When applying a participatory approach in helping shifting cultivators convert their shifting systems into more sedentary systems it is very useful to first understand their traditional practices. The main objective of this brief overview is to provide those who have to deal with the challenging task of shifting cultivation stabilisation with a general understanding of the complexity and diversity of the systems and practices used in Lao shifting cultivation. The emphasis here is on describing crop production activities under slash-and-burn agriculture. In addition, other activities such as livestock, agroforestry and NTFP collection are also briefly presented due to their importance in the livelihoods of shifting cultivators.
Description and principles of shifting cultivation

Shifting cultivation is known as hai in Lao, as ‘slash-and-burn agriculture’, ‘swidden cultivation’ or ‘swidden’ in English, and essartage, agriculture itinérante, défriche-brûlis or abattis-brûlis in French. In Laos, as in other countries where it is practised, it basically consists of cutting the natural vegetation, leaving it to dry and then burning it for temporary cropping of the land. The burning of vegetation cover and soil organic matter accelerates decomposition and releases useful nutrients for crop production. Burning also kills weeds and pests. Another important principle is the regeneration of soil fertility through plant regrowth after harvest. To rebuild the soil fertility after growing crops on a shifting cultivation plot farmers ‘abandon’ that plot and allow vegetation to regrow for a number of years. This is called the ‘fallow period’. In the meantime, they grow crops on other new plots.

The duration of the fallow period is an important element for this cyclic form of agriculture where cultivation is shifted from one location to another. In principle, the longer the duration of the fallow period, the better the crop. For a given piece of land a shifting cultivation cycle can thus be characterised by two phases:

1. The cropping phase (usually one year, but sometimes two or three).
2. The fallow phase (several years).

During the cropping phase the farmer’s main objective is to produce what he needs for food, feed and income. During the fallow phase the main objective is to regenerate the soil’s fertility by allowing the vegetation to regrow while exploiting some of the fallow resources (e.g. animal husbandry, hunting, NTFP and timber collection).

Shifting cultivation systems: diversity and complexity

There is significant diversity in the shifting cultivation systems of the Lao PDR. Diversity factors include soil category, topography, altitude, rainfall, natural vegetation type, land tenure system, level of integration into the market economy, dietary habits, ethnic beliefs and traditions, local technical knowledge, level of conversion from shifting agriculture to sedentary agriculture, level of crop-livestock integration, and so on. The heterogeneity is also high at field plot level. All this means that most of these systems function under location-specific management and thus require loca-

Land tenure, land-use planning and land allocation

Traditionally, Lao swidden farmers used their usufruct rights to exploit the forest land surrounding their villages. Nowadays, a government-sponsored land-use planning and land allocation programme is underway throughout the country and has accomplished variable degrees of achievement. Land-use planning and land allocation has been used as a tool to reduce and stabilise shifting cultivation in Laos. It regulates villagers’ access to local natural resources and generally results in shorter fallow periods.
tion-specific alternatives for those willing to modify their systems.

There are various ways of categorising shifting cultivation systems, depending on the criteria used. Two types of shifting cultivation systems are often distinguished in Laos:
(1) Rotational, and
(2) Pioneering.

**Swiddening is more than cropping**
A shifting cultivation system is not only about crop production. Animal husbandry, fishing, hunting and gathering NTFPs are also important activities for Lao shifting cultivators. In every shifting cultivation village these activities are closely interrelated with the crop/fallow cycle. For instance, fallow land is important for livestock grazing and cultivated plots must be fenced to protect them from domestic animals. The fallow area is also a major source of biodiversity and as a result, longer fallow periods generally enable the collection of more NTFPs.

In rotational shifting cultivation, the most common type in Laos, ‘established’ swiddeners keep their villages in the same place but shift their cultivated plots according to a crop/fallow cycle that depends upon several factors. In pioneering shifting cultivation systems, ‘pioneer’ swiddeners move their whole village settlements from one site to another after several years, mainly because the nearby forest has become exhausted.
An overall perspective on shifting agriculture in Laos   (Roder 2001)

"In most countries, slash-and-burn agriculture has regional importance only, but for the Lao PDR it is a major land-use practice involving more than 150,000 households or 25% of the rural population. If all the fallow land is included, shifting cultivation may use up to 80% of the soils used in agriculture. Low population densities, low incomes, and low access to inputs in the past made slash-and-burn agriculture the best land-use option for the rural population in the hilly regions of the country".

"Today, increasing population pressure, increasing degradation of the resource base, global awareness of off-site effects, and an increasing interdependence between lowland and hill farmers have changed the situation and demand a new approach. It is thus not surprising that the government has given high priority to transforming this perceived harmful system to other agricultural systems. Information on the production system and improved technologies available for extension are limited, mainly because past research and development efforts concentrated on lowland rice production systems. Furthermore, the wide diversity of biophysical and socio-economic environments provides a major challenge for the research and development process".

