Livelihood changes and landscapes dynamics in the northern upland of Laos.

by Marion Rivera

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The study reported here is a component a baseline developed by the EFICAS project to monitor its impacts village landscapes and livelihoods in 24 villages located in the three provinces of Luang Prabang, Huaphan and Phongsaly in the northern uplands of Lao PDR. The six months training period involved regular trips to ten villages in Luang Prabang and Huaphan Provinces as part of the methodology development for the project monitoring and evaluation system. I would like to thank all village communities for the support they provided to our research-development activities, for their patience during long interviews and their hospitality.

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Introduction

Swidden agriculture has traditionally been the basis of subsistence farming system in the uplands of northern Laos. This rotational system allowed to control weed pressure and to restore fertility with long fallow periods, more than 10 years. Through this system upland dwellers could sustainably ensure their subsistence based on sloping land cultivation. But recent trends of market integration led to a shift from subsistence to commercial production. New crops were introduced, such as hybrid maize, and entire villages turned to new cropping systems with shortening fallow periods. These new practices disrupted nutrient balance in the swidden system and led to gradual land degradation.

With market opening, upland households also got access to new opportunity to develop their livelihood by switching from subsistence activities to income generating activities such as trade, service provision, etc. New livelihood strategies emerged such as capital accumulation through livestock, investment in perennial crops, diversification of income generating activities, depending on the HH asset available in terms of labour, land and capital and the objectives of the farmers. Dorward (2009) and Tittonell (2014) describe 3 main HH strategies that we use to categorize the continuum of individual HH strategies observed in the uplands of Northern Laos.

In the context of our study sites, the hanging in strategy consists in maintaining traditional practices in the absence of individual capacity to change. In Laos, many households still practice upland rice cultivation for self-consumption despite the government policy to eradicate this cropping system. This survival strategy does not allow to accumulate capital and cannot lift these households out of poverty.

Stepping up strategies require to mobilize capital for investment in cash crops or livestock, allowing households to gradually accumulate capital. New income generating activities remain in the sphere of agriculture.

Stepping out strategies mark a diversification of income generating activities outside of the agricultural sphere. The capital accumulated through cash crop cultivation and animal husbandry is reinvested in off-farm activities (e.g. small trade, transportation after purchasing a truck, service provision).

But household capacity to seized opportunities does not depend only on the HH labour, land and capital available but also on factors outside of the household sphere such as village accessibility, province or district regulation, social cohesion, etc. These overarching factors are related to the village topography (e.g. % of flat and slop land), accessibility, ethnicity, settlement history, etc. Consequently, it is important to understand historical patterns of changes at the village level before disentangling the many household strategies.

Livelihood differentiation strategies, i.e. hanging in, stepping up and stepping out, have been studied at the HH level and within the larger context of the village trajectory. Dorward (2009) argues that HH livelihood strategies can be put in perspective at wider scale as an aggregation of smaller units. Indeed opportunities for changes offered to households by their socio-ecological context analysed at village, district or higher levels determine to a large extent their livelihood
strategies and their capacity to change. For example, the terracing of new paddy fields and road construction to reach production areas are undertaken by villagers as the result of individual capital accumulation combined with collective investment in opening new production areas.

Landscape transformations have to be studied and understood at different scales: at the household level to determine how HH strategy aggregation are rooted in landscape change and are influencing this changes though cumulative effects and also at village community level to explore the range opportunities offered by diverse landscape patterns to HH livelihood development strategies. A good understanding of village ‘development contexts’ (Messerli et al., 2009) and pathways of change (Castella et al., 2013) is a prerequisite to technical interventions aimed at enhancing village community capacity to undertake their own local development. The diagnostic study presented in this report is based on a method specifically designed to characterize village livelihood system and assess their pathways of change as part of the EFICAS project baseline and impact monitoring system described in Bonnin et al. (2015).

Case study sites
This study was implemented as part of the EFICAS project in Louang Prabang and Houaphan Provinces, two of the five target provinces of the project, beside Phonsaly, Sayabouri and Xieng Khouang (EFICAS Project Document 2014). The participatory village selection process involved successive steps that are reported in an internal project document (EFICAS, 2014). It was conducted in close collaboration with the provincial and district staff from the Ministry of Agriculture and Forestry. Village accessibility, size (both area and population), geomorphology and diversity of local landscapes, etc. were key criteria for village selection. The baseline methodology was developed during the period from March 2015 to June 2015 through a reflexive process (Bonnin et al, 2015) based on fieldwork conducted in 10 villages (Table 1).

