Landscape and Farming System in Transition: Case Study in Viengkham District, Luang Prabang Province, Lao PDR

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To:

My beloved family and
People who always encourage me

I dedicate this work.
The study ‘Landscape and Farming System in Transition’ was conducted as final thesis in the second year of master in Montpellier SupAgro, France. This research was initiated by Jean-Christophe Castella, the member of CIFOR (Centre International for Forest Research) team for Landscape Mosaic Project in Lao PDR and coordinator of Catch-Up Project, with the collaboration between NAFRI (National Agricultural and Forestry Research Centre) and IRD (Institut de recherche pour le développement), and also fieldwork supervisor of this research. The report was made under consultations of the concepts and under his supports and advised by Elisabeth Rasse-Mercat form Montpellier SupAgro France.

The fieldwork was conducted over three months in three villages, in Viengkham District, Luang Prabang Province that are the Landscape Mosaic Project sites in Lao PDR. During fieldwork, the author has been accompanied by Sayasith Punpakdee, a staff from NAFReC (Northern Agricultural and Forestry Research Centre), translator: Vilapong (from NAFReC) or Khamsao (Subanouwong University), and local facilitator, Bunthan, a staff from DAFO (District Agricultural and Forestry Office) Viengkham District.

By considering that there were certain limits, this research is not yet finish but it is as a base observation to the next study and project activities in the future. For this, the author has a plan to continue the research in the future. The critics and suggestion will be very welcomed in order to improve the research in the future.
SUMMARY

Among all the high biodiversity resources developing countries applying land planning and allocation for development and conservation programs, Laos was selected as one of Landscape Mosaics project sites. Three villages at Viengkham District, Luang Prabang Province were appointed as the project sites where this research was undertaken.

Considering the complex association between the land use patterns and agricultural production systems with all the incorporated factors, the research was carried out by analyzing spatial, time-scale dimensions and the system. Data collection was conducted with multiple dimension study of the affecting factors that were adapted to the actual conditions, combined data collection, and group discussions.

The research outcomes show that the major changes in land use are incorporated with land privatization, as well as the transition from annual to perennial plantation and food to cash crop. The alterations’ main triggers are market demand and government policies with varies intensity from one place to another based on its biophysical and human condition. At all the research fields, the combination of the demographic state and the applied regulation had declined the agricultural land, land access and shortened the fallow cycle of the shifting cultivation. There are four classified agricultural systems based on the rice production dependence, off-farm activities, and capitalization. Along all the research fields, the inhabitants are predominantly classified into shifting cultivation depended system.

**Keywords**: Laos, Farming System, Land Use, Land Allocation, Cash Crop, Shifting Cultivation
Pays en développement doté d’une riche biodiversité, confronté à la question de l’équilibre entre développement et conservation de la biodiversité et ayant mis en place une réforme foncière importante, le Laos a été choisi comme lieu d’étude du Projet « Mosaïques de Paysage ». Différents gradients ont présidé à la sélection de sites de recherche dans ce pays : trois villages dans le District de Viengkham, Province de Luang Prabang où cette étude a été effectuée.

Partant de l’existence d’une relation complexe entre modes de gestion de la terre et systèmes de production agricole, et de tous les facteurs corrélés, cette étude s’est axée sur l’analyse de la dimension spatio-temporelle et des systèmes. La collecte des données a été menée selon une approche multidimensionnelle du point de vue des facteurs influençant le changement, en appliquant des méthodes adaptatives tenant compte des circonstances et des contraintes locales. A ce travail de collecte, a été associé un travail d’analyse et de vérification par le biais d’entretiens avec différents acteurs dans les villages.

Les résultats montrent que les changements de mode de gestion et de mise en valeur de la terre sont en lien avec la privatisation d’une part et avec le passage des cultures annuelles aux cultures pérennes, et des cultures de subsistance aux cultures de rente, d’autre part. Les sources de ces changements sont à chercher dans la demande du marché et les politiques gouvernementales. Cependant, changements et intensité de facteurs de changement ne sont pas les mêmes d’un village à l’autre, suivant les conditions biophysiques et humaines.

Dans le site de l’étude, la combinaison des conditions démographiques et des politiques appliquées, réduit les surfaces cultivées, l’accès au foncier et la durée des jachères. De ce contexte ont émergé quatre systèmes de production se distinguant suivant le niveau de dépendance dans la production de riz, les activités non agricoles et la capitalisation. Les systèmes pratiqués par la majorité des familles reposent sur l’abattis brûlés.

**Mots clés :** Laos, systèmes de production agricole, zonage, allocation foncière, abattis brûlés, cultures de rente
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LIST OF ABBREVIATIONS

AI : Agricultural Income
CIFOR : Center for International Forestry Research
DAFO : District Agriculture and Forestry Office
GoL : Government of Laos
GP : Gross Product
GVA : Gross Value-Added
IC : Intermediary Consumption
ICRAF : World Agro Forestry Centre
IRD : Institut de recherche pour le développement
LA : Land Allocation
Lao PDR : Lao People’s Democratic Republic
LFA : Land-Forest Allocation
LUP : Land Use Planning
MAF : Ministry of Agriculture and Forestry
NAFReC : Northern Agriculture and Forestry Research Centre
NAFRI : National Agriculture and Forestry Research Centre
NBA : National Biodiversity Conservation Area
NTFP : Non-timber Forest Product
NVA : Net Value-Added
INTRODUCTION

Lao PDR is one of the lowest populated countries in South East Asia with among the greatest levels of poverty and a high richness in natural resources, biodiversity (Conservation International cite this country as one of the world’s Biodiversity Hotspots), water and minerals. The Government of Laos (GoL) (2000) recognizes that these resources are declining as a result of the war in the 1970s, poorly planned and managed exploitation activities, shifting cultivation, forest fire and logging.

With significant rates of forest cover declining, from 70% in the early 1950s to 47% of the total area in the 1990s (Countryreports 2008a; GoL 2000), deforestation is considered a main environmental issue in the country. GoL (2000) identified that deforestation is due to mismanaged logging, forest conversion caused by rapid population growth, and in particular the intensive slash and burn shifting rice cultivation which is practiced in the uplands and by farmers from highland ethnic groups. This cultivation system is still maintaining an important role, although there has been a sharp decline in slash and burn activities over recent year due to the government’s policy on stabilizing shifting cultivation. As the Ministry of Agriculture and Forestry or MAF (2006) mentioned, this cultivation system was practiced on 118,900 hectares in 2000 and reduced to 27,710 hectares in 2005. It involved 21,000 families in 2007 and 9,370 families in 2008.

This system is still considered by the Government of Laos not only as a cause of deforestation but also one of the causes of poverty in the country. Within Laos, agriculture is practiced by 80% of the population and the poor are mainly located in forest ecosystems where they depend heavily on natural resources for their livelihoods.

Reducing poverty and preserving natural resources has become an objective of the Lao Government through its policies which include land reform along with market liberalization and trade and the normalization of trade relations. Land reforms began in the early 1990s with land use planning and allocation, eradication of slash and burn shifting cultivation, and village relocation. These policies together with the demand from neighboring countries in agricultural products have triggered an agrarian transition that is profoundly changing upland livelihoods and farming systems; bringing about a shift from subsistence to market oriented systems (MAF 2008a).

As a country which has high biodiversity values and where there is a move to better integrate livelihoods into external conservation objectives, Lao PDR was selected as one of country sites of Landscape Mosaics Project. This global research project is being applied in several developing countries and in each country site it will link with ongoing land use planning and allocation activities that combine development and biodiversity conservation (International Centre for Research into Agroforestry and the Centre for International Forestry Research 2007). Within each country site, three villages located near a protected area have been selected for study and the same methodology and field activities will be applied.

The project assumes that landscape mosaics - which are the combination of protected areas, human settlements, agricultural land, and agroforestry systems - contribute to biodiversity conservation (CIFOR 2007). Many factors affect the land use transformation creating these landscape mosaics, of which the main two are: the basic needs of the population who rely on natural resources for their livelihoods; and the government’s policies
and regulations. By applying participatory action research, the project involves the local communities and other stakeholders in achieving development and conservation goals while also investing in social development.

The research “Landscape and Farming System in Transition” is a partner to this project. It applied the Landscape Mosaic framework and concept and the examined working hypothesis was based on the project’s general concept. Data collection and analysis was conducted using a multi-scale design; regarding the conservation-development issue at a global level and adapting it to local circumstances specific for the study sites in Lao PDR.

This research report is organized into several chapters: Research Context, Methods, Results, Discussion and Conclusion. The research hypotheses and objectives are introduced in the ‘Research Context’ chapter. The combination of the objectives, hypotheses, and practical constraints guided the practical application in the field of the methodological guidelines of the project. The ‘Methods’ chapter presents the data collection methods and its analysis. The ‘Results’ chapter presents the findings, structured around the hypotheses on landscape pattern dynamics and livelihood systems, driver of land use change, and farming system differentiation. The last chapters ‘Discussion’ and ‘Conclusion’ provide an analysis of field results in terms of the trade-offs between development and conservation and attempt to draw applicable lessons through comparison with other experiences from the literature.
1. RESEARCH CONTEXT - LANDSCAPE MOSAIC MANAGEMENT IN LAOS: CONSERVATION TOWARD DEVELOPMENT

This study was undertaken by adapting the method and analysis of a multi-national project. The fieldwork research was conducted using a multi-scale design; considering conservation-development issues at the global level then substantiating them at the local level. The issues related to conservation and development, including national environmental policies and their impacts on farmer’s livelihood are important bring to the project study sites selection that illustrate described at the national level.

The sites determined by the project were selected based on locations along a gradient. This site selection correlates with the specific objectives of the research which attempts to contribute to the global project and the national situation. This chapter consists of the project’s general description, conservation-development issues in Lao PDR and scope of work for the research.

1.1. THE LANDSCAPE MOSAICS PROJECT

Forest decline in the world has encouraged many conservation efforts and these primarily focus on protected areas. Several studies have shown that even though protected areas are crucial, biodiversity conservation requires more. The use of a multifunctional landscape mosaics approach has become popular in biodiversity conservation because it considers the combination of land uses, including agriculture, agro forestry, human settlement, and protected areas. This combination is referred to as a landscape mosaic (CIFOR 2007).

Many factors affect the transformation of land uses which create landscape mosaics. The two major ones are the basic livelihood needs and government policies and regulations. Understanding the landscape dynamics and contributing factors is very important. For this, the development and integration strategies are necessary to be implemented to identify any alteration of the biodiversity and living inside the landscape mosaics at the preserved area on where the relationship between social dimension and conservation efforts is ineligible. With significant decline in forest area, these mosaics are important for both livelihoods and biodiversity conservation (CIFOR 2007; ICRAF and CIFOR 2007).

