Ecological Succession of Usable Plants in an Eleven-Year Fallow Cycle in Northern Lao P.D.R.

Claudio O. Delang

Research

Abstract

In all tropical countries shifting cultivators (swiddeners, slash-and-burn farmers) are being encouraged – or forced – to stop swiddening. However, shifting cultivators obtain from the forest most of the plants that they need to survive. Once shifting cultivation has been curtailed, fallow areas gradually age, and there is an ecological transformation in the forests that surround the villages of the swiddeners. The impact of this ecological transformation on the availability of usable plants is not well understood, as there is little research on the habitats of origin of the plants that shifting cultivators gather from fallow areas. This article presents the results of a survey of the plant taxa used in a Kammu village in northern Lao P.D.R, and found in an 11-year long fallow cycle. The Kammu identified a total of 141 usable plant taxa. The Kammu and Lao names were recorded along with their use, the part of the plant used, and the age of the fallow(s) in which they were found. The results indicate that very few plants are available throughout the entire 11-year fallow cycle, and that the Kammu would experience considerable losses in resource diversity if shifting cultivation was outlawed or the fallow period shortened.

Introduction

Shifting cultivation (swiddening, slash-and-burn farming) is still a predominant form of subsistence agriculture in many tropical countries. Perhaps the most important factor that contributes to its popularity is the low fertility of the soil in tropical countries, which forces farmers to abandon the fields after only a few years of cultivation, or face a drop in the harvest. In the Mekong subregion topography and low population pressures also contribute to the prevalence of shifting cultivation. The topography makes transport difficult, and forces shifting cultivators to live in relative isolation, while a low population pressure is a precondition for shifting cultivation to be possible, since it is a very land-intensive form of farming.

Shifting cultivation involves clearing the forest towards the end of the dry season, burning the vegetation when it has dried sufficiently, farming the land for one or a few years, and letting the vegetation regrow. The ashes fertilise the soil and there is no need to apply additional fertilizers, while the fire burns some of the weeds, and less weeding is necessary. While these characteristics are common for all shifting cultivators, there are some important differences as well. A useful distinction has been made by Grandstaff (1980), who distinguished between “primary forest” or “pioneer” and “secondary forest” or “sedentarised” shifting cultivation. If one uses that classification, the differences are found in the choice of the forest that is farmed, and through the choice of the forest, differences also trickle down to the diversity and quantity of the forest products available to the swiddeners.

As the name implies, primary forest swiddeners clear and burn primary forests. When the forest is burned, the largest stems do not burn completely. They are left in the

Correspondence

Claudio O. Delang, Department of Geography and Resource Management, The Chinese University of Hong Kong, Shatin, NT, Hong Kong, P.R. CHINA.
cdelang@cuhk.edu.hk

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fields to decompose, and the remains are burned in the subsequent years. In this way, some fertility is returned to the soil, and the land can be farmed for longer, up to four or more years, in the case of rice. In many parts of S.E. Asia, once the land has been farmed for four consecutive years, it has lost most of its fertility, *Imperata cylindrica* (L.) Raeusch. takes over, and the land is abandoned with no thought of future re-use. Often the swiddeners moves on, perhaps migrating over large distances to find new forestland to clear and farm. This is the case, for example of the Hmong in Thailand up to the late 1970s or early 1980s (Cooper 1984, Keen 1983). On the other hand, secondary forest shifting cultivators cut and burn secondary forests. Because the stems are smaller, all the vegetation is burned at once. Some groups, like the Karen and Lua' in Thailand, cut the trees above the lowest buds to help quicken the regeneration of the trees (Kunstadter 1978). Others, such as the Kammu in Lao P.D.R, cut all the vegetation. The land is usually farmed for only one year, after which the swiddeners abandon the land, and cut and burn another piece of forest, as close as possible to the village to limit the time needed to travel from and to the field. The forest regrows on the farmland that has been abandoned, and once the forest is sufficiently lush, it is cleared and burned again. In this way, the farmland and forestland form a natural cycle of use and regeneration. This requires no artificial inputs, and is sustainable as long as population pressures remain low enough to allow for a sufficiently long fallow period for the forest to regenerate.

Different ethnic groups leave the fields fallow for different lengths of time The Karen in Thailand maintain that 6 years is the minimum number of years necessary to avoid a drop in the rice harvest (pers. comm.), while the Iban in Sarawak prefer 20 to 30 year long fallows (Lee 1970). While the length of the fallow period changes, sedentarised shifting cultivators – unlike pioneer shifting cultivators – have in common that they live in villages that are surrounded by forest areas of different age: fields that were previously farmed and are now at different stages in the fallow cycle (Fig. 1). From these fields, shifting cultivators gather different products – wild food plants for themselves and their livestock, firewood, medicinal plants, dyeing materials, poisons for fish and other wildlife, mushrooms, herbs, honey, game, insects, handicraft materials and timber for construction. For many communities of