<table>
<thead>
<tr>
<th>Provinces</th>
<th>District</th>
<th>Village</th>
</tr>
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<tbody>
<tr>
<td>Louang Prabang</td>
<td>Pakseng</td>
<td>Hatpha-ot</td>
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<td></td>
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<td>Nongkham</td>
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<td>Houayvat</td>
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<td>Houamuang</td>
<td>Homthong</td>
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</table>

The first round of village survey lasted about 5 days per village with two surveyors. Data were collected at two different levels:
- Village level based on focus group discussions, including: problem census with men and women, village history, village mapping, cropping and livestock system characterization, and informal conversation with village key informants about livelihood systems.
- Household level with two questionnaires:
  - Rapid exhaustive survey of all village HH consisting in basic quantitative data on production systems and income, totalling 560 HH in 10 villages.
  - Detailed survey using a more in-depth questionnaire to a random sample of 30HH per village (totalling 291 HH in 10 villages), about e.g. family composition, agricultural practices, and agrobiodiversity. These interviews also provided the opportunities to spend more time with villagers to understand the underlying causes of the livelihood changes revealed through quantitative surveys or decision making processes related to ‘production road’ opening and paddy plot terracing.

**A household differentiation model**

Data from the rapid and the detailed surveys were compiled for the 291 HH who took part in both surveys. Variables included in the final analysis where gradually selected through several Principal Component Analyses. The successive PCA allowed selecting the most representative set of variables to describe HH diversity in each village. From this selection a final PCA was used to build a livelihood strategies model based on correlation between each variables and the HH distribution.

Then a HH classification was processed using the HCPC function (Hierarchical Clustering on Principal Components, or Cluster Analysis) under R software package. This analysis yielded a typology of livelihood strategies. The village household composition in term of percentage of each HH type led to a village typology.

**A landscape differentiation model**

Villages are impacted differently by external drivers of changes depending on their specific characteristics:

- Geomorphology: relief, village position on the slope, river flowing through the village landscape, % of lowland and hillsides, etc.
- Accessibility: defines village integration to the market economy and access to basic governmental services, e.g. health centre, market places, schools, electricity, telephone, administration, etc.
- Population: demography (birth rate, mortality), ethnicity, population density, and migrations have a direct impact on the pressure on agricultural land, labour force availability, etc.
- Social cohesion: depends mainly on local leadership and history of the village. It determines the capacity of a community to respond to unexpected events and chocks by developing coping and adaptation mechanism relying on social capital

These factors were addressed though focus groups discussions with village communities and combined with expert knowledge (e.g. trader, extension agents). The collected information was combined into a village landscape differentiation model. This graphical model describes the differentiation mechanisms which led to the present situation. The village typology is based on the analysis of empirical data obtained through field survey and use of the graphic model of village differentiation.
Results

Variable selection to characterise household diversity
Variable have been selected through explorative statistical analysis. The aim of this selection process was to define the most relevant HH characteristics to understand livelihood strategies and differentiation patterns.

Population changes and labour force availability
The age distribution graphs produced from the population census of the detail survey reveal disparities between villages, but also some common features. A drop in the 0 to 5 years old age group is noticeable for example in all villages, especially Phoutong, Houayvat and Nongkham showing the recent results of birth control campaigns supported by government agencies since the early 2000s (Figure 1). Then another gap is visible in the 15 to 30 year old group, which is mainly due to emigration of young people out of the village to find temporary jobs in factories, plantation, or power plants as daily wage workers or permanent job (e.g. policeman, soldier, and teacher). This later form of emigration will probably increase in the future thanks to better access to education and increased school attendance in all the villages as revealed by the population census.

Traditionally, upland families in remote areas used to have many children who started helping the parents with agricultural tasks as soon as they could after completing the first classes of primary school. But, as a consequence of family planning and improved education policies, less children were born in the recent years and they get access to a relatively better education than their parents, i.e. a larger share reach secondary school level. Better education and access to information leads young generations to migrate to get access to income generating activities that are not available in their village. Consequently, there will be less arms available for
agricultural tasks in the future. Most households are adapting to this gradual change in labour force availability, with important consequences on agricultural practices.

Changes in agricultural practices
Combining upland rice and lowland rice to achieve rice self-sufficiency

Rice cultivation is the main staple crop grown for almost all households. Household strategies are steered towards achieving rice self-sufficiency. Therefore, upland rice is grown to compensate for the absence of paddy area or production of lowland rice not sufficient on the limited paddy area available to meet the household needs. As indicated in Erreur ! Source du renvoi introuvable, in the case of Homethong village, villagers tend to stop upland rice cultivation when they produce enough rice from their paddy fields to meet their basic needs estimated at 350kg unhusked rice per person per year. Because of gradual land degradation on the hillside due to shortening fallow periods, villagers seek to open new paddy fields wherever possible. Indeed, the land productivity of lowland rice is much higher than for upland rice leading many households to invest in terracing paddy areas whenever they get access to capital. This practice contributes to the overall trend of agricultural intensification in the surveyed villages.