In recognition of the above, The Center for International Forestry Research (CIFOR) and the World Agro Forestry Centre (ICRAF) launched ‘The Biodiversity Platform’ in 2006. The first project under the platform is named ‘Integrating Livelihood and Multiple Biodiversity Values in Landscapes Mosaics’ or briefly called ‘The Landscape Mosaics Project’. It is funded by the Swiss Agency for Development and Cooperation and also supported by other donors such as the European Commission, and the governments of Finland, Netherlands and Australia.

This project applies an approach known as participatory action research, which requires participation and collaboration with key stakeholders in the landscape to firstly understand all the different demands, opinions and tradeoffs, then to encourage the
communities to take action which will be monitored and adapted throughout the project (CIFOR 2007). Local communities and other key stakeholders are involved in this project which aims to manage landscape mosaics in a more sustainable way.

The project seeks to inform and facilitate the negotiation process on land use planning and allocation by implementing a series of socio-economic and biophysical research activities. These activities are undertaken in five different countries in order to collect comparative information that will be used to assess the hypothesis concerning multifunctional landscape mosaics. The main inquiry at every study site is: to determine how action and empirical research can improve the livelihoods and conserve biodiversity; how land use planning and policy can be influenced; and what key scientific information is required to achieve this.

Research is being conducted in developing tropical countries categorized as biodiversity hotspots (CI 2007) or megadiversity countries (See Appendix 1): Tanzania (East Usambara Mountains, Tanga Region); Cameroon (Takamanda-Mone Technical Operation Unit); Indonesia (Muara Bungo District, Jambi Province); Laos (Viengkham District, Luang Prabang Province); and Madagascar (Manompana corridor, Soanierana-Ivongo District). In each country, three representative villages have been selected based on the criteria of: distance from protected forest; population density; agriculture; and accessibility to markets. These three villages are considered as global representative samples.

Empirical research and facilitating interactions which improve existing conservation and development programs are to be carried out in all study sites. The empirical research examines and analyzes opinions about biodiversity, the roles of key species, landscape patterns, land use planning and monitoring mechanisms, and rules and authorities at various level (in order to the understand local regulatory systems). Facilitated communication is also undertaken involving workshops, focus groups and other collaborative activities.

The same research and activities are applied in all study sites within the selected countries. A series of landscape studies at the local level allow for the synthesis and analysis of project outputs into policy relevant recommendations at the global level (See Figure 1).

![Figure 1: Landscape Mosaics Project multiple entry points and scales of study](source)

Source: ICRAF and CIFOR (2007)
In Laos PDR, the project started in 2008 in Viengkham District, Luang Prabang Province and involves institutions at different levels: NAFRI (National Agriculture and Forestry Research Centre) at the national level; NAFReC (Northern Agriculture and Forestry Research Centre) at the Luang Prabang provincial level; and DAFO (District Agriculture and Forestry Office) at the Viengkham District level. Three villages in Viengkham District - Muangmuay, Bouammi and Phadheng - were selected based on the same criteria as all other country sites in the project. Their situation along a gradient of distance to Phou Louey NBCA (National Biodiversity Conservation Area), as well as ethnicity, agricultural intensification and accessibility to markets, were taken as a basis for selection.

Among the objectives of the project in Lao PDR, is to develop a biodiversity monitoring system which could be integrated into participatory land use planning of forest landscapes (CIFOR 2008). Specifically, it aims to:

- Review existing forms of land management, land use planning and monitoring practices of different key stakeholders in Viengkham District;
- Develop a participatory biodiversity monitoring system based on different actors’ means, demands, and interests; and
- Examine the methods and recommend improvement for replication and scaling up.

The three study sites are interconnected in the national context. Conservation and development issues are currently an important objective and challenge of Lao Government policies which have considerable impact at the local level. It is therefore important to have a sound understanding of the conservation and development issues in Lao PDR.

1.2. CONSERVATION AND DEVELOPMENT ISSUES IN LAOS

1.2.1. Background Information about Laos

Laos or the Lao People’s Democratic Republic is the lowest populated country in inner Southeast Asia (See Appendix 2). It is land-locked and borders Burma, China, Vietnam, Cambodia, and Thailand. With a total area of 236,800 km$^2$, the region which is predominantly forested and mountainous lies across the northern part of the country.

With an altitude of more than 500m, the northern and eastern landscapes are characterized by steep terrain and narrow river valleys (See Figure 2). The main river, the Mekong, forms a large part of the western border with Thailand. The alluvial plains, terraces and tributaries of this river cover about 20% of the land area (Countryreports 2008b).
Map adapted from www.unosat.org

Figure 2: Lao elevation map
The agricultural sector within the country covers just 3.47 to 4% of the total area or around 850,000 to 900,000 hectares of arable land. The area of permanent crops represents just 0.23% (Countryreport 2008b; Evrard 2004).

As a rural country with a large number of farmers living on the margins of survival and a low population density, Lao PDR has the profile of a village society reliant on subsistence agriculture. Dominated by rice crops, the agricultural sector accounts for about half of the overall national GDP and provides 80% of the total employment (CIA 2008). This sector plays a critical role in the development because of the growing linkages between agriculture and non-agriculture sectors (Green and Vokes 1997).

With 80% of the population engaged in agriculture, this is the premier sector within the country. It is facing the challenge of declining forested areas which undermines biodiversity and puts the sustainability of current farming systems at threat.

The forestry sector offers both ecological and social-economic benefits. The forest lands in Lao PDR typically contain high biodiversity with at least 10,000 species of mammals, reptiles, amphibians, fish and vascular plants, ranking the country as one of those with the highest levels of biodiversity in Asia. Social-economically, the forest resource represents the daily basic needs for the majority of the population and forest products contribute 34 to 50% of the national income (Evrard 2004).

From an historical point of view, Laos is renowned as a long term migratory area. Minority ethnic groups currently account for more than half of the population (Chazée 1998; Chazée 1999). The relation of both existing indigenous peoples and the complex movement of ethnic groups has resulted in Laos becoming a multi-ethnic country. There is a constant debate about the exact number of ethnic group within the country. Chazée (1999) has classified the different ethnic groups based on the social, cultural, agricultural, and religious diversities within various ethnicities. According to his classification, there are approximately 131 different ethnic groups and sub-ethnic minorities in Laos under four main ethno linguistic families.

After the colonization of the French until the Second World War, Laos was occupied by Japan in 1945. Independence was declared by 1946, but this was not recognized internationally by the United Nations until 14 December 1955. This independence herald the beginning of a new “modern life” for Laos. Unfortunately the country suffered under the Vietnam War with invasion by North Vietnamese troops, US bombing and the collapse of the Royal Lao Government (Chazée 1998; Chazée 1999; Evans 2002).

In 1975, the communist regime held the power and the monarchy was abolished. The Lao People’s Democratic Republic was founded with the government functioning as a single party, the Lao Peoples’ Revolutionary Party. Since 1980, Laos has implemented policies of decentralization, collectivization, and administrative and territorial reconstitution.

The government established a collective production system to centralize and control production and marketing management in order to: construct socialist society; decrease the rice deficiency; and eradicate the past heritage. However, the geographic dispersion of the country and multiple ethnicities has made this difficult to achieve. There was considerable migration of the population to inaccessible mountainous areas. In the same period, Laos established the open market system in 1986 to stabilize the country’s macroeconomic situation, and this was expanded to international access between 1989 and 1990 (Chazée 1998; Chazée 1999).

The various major historical events of the past have had an impact on the country’s land use. As mentioned by Fujita (2006) major events within the period from civil war until the
post-socialist era had important effects of land use. The effects caused by past major events are shown in Table 1 below.

Table 1: Major events with land use impacts for Laos

<table>
<thead>
<tr>
<th>Period</th>
<th>Major Events</th>
<th>Effects on Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Civil War (1963—1975)</td>
<td>- Bombing and disruption</td>
<td>- Forest cover 70% of total area</td>
</tr>
<tr>
<td></td>
<td>- Migration and relocation</td>
<td>- Forest destruction by extensive logging for export</td>
</tr>
<tr>
<td>Early Socialist Era (1975—1985)</td>
<td>- Collectivization</td>
<td>- Expansion of paddy field in alluvial plain</td>
</tr>
<tr>
<td></td>
<td>- Development of state enterprises</td>
<td>- Degradation of forest</td>
</tr>
<tr>
<td>Post-Socialist Era (1990—Present)</td>
<td>- Normalization of trade relations</td>
<td>- Forest cover 50% of total area</td>
</tr>
<tr>
<td></td>
<td>- Infrastructure development</td>
<td>- Land use zoning</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Control of shifting cultivation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Control of opium production</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Increased cash crop production</td>
</tr>
</tbody>
</table>

Table adapted from Fujita (2006)

In the early 1950s, forests covered 70% of the whole land area in Laos, which according to government estimation had decreased by nearly one-third in 1992 to 47% of the total land area (Countryreports 2008). Today, within the 10 million hectares of natural forest in the country, three million hectares or approximately 1.5% is established as National Biodiversity Conservation Areas or NBCAs (Doungsavanh, Bouahom and Raintree 2003). The significant decline of forested land area has occurred since the 1970s as a result of commercial logging in the late 1980s to early 1990s and the expansion of swidden or slash-and-burn farming systems (Countryreports 2008a).

Due to the country’s low population density and forest existence, the farming systems in Laos are extensive. Most farmers apply varies cultivating methods which are classified into three categories: inundated agriculture or irrigation in plain or valley zones; perennial plantations; and slash and burn in mountainous zones (Countryreport 2008b; Evrard 2004).

Based on several research, there is a trend in land use change from swidden cultivation to cash crop, including in northern of Lao PDR (Fox and Vogler 2005; Thongmanivong and Fujita 2006). This tendency is marked as well by MAF (2008a) which states that there is a trend of rapid transition from subsistence-based livelihood and farming systems to market oriented ones is being experienced in Laos. This transition is due to two main drivers. The first driver is government policies as the ‘push’ factor and the second is the market as a ‘pull’ factor coming from demand in the region for agricultural products. The first factor is directed towards: (1) reducing poverty; (2) improving the management of natural resources; and (3) stabilizing food security. The government implements several policies concerning shifting cultivation stabilization, eradication of opium production, land use planning and allocation, village consolidation and forest cover enhancement.

Generally, the main objective of government policies is to reconcile conservation and development. The important questions to be addressed are how conservation-development objectives can be achieved and how the communities’ will respond to the environmental services.
1.2.2. Land Use Planning and Allocation as an Instrument of Conservation-Development Policies

Rural development is a general objective of the Lao Government to address the problems of poverty, food security and natural resource preservation. Towards this aim, Lao has been inspired by international organizations and neighboring socialist countries to implement land reforms since the early 1990s (Ducourtieux, Laffort and Saclokham 2004). Though similar with the other countries, the land reform process in Lao has had particularly concerning social and cultural impacts. Evrard (2004) mentioned that the main target of land allocation has been minority ethnic which make up 40% of the total population.