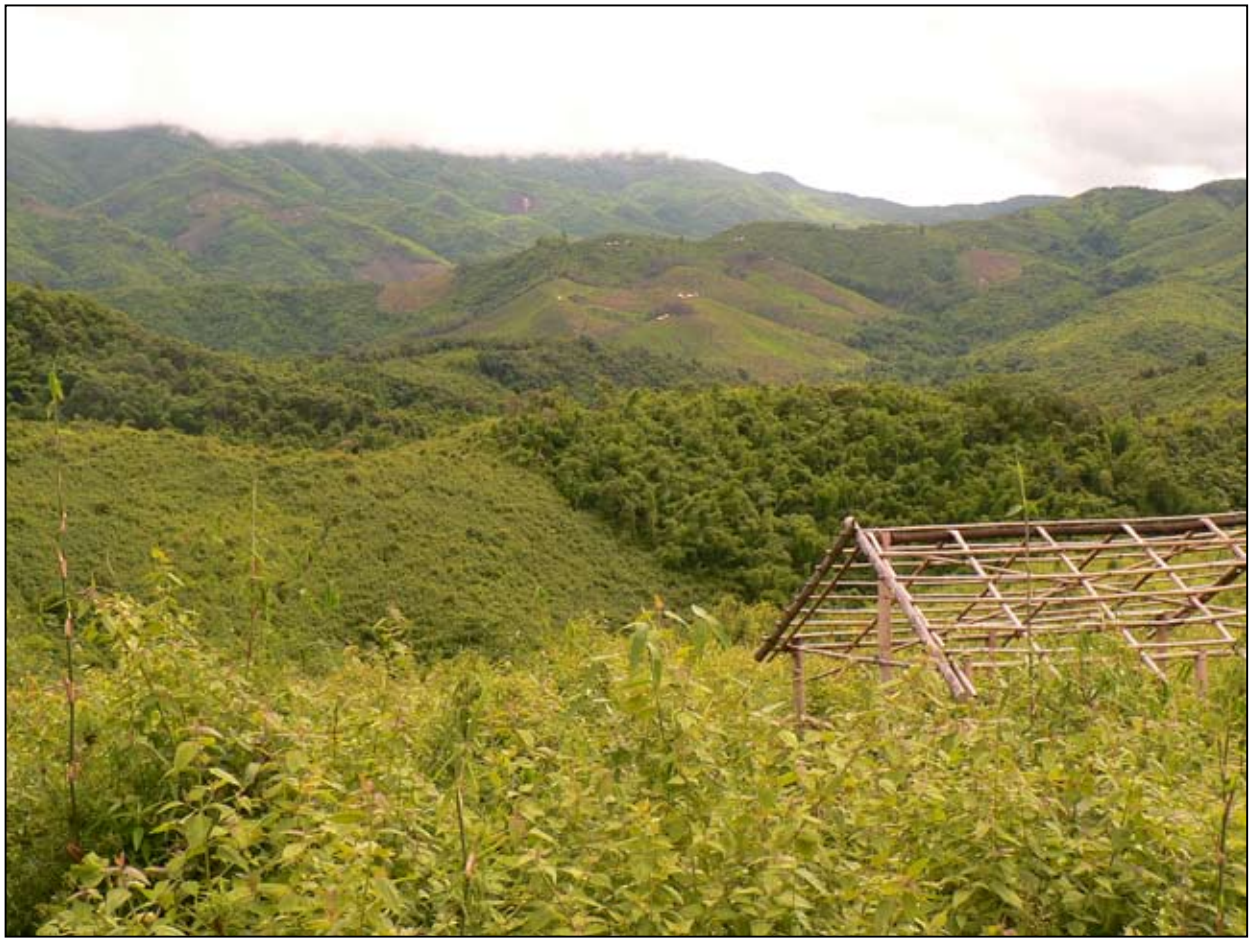

Figure 1. Rice fields and fallows in the mountains surrounding Mo Ka Khan, Bo Kaeo, Lao P.D.R.

shifting cultivators, these forest products are the bulk of their total consumption, and play an essential role in their livelihood. This is for two reasons in particular.

First, as mentioned above, shifting cultivation is a land intensive form of agriculture, and therefore villages of shifting cultivators are often rather isolated. For this reason, the trip to market towns is time consuming, and people are not able to go daily. Also, their cash incomes are rather limited, because they have few marketable goods (be it forest products or cash crops). Profit from the sale of these marketable products is further limited by the high transport costs to the market. Traders are also unlikely to come to the village to sell consumer goods, because of the isolation and small size of the villages, and lack of cash of their inhabitants.

Second it is often more efficient to gather products in the forest rather than to work for cash and buy "similar" substitutes in the market. Elsewhere, I have estimated that Pwo Karen families living in the Thung Yai Naresuan Wildlife Sanctuary (Thailand) spend approximately 117 hours (i.e. 15 days if one worked 8 hours a day) a year to gather wild food plants. If they bought "similar" food products in the market, they would have to pay 11,505 Baht, which they would need 144 days to earn, considering the local wage rate of 80 Baht for an 8-hour workday (Delang 2006a). Thus, for the Pwo Karen, gathering wild food plants is a much more efficient way to make a living than working for cash on somebody else's fields and buying similar products in the market. The same is likely to be true for many other forest products – and many other shifting cultivators.

In spite of the importance of forest products to the livelihood of shifting cultivators, their role has rarely been addressed. This is an important drawback because shifting cultivation is coming under attack from many different organizations. Governments, non-government organization (NGOs), academics, the popular press and the general population usually consider shifting cultivation – even sedentarised secondary forest swiddening – an inefficient use of forestland, that is only able to sustain a limited population at the expense of important forest resources (Delang 2002, 2006b). This is often due to a misconception of what shifting cultivation is. At least in the popular press, a distinction is only rarely made between shifting cultivation and the fires that are ravaging forested areas in tropical countries, which are not started by shifting cultivators, but by sedentarised farmers trying to clear – and perhaps claim – additional forestland. A consequence of this misconception is that in most tropical countries, governments and NGOs alike try to curtail shifting cultivation, by limiting the number of years the fields can be left fallow, or relocating the villages to areas where they are supposed to engage in sedentarised farming (Baird & Shoemaker 2005).

Shortening the fallow period has two consequences in particular. First, there is a drop in the rice harvest. This has already been studied quite extensively, and the process is fairly well understood, although many uncertainties remain (Mertz 2002). The second consequence of shortening the fallow period is that some of the forest habitats disappear. A village with a 15-year long fallow period is surrounded by patches of forest between one- and 15-years old, while a village with a 3-year long fallow period is only surrounded by patches of forest that are only one-, two- and three-years old. Several authors (for example El-Sheikh 2005, Kupfer *et al*. 2004, Schmidt-Vogt 1997) have described the ecological succession that takes place as the forest ages, and species die or emerge as the shade, temperature and humidity change. It is to be expected that this ecological succession also affects the plants that are used by the shifting cultivators, and that fewer species will be available, as those that only grow in 4-year to 15-year old fallows disappear. Furthermore, as the fallow period is shortened to 3 years, the fertility of the soil gradually decreases and fewer species grow in the fallow areas.

While people are able to substitute one plant for another – and they do during the dry season, when fewer plants are available (Delang 2006c) – they can only do that if there are substitutes that can be used. In very short fallows very few substitutes are available, and swiddeners have to turn to expensive marketed products. Unfortunately, little research has been done to estimate the losses in terms of forest products available to the people as the fallow period is shortened, or even to identify the habitats of origin – in particular the age of the fallows – of the forest products that people gather. One notable exception is the study of Dalle and de Blois (2006), who looked at the effect of shortening the fallow period on non-crop plant resources by comparing 26 fields that were 1.5 years old but differed in the length and frequency of past fallow cycles.

This paper addresses the issue of the loss of forest products that follows the curtailment of shifting cultivation by looking at the habitat of origin of the forest products used in one Kammu (also spelled Kmhmu' or Khamu) village in Northern Laos – Mo Ka Khan, in Pha Oudom district, Bo Kaeo province – with an 11-year long fallow cycle. It does so by surveying the availability of the usable products found in fallows of different age. It is hoped that this paper will shed light on the importance of the forest to the livelihood of the Kammu, and will help appraise the losses that the people would face were they no longer allowed to continue swiddening.

The Kammu in Lao P.D.R.

Lao P.D.R. has a total population of approximately 6 million people. With about 500,000 people, the Kammu are the largest minority group in Lao P.D.R. and the second ethnic group after the ethnic Lao themselves, who number approximately four million. The Kammu inhabit mainly