Livestock as an economic safety net

Nowadays, large livestock (cattle and buffaloes) are mainly sold to the meat market in Vietnam. Livestock are used for capital accumulation, for big investments (e.g. house construction, land purchase or terracing) or as safety net in case of bad harvest or health problem of family members. A big buffalo can be sold more than 10 MLAK (eq. 1.250 USD).

Pigs are traditionally raised in the village mainly for selling and ritual purpose. But the capital accumulated through small livestock is usually used for daily occasion: daily consumption, children study, or small equipment as rice mill or motorcycle.
Goats raising has been introduced more recently in the study villages by development projects. Then in 2014, the goat price was high (40.000 LAK/kg eq. 5 USD/kg), which pushed some farmers to invest spontaneously in goat raising.

Livestock is not sold every year but occasionally according to the need of each HH. The livestock can represent very important ‘living savings’ in some villages. However, this activity is very sensitive to disease outbreaks and also changes in agricultural practices. Historical analyses showed that in some villages, diseases almost completely wiped-out the livestock herd within a few weeks. Many households also sold their animals by fear they would get contaminated before they could sell them (e.g. Houayvat in 2014). In other villages, villagers feared damages from roaming livestock to newly planted rubber plantations or other cash crops and sold their whole herd. These villages then become more vulnerable to external shocks as they have lost an important safety net.

Cash crop cultivation and market integration

In the recent years, the area under cash crops has increased tremendously in all villages. Agricultural expansion was essentially triggered by the market demands for agricultural products and the improvement of village access to the market. Depending on market opportunities provided by traders and middlemen, villagers engaged in the cultivation of annual cash crops such as maize, sesame, sticklack, or job’s tears or perennial crops such as rubber, tea or coffee. Some vanguard farmers usually tested the crop for one or two years before the whole village followed into the innovation. But the market prices fluctuate a lot depending on how the traders handle their business (e.g. contract breaking are common), and on how fashionable crops are. When produced by many farmers, they saturate the limited local market demand getting the prices down. In addition farmers often have to get credits to buy expensive inputs (e.g. hybrid seeds, herbicide), which makes cash crop production a risky business for villagers. This engagement in a new crop is therefore a combination of individual strategy and collective process of innovation involving the whole village.

Income from cash crops can contribute to rapid capital accumulation (e.g. hybrid maize). This money is usually invested in HH daily consumption, children education or equipment. Some practices are obviously non-sustainable and farmers know that they cause land degradation. However, they consider maize cultivation as a temporary income generation option that allow them to reinvest in more sustainable practices such as paddy rice terracing or purchase of livestock head or further expansion of agricultural land through investment in road constructions to reach more fertile production area that are distant from the village.

Off-farm vs on-farm income

Different sources of off-farm income have been addressed through the rapid survey: handicraft, wage, trade, renting, pension and remittance. Off-farm activities respond to two different livelihood strategies: either off-farm activities do not require big initial investments (e.g. daily wage worker, emigration of the children who sent remittance to their parents), or they require from the HH an initial process of capital accumulation prior to large investment: buying a shop
for local trade, a car or tractor to provide paid services to other villagers. In both cases the HHs diversify their source of income without necessarily dropping agricultural activities. But this diversification can occur either as a way to sustain their livelihood because farming activities cannot sustain it anymore or to diversify their source of income in order to accumulate capital.

The average income distribution shows these two type of diversification through off-farm activity. In Hatsam village for example, a rubber concession took a large area from the village, reducing the land available for villager to practice shifting cultivation, and as a result decreasing the fallow period. In this village, off-farm activities are considered as a way to sustain livelihoods (Figure 3). On the other hand, Samsoum engagement in off farm activity is the result of capitalisation through livestock raising.

Household acquisition of equipment also contributes to off-farm income opportunities. It is a step by step process depending on the income surplus generated by the family or to the bank loan opportunities in the village. The detailed survey showed that equipment is generally acquired in this order: motorcycle, TV, rice mill and hand tractor (Figure 4). This succession reveals the HH priority in improving their livelihood: mobility, light mechanisation and then heavier mechanisation can be considered as labour saving investments. The total number of equipment owned by the family was chosen as a proxy for capital accumulation as it reveals quite well at which stage of asset accumulation process a HH is.

![Figure 3: Average income distribution per HH in the surveyed villages](image-url)
Household differentiation model

**Characterizing household diversity**

The variables selected as indicated in the previous section were processed through a Principal component Analysis (PCA - Figure 5) and HH types were defined through a Hierarchical Clustering on Principal Components (HCPC - Figure 6).
The PCA reveals a HH differentiation pattern according to the level of capital accumulation on the first horizontal axis, represented by the cash crop income, equipment, and livestock owned by the HH. On the second, vertical differentiation axis HH relying mainly on upland rice are located at the top of the graph while HH relying on lowland rice from their livelihoods are located at the bottom.