Land reform is expected to halt deforestation (of which swidden cultivation is seen as the main cause), to intensify agricultural production and improve government revenue from land tax. The assumption is that lands in private poverty and land security encourage agricultural investment, intensive land use, and an increase in market-oriented agriculture (Evrard 2004; MAF 2006).

Land allocation was first implemented in Luang Prabang and Sayaboury Provinces in 1990 with the support of the Food and Agriculture Organization (FAO) and the Swedish government. Since 1994, the process has been conducted across the country, directed by the central government and executed at the provincial level (Ducourtieux, Laffort and Saclokham 2004).

Temporary Land Use Certificates are issued for land utilization and determine the rights for use of that land with a maximum of 25 hectares for every active member of a family. The certificates are valid for three years, and after this time, the government can issue permanent full ownership.

This certification process in urban and semi urban areas is called land titling. While in rural areas, the land allocation process follows land use planning.

In land use planning, each village’s areas are divided into several zones, according to their use by villagers and the existing vegetation. The forest areas are classified into conservation, protection, production, regeneration or degraded forest.

The implementation of land use planning and allocation at present has many social impacts. As mentioned by Evrard (2004), there are several negative perceptions of this program which are based on the general reform process. These include reduced land access, the degradation of local living conditions, the absence of agricultural intensification, and the continued relocation of villages from highland areas. There are also environmental impacts such as ongoing deforestation despite the program’s implementation, as reported by Ducourtieux, Laffort and Saclokham (2004). Without alternative resources, villagers continue to exploit forest resource for livestock, swidden agriculture, permanent cultivation, and the collection of forest products.

A reduction in the amount of, and access to, agricultural land, inadequate data recording systems, inadequate land certificates for registration purposes, financially under-resourced enforcement and monitoring programs and the limited knowledge of staff are the main issues identified by MAF (2008b). To address these, it is necessary to improve negotiation mechanisms among stakeholders, provide a voice to poor farmers, and revisit land use planning and allocations processes.

World Bank (2008) argued that the combination of government policies and market factors could be resolved positively, but may result in some contradictions. These might include: placing restrictions on remote upland farmers above the private sector in cases where
there is more market access; the absence of a policy framework to guide commercial investment or monitor its implementation; weakness of central level control; oversimplifications of land use zoning practices leading to unsustainable practices; and also infra-strategy contradictions arising between different policy goals and programs.

1.3. **Scope of the Field Study as a Part of Landscape Mosaics Project**

1.3.1. **Objectives of the Research**

As presented earlier, the study was in line with the general objectives of the Landscape Mosaics Project and the environmental impacts of the transition from subsistence to commercial agricultural in Lao PDR. The general objectives of the study were to:

- Characterize landscape patterns and livelihood systems based on key variables and criteria;
- Identify the internal and external driving forces of land use change; and
- Inform and support land use planning to balance conservation and development goals.

It is hoped that the fieldwork findings at the local level can be useful at the national level. Landscape and livelihood assessments used analyses of spatiotemporal trends, local livelihoods and biophysical surveys within the study sites to better understand the complex relationships between people and their environment.

The output of the study was expected to be addressed within the general objective, fieldwork’s constraints and also time limit frame in the fieldwork periods. These expected outputs are related to the general characterization of:

- Human and biophysical environment;
- Landscape dynamics in the study sites;
- Typology and evolution of farming systems; and
- Economic analysis of land use systems.

1.3.2. **Hypotheses**

There is a complex relationship between land use patterns and agricultural production systems, and the factors that influence them (Figure 3). Based on this consideration, the research was conducted according to a multiple dimension approach study of influenced factors’ point of views. Including historical land patterns’ changes that shows the dynamics of changes.
The hypotheses of this research are related to spatial, time-scale and system analysis dimensions. The hypotheses tested were:

1. The distance of villages along a gradient from the National Protected Area to the road creates a range of biophysical and socioeconomic conditions and therefore a diversity of landscape patterns and livelihood systems (spatial dimension).

2. Landscapes and livelihoods are in transition due to land use changes and their complex combination of drivers (time-scale dimension);

3. The differentiation among farming households creates a new range of agro-diversity in production and land use systems (system analysis).

1.3.3. Institutional Framework and Constraints

1.3.3.1. Timing and Research Management

Fieldwork in Lao PDR was conducted from April until early August 2008 in three villages that were selected by the Landscape Mosaics project: Muangmuay, Bouammi and Phadheng. The work was divided into three stages: first contact fieldwork preparation at the beginning; collecting data in the three villages; and also recapitulation of data in Luang Prabang and Vientiane Provinces (See Appendix 10 for research timetable).

During the data collection period, reports on the progress of research were presented in each village as well as at NAFRI and NAFReC. Consultation was carried out regularly, from the beginning stage up to the field data collection and the report writing stage.

This research was financed by various sources. A French Government scholarship, which is organized by CNOUS (Le Centre national des œuvres universitaires et scolaires) financed the transportation from France to Lao PDR. While in Lao PDR, the research was
supported by the collaboration of the project and other institutions. Field studies were funded by the Landscape Mosaics Project through the Swiss Cooperation Agency (SDC) via CIFOR and the Policy Research Centre of NAFRI. The contribution to the Landscape Mosaic Project was managed by the Catch-Up Project through collaboration between NAFRI, CIFOR and IRD (l’Institut de recherche pour le développement).

NAFReC also facilitated this research by providing field study staff assistances. An additional staff member for data collection assistance came from the Viengkham District Agriculture Office. Besides facilitating assistance for data collection, these two institutions also provided transportation to the research sites.

### 1.3.3.2. Language and Communication

The main constraint in this study was communication in Lao and English. The limited English of the interpreter during fieldwork impacted on the effectiveness of the liaison between participants in both interviews and discussions. There were frequent misunderstandings and difficulties in distinguishing between the facts in reality versus what is officially correct. In addition, the translation from Lao to English during or after interviews required additional time which had to be managed within the time limitations for finishing the fieldwork.

The fieldwork research which was conducted at the beginning of the project encountered many difficulties regarding coordination and communication between partnership institutions and the local community. This influenced the quality of interactions among all stakeholders at the beginning of a long-term project.

The combination of research objectives, hypotheses tested and practical constraints presented above has guided the design of the methodology. The methods applied during the research period will be outlined in the next chapter.
2. METHODS

The Landscape Mosaics Project in Lao PDR focuses its activities in three villages: Muangmuay, Bouammi (which consists of Old Bouammi and Vangmat sub-village) and Phadheng. These three villages are located in Viengkham District, one of four poorest districts in Luang Prabang Province (see Appendix 2—9 for general conditions of Viengkham District and village study sites). Figure 4 shows the position of each village and its differing distance from Phou Louey National Protected Area and road access.

![Map adapted from CIFOR (2008)](image)

**Figure 4 : Landscape Mosaics Project sites in Lao PDR: Muangmuay, Bouammi and Phadheng villages**

This research was undertaken in the three villages by applying different methods that were adapted to local circumstances. The adaptive research methodology combined data collection, analysis and verification through several focus groups conducted within each village.

The fieldwork combined qualitative and quantitative methods. Different methods were used at each stages of the research. Data from different sources was cross-checked at each stage. Figure 5 shows the several stages in each method and the data cross-checking that occurred between them.
In the first stage, participatory mapping was done qualitatively. It was carried out firstly by preparing a map, then conducting focus groups, followed by map verification through several direct observations and focus groups (described in 2.1.1).

Participatory mapping was used to understand actual land use and dynamics. This was the second stage of the qualitative method and it was completed using surveys. Two types of survey were conducted in this research: household and demographic. The surveys involved 100% of correspondences targeted. They were carried out with all household chiefs in the village (two types of survey) and also 100% of women aged more than 15 years (demographic surveys only).

The third stage consisted of semi-structured interviews: with key resource people and through focus groups. The first type of interview was done with people who were thought to have particular insight into the topic under study. The second was a semi structured interview with homogenous or mixed groups on particular topics in detail (Mikkelsen 2005).

Personal life history and focus groups were used to obtain information about the historical situation. This was quantified by several individual interviews conducted through people selected for sampling. Then, quantitative and qualitative methods were analyzed by cross-checking the data collected in each method and by comparing this to the literature and secondary data reviews.

Literature and secondary data were reviewed prior to the commencement of the research. This was done by examining several related publications and information, with additional detail obtained from secondary data available from a number of sources. Information on climate, district history, and other basic data was obtained from DAFO and the District Governor. From each village, a list of household and village mass organizations was utilized as well as secondary data sources.

Figure 5 : Qualitative and quantitative methods for data collection
This complete set of data collection activities was carried out in each village. The fieldwork started and focused on Bouammi Village with the longest fieldwork period and where the greatest sampling through interviews was conducted. The fieldwork in Muangmuay and Phadheng was conducted using the same set of activities but with a fewer number of interviews. The next sub-chapter will further explain the data collection within the villages.

2.1. DATA COLLECTION

2.1.1. Participatory Mapping and Direct Observation

Mikkelsen (2005) provides a definition of participatory mapping and direct observation. Participatory mapping allows for the distribution of information relating to a limited physical space and settlements, and these are drawn collectively as a map on paper. Direct observation is the observation of physical structures, social differences, behaviors, actions and symbols, in solitude or with others, with whom observations are discussed, providing important information on central questions.

Prior to the field survey, large scale topographic maps of each village (scaled approximately 1:30,000) were prepared using existing topographic maps with a scale of 1:100,000 from the Geographical Service of Lao PDR, 1983. The existing maps were scanned and projected onto a wall using a video projector, and then a base map was drawn by hand on a sheet of paper, resulting in approximately 1:5,000 scale topographic maps.

At the beginning of the field visit, participatory mapping with group discussions using the enlarged topographic map. This helped to identify the territories of several villages and basic data, such as the border of village, actual land use, village position, the names of rivers, and the history of land use changes based on several periods in the past that were important within the village.

Data cross-checking and verification were carried out through direct observation and with the villagers while walking around the village to obtain the additional information required. The observation was based on several transects which were conducted in order to gain the information by walking through the area and observing, discussing and registering the observation and problems of the area. Based on these observations, the focus groups were repeated several times to ensure in re-discussion and verification. This is an interactive process of data collection and the verification brings a new round of participatory data collection and so the process continues (see Figure 6).
Analysis of land use changes was conducted in the three villages. In Bouammi, the research was specifically conducted separately for the two sub-villages (Old Bouammi and Vangmat sub-village) as each one has its own different history and specific characteristics, even though they fall under the same administrative system. Furthermore, all villagers in both of the sub-villages still recognize the boundary between the sub-villages’ and keep to their own territory.