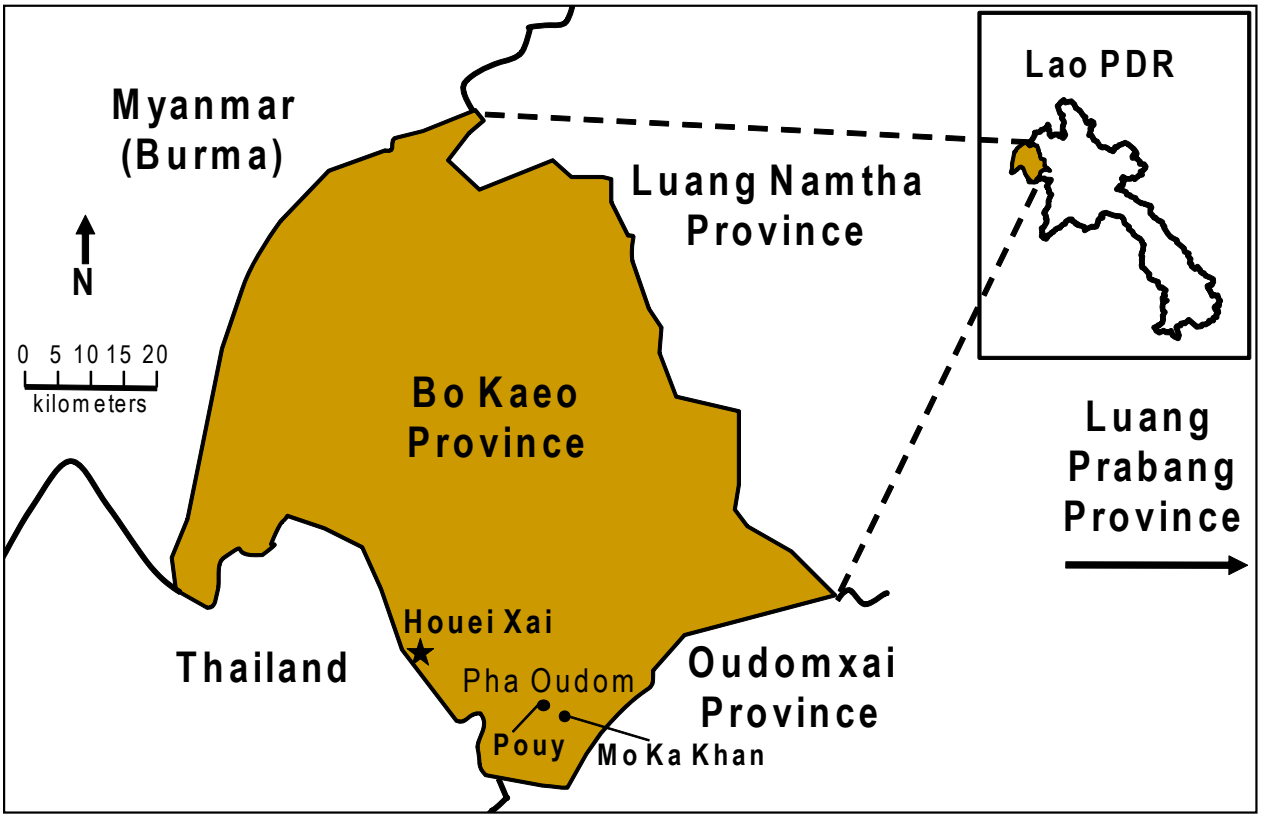

Figure 2. Field work area in Pha Oudom District, Bo Kaeo Province, Lao P.D.R.

the northern provinces of Bo Kaeo, Luang Prabang and Luang Namtha (Simana 2003, see Fig. 2). The Kammu, unlike the Lao Loum (Lowland Laotians) live in the middle altitudes, where they traditionally practice shifting cultivation. Elders maintain that in the past they regularly moved their village to live closer to the fields. However, this practice is no longer followed, also because the government has regulated land use in the highlands, forcing the villages to settle in one particular location (sometimes chosen by the government), demarcating the land available to each village, and forcing them to set aside some forestland for conservation.

The district of Pha Oudom is divided into two distinct areas, a highland area, at about 800 m above sea level (ASL), and a lowland area, at about 400 m ASL (Fig. 3). Mo Ka Khan, a medium-sized village of about 35 households and 250 people, is one of the villages in the highland area, and has been sited at the present location by the government about 15 years ago. The highland villages, including Mo Ka Khan, are still able to have a fallow period of about 11 years, after farming the land for one year. On the other hand, most lowland villages have a fallow period of only 3 years, if they are able to have one at all.

Mo Ka Khan is more than two hours walk from the district capital, where the nearest market is located. In May 2007, the German Agency for Technical Cooperation (GTZ) completed a road from Pouy (in the lowland area of Pha Oudom district) to Oudomxai (Fig. 4). Mo Ka Khan is along that road, and one could theoretically travel from Mo Ka Khan to the district capital by car or motorcycle. Unfortunately during the time of the fieldwork (June-August 2007) nobody in Mo Ka Khan owned a motorcycle or car.

Local sources of cash include the sale of the surplus of glutinous rice, which villagers transport on their backs to the district capital. During the dry season, many households also sell a few forest products in the district capital – since few traders comes to the village. These include: ລ້ຽຕຣາ (broom grass) [*Thysanolaena maxima* (Roxb.) Kuntze.] ຫູດຫຼ້ຽ [*Boehmeria malabarica* Wedd.], ປ໋ສາ (papermulberry) [*Broussonetia papyrifera* (L.) L'Hér. ex Vent.], ໝາກແໜ່ງ (cardamom) [*Amomum xanthioides* Wall. ex Baker] and bamboo worms. Two households in the village have opened small shops, but only sell a few goods, such as eggs, monosodium glutamate (MSG), noodle soups, cigarettes, and sweets for children. One Chinese trader comes to the village once a week or so, but mostly exchanges hair (for wigs) with balloons or hair clips (Fig. 5). Thus, very few goods can be bought in the village. Many villagers go regularly – once a month or so – to the market in the district capital to buy goods they can't find locally, such as spices, clothes, mosquito nets, or cooking uten-

Figure 3. View from the highlands to the lowlands in Pha Oudom District, Bo Kaeo Province, Lao P.D.R.

Figure 4. The road from Pha Oudom District capital, Bo Kaeo Province, to Oudomxai Province, Lao P.D.R.

Figure 5. Chinese trader, exchanging Kammu hair for balloons, hairpins, mirrors and similar items in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

sils. However, by far most of the goods that people need come from the forests that surround their villages. While people would easily be able to live without the few goods they can buy in the local shops – or those purchased in the district capital – nobody would be able to survive without the forest products.

Methods

This article looks at the amount of usable plants found in fallows of different age surrounding the village of Mo Ka Khan. Fallow areas of one, three, five, seven, nine and 11 years, together with the conservation forest, which was said to be about 20 years old, were selected by the villagers, according to accessibility and distance from the village. Five elders from the village (Fig. 6), familiar with the local plants and their uses, were hired to help identifying the different plants, their use, and the part of the plant consumed.

A square of 35x35 meters (1,225m²) was demarcated in the middle of each field with a cord (Fig. 7, Fig. 8). The square was divided into 17 tracts 35 meters long and approximately two meters wide. All 2x35 meters tracts were surveyed by one elder each. The names of the plants were called out and recorded on a table. Together with the data on the presence of plants, we also recorded data on the number of times each taxa was found, and the circumference of each plant at chest height (Fig. 9). However, these information are incomplete, and are not presented here. Once back in the village, information were gathered as to the uses of each plant taxon and the plant parts used. The survey in the forest took approximately one day for each fallow area. Only one fallow of each age was surveyed.

The location of the fields was identified with the help of a hand-held GPS. Only one point in the middle of each 1,225m² area that was surveyed was recorded. Table 1 shows the location and altitude of the village of Mo Ka Khan and the center of the fields that were surveyed. Figure 10 shows the same information graphically, to give an idea of the distance between the village and each field.

Figure 6. The team of Kammu elders during a break in a young fallow in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Figure 7. The team of Kammu elders demarcating a young fallow with a red rope in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Figure 8. A Kammu elder demarcating the boundaries of a fallow in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Figure 9. A Kammu elder measuring the circumference of a tree at chest height in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Table 1. Locations of Mo Ka Khan village and fallow fields in Pha Oudom District, Bo Kaeo Province, Lao P.D.R.