Three main HH types (i.e. HH Types 1, 3 and 4) were identified through the statistical classification. The three HH types rely on slash and burn cultivation for their livelihoods with a differentiation process driven by labour force availability and capital accumulation:

**Survivors – HH1** is composed of HH that are at the beginning of their family life cycle (young couple without or with young children) or at the end (old couple). These HH are mainly engaged in upland rice cultivation in order to reach rice sufficiency. Labour force is dedicated entirely to fulfil subsistence needs. No production surplus is generated, so no production can be sold. Engagement in cash crop production is compromised for this HH type.

**Intensifiers - HH3** is composed of HH in the middle of the family life cycle with all children still living with the parents. These HH are engaged in upland rice cultivation and usually reach rice sufficiency. Thanks to an abundant labour force they can generate surpluses that are invested in

**HH Type 1 - Survivors**
HH with limited labour force engaged in subsistence agriculture

**HH Type 2 - Lowlanders**
HH in villages with large paddy areas

**HH Type 3 - Intensifiers**
HH engaged in swidden agriculture- diversifying their production thanks to labour force availability

**HH Type 4 - Diversifiers**
HH investing in other activities through financial investment
cash crop cultivation. The income generated from cash crop cultivation is often invested in small livestock (goat and pig), to start the capital accumulation process.

Diversifiers - HH4 is composed of large family households that are engaged in cash crop cultivation and have accumulated enough capital to invest in small livestock (goat and pig) and then to large livestock (cattle and buffalo).

These three HH types correspond to an increasing number of HH members and labour force available to produce surpluses beyond rice self-sufficiency. As traditional upland agriculture relies essentially on manual labour with very limited mechanisation, labour force availability makes a big difference in term of livelihood options.

Lowlanders – HH2 includes HH having an access to paddy field. In village where paddy fields are available the access to paddy land is the most discriminating factor. This HH type is not involved in the same differentiation process than the three others. Indeed with an access to paddy cultivation, rice sufficiency is more easily reached because paddy land is more productive per unit area and also per unit labour than shifting cultivation.

Off-farm income is not well represented in the first two dimensions of this PCA. This poor representativeness may result from the two different statuses of off-farm activities. As mentioned above, off-farm activities can be part of a survival strategy for poor households or a stepping-out strategy for diversifiers that would require some initial investment.

The general trend revealed by the PCA is a gradual demise of shifting cultivation system as farmers get access to alternative diversification pathways. A two steps differentiation pattern can be observed. Firstly, family labour force is invested in cash crop production for an initial capital accumulation. Secondly, the capital is invested in other productive assets such as livestock, tree plantation or off-farm activities (e.g. trade, transportation service). Cash crops production is often seen as a temporary phase in the capital accumulation process. Therefore, from the point of view of most villagers, cash crop production practices do not need to be sustainable as they are a mean to jump to the next level of capital accumulation in a stepping-in process. Villagers who are still at the initial phase of the accumulation process make decision on cropping practices without considering sustainability and resilience of their production system in the next stages. As long as natural resources can sustain the initial accumulation process, they are satisfied.

In local contexts where paddy land is not available, HH that lack labour force are trapped in upland rice cultivation. In that case, HH have to find other “escape strategy” in order to maintain their livelihood, for example selling their labour force as daily wage workers. These strategies ultimately lead to stop shifting cultivation. On the other hand, HH who have stepped-in thanks to cash crop production often invest in more sustainable practices involving big investments such as land terracing and digging irrigation systems to produce paddy rice or road construction to get access to new production areas. This pathway also leads to the demise of traditional shifting cultivation.
Investment in paddy terracing and road opening are two major drivers of landscape changes at the moment. Road opening on the hillsides allows rapid agricultural expansion as it provides access to small tractors and trucks. Indeed, cash crop harvests are often much heavier than upland rice (e.g. 5t/ha for maize vs 1t/ha for upland rice) and villagers would not dare to carry back such heavy loads by hand. The road is built with the money from cash crops and it allows further expansion of cash crops to maintain the level of production in the face of land
degradation in initial production areas. They are therefore key elements of a pioneer front that progress up to the point when the land frontier is reached. Village HH are thus engaged in successive steps that bring them from traditional swidden systems based on upland rice to a rotational monocropping systems based on cash-crops, then expansion of cash crops areas through the investment in road constructions and finally, intensification through investment in paddy terracing, irrigation when feasible and adoption of more sustainable cropping practices. Despite the key importance of cash crop in the process of capital accumulation, rice self-sufficiency remains an important component of farmers’ livelihood systems.

