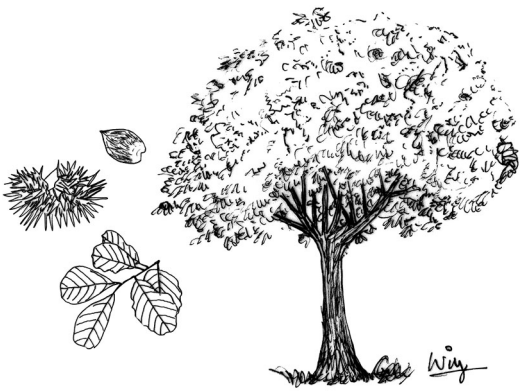
FIGURE 34-8: *S. tonkinensis* growth rates and land-cover classifications.

Source: Field data, 2016.

In practice, the enforcement of forest-conservation laws as they apply to shifting cultivation and *S. tonkinensis* cultivation has been mixed. Lack of clarity with regard to legal provisions, contradictory policies and the local political consequences of implementation have often chilled enthusiasm for strict enforcement. Until now, this has resulted in the tenuous persistence of shifting cultivation, albeit under increasingly restrictive conditions. Nevertheless, this study identified forest-conservation policies as a leading reason for the reduction in fallow periods and the abandonment of *S. tonkinensis* cultivation, consistent with a trend that is widely acknowledged across the country (Fujita and Phanvilay, 2008; Schmidt-Vogt et al., 2009).

Despite the historic ambiguity that has allowed the persistence of 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 *Resolution on the Enhancement of Land Management and Development in New Period* (2017) reiterated the Government's long-standing goal of achieving 70% forest cover by 2020. Despite current forest cover being only about 63.5% (DoF, 2018), the 70% goal is also a precondition for Laos's bid to graduate from Least Developed Country status by that same year. Without a radical redefinition of what constitutes forest, it can be argued that this is impossible to achieve while shifting cultivation continues to occupy such a dominant role in the Lao uplands. The eradication of shifting cultivation and the succession of fallows to forest is widely viewed as the 'low-hanging fruit' for the achievement of national forest-cover goals (Dwyer and Ingalls, 2015; cf. DoF, 2018). High-level endorsements (such as the Politburo resolution) have galvanized those forest-conservation advocates who are opposed to shifting cultivation. This is reflected in recent revisions of the Forestry Law and the National Land-use Master Plan, each of which envision the near-term replacement of shifting cultivation with intensive 'sedentary' alternatives.

There may be another way to achieve these national-development and forest-conservation goals, one that builds on (rather than undermines) indigenous



Castanopsis hystrix Hook. f. & Thomson ex A. DC. [Fagaceae]

This evergreen broadleaf tree grows to 30 metres and is commonly found in the forests of northern Laos. The seeds are edible either raw or cooked. Such is the value of its hard wood that southern China has plantations of *C. hystrix* covering about 5000 hectares. The timber is used for both construction and making furniture.

livelihood systems rooted in Laos's multifunctional landscapes and agroecological diversity. *S. tonkinensis* cultivation in long-fallow systems is representative of such an alternative option. Benzoin production within long-fallow shifting cultivation has all the hallmarks of the plantation-forestry alternatives proposed by forest-conservation advocates. Like rubber (*Hevea brasiliensis*), which is regularly touted as an alternative for upland systems, *S. tonkinensis* is a fast-growing species that rapidly matures to forest, produces a high-value resin with a strong global market demand and has a low labour-to-area ratio suited to the low labour density of the Lao uplands. Old *S. tonkinensis* trees whose resin-yields have declined have also shown some promise as sources of pulp and plywood in Vietnam (Fischer et al., 2007). This is similar to pulpwood species such as eucalypts (*Eucalyptus* spp.) and acacia (*Acacia mangium*), both of which are other proposed alternatives for reforesting the Lao uplands.[3] However, unlike rubber and eucalyptus, *S. tonkinensis* has three distinct advantages: (1) it is suited to intercropping with rice and other species; (2) it has deep biocultural associations with upland communities and uses 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 multifunctional upland landscapes.

While policies to protect and promote *S. tonkinensis* and other endemic fallow species and the shifting cultivation landscape more generally are a necessary precondition to realizing their potential for livelihood and ecosystems benefits, such policies alone would not be enough. There must also be adequate recognition of customary use and tenure over these resources. As we have said, tenure security within the uplands of Lao PDR is weak, particularly for communally-managed shifting cultivation fallows. In recent years, innovative approaches such as participatory forest and agricultural land-use planning and management 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. By using participatory forest and agricultural land-use planning and management, 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. At the time of writing, participatory planning for collective rotational shifting cultivation within existing fallows has been used by more than 200 communities to increase both fallow lengths and forest cover under village management (Dwyer et al., 2018). At the same time, this has generated a measure of formal recognition of customary claims over land and forest resources.

While 'win-win' is certainly a fraught term, we cautiously suggest that cultivation of *S. tonkinensis* within long-fallow shifting cultivation systems, made possible by community-led land-use planning, may be just that: local innovations that enable both enhanced forest cover during the long period of mature tree management and tapping, and the creation of 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 environmentally grounded in land-sharing (rather than land-sparing) paradigms in multifunctional landscape systems, within which long-term tenure security was ensured. At present, despite the partial security afforded by land-use plans, stands of *S. tonkinensis* in shifting cultivation fallows remain largely insecure in terms of local tenure claims because they 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 protection, *S. tonkinensis* continues to be seen as part and parcel of the shifting cultivation system demonized by many forest-conservation advocates, particularly since *S. tonkinensis* stands are cleared and burned, a practice with all the trappings of 'slash-and-burn' farming.

Formal recognition of both customary tenure and culturally embedded management regimes is essential if a sustainable future for Laos's multifunctional upland landscapes is to be ensured. This is currently lacking. While formal collective land titling has been piloted in Laos on a limited basis, 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.

Conclusions

The sustainability of the Lao uplands depends on policy directions that remain contested and uncertain; policies that will ultimately decide the fate of upland communities, their multifunctional landscapes and the complex interplay between social and ecological dynamics that have shaped their character. While contemporary discourses have framed these choices as zero-sum, there are legitimate alternatives. It remains possible to employ robust systems of local knowledge, innovation and

agroecological diversity to achieve key national goals for both rural improvement and environmental sustainability. Our research suggests that benzoin production in long-fallow shifting cultivation systems in the Lao uplands is a preferred alternative to either a transition toward sedentary commercial cultivation of commodity crops, on one hand, or strict forest protection on the other. But a better enabling environment is needed, one that values these systems and provides tenure security for upland communities. As we have said, Laos is at a crossroads. The fate of multifunctional upland landscapes hangs in the balance and, with them, the future of benzoin production and the broader agroecological systems of which it is a part.

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Notes

1. Especially the Agroforex Company of Vientiane.
2. This name of this ethnic group is variously transliterated as Khmu, Kh'hmu, or Khamu.
3. The definition of forest in the Lao PDR, consistent with that of the Food and Agriculture Organization of the United Nations, includes monocultural plantations of non-native species as 'forest', despite the obvious and substantial differences with regard to ecological functions.