Village and age of the fallow (years)	Field Location Coordinates	Elevation (m ASL)
Mo Ka Khan	N 20°04'31.3" E 100°55'28.3"	760
1	N 20°05'01.4" E 100°55'12.8"	709
3	N 20°04'01.2" E100°56'01.1"	847
5	N 20°04'04.0" E 100°56'22.6"	738
7	N 20°03'51.8" E 100°55'50.3"	793
9	N 20°03'38.2" E 100°55'51.8"	732
11	N 20°04'20.5" E 100°55'12.0"	764
20	N 20°04'23.0" E 100°55'56.8"	784

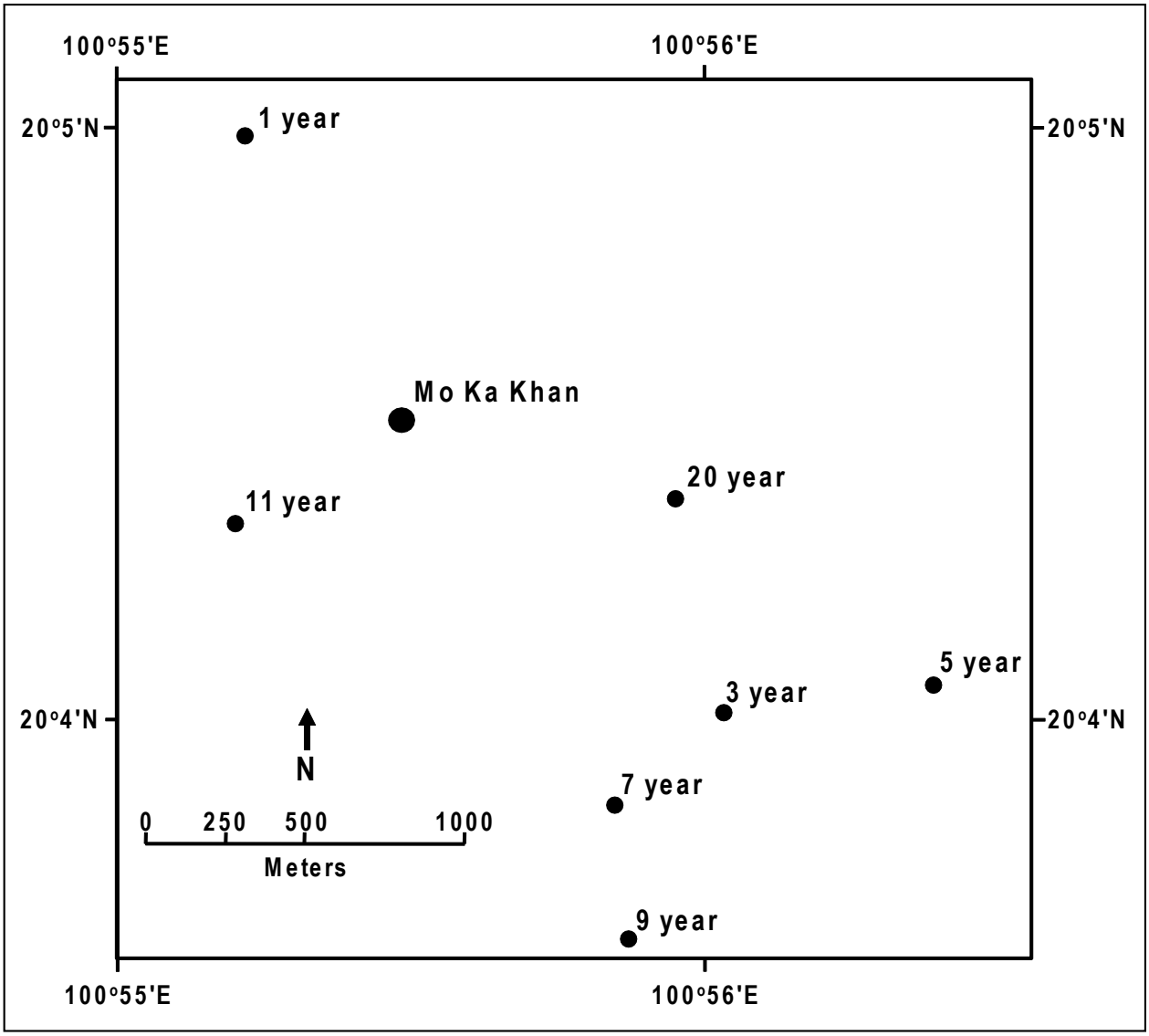

Figure 10. Mo Ka Khan village in Pha Oudom, Bo Kaeo Province, Lao P.D.R. and distribution of surrounding study site fields of varying fallow ages (noted in years).

Results

Table 2 shows the results of the survey. The first two columns list the local Lao and Kammu names of all the usable plants identified in the fallow areas and the 20-year old forest. These were given by the Kammu elders who identified the plants in the field. It should be noted that the Kammu names may change in different areas in Northern Lao P.D.R, even in the same province of Bo Kaeo. An effort was made to avoid duplications in the vernacular nomenclature. The third column shows scientific names. The scientific names were obtained by looking up the Lao names in Callaghan (2004), Lehmann *et al*. (2003), and NAFRI, NUoL & SNV (2007). Not all plants were identified. Specimens were not collected, and it is very likely that the list of scientific names includes a number of mistakes. The list is included here only as a first hypothesis of the scientific equivalent. Validation will require further research and herbarium voucher specimens of plants identified by expert Kammu informants. The fourth and fifth columns list the use of the plant and the part of the plant used, respectively, as reported by the Kammu elders who helped in the fieldwork. The remaining columns show the presence or absence of the plant in each fallow area.

Discussion

Table 2 and the tables that follow show the presence or absence of plants, rather than the frequency of consumption or whether the Kammu consume the plants from that particular fallow area. For example, construction materials might be present in the 1- and 3-year old fallows, but only from year 9 or so would the plant have grown sufficiently to be used for construction purposes. Also, firewood would not be harvested before year 5 or so, even though the plant might be found in a 1-year old fallow area.

The plants in Table 2 are listed in order of their presence or absence during a particular fallow period. The plants that are found in the fallow areas every year are listed first, followed by the plants that might disappear with a longer fallow period, and so on. The presence and absence of the plants in each fallow is obviously incomplete. For example, ກອຍປຣ [*Fagraea fragrans* Roxb.] was found in the 1-, 3-, 9-, and 11-year-old fallow areas and the 20-year-old forest, but not in the 5- and 7-year-old fallow areas, while it would obviously also be there. Therefore, definitive conclusions are difficult to draw. (This is a limitation of having been able to only survey one relatively small (35x35 m) area in each fallow, and only one fallow of each age. A survey of a statistically significant number of fallows of each age would likely have removed this problem.)

In spite of the difficulties and uncertainties, we can draw some tentative conclusions, which seem to indicate that there is indeed an ecological succession in the plants used by the Kammu. Of the 141 taxa identified, only 14 were found throughout the whole 11-year long fallow cycle. Most taxa were only found in one particular area (taxa found only in the 1-year old fallow area = 15, in the 3-year old fallow = 5, in the 5-year old fallow = 8, in the 7-year old fallow = 9, in the 9-year old fallow = 20, in the 11-year old fallow = 28, and in the 20-year old forest = 15). A few taxa were only found in the young fallows: two taxa were found only in the 1- and 3-year old fallows, whereas another two taxa were found only in the 1-, 3-, and 5-year old fallows. On the other hand, a small number of plants were only found in older fallows: four plant taxa were found in the fallows that were 3-year old or older, six taxa in the 5-year old or older fallows, three taxa in the 7-year old or older fallows, seven taxa in the fallows that were 9-year old or older, and two taxa in the 11-year old or older fallows.

Table 2. Usable plant taxa in Kammu swidden cycle (11 years of fallow). Lao and Kammu names were obtained through direct interviews with native Kammu speakers. However, scientific names were only obtained by looking up the Lao names in Callaghan (2004), Lehmann *et al*. (2003), and NAFRI, NUoL, and SNV (2007). Specimens were not collected and therefore, although the Lao and Kammu names provided below are useful, the scientific names are to be considered as highly suspect and lacking scientific evidence (voucher specimens).