The distribution of the different HH according to their livelihood strategy and their level of investment in paddy terracing and road opening allows to classify them according to the successive stages in the agrarian transition described here above. The most important HH type investing in paddy terracing is Lowlanders (HH2), with a significant expansion of paddy area by families who already owned paddy fields (Figure 7). The households belonging to Survivors (HH1) type is very limited, showing the difficulty of HH trapped in swidden agriculture to invest in new assets allowing them to change production practices.

The investment in road construction also mainly concern Lowlanders (HH2) households (Figure 8). Road construction is done in parallel with paddy rice terracing as the equipment required are the same, i.e. levelling tractor or bulldozer. Paddy areas require less labour than upland rice for similar production level allowing to free labour force that can be invested in further cash crop cultivation.

The investment in road opening of Intensifiers (HH3) household type demonstrate their engagement in cash crop cultivation and their objective to optimise the use of their labour force by getting easier access to production area. This marks the end of shifting cultivation for Intensifiers (HH3) farmers. Notwithstanding their more important income, Diversifiers (HH4) households are not the one investing the most in road opening. These HH are generally not located in villages where big investments can be done for road opening because the slopes around the village are too steep.
FIGURE 9: INVESTMENT IN ROAD OPENING IN THE LAST 10 YEARS ACCORDING TO THE TOTAL HH INCOME IN 2014 (MILLION LAK)

FIGURE 10: PADDY TERRACING INVESTMENT IN THE LAST 10 YEARS ACCORDING TO THE HH TOTAL INCOME IN 2014 (MILLION LAK)

Figure 9 and Figure 10 show that investments in either road opening or paddy rice terracing are not related to the total HH income. These investments depend highly on village characteristics. The enabling conditions to landscape changes are therefore not only related to household individual conditions and decisions but also to village characteristics as described below:

- **Geomorphology**: village relief steepness impacts the level of investment needed for paddy terracing, irrigation or road opening,
- **Social cohesion**: in particular for road opening, this kind of large investment (human or economic) requires a collective arrangement that is negotiated with the trader, for example for credit scheme, not by individual households but by representatives of the village community (e.g. villages head, village committee). Paddy terracing investments are more seen as individual initiatives but they usually have to receive the agreement of the village authorities.
- Contract opportunity: road opening or paddy terracing often result from a contract opportunity in relation to an agricultural production (e.g. rice, maize, rubber). The company or entrepreneur includes the road construction in the contract farming negotiation (e.g. Phoukang and Houaykai villages). The contracts can also be supported by projects or banks (especially Nayobay Bank in the research sites) that provide additional guarantees to the company.

In Samsoum village, for instance, the road construction took place in 3 steps: in 2010, the whole community was involved in the opening of one road with manual equipment, then the village invested collectively twice (in 2011 and 2012) in the opening of two more roads that were contracted to a company and paid by villagers through a collective loan to the Nayobay Bank. Each HH has to reimburse a different amount of money according to (i) their implication in the road construction work, (ii) if they have a truck or a hand-tractor and therefore use the newly opened road, and (iii) according to the poverty level of the HH (poor, medium, rich).

**Distribution of livelihood systems in the villages**

Obviously, an understanding of the local context is necessary to fully describe household livelihood strategy at the village level. Road opening and paddy terracing are only two examples of stepping up strategies that are decided at the individual level but are in interaction with the village community. A first approach of village contexts consists in analysing their composition in term of the different household types identified (Figure 11).

![Distribution of livelihood systems in the villages](image-url)

**Figure 11: Village typology based on the distribution of HH types in each village**
Some villages have all HH engaged in slash and burn agriculture, i.e. HH1 and HH3 households.

**Hanging in**

Hadphaot and Hatsam villages for example are under severe land constraint as they cannot extend their cash crop area because of land use regulation (government promotion of livestock) and private investment (rubber concession) taking away a big part in the village area. These villages are apparently trapped in slash and burn agriculture. Under these constraints, alternatives to slash and burn are sought through introduction of high value cash crops such as Sacha inchi or vegetable production, intensification of livestock systems, or off-farm activities as daily wage workers for the rubber company.

**Stepping up**

In the recent years, Houaykay has expanded its agricultural area for cash crop cultivation and eventually capital accumulation and construction of production road. We can expect that the percentage of HH3 will increase in this village in the future and the population differentiation will carry on until the emergence of HH4 households.