Because the data about surface in each village or sub-village is unavailable, the map resulted by participatory mapping is used to predict the surface in each area (Appendix 11). Moreover, because of the limited scope of this study, the participatory mapping was a predicted map based on discussions with the community and some variations in map drawing and map productions in detail were encountered.

2.1.2. Households Surveys and Interviews

In order to learn each household’s general basic condition and for sampling purposes, the household surveys were conducted in each village. They were based on the list of households in the village and the survey was conducted with all households within the village.
Basic information concerning members of the family, such as wealth ranking, the amount of capital, livestock and cropping activities, were collected during the survey. The specific information collected varied from one village to another, this was determined by a preliminary interview with village leaders about the main activities of villagers. One example that differed between two other villages was the question about cattle breeding. It was not asked in Bouammi village as this activity does not occur there. The data recapitulation in each village can be seen in Appendix 12—14.

After the collection of basic information for each household, sampling for personal interviews was undertaken (based on the household survey results) in order to study farming and livelihood systems. The chosen samples were households grouped by several specific criteria, such as sub-villagers, ethnicity, wealth, capital, labor force, responsibility in the village, and the types and quality of crops and livestock.

Based on those criteria, 50% of total households in Bouammi village were sampled. The large quantity of sampling was done by using this village as a focus for a study of farming systems and making a basic comparison with the other two villages. This pre-classification was useful in determining samples in Muangmuay and Phadheng because it predicted the similar and different type that founded in Bouammi. Through this method, the chosen samples interviewed in Muangmuay and Phaldeng were much smaller than in Bouammi, amounting to no more that 15% of all households in these villages.

All households selected for sampling were interviewed about the condition and history of the household, about technical agricultural practices, livelihood systems, problems and hopes for the future (See some interviews conducted and data recapitulation in Appendix 15—19). Thorough interviews about agricultural practices were conducted by an additional interview which was usually done simultaneously with field observation and direct field demonstration with the farmers.

Among the samples, especially older people, the ‘life story’ interviews were conducted as well. This is a kind of case story based on personal life history with key people providing a narrative so that information about land use changes and drivers of change can be gained. This information about the history and land use dynamics was obtained not only from individual interviews, but also by several focus groups, including the focus group discussed before as part of the participatory mapping process. Group interviews were also conducted to have quantification of general agricultural and non agricultural activities in the village (See Appendix 20—22).

2.1.3. Demographic Surveys

The demographic survey was aimed at characterizing the population in its various components: economic, social and cultural, from a quantitative point of view (Chesnais 1998). A demographic study was used in this research in order to analyze the human environment in the study sites through considering demographic aspects (such as basic characteristics of population, ethnicity and migration), as an internal factor of land use management and changes.

With several basic demographic data to be confirmed, the demographic surveys were undertaken based on the assumption that the demographic condition in each village varies through at each village according to their position along gradients. In obtaining the results desired to analyze this variation, two types of questionnaires were applied based on correspondences targeted: ‘household’ and ‘women’ (See Appendix 23—25 for data codification and recapitulation). These questionnaires were conducted simultaneously.
The first questionnaire was conducted on all household chiefs to record the quantity and condition of family members. The women’s questionnaire was conducted on each woman above fifteen years in each household to record the birth rate per woman. The demographic analyses in each type of questionnaire will be discussed further in the next sub-chapter.

Due to time and resource constraints, this study was conducted at Bouammi and Phadheng only. For Muangmuay village, the collected demographic data only included general information, such as the number of households, ratio of male to female, and the dependence reports between productive and non-productive aged population.

2.1.4. Prospective Study and Participatory Scenario Analysis

A review of the villagers’ future life condition perspectives was undertaken considering the concerns that inhabitants’ themselves had, what would be their ideal conditions, and the obstacles to achieving these. The visioning exercise revealed how they perceived their own village and the way they identify their real constraints and demands.

The pooling of inhabitants future perspectives was carried out through the focus group and personal discussions then combined with technical and life history interviews and the recording of direct comments. By using several basic questions as a guideline, some scenarios for the future were presented in with the aim of achieving a positive response. The basic questions were:

- Please describe the most ideal circumstances for this village?
- What kinds of livelihood activities would you like in the future?
- What are your wishes and hurdles that you would like the government to know?

2.2. DATA ANALYSES AND REPORTING

2.2.1. Spatial Analyses of Land Use Change

Through participatory mapping, the research studied the spatial organization of land use systems in Muangmuay and Phadeng villages and each sub-village in Bouammi (Old Bouammi and Vangmat). The land use systems were described for several periods in the past, which were considered as important by villagers.

Based on these results, land use change was analyzed for each village to observe the specific characteristics and make a comparison between them. The comparison of the three villages was conducted to determine the different land uses’ trends and dynamics.

Within each village and sub-village, the land use change was related to several important events in the past, major agricultural activities, land use change mapping and illustration and the density of household. This information was gained from focus groups and several interviews conducted with elder persons.

The information about the area of villages’ territory was needed to calculate the household density, agricultural area and its change. For this, an estimate was calculated for each village by using the participatory mapping and topographic maps, because there was no pre-existing information.
2.2.2. Farming System Typologies and Economic Evaluation

By understanding the history of households and their livelihood activities, an analysis of farming systems and its dynamics could be conducted. The changes in farming systems were analyzed in-depth in Bouammi followed by a rapid investigation in Muangmuay and Phadheng. Figure 7 shows the steps for analysis.

A typology of the farming systems was conducted with different possible combinations of activities and criteria for farms which could distinguish one typology from another. The criteria were: kinds of main agricultural products and their contribution to total agricultural income; differential techniques; the amount of labor required; cropping associations; and crop rotation. Composition and grouping criteria, as well as economic analysis of each production system, made it possible to determine the typology.

Each farming system has a combination of specific cropping or livestock systems with specific performance. Thus, the economic analysis of each system must first be understood. With a gross product and work load calculation, the land and work productivity can be compared using the performance of every crop or livestock system.

For economic analysis of each farming system, several combinations of livestock and cropping systems were taken into account, from the calculation of Gross Product (GP) to obtaining the Agricultural Income (AI) for each surveyed farming system. Figure 8 shows the flow of the applied economic calculations.

Figure 7: Data collection and analysis on farming system diversity and its economic evaluation
This calculation was applied twice, first by model establishment based on the field reality, and second with data calculated from each farm interviewed. By establishing models of farming systems, comparisons of land and work productivity then Agricultural Income could be analyzed.

As comparison with agricultural income and survival rate, the quantification of basic need was calculated. Based on the observation and interviews in the households, the basic need was generated by one family for fulfill nutritional and non-nutritional daily basic needs for one year (See Appendix 26 for basic needs calculation).

The analysis of farming systems was designed so as to answering the following questions:

1. How can farming systems survive with their current agricultural activities? In what condition?
2. What is the performance of each cropping and livestock system, in terms of work and land productivity?
3. What is the dynamic of farming systems?

### 2.2.3. Analysis of Demographic Data

The collected data from the two questionnaires was based on its source of information: ‘household’ and ‘women’. These questionnaires were analyzed to obtain the classification of data based on age, gender, so as to produce age pyramids. Data analysis on both questionnaires was combined to create the demographic profile of the study sites. Table 2 indicates the data collected and the obtained results for each questionnaire category.
As part of the demographic data analysis, the dependence ratio was calculated. This indicator compares active population and inactive population. It was based on data from the last survey in Lao PDR, which assumes people aged 15 to 59 comprise the labor force, although in reality the labor force can also be found outside those ages.

Another demographic analysis was related to education level. This data was analyzed after the population was divided into 20 year classes, assuming that after 20 years people are no longer in school in the study area. Analysis was done by computing the relative percentage of the population by age group and gender. Then, the literacy level was analyzed from a demographic aspect. It was analyzed by dividing people over 15 years based on gender.

With regard to the movement of the population, incoming and outgoing migration was measured. The incoming migration rates for Bouammi and Phadheng were assessed by surveying birth places, year of migration and migration motive. While outgoing migration was measured by through an inventory of the migration of people who were originally born in the village and based on focus group interviews.

<table>
<thead>
<tr>
<th>Source of Information</th>
<th>Data collected</th>
<th>Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household</td>
<td>Age, sex, origin, arrival year, motive of migration, literacy, education level, profession, ethnicity of every household member.</td>
<td>Population’s general information, pyramid of age, dependence report, education level, literacy, migration level to the village.</td>
</tr>
<tr>
<td>Women (up 15 years)</td>
<td>Age of marriage and survival birth rate of every woman. Birth year, condition, place, motive of migration, mortality and its cause.</td>
<td>Mean survival births per woman, birth and mortality rates, migration out of the village.</td>
</tr>
</tbody>
</table>
3. RESULTS

As mentioned in the Methods chapter, the results were achieved by qualitative and quantitative way at several levels, from village level to individual level. All the results are organized in this chapter according to the working hypotheses that was tested, from spatial and time-scale dimensions and also from a system analysis point of view.

The first sub-chapter 3.1 describes the analysis from spatial and time-scale dimensions. It aims to describe the diversity between the dynamics of landscape patterns and livelihood systems in the study area. The biophysical environment and human characteristic- including a diversity of population and also social organization which influences the dynamics of land patterns from a time-scale point of view - will be delivered in this section.

The preliminary findings from the first sub-chapter conclude that there are the linkages between the diversity of dynamics of land use, evolution of population, biophysical condition and different intensities of political influence. This leads to the identification of driving forces of change in the sub-chapter 3.2. This chapter will present the driving forces identified, and also local perceptions about people’s actual and future conditions and activities.

The last sub-chapter 3.3 describes the analysis of livelihood and farming systems. The differentiation of systems within each village is a result of driving forces of change that motivate households to cope with the change through different strategies and typologies of farming systems.

3.1. CHARACTERIZING THE DIVERSITY OF LANDSCAPE PATTERNS AND LIVELIHOOD SYSTEMS WITHIN THE STUDY AREA

The diversity of gradients within the village may be considered as a constraint to developing policies over heterogeneous environments. But on the other hand, this can be an asset for agro-biodiversity which is an important factor in resilience of the overall system. For this, it was hypothesized that the gradient of villages creates a range of biophysical and socio-economic conditions, and therefore a diversity of landscape patterns and livelihood systems that may help villagers to cope with ongoing changes. The characterization of biophysical and human environments, and also the dynamics of land use within the village, was conducted to examine the above hypothesis.

Based on field observations, the basic differences between the three villages studied are the biophysical condition and human environment within the village. These gradients within the village can affect opportunities for different social and economical access, such as communication, information, development projects and also market access.

3.1.1. Biophysical Diversity and the Economical Environment

3.1.1.1. Tropical Humid Climate

Laos experiences a tropical monsoonal climate with a pronounced rainy season from May through September-October, a cool dry season from November through February, and a
hot-dry season in March and April. Monsoons occur at the same time across the country though the timing may vary significantly each year as the rainfall varies regionally.