Lao Name	Kammu Name	[Scientific Name] See caution in description*	Use	Part Used	Year after Cutting						
					1	3	5	7	9	11	20
Plant taxa found on fallows of every age											
ມັ່ປ່ຳ	ກອຍປຣ	[*Fagraea fragrans* Roxb.]	Animal feed/Food	Leaf/Root	x	x			x	x	x
ຄອມ	ກ້ຳລະ	[*Ziziphus cambodiana* Pierre]	Animal feed	Fruit	x	x				x	x
ເປົ້ຳ		[*Croton joufra* Roxb., *C. laevigatus* Vahl]	Firewood/ Medicine	Stem/ Leaf	x	x	x	x		x	
ໄມ້ຢ່ຳ	ຕູດສຸກ	[*Bambusa tulda* Roxb.]	Construction/ Food	Stem/ Shoot	x		x			x	
ກ້ຳໆຢູ	ເຕ໊ເລ	[*Dendrobium* sp.]	Food	Leaf/Fruit	x			x	x	x	x

Lao Name	Kammu Name	[Scientific Name] See caution in description*	Use	Part Used	Year after Cutting						
					1	3	5	7	9	11	20
ไม้ซางๆ	ตูดละหางๆ	[*Dendrocalamus membranaceus* Munro., *D. strictus* (Roxb.) Nees]	Construction/ Food	Stem/ Shoot	x		x			x	x
หวาย	ปองจ้ง	[Rattan species]	Handicraft/ Food	Stem/ Shoot	x		x				x
เบอ้า	ป่องเปาะ	[*Melastoma sanguineum* Sims]	Hang on door of newly built house	Leaf	x			x	x		
แขม	ล้งตธา	[*Thysanolaena maxima* (Roxb.) Kuntze.]	Market	Flower	x	x		x	x		
แก้มอี้	ปอมตู	[*Diospyros* sp.]	Medicine	Bark	x			x			x
เธือหิ้ง	ตะโลกอง	[*Crassocephalum crepidioides* (Benth.) S. Moore]	Food	Leaf	x				x		
เหมี้า	เตาะตำล้ง	[*Antidesma bunius* (L.) Spreng.]	Food	Leaf/Fruit	x					x	
ตองหิ้ง	ตูดตุก	[*Macaranga* sp.]	Medicine	Root	x					x	
หมากและ	จะและ	[Papilionoidea]	Medicine/ Animal feed	Root/ For animals: Leaf/Fruit	x				x	x	x
Plant taxa that might disappear with longer fallow ages											
สีมพิด		[*Rhus chinensis* Mill.]	Food	Fruit	x		x				
เปือย		[*Lagerstroemia* species generally]	Firewood	Stem	x		x				
ไม้ก่ำ	ตูดคะ	[*Castanopsis*, *Lithocarpus* & *Quercus* species generally, *Pometia pinnata* J.R. & G. Forst.]	Animal feed	Fruit	x			x			
ต๋องแต่ง	กะปี้งปอง	[*Clerodendrum* sp.]	Food	Fruit	x			x			
Plant taxa found only on the 1 year old fallow											
หมากแค้ง	กะยอง	[*Solanum torvum* Sw., *S. trilobatum* L.]	Food	Fruit	x						
	จะอม		Food	Leaf	x						
	ตูดไห		Firewood	Stem	x						
ผักกู้ง	ตูดละอรั	[Edible Fern (taxa unidentified)]	Food	Leaf	x						
หอบแหบ	หมากตะ	[*Connarus* sp.]	Food	Leaf	x						
เถือตายดิบ	อาปิด	[*Combretum* sp.]	Medicine	Leaf	x						
	ปาตะม		Medicine	Root	x						
หมอหม่าย	จะง้องปี		Medicine	Leaf/Root	x						
เป้าหอง	เตีแองลอย	[*Leptostachya* sp.]	Medicine	Leaf/Latex	x						
พองพี้ง	ตะมัก	[*Clerodendrum* sp.]	Food	Leaf	x						
กะละ	จ้งโก	[*Curcuma* sp.	Food	Shoot/ Flower	x						
มับขู			Medicine	Root	x						

Lao Name	Kammu Name	[Scientific Name] See caution in description*	Use	Part Used	Year after Cutting						
					1	3	5	7	9	11	20
ເມືອດແອະ	ກะເອືອມ	[*Symplocos* sp.]	Animal feed	Fruit	x						
ໜາດ	ตะสู	[*Blumea balsamifera* (L.) DC.]	Medicine	All	x						
ກູດງ້ອງ	ກาดอัธ	[*Lycopodium cernuum* L.]	Food	Leaf	x						
Plant taxa found on 3 and more year old fallows											
ບ້ຽ	ตูดสุก	[*Bambusa tulda* Roxb.]	Construction/ Food	Stem/ Shoot		x		x	x		x
ເດື່ອ	ละสะ	[*Ficus* spp. generally]	Food	Leaf/Fruit		x				x	
ໝາກຊິມ	ทะเลาะ	[*Amalocalyx* sp.]	Food	Fruit		x	x				
ໝາກເກືອ	กอตำ	[*Mitrephora* sp.]	Dye	Fruit		x		x			
Plant taxa found only on the 3 years old fallow											
ເປືອກເມືອກ	ตูดญ้ง	[*Boehmeria malabarica* Wedd.]	Market	All		x					
ປໍສา		[*Broussonetia papyrifera* (L.) L'Hér. ex Vent.]	Market	Bark		x					
ມັ້ນ	กอยธั้	[*Manihot esculenta* Crantz]	Food	Leaf/Root		x					
ສ້ຽວ	ลืปาง	[*Bauhinia* spp. generally]	Medicine/ Food	Bark/Leaf/ Flower		x					
ເລົ່າ	แญง	[*Erianthus arundinaceus* (Retz.) Jeswiet]	Food	Shoot		x					
Plant taxa found on 5 and more year old fallows											
ติ้ວ	จะลืม	[*Cratoxylum* spp.]	Firewood	Stem			x			x	x
	เงืือย		Firewood	Stem			x				x
ໝາກຫວ້າ	ໝากห้า	[*Ficus auriculata* Lour., *Syzygium cinereum* Wall.]	Food	Fruit			x	x	x		
ส้ำ		[*Dillenia* spp. generally]	Animals feed	Fruit			x	x			
	สะละหา	[Papilionoidea]	Used for smoking	Leaf			x		x	x	x
	จำจูอ		Food	Leaf			x	x		x	x
Plant taxa found only on the 5 year old fallow											
ເลื่ອม			Firewood/ Food	Stem/ Fruit			x				
ຂามป้อม		[*Phyllanthus emblica* L.]	Food	Fruit			x				
	กอกโจะ		Fish poison	Bark			x				
	สะเลาะ		Food	Leaf			x				
ຂี้ม่อด		[*Cratoxylum* spp.]	Firewood	Stem			x				
ເถือเข้ามอก			Medicine	Root			x				
ໝากຊิม	ตูดเหาะ	[*Amalocalyx microlobus* Pierre, *Streptocaulon tomentosum* Wight & Arn.]	Food	Fruit			x				
เพ้ยฟา		[*Cipadessa cinerascens* (Pellegr.) Hand.-Mazz.]	Food	Leaf			x				