**Stepping out**

Villages that are more advanced in the differentiation process (with an increasing share of HH4) often reach the physical limits of agricultural expansion and intensification when the tough relief constrain terracing and irrigation works at reasonable cost. Some villagers in Samsoum and Houayvat villages have invested in paddy land or other activities in other villages and then moved definitely after an initial period of installation in their new village. Samsoum underwent two emigration waves in 1999 and in the past 2 year (2014 and 2015). These migrations usually concerned the richest HH in the village as the migrants of the second wave had to buy lowland in their new village location for 45 million Lak/ha (approx. 5.600 USD/ha) in 2014. In Houayvat two families invested in paddy land in a remote village in order to move out of the village in the future or for their children who live in Louang Prabang.

**Paddy-based system**

Big inequalities exist within villages between households who have access to paddy fields and those who don’t. For HH2 type households rice sufficiency is reached more easily than for the others and their labour force is reinvested in cash crop production allowing for rapid capital accumulation. But HH1 households (i.e. young HH who haven’t inherited paddy field from their parents yet or HH newly arrived in the village) also represent a significant share of the village population. They have no access to paddy field and lack labour force so they don’t have the possibility to engage in the cash crop cultivation. The differentiation process is quite limited in these villages, leading to a dual system with rich lowlanders and poor shifting cultivators. Each household type will remain the same over long period except when young couples inherit paddy land from their parents at some stage. Moreover the percentage of HH involved exclusively in slash and burn agriculture is too low to allow mutual help in the upland fields and so to compensate for the lack of labour force in the young HH. These HH are durably trapped in HH1 type.
This first level of analysis based on quantitative data calls for a more refined understanding of the village history and current landscape dynamics prior to development intervention. Indeed, statistical analyses reveal the relations between variables or similarities between households or villages but fail to show causal relations between variables or the pathways of change that targeted interventions have to build upon.

Landscape differentiation model

A common local history but different village trajectories

The village history over the last four decades was addressed through focus group discussions. Three main events were common to all villages in the study region: (i) village settlement at the end of the Indochina war, (ii) construction of the main road and resettlement of the village alongside the road, and (iii) introduction of cash crops thanks to gradual market integration. But the impacts of these events on the village landscape and livelihood dependent to a large extent on their geomorphologic characteristics, social cohesion, land use regulations and also individual livelihood strategies adopted by village HH over time (e.g. engagement in cash crop cultivation, in livestock raising, in off-farm activities). From common initial conditions at the end of the war, in the late 1970s, which can be described as an extensive slash and burn system diluted in a forest matrix, the villages landscapes and livelihoods evolved along different trajectories of change. Participatory mapping exercises combined with storytelling and collection of statistical information about the village led to a graphic description of the village spatial organisation and change pathways. The resulting graphic models are presented in this report for the three villages of Samsoom, Houaykay and Hadphaot (see also Table 2).

<table>
<thead>
<tr>
<th>Village</th>
<th>Year Main Settlement</th>
<th>Main Road Opening</th>
<th>Year Main Cash Crop Introduced</th>
<th>Main Cash Crop</th>
<th>Under Contract?</th>
<th>Year Production Road</th>
<th>Fallow Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hadphaot</td>
<td>1975</td>
<td>1995</td>
<td>1990</td>
<td>sesame</td>
<td>no</td>
<td>no road</td>
<td>4-5 years</td>
</tr>
<tr>
<td>HouayKai</td>
<td>1973</td>
<td>1984</td>
<td>2013</td>
<td>maize</td>
<td>yes</td>
<td>2013</td>
<td>5-7 years</td>
</tr>
<tr>
<td>Samsoom</td>
<td>1974</td>
<td>1985</td>
<td>1998</td>
<td>job’s tears</td>
<td>no</td>
<td>2010</td>
<td>8 years</td>
</tr>
</tbody>
</table>

In the graphic model village boundaries are represented by a stylized shape to focus the attention on the differentiation elements which occurred in the 4 past decades and not on the initial differences in the villages. The differentiation patterns of each village are illustrated by the different landscape components, their evolution in time, and the interactions between each component.

The landscape components are shown in Figure 12:

- Matrix elements: forest or agriculture area,
- Patch elements: cropping area, village settlement,
- Main road, production roads and foot paths,
- Interactions between components of the village landscape.
A graphic model of village landscape trajectories
The graphic model of village land use changes adds the time dimension to more static analyses of livelihood systems presented in the previous section of this report (Figure 13).
Livelihood changes are analysed as the impact of historical changes on the village landscape:

**Hadphaot** exemplifies the swidden-based *‘hanging in’* villages as described in the previous section. This village is trapped in a non-sustainable slash and burn system with decreasing fallow length due to the shrinking area available to agriculture. The cropping area has been first reduced by a rubber concession imposed by the district authorities in the northern part of the village in 2007. About 300 ha of swidden land (20% of the village area) was given away to a Chinese company for rubber plantations and is therefore not available anymore for food crop cultivation. Then the district authorities dedicated all the southern part of the village (300 ha or 20% of the total village area according to the PLUP 2012) to livestock production. As a consequence, villagers have to engage in new intensive production systems such as vegetable or livestock raising in the village dedicated area. Reduction of the fallow period from 10 to 4 years led to land degradation and yield decrease in former upland rice fields. Moreover 40% of the village area has over 25° steep slope, which doesn’t allow road opening or paddy terracing. Villagers are desperately searching alternatives to former swidden systems.