"An in-depth understanding of the existing production system is required to formulate recommendations for changes. Quantitative data on soil, water, plants, and other biophysical factors of the systems remain limited. It must also be emphasised that long-term solutions to the problems faced by Lao slash-and-burn farmers cannot be found by focusing on their production systems in isolation. The problem can only be solved by a holistic approach that takes into consideration the entire economy and social fabric of the country and its neighbours. Interdependencies and linkages in the national economy, especially employment opportunities, market opportunities, access to social institutions, and rules regulating off-site effects, need to be recognised and exploited to optimise benefits for the households that now depend on slash-and-burn agriculture".
The fallow vegetation type can also be used as a criterion to differentiate swidden systems: forest or savannah. Forest fallow (mainly secondary forest) is more common than savannah in Laos. Swidden farmers are also categorised into ‘integral’ or ‘partial’ swiddeners. Integral shifting cultivators are those for whom swiddening has traditionally been of primary importance in their livelihoods, while partial swiddeners are sedentary lowland farmers who also do some swiddening to complement their needs.

**Evolution of shifting cultivation systems in the Lao PDR**

The Lao government objective of reducing and stabilising shifting cultivation is well known throughout the country and is certainly the major reason for the decrease and other changes recently observed in shifting cultivation areas throughout Laos. However, there are other factors that influence swidden systems and practices such as population increase, growing market opportunities, and changes of attitude among shifting cultivators. Although many Lao farmers have already reconverted their shifting cultivation systems into sedentary agricultural systems, there are still many farmers who cannot completely reconvert their systems due to various constraints including limited availability of flat land, limited family manpower for more intensified forms of agriculture, limited technical know-how for growing wetland rice, ethnic traditions revolving around the rice cycle, and limited knowledge of crop science.

**The fallow phase and period**

The duration of the fallow period is very important when trying to understand the functioning of a given shifting cultivation system and envision the possible alternatives. Traditionally, Lao shifting cultivators have tended to apply a fallow period of between ten and twenty years to allow the forest to regenerate. This is not practical anymore though, due to population increase, limitations of geography, and government policy. In many villages the fallow period has dropped to three to five years, especially near roads and in areas with higher population density. However, there are still a few remote villages where the fallow period is over five years and can even be ten years or more.
Fertility decline, weed infestation, forest destruction, and loss of biodiversity are all associated with the shortening of fallow periods. For a shifting cultivation system to remain balanced without additional inputs, it is generally considered that the fallow period should be about eight to twelve years, depending on the soil and natural vegetation types. When the fallow period is shortened there is a need to compensate for the fertility decline. The impact of the shortening fallow period is the main constraint agronomists have to address when developing technology options to stabilise shifting cultivation systems in Laos.

NTFPs represent an important source of income for shifting cultivators and for the country, and fallow management plays a very important role in their availability. Several NTFPs require a relatively long fallow period while the level of biodiversity is also generally higher in fallows of long duration.

### The cropping phase and systems

The main cropping period for shifting cultivators is the wet season. A shifting cultivation plot is generally cultivated for one year without tillage but sometimes the same plots are planted for two or three consecutive years. When this happens, tools are then used for tillage before sowing.

Upland rice is the main crop grown by Lao shifting cultivators. In addition, several other crops are grown in smaller quantity, either in the same or in adjacent plots: cassava, maize, cotton, yam, cucurbits, chillies, sesame, Job’s tears and sweet potato. Shifting cultivators generally practice mixed or multiple cropping and agricultural diversity tends to be higher in shifting cultivation systems than on the sedentary farms of the lowlands.

Although most crops grown by shifting cultivators are produced for self-consumption, many upland farmers throughout the country are also involved in the production of cash crops such as cotton, sesame, Job’s tears, paper mulberry, maize, opium poppy, fruit and vegetables. Some are also becoming more involved in plantation crops (coffee, tea,
Cropping calendars and farming practices

<table>
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<tr>
<th>Activity</th>
<th>Period</th>
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<td>Tool preparation</td>
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<td>Slashing</td>
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<td>Main burning</td>
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<td>Clearing and second burning</td>
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<td>Building field house</td>
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<td>Sowing</td>
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<tr>
<td>Threshing and transport</td>
<td>September-November</td>
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*These operations do not necessarily strictly follow each other and actually often overlap. Throughout the country, variations exist in techniques and timing of the operations. For example, fencing often happens before sowing.*

rubber, cardamom) or timber (teak). Domestic animals and NTFPs are often sold by shifting cultivators, while nowadays most Lao upland farmers are connected to the market economy even if they still often practice barter trade.