Lao Name	Kammu Name	[Scientific Name] See caution in description*	Use	Part Used	Year after Cutting						
					1	3	5	7	9	11	20
Plant taxa found on 7 and more year old fallows											
ສະເມັກ	ເດີລ໊ດ	[*Commelina zeylanica Falkenb.*]	Food	Fruit				x	x		
ດู่		[*Pterocarpus* spp. generally]	Firewood/ Medicine	Stem/ Latex				x	x		
ໝາກເລັບແມວ	ตะละมอๆ	[*Diospyros* sp.]	Food	Fruit				x	x		
	เก้ๆ	[*Dalbergia* sp.]	Firewood/ Construction	Stem				x	x	x	x
Plant taxa found only on the 7 year old fallow											
	ภาำยา		Medicine	Latex				x			
	สี๊อย		Food	Fruit/Leaf				x			
ตอๆหี๊ๆ	ภัลาภ	[*Macaranga* sp.]	Firewood/ Medicine	Stem/ Fruit				x			
จอๆจั	ตะลายโอย	[*Cinnamomum litseaefolium* Nees., *C. bejolghota* (Buch.-Ham.) Sweet, *C. iners* Reinw. ex Blume, *Viburnum odoratissimum* Ker Gawl.]	Put inside dead body	All				x			
	ตูดเลีย	[*Garcinia* sp.]	Firewood	Stem				x			
	ธาๆจี๊ๆ		Medicine	Bark				x			
หาๆเสือ	ตะละอาย	[*Uraria macrostachya* Wall.]	Medicine	All				x			
	เมลาย		Firewood/ Construction	Stem				x			
ໝາກม่วงป่า	เปฺ๊ภุ	[*Mangifera* sp.]	Food	Fruit				x			
Plant taxa found on 9 and more year old fallows											
	จะลัก	[Rubiaceae]	Medicine	Root					x		x
	ตาำๆ๊ด		Medicine	Root					x		x
เดือ	ภ๊สา	[*Ficus fistulosa* Reinw. ex Blume]	Food	Leaf/Fruit					x	x	
ยิงเลือด	ลายาม		Medicine	Bark/ Latex					x		x
เห้ดถิ		[*Termitomyces* sp.]	Food	All					x	x	
หย้าสามล่ม	ลาำเขุภ	[*Cyperus* sp.]	Medicine	Root					x		x
ก๋ำ	ตูดละ	[*Lithocarpus* & *Quercus* spp. generally]	Animal feed	Fruit					x		x
Plant taxa found only on the 9 year old fallow											
สะโภ	ตูดภอาๆ	[*Anthocephalus chinensis* (Lam.) Rich ex Walp.]	Firewood/ Construction	Stem					x		
เถือหวายดิ	ตูดยา	[*Combretum decandrum* Jacq.]	Construction	Stem					x		
ฮิมฟาด	เปต๊ม	[*Bischofia javonica* Blume]	Food	Leaf					x		
ผ๊ภาลาด	ละฮิด	[*Spilanthes* sp.]	Food	Leaf					x		
แผดิเย้		[*Scoparia dulcis* L.]	Medicine	All					x		

Lao Name	Kammu Name	[Scientific Name] See caution in description*	Use	Part Used	Year after Cutting						
					1	3	5	7	9	11	20
	ละอา		Food	Leaf					x		
	ภะโจะ		Firewood/ Construction	Stem					x		
เถือจา	จะง้อ	[*Argyreia pierreana* Bois]	Medicine	Bark					x		
	ตูดภาย		Firewood	Stem					x		
ทอมแก่อ		[*Eclipta prostrata* (L.) L.]	Medicine	All					x		
ตีไก้	ตั๊งแภะ	[*Alstonia* sp.]	Food	Leaf					x		
	ภะลิภา		Food	Fruit					x		
ฒาภาอด		[*Ficus semicordata* Buch.-Ham. ex Sm.]	Food	Fruit					x		
	อิละอาย		Medicine	Leaf					x		
บ้าและ	แถะ		Medicine	Fruit					x		
	จะลอย		Food	Fruit					x		
หาๆฒู	ตะเลาะ	[*Tinospora crispa* (L.) Hook. f. & Thomson]	Medicine	All					x		
บ๋อี้ตู่	มุภาสะตา	[*Helicteres angustifolia* L.]	Medicine	Root					x		
บิถี	ตูดยา	[*Brucea javanica* (L.) Merr.]	Medicine	Root					x		
	ตูดตำลา		Medicine	Root					x		
Plant taxa found on 11 year or older fallows											
	ตูดไล		Fish poison	Bark						x	x
ภิภาแถ	ลั๊งจาภา	[*Fernandoa* sp.]	Food	Flower						x	x
Plant taxa found only on the 11 year old fallow											
จ้มาภา			Food	Leaf						x	
	ตูดแจภา		Animal feed	Fruit						x	
ต้าๆไก่	ภะลอด	[*Leea rubra* Blume ex Spreng.]	Food	Leaf						x	
บุ่เท่า		[*Microcos* sp.]	Medicine	Stem						x	
เปือยค้	จัโาย	[*Lagerstroemia balansae* Köhne]	Firewood	Stem						x	
ถำพะม้า/		[*Saraca declinata* (Jack) Miq.]	Medicine	Bark						x	
	ดาปะ๊ม		Medicine	Root						x	
ฮิ๊งฮู่	ตูดจะอม		Food	Leaf						x	
เถือปิ๊	ตุ๊ๆตะยาภา		Animal Food	Leaf						x	
เถือหั	ตูดปั		Fish poison	Bark						x	
ฒาภาเก้	ภะตี	[*Flacourtia rukam* Zoll. & Montzi]	Food	Fruit						x	
	ลิ๊งจอๆ		Medicine	Latex						x	
เถือกู่	ปูดสะจาๆ		Medicine	Latex						x	
ฒ๊อย	ละเมียภะเอ	[*Cyclea barbata* Miers]	Food	Leaf						x	
	ละเล้งออๆ		Food	Fruit						x	
	เตะตะลั๊ง		Food	Leaf/Fruit						x	

Lao Name	Kammu Name	[Scientific Name] See caution in description*	Use	Part Used	Year after Cutting						
					1	3	5	7	9	11	20
ຫວາຍ	เป้ง	[Rattans generally]	Handicraft/ Food	Stem/ Shoot						x	
ສົ້ມໂກ່ຍ	ริ็มตู	[*Ampelocissus latifolia* (Roxb.) Planch.]	Animal feed/Food	Leaf/Fruit						x	
	ตั๋งโอ		Medicine	Latex						x	
	เอกโตบ		Medicine	Stem						x	
ເຄືອແບ	ลางลุงลุด	[*Eranthenum* sp.]	Food	Flower						x	
ຕ່ຶ້ງຕ່ຶ້ງ	ตะปัยอก	[Annonaceae]	Use for rope	Bark						x	
ໜາມກະແຫວ	จะละแปกแอง	[*Pterolobium platypterum* Gagnep.]	Medicine	Latex						x	
ເຄືອຫ້ອຍ	ลองตาง	[*Albizia* sp.]	Used for washing	Bark						x	
ໄມ້ຮາກດຽວ	ตางโอ	[Rubiaceae]	Medicine	Bark						x	
	มูกตำ	[Lauraceae]	Medicine	Root						x	
ກ້ຳເຫຼືອງ	บ๊ลิ	[*Gonocaryum lobbianum* (Miers) Kurz]	Animal feed/Food	Leaf/Fruit						x	
	ตูดจั		Animal feed/Food	Fruit						x	
Plant taxa found only in the older forest (20 years old)											
ໄມ້ຂີ້ມ		[*Indosasa sinica* C.D. Chou & C.S. Chao]	Used/Food	Stem/ Shoot							x
	ตูดปูาย		Food	Fruit							x
ໄມ້ຫີກ		[*Dendrocalamus* species generally]	Construction/ Food	Stem/ Shoot							x
ເຄືອມ້ວຍ	เปาะเจ้ง	[*Gnetum scandens* Roxb.]	Food	Fruit							x
ໝາກແໜ່ງ	ໝາກแหน่ง	[*Amomum xanthioides* Wall. ex Baker]	Medicine	Fruit							x
ໝາກໄຟ		[*Baccaurea oxycarpa* Gagnep.]	Food	Fruit							x
	จะเก้ก		Food	Leaf							x
	เก้ปุ		Market	Stem							x
	ตูดกำอุง		Medicine	Bark							x
ພຸດປ່າ	ละดอก	[*Gardenia* sp.]	Food	Leaf/Fruit							x
ຊາງ		[*Dendrocalamus membranaceus* Munro]	Food/Use	Stem/ Shoot							x
	ตองปูาส		Medicine	Root							x
ຕີເປ໊ດ	จอตะล๋	[*Alstonia rostrata* C.E.C. Fisch.]	Firewood/ Construction	Stem							x
ໝາກຊ້ກ	จะแลง	[*Sapindus rarak* DC.]	Animal feed	Fruit							x
ໝາກກອກ	ตูดกิก	[*Spondias cytherea* Sonn., S. pinnata (L.f.) Kurz]	Food	Fruit							x