**Houaykai** village head signed a contract with a maize company that opened production roads in 2013. But before this date, the village was already engaged in maize crop expansion through labour-saving use of herbicide. This expansion process has been reinforced by the village engagement in a maize contract and the construction of 3 production roads in the village. This unregulated expansion of the cropping area led to crop damages caused by roaming livestock. These damages pushed villagers to sell their livestock. Then livelihood systems and land uses tended to concentrate on maize cultivation. Rapid deforestation further led to land degradation and decreasing maize yields; up to a point when maize production was not sufficient to reimburse the money borrowed for the road construction and farmers got trapped into indebtedness.

**Samsoum** is a Hmong village with a lot of labour force available in large HH units (up to 20 HH members for the family of the village head). Recently, they invested their labour force in Job’s tear cultivation and then reinvested the benefit obtained from cash crops in the purchase of large livestock heads. Buffaloes and cattle represent a key capital asset in the village, more important than in the 2 other villages; average of 7.6 animal/HH in Samsoum, 1.7 for Houaykai and 2.2 for Hadpha-ot. After a population peak in the 1980s (70HH), the village underwent

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**Figure 13: Village differentiation pattern in the three cases study sites**

<table>
<thead>
<tr>
<th>1974: creation of the village</th>
<th>1984: Village resettlement creation of the road</th>
<th>2010-2012: construction of the production road</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Timeline Diagram" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
successive emigration waves to village where paddy fields were available. Moreover the secondary school established in the village in 2007 led to an increase of the school attendance rate and a decrease of the children and teenager labour force availability for agricultural tasks. Under labour constraint, the HH diversified their upland rice production with cucumber in association with rice cultivation for selling.

The drivers of landscape differentiation

In the three cases studies presented above an agricultural mosaic has replaced the forest matrix leading to different landscape patterns (Figure 14). Agricultural expansion through cash crops reinforced itself through reinvestment of the capital from cash crops into road construction that provide access to new cropping area. Remaining forest is present in the village only as scattered patches. The expansion of the cropping area went together with intensification and labour force saving strategy thanks to the use of herbicide and road construction which allowed carrying heavy harvest loads from the production areas using trucks and hand tractors (Castella et al., 2012). This intensification process led to a gradual specialisation of the village in cash crops because of the investments in road and chemical inputs that need to be reimbursed to the traders by selling the contracted cash crops. Very little capital or labour force remained to be invested in livestock.

Diversification to livestock production occurs as seen in the village typology after capital accumulation from cash crops is sufficient, i.e. farmers can repay their debts, or when the village is constrained in term of agricultural expansion leading to higher levels of diversification.

Constraints to agricultural expansion can be different depending on the village context:

- General lack of labour force in the village,
- Village regulation on the use of chemical input, animal roaming,
- Village geomorphology (i.e. not enough suitable land available),
- Poor social cohesion.

These constraints push villagers to diversify their production to labour force saving alternatives with low level of capital investment.
Discussion

Towards a landscape approach to livelihood strategies

From common initial situations (traditional system swidden system or paddy based system), the villages have evolved towards their current situation under the influence of external drivers and internal adaptations based on local resources available (e.g. land, capital, knowledge, social cohesion). Our village typology shows that villages can be characterised by the percentage of HH adopting a particular livelihood strategy. But a historical analysis of land use changes is necessary in order to understand how the village community reached its present situation and what leverage points are available for intervention.

Access to market depends obviously on the road access to the village, but also on the village production in quantity and diversity. Thus from the initial traditional farming systems (traditional swidden system or diversified paddy system), most villages intensified their farming practices though maize roads and used herbicide up to a point where the villages were under constraint because of a general lack of labour force or strict land use regulation. Unfortunately, market integration is often linked to land degradation (Figure 15) as a result of crop expansion and input-use intensification (i.e. herbicide use, mechanisation).
Recent landscape and livelihood changes have contributed to increase both the ecological (e.g. land degradation, soil erosion, fertility loss) and economic (e.g. indebtedness, contract breaking, price fluctuation) vulnerability of the study villages.