**Production inputs: labour and tools**

Compared to more modern sedentary lowland farmers, shifting cultivators generally use much fewer purchased inputs. The main inputs are family labour, hand tools, seeds and animals. Purchased fertilisers are never used on sloping land (they would be washed away by the rain anyway). A small number of mountain villagers use commercial herbicides to reduce the need for weeding upland rice, but Lao shifting cultivators rarely use insecticides.

The tools used by Lao shifting cultivators are generally locally-made traditional implements but market-bought tools such as hoes, knapsack sprayers and modern axes are now reaching some remote upland villages. Tools used for cutting the vegetation include various types of axes and knives or machetes. Planting or ‘dibbling sticks’ are used for sowing. Locally-made small weeding tools are used everywhere, sometimes alongside bigger hoes that are purchased for land preparation. Not all upland farmers use sickles to harvest rice: many farmers strip the grain straight from the panicles into their baskets. Various types of such local basket are used to carry seeds, agricultural products, firewood and other NTFPs.

When shifting cultivators reconvert themselves into sedentary farmers they have to learn how to use new tools and techniques never used before on sloping land including buffalo ploughing, tractor ploughing and wetland rice cultivation. The learning curve can be long and difficult.
**Site selection**

The village community chooses where the fields for the coming season will be established. In most cases, several groups of families will have their plots adjacent to each other on the selected sites. The size of each family plot depends on the availability of workforce in the family. There are various indicators used for site selection: forest cover, soil type, plant species, presence of leaches, field orientation, distance to village, and so on. Primary forest with too many tall trees is not often selected for cropping because it requires more work to slash the vegetation; secondary forest is often preferred. Long-established shifting cultivators generally have an intimate knowledge of their environment.

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**Slashing standing vegetation**

Slashing the bush vegetation is a community activity practised across Laos. The duration of slashing operations depends on the biomass to be cut, varying from 100 hours per hectare for a herbaceous to bushy fallow (fallow period of two or three years) to 500 hours for an older fallow of ten years with trees. Machetes are widely used for cutting the vegetation but bigger trees are cut with axes and sometimes saws.

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**Drying slashed vegetation**

This operation simply requires leaving the slashed vegetation to dry in the sun for about three to four weeks. This creates a humic natural mulch that covers the soil and protects it against the sun and the impact of violent tropical rains. The degrading organic matter not only preserves the structure of the soil but also stimulates microbial fauna. The combined effects are good for seed germination.

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**Main burning of dry vegetation**

The day for burning is carefully chosen since it is a delicate activity. All family plots must be burnt the same day and as quickly as possible to ensure the maximum consumption of organic matter. Burning generally takes place during the hottest sunny hours of the day but if the risk of village fire is high, burning takes place at night as it is then easier to spot accidental fires. The main burning is a spectacular and noisy operation, causing huge flames on the hills and producing heavy smoke that reduces visibility and pollutes the atmosphere. The
burning quickly decomposes vegetation and soil organic matter into plant nutrients that are readily available for the crops. It reduces soil acidity, increases the availability of phosphorus, and also kills weed seeds and parasites.

Clearance and second burning

Depending on the quality of the main burning, a second burning may be required before trunks and debris are removed from the field. This clearance is a family activity (husband and wife) performed at the level of each individual family plot, but systems of mutual assistance or labour exchange are used if there are high volumes to be removed. The activity requires between 50 and 250 hours, depending on the volume of organic matter to be reburnt or removed from the field. Burning stacks of debris results in spots with higher concentrations of ashes that are often used for planting some associated crops.

Land preparation, tillage and weeding

Before sowing there is generally no tillage in shifting cultivation fields. In a few cases however, especially under short fallows or when a field is used for a second or third consecutive year, tillage and weeding are performed using a small hoe. This long and exhausting activity is mainly executed by women and takes about 100 hours per hectare. Stumps are not removed unless the field is progressively being converted into a permanent field. Termite mounds are kept and never levelled. A swidden field presents a lot of micro-site heterogeneity. The lack of tillage on sloping land and the presence of much debris in the field drastically reduce soil erosion during the first weeks of the cropping period.

Sowing

Sowing is a very important family activity in shifting cultivation with traditional religious, social and economic connotations. Rituals are generally performed before and during sowing. Men make holes using a dibbling stick while women follow with seed bags and throw the seeds in the holes. Rice is the main crop sown but rice seeds can be mixed with other crop seeds. The time for sowing varies between 70 and 150 hours per hectare, according to the experience of the team. In fields where tillage is performed (as in the case of second- and third-year fields) rice seeds can be broadcast instead of being planted in the holes made by planting sticks.