There are three main climatic regions in the country: sub-tropical with a rainy and dry season in the mountainous zone of the north and northwest of Laos (where this research was conducted); a monsoonal tropical zone in the central and south of the country; and a tropical region with a rainy and dry season along the long plain of the Mekong River (Chazée 1998).

The average precipitation and temperature in Luang Prabang Province in a year is illustrated in Figure 9. Precipitation is a limiting factor for agricultural activities, especially those which are not supported by irrigation systems, due to the significant rainfall variation between rainy and dry seasons. The rainy season begins in April and ends in October while the dry season is from November to March with relatively stable air temperature throughout the year.

![Figure 9: Average yearly precipitation and temperature in Luang Prabang Province](http://www.wunderground.com/NORMS/DisplayIntlNORMS.asp?CityCode=48930&Units=both)

The planting season begins in April and harvesting usually occurs in October each year, but with a variation in the beginning of the rainy season, planting and harvesting can be modified from one year to another. As most farmers practice a slash and burn rice cropping system, their production is highly dependent on rainfall patterns, resulting in a large variability in rice yields. Figure 8 shows the last three-year’s average rainfall distribution by month and seventeen years of rainfall variation in Viengkham District, Luang Prabang Province.

The data obtained from DAFO Viengkham District shows that rainfall from 2005 to 2007 varies. In 2005, rainfall was relatively higher compared to the same month in the two following years (Figure 10).
In the study site, rainfall and temperature patterns vary with the altitude. The average temperature is decreasing while rainfall increases as a function of altitude. Among the three villages studied, Phadheng, which has the highest altitude, also has the highest rainfall and the coolest temperature. This difference can affect the different agricultural activities. In Phadheng, for upland rice cropping for example, farmers use long cycle rice varieties which are harvested later than varieties found in Muangmuay and Bouammi.

Based on field reality, the diversity of agricultural and non-agricultural activities is influenced not only by micro climatic factors, but also by the distance of the village from road access and preserved area, as well as the diversity of topographic conditions. The next section will discuss the remoteness, escarpment and altitude diversity among the villages.

### 3.1.1.2. Remoteness and Escarpment Diversity

All the three study villages, Muangmuay, Bouammi and Phadheng are situated along different gradient of accessibility, distance to market access and to preserved area. Figure 11 shows that Muangmuay is located on a national road, Bouammi is accessible by a semi permanent road, but for Phadheng there is no road access. These three villages are also on a
different gradient in distance to the preserved area (Phou Leuy NBCA) with Bouammi closest to the NBCA and Phadheng village the furthest.

![Map adapted from CIFOR (2008)](image)

**Figure 11: Village accessibility to the main road and to preserved area**

The different distance to the national road affects the different opportunities to reach facilities including education, markets and health service. Muangmuay, which is located along the main national road, has better access to facilities and markets. In Bouammi, the villagers have to walk two hours or travel an hour by motorcycle along a semi-permanent road to reach the national road in Muangmuay Village. In Phadheng, external interaction can be reached after three hours walk to the semi-permanent road in a neighboring village and then two hours walk to the national road.

With regard to distance to the preserved area, Bouammi has a direct boundary with the NBCA and Phadheng is the furthest away. Officially, land allocated for forest conservation and protection is more commonly found in Bouammi than in the other two villages.

Based on observations in the study site, different states of secondary forest can be found. In Phadheng, the most remote village, the secondary forest is older than in the other two villages. This forest is a result of the long duration of fallow in rotation with upland rice crops. While in Bouammi and Muangmuay, the majority of the area is occupied by young secondary forest or bush that can support livestock such as buffalo and cattle.

Furthermore, each of the three villages has its own biophysical conditions, such as the altitude and escarpment. These conditions affect the amount of the total area which can be exploited for agricultural purposes.
The estimate of surface area that can be used for agricultural activities is taken from Dufumier (1996) who assumes that 70% of the total area in upland zones can possibly be exploited for agricultural activities. This assumption was used in this research because of the absence of a past spatial study for the study site. The cultivatable areas in Phadheng represent 70%, 90% for Muangmuay and 80% for Bouammi. Mosaics of land cover and hilly
topography in the area give the mosaics of color and soil structure. Soil observation was done by collecting information about the criteria for good soil from farmers: the slope, spontaneous vegetation cover, soil structure and the history of utilization of the soil in the past.

The different types of landscape and agricultural land availability affect the options for different land uses in each village. As an example, the development of paddy field in Muangmuay could not be found in the other two villages. In Bouammi, the relatively flat plain landscape around the river and the semi-permanent road allow for cropping, vegetable gardens and perennial plantations.

Based on field observations, agricultural activities and roads are organized along the hydrographic system. The hydrographic system is very important as it guides human settlement and the kind or agricultural activities that are practiced (Figure 12).

The climate condition in Muangmuay is identical as presented in Figure 9 earlier, and the village sits at an altitude of 600m and with a developed hydrographic network. The main settlement is located near the Nam Seuang (Seuang River) and benefits from an alluvial plain where it has been possible to develop irrigated rice fields. Around the plain area, there are hilly areas with valleys, but several areas are equipped for irrigation. According to the farmers, the area that is difficult to use for agricultural purposes, represent 10% of the village surface.

In Bouammi, at 800m altitude, the main settlement is located between the semi permanent-road and the river for Old Bouammi sub-village, and along the road for Vangmat sub-village. This village is located at a higher altitude than Muangmuay, has more escarpment and the area that can be used for agricultural activities represents 80% of the total village area. Cash crops and perennial plantations are located near the road and stream to maximize transportation access.

The main settlement in Phadheng is at the highest altitude (1,100m) compared to Muangmuay and Bouammi and the area is hillier with a significant escarpment. The main land use for agricultural activities is maize, cassava, and upland rice crop. Only 70% of the area is categorized as land that can be cultivated. The remaining areas are difficult to use for agriculture due to the escarpment and slope.

As mentioned before, there are gradients of micro-climate, remoteness and biophysical condition. This different gradient determines the resources available for agricultural or other human activities. It also determines the opportunities for accessing information about development projects and market access, which will be described in the next sections.

### 3.1.1.3. Development projects

According to the data obtained from the Viengkham District Planning Office, several foreign projects have been implemented in this district (Table 3). Of these, the Lao-American project was carried out in the study site, i.e. at both Muangmuay and Bouammi villages. The project was also implemented in surrounding villages, i.e. Paklao and Pukheo village.
Table 3: Foreign development projects in Viengkham District

<table>
<thead>
<tr>
<th>Periods</th>
<th>Project</th>
<th>Domains</th>
<th>In Village Study Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>Chinese Government</td>
<td>National Main Route Access</td>
<td>Yes: Muangmuay</td>
</tr>
<tr>
<td>1992—now</td>
<td>Red Cross Project, funded by Swiss Foundation</td>
<td>Water Supply</td>
<td>No</td>
</tr>
<tr>
<td>2000</td>
<td>Vietnam Government</td>
<td>Dam building for supporting paddy field activity</td>
<td>Yes: Muangmuay</td>
</tr>
<tr>
<td>2000—2007</td>
<td>European Union Project</td>
<td>Livestock</td>
<td>No</td>
</tr>
<tr>
<td>2003—2007</td>
<td>Lao-American Project</td>
<td>Opium eradication</td>
<td>Yes: Bouammi and Muangmuay</td>
</tr>
<tr>
<td>2004—now</td>
<td>Forcom Project (Japanese Government)</td>
<td>Livestock and Pigeon Pea</td>
<td>No</td>
</tr>
</tbody>
</table>

Source: Planning Office of Viengkham District 2008

The aim of the Lao-American project was the eradication of opium plantations. It was implemented by building an access road and providing alternative cropping and plantation activities. In Bouammi, the project resulted in the construction of the semi permanent road to reach the national road in Muangmuay village, land allocation, seed distribution of industrial crops and supply of livestock animals (Figure 13).

![Figure 13: Land allocation map (a) and semi permanent road (b) in Bouammi Village implemented by Lao-American Project](image)

In Muangmuay, the Lao-American Project contributed to the development of several public facilities such as a water supply, school buildings and sanitation facility, as well as supplying livestock (cattle and goats). Land allocation was also implemented in the village, though this has not been properly executed as the map for land allocation and land use were unavailable.

Although there were no opium plantations in Muangmuay or in Bouammi, the Lao-American project was implemented in these two villages but not in Phadheng, a village which did cultivate opium. Bouammi declared that there were opium addicts in the villages in order to attract the project to their village and benefit from the project facilities and semi-permanent road construction in 2006. After several years of road construction (completed in 2008), the
semi-permanent is need of repair and cannot be passed by cars. There has been no initiative taken to fix this problem with the road connecting several villages.

Besides the Lao-American project, there have been other development projects involved in main road and dam development construction, especially in Muangmuay (Figure 14). The road development project was funded by the Chinese Government and brought about social and economic changes in Muangmuay, opening up market and other transportation opportunities for inhabitants.

Figure 14: National road built in 1978 by Chinese Government Project (a) and the Dam by Vietnamese Government Project in early 2000 (b) in Muangmuay Village

Another project implemented in Muangmuay was dam development funded by the Vietnamese Government. The project also developed irrigation that increased paddy field activities in groups, although a long time before the project these activities had already appeared.

In Phadheng, there have been few foreign projects in the village, but land allocation has been implemented. Four this project, every household has been allocated four fixed plots (approximately one hectare per plot) for rice and burning activities.

In addition, land classification based on specific function has occurred in the three. Even though every household has been allocated fixed plots officially, in reality this is not yet really implemented in Bouammi and Phadheng because of weak control by the government.

The development projects implemented by foreign institutions and Lao Government appear to be focused on accessibility, land allocation and providing other social facilities. Although this is happening in the three villages, accessibility is not always dependant on external projects, but on internal initiatives.

As mentioned before, the initiatives are important before and after the project. For example, in Bouammi there has been no initiative to fix the semi-permanent road that became broken after the project finished. In contrast, the neighboring villages of Phadheng (Omring and Phoukhong villages) have constructed road access by themselves without the support of a project or government agency. Phadheng, however, did not join this activity.
3.1.1.4. **Market Access**

Market transactions of agricultural or non-agricultural products have occurred within and outside villages (See Figure 15). In the first case, products were sold among residents or buyers came from outside to the villages. In the second case, the products were brought to the market by the producers or collectively by several persons using transportation. Product transactions can occur directly with consumers or through collectors of agricultural products.

![Diagram of market chain in the study site](image)

**Figure 15 : Chart of market chain in the study site**

Based on the chart above, accessibility is an important aspect in product marketing as the good access will enable produce to be sold outside the village. Among all the three villages, Muangmuay has the best opportunities as it has the best access road and the simplest product sale system.