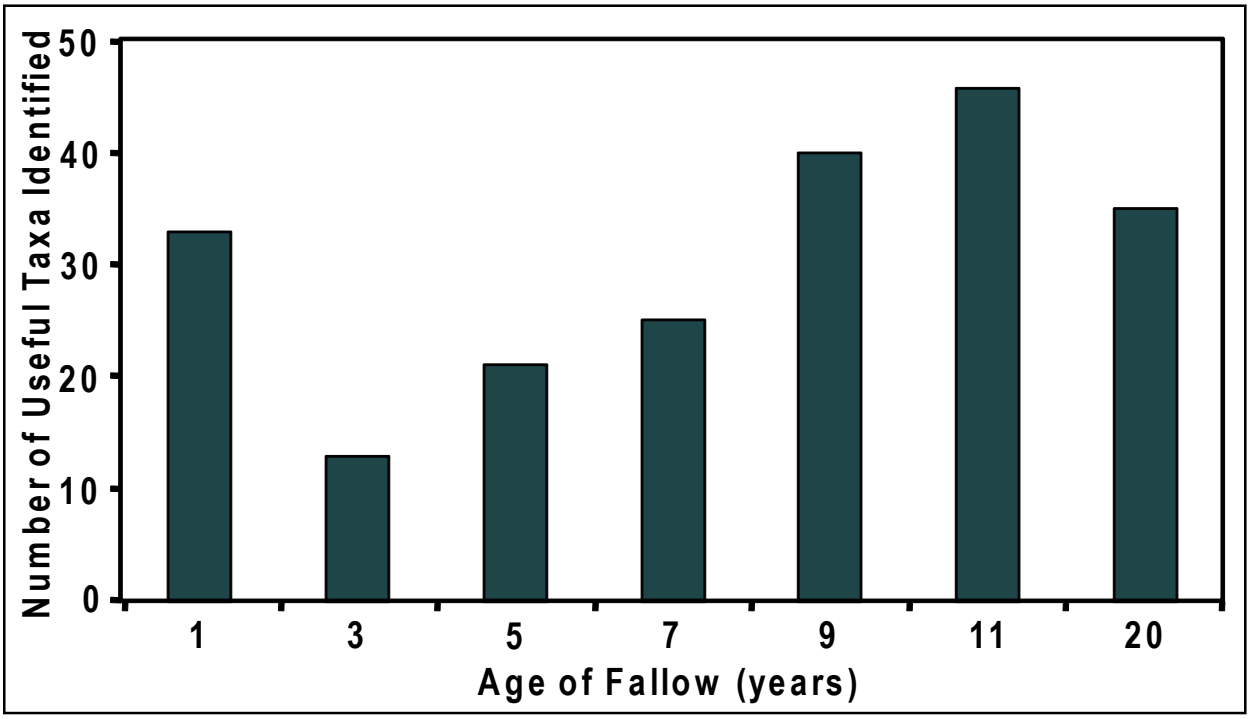

Figure 11. Observed number of usable taxa identified in fields representing an eleven year swidden cycle in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Fig. 11 shows graphically the number of plant taxa found in each fallow area. The Kammu clear-cut the forest when they grow rice, and casual observation indicates that there are fewer plants in the 1-year old fallows compared, for example, to those in the Karen fallows in Thailand (Delang 2006b). However, the Kammu use a large number of plants in the 1-year old fallow. This might be due to the fact that many of the plants in the younger fallows are grasses or plants whose leaves the Kammu like to eat (the Kammu eat the leaves of 14 of the 33 usable taxa found in the 1-year old fallow). After the first year, the number of taxa used by the Kammu decreases drastically. In the third year there are only 13, but the number gradually increases until year 11, when there are 46 taxa. In year 20, the number of taxa decreased again. The reason for this drop of usable taxa in the older forests is uncertain. It might be because 1) species diversity in the older forest decreases and therefore there are also fewer usable plants, or 2) while there is more species diversity, there are fewer usable plants, or 3) the older forests are denser, so the villagers tend to avoid going there and are less familiar with the plants found there. Since the policy of curtailing shifting cultivation results in the forest ageing, additional research to understand why older forests have fewer usable plants, and what can be done to increase the number of plants, would be very useful.

As mentioned above, some taxa (30 out of 141) were not found in habitats where they should logically grow. For example a taxon found in a 1-year and 5-year old fallow should logically also grow in a 3-year old fallow. Figure 12 is an attempt to address the incompleteness of the data, by including the missing years (for example assuming that a plant found in a 1-year old and 5-year old fallow also grows in a 3-year old fallow). Years 1 and 20 are excluded, because the available data cannot let one deduce whether the plants which where not observed in these fields also grow there. Thus, it is quite possible that Figure 12 gives a more accurate description of the plants found in 3-year to 11-year old fallows, while underestimating the plants found on 1-year old fallows and 20-year old forest.

Table 3 (obtained with the observed data in Fig. 11, rather than the estimated ones shown in Fig. 12) summarizes the fieldwork findings in terms of the uses of the plants found in each fallow area. The total number of plant taxa adds up to more than 141 because each plant is marked for each use it has in each area.

The most common forest products are wild food plants, followed by medicinal plants, fire wood, animal feed, and construction. Only wild food plants (for people and livestock) and medicinal plants have a pattern similar to that found in Figures 11 and 12, with the number of taxa increasing from the 3-year to the 11-year old fallows, and decreasing in the 20-year old forest. For these two uses of plants, it seems that shortening the fallow period would indeed have very important negative consequences. A possible consequence of shortening the fallow period might be that more food would have to be cultivated in gardens

Table 3. Number of useful plant taxa per major use identified in different age fallow fields representing an eleven year swidden cycle in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Ages of fallows	Uses							
	Food	Medicine	Firewood	Animal feed*	Construc-tion	Market	Fish poison	Other
1	16	10	3	5	2	1	0	1
3	7	2	1	2	1	3	0	0
5	12	2	6	1	2	0	1	2
7	9	7	6	2	3	1	0	2
9	17	15	5	3	5	1	0	2
11	22	13	4	8	3	0	1	3
20	16	9	4	5	4	1	2	3
Total †	99	58	29	26	20	7	4	13

*Animal feed is mostly for pigs. Cattle and buffalos are usually left in the forest.
†This table contains 141 taxa recorded against every fallow area in which it was found.

in the villages. Indeed, very little food is cultivated in Mo Ka Khan compared to the lowland villages with three years of fallow. My casual observations are that on average gardens are less than 4 m² per household in Mo Ka Khan compared to about 25 to 30 m² per household in many lowland villages. Thus, outlawing swiddening or shortening the years the fields can be left fallow involves more forestland clearance for gardens in or near the village, and the villages to become spread over a larger area.