Fencing and field houses

Fencing takes place before or after sowing, using wood and bamboo or sometimes even by digging trenches around the swidden field. The fence protects the field against buffalo, cattle, horses, goats, pigs and also wild animals (wild boars and deer in particular). The time required for fencing varies from 50 to 120 hours per hectare according to its quality. It is generally an activity performed by men. A field house is also built to shelter family members, for cooking and eating, for keeping tools and for storing harvested products.
**Weed management**

Weeding is the most labour-consuming and tedious activity of the cropping cycle. Weed infestation is particularly problematic under short fallow periods: in general, the shorter the fallow period, the more weeds affects crop yields. Weeding is performed almost continuously from May to October, most often by women and children, using small hoes and machetes. In three-year fallow fields it takes 400 to 1,000 hours per hectare to remove weeds. Weeding may account for up to 50% of the labour inputs of a cropping cycle and is perceived by many Lao shifting cultivators as the major constraint to upland rice production (ahead of pests, insufficient rain, and land availability).

**Harvesting**

Rice harvesting techniques vary widely according to ethnicity. Mon-Khmer groups such as the Khamu, Katang, and Mankong prefer to strip the grain from the panicles in the field using bare hands, and put it straight into baskets. No threshing is required and the grain can immediately be stored in granaries. Others, such as the Tai-Lao, Hmong and Yao, prefer to use sickles for cutting stems and leave the sheaves to dry in the field before collecting and threshing them. It takes more than 150 hours per hectare for the manual stripping method and about 100 hours per hectare for the sickle method. Associated crops are generally harvested before rice. Upland rice yields vary from between 0.8 and 2.5 tonnes per hectare, depending on fallow length, seasonal rainfall, soil type, pest incidence and weed infestation.

**Livestock and fisheries**

All Lao shifting cultivators also raise animals. Livestock represents a major source of income and is also used in rituals. Most families have small livestock: poultry, pigs and goats. More affluent families also have large livestock: cattle, buffaloes and horses. Forest fallows, shrubby fallows and harvested fields are used as free grazing areas for cattle, buffaloes and goats. Poultry and pigs are often fed with maize, rice bran and other feed. Livestock development plays a major role in villages where shifting cultivation is being reduced and stabilised.

Although fish is less important than livestock, fishing and fishculture can be significant for some shifting cultivation communities, depending on their access to streams and water bodies. Bee keeping is also practised in several shifting cultivation villages.

**Transport and storage**

Transporting the harvest to storage systems can be tedious when fields are far away, so horses and buffalo are sometimes used to carry the crops. A number of different storage systems exist: bamboo granaries on stilts, bamboo jars, storages under houses, and sophisticated wooden granaries. In Khamu villages rice granaries are located away from the house to protect them in case of accidental fire. When the harvesting is finished, the rice is transported to storage locations immediately.
Rice milling

Rice milling is traditionally performed either by using a foot-operated rice pound or by using hand-operated wooden utensils. More and more small engine-powered rice mills are now being used throughout the country, even in villages located several hours away from the road.

Conclusion: key points about shifting cultivation systems in the Lao PDR

Important aspects of shifting cultivation with implications on strategies for developing potential alternatives include the following:

- Shifting cultivation systems and farming practices are diverse in the Lao PDR and are most common in the uplands.
- Lao swidden systems are not static: most of them are progressively evolving into more sedentary forms of agriculture.
- Government policy, population increase, social change and market integration are major factors for change.
- Fallow periods are generally becoming shorter.
- Slash-and-burn agriculture is practiced by all ethnic groups and has an important socio-cultural dimension.
- Upland rice is still the major crop grown by Lao shifting cultivators, in association with several other crops, including some cash crops.
Besides crop production, Lao swiddeners are also involved in livestock and NTFP collection, which generally represent their major source of income.

The majority of Lao shifting cultivators belong to the poorest section of society and are presently the focus of most rural development programmes.

Lao integral shifting cultivators possess an intimate knowledge of their biophysical environment. Their indigenous knowledge can be combined with scientific experience to develop sustainable alternatives to swiddening.

The most criticised aspects of shifting cultivation include cutting trees, use of devastating and polluting fire, lack of ‘modernity’, use of large amounts of land, and lack of sustainability under high population density.

The most attractive aspects of long-fallow shifting cultivation include adaptation to forest farming, suitability for highly heterogeneous environments, low incidence of pests and diseases, independence from purchased inputs and maintenance of agricultural biodiversity.

Selected references


Author:
Dirk Van Gansberghe, dirkvangansberghe@yahoo.com

Improving Livelihoods in the Uplands of the Lao PDR was produced in 2005 by NAFRI, NAFES and NUOL.