Interviews show that an increase in marketing in Bouammi started in 2006 with the construction of the access road. In Muangmuay as well, increased commercialization occurred after road construction in 1978. While Phadeng which has typically not had through road facilities since 2006, residents wanting to sell their products must walk three hours along a small track to reach the semi permanent road access in the neighbouring village and then continue for one hour’s walk or travel by motorcycle to the national road. The time required for selling products is shorter than before, but the product quantity commercialized is limited by the mode of transport.

The access road also influences how surrounding villages sell or buy products. There is a market once a month in Omring village close to the national access road. In this market, people from several villages buy and sell agricultural or NTFP products. Therefore, accessibility is restricted; product marketing from Phadeng is mostly done person to person individually. This phenomenon is due to the limited labor capacity to carry products to market (Figure 16). For this, the product sold is the product with higher price per weigh unit, such as *peuakmeuak*, opium, and cardamom.
3.1.2. Diversity of Population and Social Organization

3.1.2.1. Demography, Migration and Education

Based on government classification, the population in Lao PDR is categorized into three ethnic groups. The first classification is the Lao Lum, inhabitants of lowlands, valleys and plateaus, generally situated at 200 to 400 meters altitude. The second is Lao Theung, who inhabits areas near the watersheds, slopes and valleys, and watersheds around the plains at between 300 and 900 meters altitude. The third is Lao Soung, the inhabitants of summits of mountain ranges, above the Lao Theung, at 800 to 1,600 meters altitude (Chazée 1999).

The government’s classification is sometimes inappropriate for certain groups (Chazée 1999). For this study, the classification of ethnic groups uses the categories based on linguistic classification. The Lao Lum that inhabitant Muangmuay and Bouammi villages will be called ‘Lum’. The Lao Theung in these two villages will be called ‘Khamu’. Whilst the inhabitants of Phadheng are categorized as Lao Soung, are called ‘Hmong’.

From the demographic survey results for the three villages, the main ethnic groups and population density can be defined. Muangmuay and Bouammi are predominately Lum and Khmu ethnic groups, while Phadheng is settled by Hmong (Table 4). The highest density of population was found in Muangmuay, it represent five times greater density than found in Phadheng.

Historically, the Lum group settled along the rivers as paddy growers and the Khamu arrived later, occupying the higher slopes. The three ethnic groups developed exchanges among each other across the landscape.

Figure 16: Product commercialization by Phadheng inhabitants through carrying the product which limits the volume which can be commercialized
Table 4: Population data for Bouammi, Muangmuay and Phadheng

<table>
<thead>
<tr>
<th>Village</th>
<th>Sub-Village</th>
<th>Ethnicity</th>
<th>Households</th>
<th>Population</th>
<th>Population per km sq.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muangmuay</td>
<td></td>
<td>Lum</td>
<td>31</td>
<td>167</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Khamu</td>
<td>123</td>
<td>715</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>154</td>
<td>882</td>
<td></td>
</tr>
<tr>
<td>Bouammi</td>
<td>Bouammi</td>
<td>Lum</td>
<td>57</td>
<td>276</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Vangmat</td>
<td>Lum</td>
<td>7</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Khamu</td>
<td>6</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>70</td>
<td>349</td>
<td></td>
</tr>
<tr>
<td>Phadheng</td>
<td></td>
<td>Hmong</td>
<td>40</td>
<td>285</td>
<td>7</td>
</tr>
</tbody>
</table>

* The estimated area from topographic maps combined with village boundaries identified through participatory mapping

Source: demographic and household surveys

To visualize the population structure, a population pyramid was developed. Age is the first element which contributes directly to the dynamics of a population (Vallin 2002). The second is sex because of the capacity for reproduction of individuals in the same age group. Based on the population categories of sex and age class, the age pyramid and population size was constructed for Bouammi and Phadheng, where demographic questionnaires were undertaken. The gender and age pyramids are shown in below illustrations (Figure 17).

![Population Pyramid of Bouammi](image1)

![Population Pyramid of Phadheng](image2)

Figure 17: Population pyramids for Bouammi and Phadheng

The population distribution in the two villages shows the form as a pyramid, which means that younger people dominate the village population and there is a trend towards rapid population increase in the future due to the significant composition of younger people. The
dependence ratio was calculated by comparing the active age population with the inactive age population.

From the total population of each village, Phadeng’s dependence ratio (1.1) is higher than that of Bouammi (0.8), and less in Muangmuay. This ratio indicates that Phadeng has a greater population of productive age than nonproductive age. Due to the fact that the agricultural sector in the study site represents the main occupation, the calculation of a dependence report shows the average number of active people compared to the number of people dependent on the agricultural sector.

It is important to study the land use dynamics and to know the incoming and outcoming migration as this contributes to the dynamics of the population in each village. The migration levels in Bouammi and Phadeng are illustrated below in Figure 16. In Bouammi, before the 1980’s, the incoming migration was predominantly motivated by war, whilst afterwards it was related to marriage. In Phadeng, the main migration motive is marriage and family relationships as well as for farming land. The migration frequency per period in Bouammi and Phadeng is illustrated bellow.

Comparing migration in the two villages, there were a significant number of incoming migrants in the post war period (before 1975) and during the period of village land allocation (1995—2004). In Muangmuay however, the periods of migration start after the war in 1973 with the number of migrants the most significant among the three villages.

Figure 18: Motives of incoming migration in Bouammi and Phadeng
During the period 1995 to 2004, several households moved to Bouammi and also Phadheng for reasons of land access. The new households moved to the village for rice cropping and other plantation such as oranges and teak.

From the point of view of outgoing migration, the number of migrations away from the village of Bouammi is higher than for Phadheng. Also, the number increases from 1975 to 1995 in both villages (which will be described more in the next section). Due to greater access to the road, people from Bouammi and Muangmuay are more mobile than the people from Phadheng. The reasons for this movement include searching for paddy fields, marriage, working in other domains (such as construction or transportation), searching for better health and access facilities, and for study.

Based on interviews conducted, the majority of correspondents plan to send their children to school. This indicates there is a priority for investment in education every year, although not every family is capable of this. Besides the household expense for education fees, the level of education in each village indicates the opportunities for employment outside agriculture. Figure 19 shows the education levels in Bouammi and Phadheng.

![Percentage of Education Level per Gender and Age Groups in Bouammi Village](image1)

![Percentage of Education Level per Gender and Age Groups in Phadheng Village](image2)

**Figure 19**: Educational level in Bouammi and Phadheng

In both Bouammi and Phadheng villages, the level of female education is lower than for males. Education levels in both villages vary. Generally, most Bouammi people have a basic education as they have better facilities and village access to educational activities.

Bouammi and Phadheng both have primary schools and students must travel to other villages for higher levels. Phadheng, as the most remote village with obvious access constraints, only has one resident who has studied at secondary school. The existing local custom of Hmong is that women and children work in the farm. Thus, women and children
are predominantly involved in agriculture and not education. Unlike in Phadheng, in Muangmuay village there is better access to higher educational facilities and most of households integrate education sector in their future family’s planning.

The capability for communication in Lao language indicates the capacity to interact with other people from outside the village, the local authorities and traders. The literacy data (See Appendix 27) shows that generally male literacy rate is higher than for females. The number of people with writing skills in Bouammi is higher than for Phadheng. This phenomenon originates from the fact that people in Phadheng do not apply Lao as their language for daily communication, only for social networks with other villages and tribes. People in Muangmuay and Bouammi, however, use Lao as the language for daily communication.

3.1.2.2. **Village Spatial Organization, Administration, Institution and Power Relations within the Community**

Village organizations hold important roles in general decision making, including decisions about land utilization. In general, all village organizational structures are uniform with some variation. In Muangmuay, the village organizational structure is more complex as the village is larger than the others (Figure 20).

![Figure 20: Village organizational structure](image)

Officially, each village has its own organizational structure to indicate the hierarchy from head of the village. The vice head of the village is responsible for operational organization and specific duties. The deputy head economy and deputy head security report directly to the head of village. Each deputy head is responsible for controlling a specific unit. In Muangmuay, the head of the village controls the chief of sub villages, deputy of education and social affairs as well as the village police. Decision making relating to public needs is always undertaken by the community through general village meetings led by the head of the village and attended by the community, or at least the person in charge of every level of organization in the specific village.
Table 5: Factors influencing village social organization

<table>
<thead>
<tr>
<th>Village or Sub-village</th>
<th>Permanent Settlement</th>
<th>House Field</th>
<th>Population Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bouammi</td>
<td>[Illustration]</td>
<td>-</td>
<td>[Illustration]</td>
</tr>
<tr>
<td>Muangmuay</td>
<td>[Illustration]</td>
<td>[Illustration]</td>
<td>[Illustration]</td>
</tr>
<tr>
<td>Phadheng</td>
<td>[Illustration]</td>
<td>[Illustration]</td>
<td></td>
</tr>
</tbody>
</table>

In Bouammi, people are regularly assembled for common decisions, whilst people in Phadheng and Muangmuay are rarely assembled for such occasions. This is influenced by the size of the population (especially in Muangmuay), and the existence of hamlets (secondary settlements near actual agricultural land) as well as the permanent settlement structure (Table 5). For these reasons, the level of social relationships is different between the villages. In Bouammi and Phadheng villages, both with low populations, grouped settlements, and tight social relationships, people are more easily assembled for a discussion which is not the case in Muangmuay.

(a) Grouped Settlement in Old Bouammi

(b) Settlement along the road in Vangmat

(c) Settlement along the road in Muangmuay

(d) Settlement dispersed in Phadheng

Figure 21: The different settlement structures
The settlement structure is different in each village. In Bouammi (especially in Old Bouammi Sub-village which is Lum group), the inhabitants settlement is grouped and surrounded by a single fence. In Vangmat Sub-village and Muangmuay Village, which are Khamu group, the inhabitant’s settlement without collective fence and arranged along the road. Whilst in Phadheng, the main settlement is configured with each house individually fenced. This phenomenon determines the ease of assembling for common decisions, which is easier in Bouammi than Phadheng or Muangmuay. Figures 21 illustrate these different main settlements in the three villages.

The tendency for dispersed hamlets was found at Phadheng and Muangmuay (Illustrated on Figure 22). In Phadheng, in order to control the village, it is compulsory for people to stay in the main accommodation and they are prohibited to stay at a field house. In Muangmuay, there is a local regulation where every ten days a delegation from a family who stays in a field house must come back to the main settlement. In Muangmuay, the existence of hamlets in groups allows for group decisions to be made about collective agricultural activities. At the village level, this phenomena results in a tendency towards compartmentalizing among the groups.