On the other hand, for firewood and of course construction materials, shortening the fallow period is likely to have few – if any – negative consequences. These remarks should be weighted against the fact that presence or absence of a plant does not inform how often it is used, whether it fulfills important roles during particular seasons, and in general its importance in people's livelihood. For example, although very few plants are sold, these marketed plants are nevertheless very important in people's livelihoods,

Figure 12. Estimated number of usable taxa in fields representing an eleven year swidden cycle in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Table 4. Part of the plant used for human consumption from useful plant taxa identified in different age fallow fields representing an eleven year swidden cycle in Pha Oudom, Bo Kaeo Province, Lao P.D.R.

Ages of fallows	Plant part								
	Leaf	Fruit	Stem	Root	Shoot	Bark	Flower	Latex	All
1	15	5	6	6	4	1	2	1	1
3	4	4	2	2	2	1	2	0	1
5	5	6	9	1	3	1	0	0	0
7	5	9	7	0	1	2	1	1	2
9	11	9	7	8	1	2	1	1	4
11	11	10	9	5	3	6	2	4	1
20	9	8	11	6	5	4	1	1	0
Total	60	51	51	28	19	17	9	8	9

since they are among the very few – and for many households the only – local sources of cash.

An important role of the forest is to provide fodder for livestock. A few Kammu have cattle and water buffalo, which they leave in fenced areas in the forest. The food eaten by these animals is not included in the dataset, but the dataset does include the food that is given to pigs. Most Kammu keep pigs, which are fed with food that is gathered daily from the forest and cooked. These domestic animals are sold rather than eaten by the Kammu themselves (except for special occasions, the Kammu only eat chicken and hunted animals). Thus, animal husbandry can be considered a source of income from the forest that requires the transformation of the end product (in the same way as handicrafts) in the form of cooking the food for the pigs and in some cases building fences.

Table 4 shows the parts of plants that are used for human consumption (animal feed is excluded). The most common forest products consumed by the Kammu are leaves, many of which come from the 1-year old and older than 9-year fallow. Fruit trees are more common in the older fallows and 20-year old forest. Plants from which the stems are consumed are equally common in all of the fallow areas between 5-year and 11-year old, and more common in the 20-year old forest. Roots are also more common in older fallows, while the other plants seem to be equally present in all fallow areas.

Conclusions

The information presented here shows the considerable amount of forest products that the Kammu consume, and demonstrates the fact that these products are found in fallows of different ages. Although additional research is needed to corroborate these results, there does seem to be an ecological succession of the plants that the Kammu use. Only a small minority of plants are available in the fallows of every age, and one can easily understand the losses to the Kammu that would result should they no longer be able to maintain a fallow period of 11 years, either because of population pressures or because of government intervention. Figure 2 shows the small numbers of usable plants that are found in the young (3- and 5-year old) fallow areas. It is very likely that shortening the fallow period would result in a loss of soil fertility that would reduce these numbers even further. In many cases, the Kammu would certainly be able to substitute some plants for others, but such substitution could not take place indefinitely. If shifting cultivation were to be completely curtailed, it is very likely that the Kammu would lose most of the plants that they use now. On the other hand, it is clear that some forest products are gathered near streams, especially during the dry season, when less vegetation can be found in the fallow areas (Delang 2006c).

It seems strange that given the importance of forest products to the livelihood of shifting cultivators, so little research has been carried out on the area of origin of these forest products. As governments around the world (and the Lao P.D.R. government is no exception) are seeking to curtail shifting cultivation or severely reduce the number of years that swiddeners can leave the fields fallow, it seems that a better knowledge of the habitats of origin of the forest products used by shifting cultivators is vital in estimating the potential losses and economic costs that they incur in their shift to sedentarised farming. In most case, sedentarised farming is associated with the purchase of food, medicines, meat, and construction materials that replace the forest products that the shifting cultivators gather for free. In some cases this is because population pressures have reduced the forested areas, but in other cases it might be because the ecological transformations of the forest has reduced species diversity. This shift from a subsistence to a market economy involves very high monetary costs if the people are to maintain a similar standard of living. This is rarely accounted for in the development planning process, and is likely to be one of the reasons for the increased poverty that often results from the relocation of shifting cultivators or curtailment of

the fallow cycle (Baird & Shoemaker 2005). Thus, while the reliance of shifting cultivators upon forest products is ignored, that dependence is being undermined by government policies – which ironically are often put forward with the objective of alleviating poverty.

This research is meant to be an initial, partial study of the phenomenon of ecological succession of usable plants in fallow areas. More research is needed to corroborate these results or disprove them. There is great scope for future research, which can address, among others:

1. The frequency of consumption of each forest product, in each fallow habitat. This research only addressed presence/absence of the forest products, not whether they are actually gathered in a particular habitat, or the quantity gathered in each habitat. This information will give a better picture of the losses to the people as habitats disappear.

2. The replaceability of the various forest products. If it is found that all products can be substituted with forest products found in older forests, the negative consequences of outlawing swiddening is reduced.

3. The forest products available from nearby streams. During the dry season, the Pwo Karen in Thung Yai Naresuan Wildlife Sanctuary gather most of their wild food plants near streams, when fewer plants are available in fallow areas (Delang 2006c). The same might be true for other shifting cultivators, although in the case of the Kammu this might be less so: the Pwo Karen build their villages near the streams, while the Kammu tend to build them at the top of mountains.

4. Seasonal variation in the availability of forest products in different areas. Some areas might have few forest products, but these might be very important because they are the main (or only) source of forest products during particular seasons. For example, during the dry seasons the Pwo Karen gather most of their wild food plants near the rivers because few plants are available in the fallows (Delang 2006b).

5. The reasons for fewer usable products to be found in older (20 years old) forests and the way this problem can be addressed. Since shifting cultivators who see their farming practices outlawed will be surrounded by gradually older forests, it would be useful to understand whether it is true that these contain fewer forest products, and if so, why. It might also be useful to understand the ways in which the number of usable plant taxa can be increased, perhaps through agroforestry or with selective –smaller – land clearings to reproduce the habitats created by shifting cultivation.

6. The productivity of different agricultural systems by the same community. It was mentioned that as the fallow period is shortened, fewer plants can be found in fallows and people have to grow more food plants in gardens. It might be interesting to compare the amount of forestland that is allegedly saved by outlawing swiddening to the amount of forestland that is converted to gardens.

7. Probably most importantly, it would be useful to compare the number of species and quantity of forest products in fallow cycles of different length, in order to validate the partial results and conclusions presented here. For example, it would be useful to compare the number and quantity of forest products found in a 15-year long fallow cycle to those found in an 11-year long fallow cycle, a 7-year long fallow cycle, a 3-year long fallow cycle and a field without fallow. Only this will provide a clear picture of the losses that shifting cultivators experience when the fallow cycle is shortened.

To avoid the risk of making generalizations based on forest resource use in only one village, the same research should be duplicated in other villages.

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