The combination of HH and village level analysis support the interpretation of the non-sustainable cropping practices as contributing to a temporary capital accumulation process that aims at lifting poor households out of poverty before they can invest (i) in more sustainable agricultural practices e.g. through paddy terracing or (ii) in children education in the hope they can invest their good education towards off-farm livelihood systems.

Towards a generalization to the northern uplands of Laos
A recent meta-analysis of agrarian changes in the northern uplands of Laos (Buchheit 2011, Castella et al., 2012), showed that village differentiation is driven by (1) the changing accessibility to market (2) expansion of cropping area (3) successive land policies (e.g. land use planning, land allocation, village consolidation and resettlement, land concessions); and (4) environmental regulations. Our HH differentiation model is driven by labour force availability which allows farmers to shift from upland rice to cash crop cultivation and thanks to gradual capital accumulation can further invest in large livestock and in farm equipment. But this differentiation is allowed only if cash crop and livestock markets are available. Higher levels of integration, i.e. beyond HH and village, are therefore essential to address to understand how village communities are exposed to new risks (e.g. contract breaking, price fluctuation) and new vulnerabilities (e.g. indebtedness, tenure insecurity) in relation to market integration.
The shift from subsistence agriculture to a market oriented agriculture obviously improved rural livelihoods by increasing agricultural income of the family in the short term but non sustainable practices may jeopardise these benefits on the long term through ecosystem degradation (Downing and Lüdeke, 2002). On the other hand, HH differentiation patterns described here above lead to diversification after an initial phase of agricultural expansion and intensification. After a phase of accumulation of financial capital at the expense of the natural capital, livelihood systems enter into a phase of diversification. The economic benefits from cash crop cultivation are invested in perennial plantation, paddy terracing, intensive livestock systems or off-farm activities. The diversification of livelihood systems has been shown to reduce HH vulnerability to external shocks and to increase adaptive capacity to climate change.

Livelihoods diversification generally first occurs in villages where cropping system expansion is limited by internal or external constraints. Where the agricultural system is not under pressure (e.g. geomorphological, land tenure, regulation) agricultural expansion expose villagers to fall into poverty traps because of high land degradation or indebtedness (Lybbert et al., 2004). Therefore, in a context of rapid agricultural intensification and increasing vulnerability, solutions have to be developed in order to steer the current trajectory of change towards more sustainable futures. Castella et al. (2012; 2013) argue that development efforts and resources would be better invested in buffering the potentially negative consequences of rapid market integration on people and the environment through diversification of the landscapes and livelihood systems, because HH and villages have already invested in the intensification phase of the trajectory.

Limits and perspectives of the study
The challenge of the Eco-Friendly Intensification and Climate resilient Agricultural Systems (EFICAS) Project is to identify pathways towards a sustainable intensification of agricultural practices at both HH and village levels to maintain reasonable levels of production while avoiding land degradation. The study reported in this document is a first diagnosis of the situation based on 10 villages located in 2 provinces. The main purpose of this preliminary analysis was to develop the method for both data collection and analysis. A total of 24 villages in 3 provinces will be included in the next phase of this study.

Paddy related livelihood strategies are not addressed in detail in this study because only few villages had paddy land in our first sample of 10 villages. Adding the other villages will support the reflection about HH and village diversity in the northern uplands of Laos. How villagers invest in landscapes and livelihoods differentiation after the agricultural expansion and intensification phase will be further analysed based on a larger database that was not available at the time of this report.

Indeed, the landscape differentiation model presented in this study is exclusively based on qualitative data obtained through focus group discussions. More quantitative landscape studies including statistical analyses and use of satellite imageries are needed in order to combine second hand historical information from focus group with empirical data from satellite images and field measurements.
Conclusions

Robinson et al. (2015) define sustainable intensification, as an intensification which allows a decrease of HH and village global vulnerability. Past intensification through monoculture, road construction and use of pesticide tended to increase both environmental and economic vulnerabilities, by land degradation, indebtedness and investing in a single outlet (i.e. hybrid maize). The first HH differentiation model showed that in swidden system, an initial phase of capital accumulation is necessary before engaging in diversification and capital securing through livestock raising.

Our study provides preliminary empirical evidences about how livelihood strategies and landscape differentiation patterns are intimately linked. They should therefore be studied together and at multiple scales from HH and village levels and up to district, provincial and regional levels to understand the drivers and the impacts of the on-going agrarian transition. Bonnin et al. (2015) have developed a conceptual and an operational framework for data collection and analysis that provides a basis for a general understanding of village dynamics. Based on the diagnostic study presented here the project engaged village communities into a theory of change process (Bonnin et al., 2015). Local stakeholders were involved in a long term participatory process that consists in exploring future development pathways, designing more desirable landscapes, and creating enabling conditions for alternative livelihood systems that would lift them out of poverty while preserving natural resources (Castella et al., 2015).

References


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