Despite the difficulties in gathering people for a group discussion, during every planting season there is a general meeting among the household chiefs to decide on which land will be used for rice cropping. This starts with a survey to find potential land for rice crops, followed by discussions regarding the potential lands, and allocation for each household. All of these official decisions have to be approved by the District Agricultural and Forestry Office (DAFO) especially in Bouammi and Phadheng. In Muangmuay, due to collective management at the small group level, the decisions are made by the group and approved by the village organization and then DAFO.

Such processes occur at the village level, especially in Bouammi, where this is done separately in each sub village to be later approved by the DAFO. Therefore the identification of rice cropping areas is more easily settled in Muangmuay as the number of areas is less than the number of inhabitants, and some groups of families already have a fixed cropping area.

Decision making about other land uses such as a new house for a new family or newcomer and where to grow gardens, cash crops or perennial plantations are also decided at the village level. Certain farmers propose the plantation land to the DAFO for land registration, especially for plantations such as teak and fruit trees. The final land certification,
both for utilization or property, must be done at the district level. With this approval, one the implication is the requirement to pay government tax for every utility plot utilized.

The different conditions of mutual aid reflect on the different social relationships in each village as well. In Bouammi, where rice cropping is done collectively in a large group, the people work together to burn the parcel of land in preparation for planting, more over this village has collective management of rice credit system and also for collective organization for certain activities, such as searching the gold and fishing in conservation river. Not only this, there is also mutual aid between certain households in agricultural activities. Different conditions can be found in Muangmuay where there is rarely mutual aid between households but employed agricultural labor is very common. The same tendency was found in Phadeng village, even though this is the most remote village, agricultural employment between the villagers is very common.

Another finding regarding social relations is the equality of information access within the village. As the village chief has good information access about policy issues or development projects In Muangmuay, there is a tendency for such opportunities to benefit villagers who have close relationships with the village chief. While in Bouammi and Phadeng, this information and opportunities are equally distributed among the villagers.

3.1.2.3. Map of Land Use and Spatial Organization

To understand land use change and the key periods in the past, land use changes in each village will be described. Next, the approximate number of households and surface of agricultural area will be compared in order to represent the actual demographic situation for each period.

**Muangmuay Village**

The community of Muangmuay was originally established on the road and near a large river together with several small road junctions connecting villages with one another. Rice crops and plantation areas are located next to the settlement and small roads. From the 1940s until the early 1970s, the non-cultivated areas or the fallow vegetation areas were classified as dense forest. There was also dense forest at the northern side of the village which had never been opened to agriculture. During this period, it can be assumed that the area with potential for agricultural use represented about 90% of the total village area.

There was a national main access route constructed through Muangmuay after 1978. The population in the village increased after the main road development which increased the demand for rice crop plantation area. The slash and burn rice cropping method is still applied today in groups. Table 6 shows the land use change in this village.

In the 1980s, classification of the area was based on its function: utilized and degraded; protection; and conservation forest. The dense forest north of the village was not categorized as a specific area but was reserved for agriculture. During this period, it can be assumed that the area with potential for agricultural use represented about 90% of the total village area.

In 1990, people in the village moved to the main road and new activities began to change land use around the river into paddy field, especially after the irrigation development project in the village. Today, besides the upland rice cultivation in large groups (more than three families in each group), they also carry out activities in small groups. Because of the distance of agricultural land to the main settlement, the different ethnic communities in the same village compete for land access. These results in the rice crops being more dispersed in this village.
### Table 6: Land use change in Muangmuay

<table>
<thead>
<tr>
<th>Periods</th>
<th>Land Use Illustration</th>
<th>Household Density/km² (in year …)</th>
<th>Agricultural Activity and Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940s until early 1970s</td>
<td>- Before the American War (1925)</td>
<td>- 1 (1925)</td>
<td>- 90% of area has agricultural potential (of 2500 ha)</td>
</tr>
<tr>
<td></td>
<td>- Opium trading the major occupation (1925)</td>
<td>- 1.8 (1945)</td>
<td>- 4—5 ha or more rice crop per family, with more than 10 years of fallow</td>
</tr>
<tr>
<td></td>
<td>- Upland rice cultivated in big groups</td>
<td>- 2.8 (1967)</td>
<td>- Cultivable area and fallow area are classified as dense forest by inhabitants</td>
</tr>
<tr>
<td></td>
<td>- Area north of the village is still in heavy forest which had never been used for rice crop</td>
<td></td>
<td>- Area north of the village is still in heavy forest which had never been used for rice crop</td>
</tr>
<tr>
<td>1970s until 1990s</td>
<td>- Main road construction</td>
<td>- 3.6 (1978)</td>
<td>- Rice crop as main occupation, diminution of fallow period and area</td>
</tr>
<tr>
<td></td>
<td>- Land Use Allocation</td>
<td></td>
<td>- Market integration</td>
</tr>
<tr>
<td></td>
<td>- Important Incoming Migration</td>
<td></td>
<td>- Cash crop and perennial plantations near the village and the road</td>
</tr>
<tr>
<td></td>
<td>- Rice crop (approximately 14% of total area allocated for forest area)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990s until now</td>
<td>- Fixed rice crop area management in groups</td>
<td>- 4.4 (2002)</td>
<td>- 80% agricultural area</td>
</tr>
<tr>
<td></td>
<td>- Village settlement moved to near the road</td>
<td>- 6.2 (2004)</td>
<td>- Rice crop and paddy field as main occupations</td>
</tr>
<tr>
<td></td>
<td>- Soldiers and their families settle (20 families)</td>
<td>- 7 (2008)</td>
<td>- Management of rice crop in fixed groups</td>
</tr>
<tr>
<td></td>
<td>- Diminution of fallow period, just 3—4 years, with smaller area per household</td>
<td></td>
<td>- Diminution of fallow period, just 3—4 years, with smaller area per household</td>
</tr>
<tr>
<td></td>
<td>- Teak plantation increase since 1995</td>
<td></td>
<td>- Rice crop in fixed groups</td>
</tr>
<tr>
<td></td>
<td>- Cash crop increase since 2004</td>
<td></td>
<td>- Diminution of fallow period, just 3—4 years, with smaller area per household</td>
</tr>
<tr>
<td></td>
<td>- Fishpond introduced since 2000</td>
<td></td>
<td>- Rice crop in fixed groups</td>
</tr>
<tr>
<td></td>
<td>- Large livestock increase</td>
<td></td>
<td>- Diminution of fallow period, just 3—4 years, with smaller area per household</td>
</tr>
</tbody>
</table>
The spread of rice cropping areas in the region has stimulated the development of hamlets settlements with each one containing three to 11 families. The development of non-permanent settlements started in 1980 and grew intensely in the 1990s until the early 2000s.

**Bouammi Village**

The analysis of the history of changes in land use until now was conducted for the two separate sub-villages. Land use in both sub-villages has been managed separately therefore the sub villages have different histories. Although the people live inside the same administrative village, both sub-villages organize land use separately.

In Bouammi, information about land use in the past can be gained from the period prior to the exodus during the last war in 1965. Before the 1970s, the residents stayed in Bouammi’s actual area and in Namtam Village which was located inside the Phou Loeuy NBCA area. Each sub-village applies slash and burn rice cropping as the main occupation.

In the past, the slash and burn area used to be determined as a group in order to protect wildlife, such as in Namtam Village. These areas are close the pathways and the river to enable transportation.

From 1970 to 1973, residents escaped from the American soldiers to the forest and began to come back to Bouammi in 1973, including most of the families from Namtam. This increased the population and farming area.

The land was still dominated by rice crops until the beginning of 1990, when teak and orange plantations emerged on former rice farming areas next to the settlement. The teak plantations were introduced by farmers who saw this plantation in other villages and collected or bought teak seed, and then tried planting it in their village. The orange plantations were started by newcomers from other villages.

From 2006, due to Lao-American project activities, semi permanent roads were constructed for transport access. Land allocation was also carried out for the village. Forest conservation has also been applied around the national park area. The conservation area has never been used for plantations but has been used for non timber product gathering, such as mushrooms and natural medicines. The main function of forest protection along rivers and streams is for land and water resource conservation. The utilization of the degraded forest was decided on the former fallow areas and the area functioned as a place to gather wood and non-timber products for resident’s daily needs.

In conjunction with the decisions about land allocation, perennial plantations became more diversified in the last period. Diverse crops were planted next to roads and rivers including teak, pigeon pea, eaglewood, orange, and sesame plantations (Table 7).
### Table 7: Land use change in Old Bouammi Sub-village

<table>
<thead>
<tr>
<th>Periods</th>
<th>Land Use Illustration</th>
<th>Household Density/km² (in year ...)</th>
<th>Agricultural Activities and Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960s until 1973</td>
<td></td>
<td>- 0.8 (1971)</td>
<td>- 80% of area with agricultural potential (of 2500 ha)</td>
</tr>
<tr>
<td>- Village establishment in 1971</td>
<td></td>
<td></td>
<td>- Rice cropping in large groups, could be more than 4ha of rice crop per household, fallow period more than 15 years</td>
</tr>
<tr>
<td>- Several future populations stayed in Namtam Village (in NBCA area)</td>
<td></td>
<td></td>
<td>- Area outside rice crop and fallow period are categorized as heavy forest</td>
</tr>
<tr>
<td>- Before the American War</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1973 until 1980s</td>
<td></td>
<td>- 2 (1973)</td>
<td>- 80% of with agricultural potential</td>
</tr>
<tr>
<td>- Resettlement after refugee during American War</td>
<td></td>
<td>- 1.6 (1977)</td>
<td>- Rice crop in large groups, could be more than 4ha of rice crop per household, fallow period could be more than 10 years</td>
</tr>
<tr>
<td>- Outgoing migration</td>
<td></td>
<td></td>
<td>- Areas except crop areas are still categorized a heavy forest</td>
</tr>
<tr>
<td>Early 1990s until early 2000s</td>
<td></td>
<td>- 1.8 (1998)</td>
<td>- 80% of with agricultural potential</td>
</tr>
<tr>
<td>- Teak plantations</td>
<td></td>
<td></td>
<td>- Rice crop in large groups, up to 10 years of fallow period</td>
</tr>
<tr>
<td>- Village fusion with Vangmat</td>
<td></td>
<td></td>
<td>- Teak plantations by several households</td>
</tr>
<tr>
<td></td>
<td><img src="image1" alt="Land Use Illustration" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
In Vangmat Sub-village, land use change is described in Table 8. In this sub-village, rice-cropping areas are always located next to the rivers and on higher elevations than the living areas. The slash and burn activities are done in groups.

In the last war period, there were more than two large groups rice cropping whilst in the period from the beginning of the settlement to the allocation of rice cropping land, areas were categorized as dense forest according to the villagers.

When the war finished, the people who had escaped and separated to the forest came back to stay in Vangmat Sub-village together with new comers from other villages. The post war resettlement in Vangmat triggered an increase in population and brought wider rice cropping areas.

After 1973, there were important incoming migrations of Khamu from Pukhang, the neighboring village. But in the next several years, there were a significant number of out migrations from the village. Since the 1980s, the household number has remained relatively constant. Then, the resettlement occurred during the 1980s until the beginning of 2000s, with the fallow (reservation) and rice cropping areas remaining relatively constant and a decline in the fallow duration.
Since the end of the 1990s, there have been two four households from others villages (including Muangmuay) renting land for rice crops. The rental land area is located outside the rice cropping areas in Vangmat Village but still inside the village territory, and this situation still exists.
When the access road reached Vangmat in 2006, the settlement construction along the road increased. At this time, the regulation was for a maximum of three plots of land in the reserved area per family, and regulations for forest functions in specific areas was also implemented.

**Phadheng Village**

Slash and burn rice cropping is generally carried out close to the settlement area, and is the main source of living in Phadheng. Until recently, the people moved their houses to new areas, on average every 20 year, to be close to their rice crops and opium plantations. Based on the area’s altitude and structures, Phadheng is suitable for opium cultivation which had occurred for a long time. From 1941 to 1965, the settlements were relocated to the new location close to opium plantations and rice crops were established around them (Table 9).

**Table 9 : Land use change in Phadheng Sub-village**

<table>
<thead>
<tr>
<th>Periodes</th>
<th>Land Use Illustration</th>
<th>Household Density/km² (at year …)</th>
<th>Agricultural Activity and Land Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918 until 1940</td>
<td>- French occupation - Village relocation - Opium producer</td>
<td>1.3 (1922)</td>
<td>- 70% with agricultural potential (of 4000 ha) - Rice crop area near to the village settlement - Rice, maize, and cassava crops planted by rotation in this area with fallow period relatively long (up to 30 to 50 years) - Rice cropping in small groups but in the same large area</td>
</tr>
<tr>
<td>1941 until 1965</td>
<td>- Village relocation - Opium produced</td>
<td>1.3 (1963)</td>
<td>- 70% with agricultural potential - Settlement moved to new area near opium plantation - Rice cropping areas around opium plantations and settlement.</td>
</tr>
<tr>
<td>Periods</td>
<td>Land Use Illustration</td>
<td>Household Density/km² (at year …)</td>
<td>Agricultural Activity and Land Use</td>
</tr>
<tr>
<td>------------------</td>
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<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1974 until 1981</td>
<td>Village relocation - Opium producer</td>
<td>1.3 (2001)</td>
<td>- 70% with agricultural potential&lt;br&gt;- Opium plantations located in the same area for many years</td>
</tr>
<tr>
<td>1981 until 2003</td>
<td>Village relocation - Land allocation - Opium produced</td>
<td>1.3 (2001)</td>
<td>- 70% with agricultural potential&lt;br&gt;- Striped region on the map is the field for fallow and rice cropping areas&lt;br&gt;- Field houses close to the location of next village relocation area</td>
</tr>
<tr>
<td>2003 until 2008</td>
<td>Village to be relocated the next year - Land allocation - Official announcement for village</td>
<td>1.3 (2008)</td>
<td>- 60% agricultural area&lt;br&gt;- Land allocation (approximately 20% allocated for forest functions)&lt;br&gt;- Opium was not planted in the village and that area categorized as utilization forest&lt;br&gt;- Rice and maize crops cultured much further from the settlement and close to the next settlement relocation area</td>
</tr>
</tbody>
</table>

The relocation of settlements and rice cropping areas commenced in the beginning of the 1970s when the village decided on the specific land use for utilized and degraded forests. The land allocation process was then implemented in 2003.

Prior to the land allocation program, all areas outside the rice cropping and fallow area were reserved for agriculture and could be cultivated by the villagers. The reserved area was also dense forest where people could gather timber and non-timber forest products. The area was also occupied by livestock; cattle and buffaloes.
The typical case from the 1980s until 2003 - when opium plantations were prohibited and the former plantation lands were reformed to ‘degraded’ forest - rice cropping areas were located far from village settlements but near the village’s next settlement area, where the village relocated to in 2003.

After being settled since 1981, the main settlement moved again in 2003 to its current location because of human stomach disease. The rice cropping areas are not far from the main settlement. But in 2008, the rice cropping area will be far from the main settlement because the village is due to be relocated to a new settlement area by the end of this year. This is the reason why the rice cropping areas are located far from the main settlement, but near to the new location of what will be the main settlement next year.

3.1.3. Conclusion

Several major changes in land use were identified in the study site. The first was the privatization of natural resources and the associated shortening of fallow periods. Fixed plots issued for each household and demographic pressure encouraged farmers to shorten their fallow period in upland rice cultivation. This has begun to occur in Muangmuay and is just about to occur in Bouammi and Phadheng. In the latter two villages, the land use management is decided by the village collectively, while in Muangmuay it is decided by several groups with a number of households operating collectively.

Plot fencing is a method of indicating plantation area boundaries by installing bamboo fences that act as the property boundary as well as confine animals. The perennial plantations, such as teak, are used to limit and mark the property. A plot planted with teak aims to declare the ownership and this can be validated by DAFO acknowledgement, meaning it is possible for the plot to be declared as a private property in the future. Many farmers in Bouammi start cultivating their crops by intercropping with teak or pigeon pea for the first year and leave the perennial plantation in the plot during the second year as a strategy to mark the land ownership.

The data shows a trend in farming activities away from ‘volunteerism’ towards a ‘professional’ mode as the various capitals among farmers create labor demand and supply. Unlike in Bouammi, the field study revealed that paying agricultural employment is very common in Muangmuay.

The second identified major change is the transition from annual to perennial plantations. Though not a major obvious transformation, many households have changed their production systems from annual to perennial plantations under certain conditions, such as the suitability of biophysical conditions, land access and capital.

Third, the observed change is from food to cash crop farming. Due to the market value of cash crop products, land access and an interest in marking land as their property, the farmers are changing their systems to produce cash crops such as Pigeon Pea.

The above result shows that the three villages have specific biophysical and human environmental conditions and a variety of social organizations, information and development project access, market access opportunities, education, external relations, and engage in several agricultural activities. Access roads from one village to another will stimulate the change in trends of land use. Meanwhile, the skill and information required to grow cash crops and perennial plantations gained from development projects and network support have changed the land utilization close to transportation facilities, river and road.
The land allocation rules which have commenced, and which determine one area that is designated as an agricultural area for rice field activities, has become a major issue within the villages. Moreover, the fixed plot allocation for each household (three to four plots per household) has stimulated farmers to mark their own plots with industrial or wood plantations. The diversity of cropping and livestock systems are each performed differently, in term of land and work productivity.

The landscape transformation cannot be identified by a simple description of actual land usage as the landscape mosaics are dynamic. They result from relationships between humans and their environment, important events, and also government policies. They can be recognized by the changes which have occurred to bring about the current conditions. By analyzing this view, the driving factors of change will be identified in the next sub chapter.

3.2. DRIVING FORCES OF CHANGE

The gradient of village study sites is related to the diversity of biophysical conditions and human-demographic environment linked to social organization and access to the market, public facilities, information, and development projects. The dynamics of land use are linked to changes in agricultural activities to diversify from non-rice cropping systems. There are not only internal aspects which affect the ongoing changes, but also aspects related to national policies which are implemented at the local level.

MAF (2008b) stated that the transition from subsistence-based livelihood and farming systems to market oriented ones was due to two main driver of change: market demand and government policies. The first driver of change, market demand, has little direct impact on the study site, even though Viengkham District is located near the boundary with Vietnam. The market demand mentioned by MAF is related to regional investment from China, Thailand and Vietnam in cross border transactions. This differs from what can be found in the neighboring province, Luang Namtha which has a boundary with China; the second biggest investor in Lao after Thailand (Pedroletti 2008).

The second driver of change (government policies) which has been implemented in the study sites, contributes substantially to local land use changes. This sub-chapter outlines the relevant policies which are driving forces of these changes and villagers perspectives of their actual and future condition, which is influenced by the national political environment.

3.2.1. Related Policies

Based on several interviews in the three villages and a review of literature studies, certain policies being implemented were identified. There is a difference in the application time and intensity of the policies in the study sites.

There are at least four land management policies implemented (based on key policy programs identified by MAF [2008b]) in the study sites. First, in 1986 the Lao Government issued a policy program ‘Village Relocation and Consolidation’ which regulates that a village should have at least 50 households. Second, in 1989 with a program called ‘Shifting Cultivation Stabilization and Elimination Program’, the Lao Government applied forest and land allocation as well as integrating commercial crops with upland rice crops. The third policy program is the ‘Focal Site Strategy (Rural Development Program)’ that has the same
objectives as the first policy. And last, the ‘Village Land Use Planning and Land Allocation’ policy which takes a village boundary approach with land use zones, fixed areas allocated to each family and the potential for issuing land use contracts during 1995—1996. Another policy which is not directly related to land management policy is the opium eradication policy.

The policies above can be divided according to their methods of implementation. The first is ‘Project-Related Settlement’ that concerns management of population settlement; i.e. ‘Village Consolidation and Relocation’ and ‘Focal Site Strategy’. The second is related to the stabilization-elimination of shifting cultivation and opium eradication through the policies: ‘Shifting Cultivation Stabilization and Consolidation’, ‘Land Use Planning and Land Allocation’ and ‘Opium Eradication Program’.

3.2.1.1. Project-Related Settlement

There are three project-related settlements applied in the study site, the first is Village Relocation – Consolidation which has been applied since 1989 and the second is the Focal Site Strategy Program applied since 1995-96. Nationally, the settlement projects relocate communities for large infrastructure projects such as roads, forests, mining concessions or hydropower dams, as a way to increase benefits to indigenous communities as Laos opens to foreign investment (Baird and Shoemaker 2005).

Furthermore, village consolidation combines scattered smaller settlements by resettling people into larger permanent villages, with the new sites providing services, and more easily administrated by the GoL (Baird and Shoemaker 2005; MAF 2008b). This governmental regulation regarding a minimum of 50 households in a village was applied in the study sites, especially in Bouammi by the end of 1990s. In this village, old Bouammi and Vangmat Sub-village were combined and sit under the same administrative board named Bouammi Village.

However, each sub-village lives in a separate region with its own organizational structure, board of representatives and discrete boundaries of land and properties, all the national administrative systems, such as annual rice crop approval and development projects, are undertaken mutually. Under this current situation, Vangmat’s participation is less than Bouammi’s due to the administration center being based in Old Bouammi Sub-village.

On the other hand, over time the separation between villages lessens. For example, the brother of the Bouammi Village head moved to Vangmat and became sub-village chief then party secretary there. There are also internal migrations among the sub-villages associated with marriage.

Recently, the policy related to settlement has also been applied in Phadheng, where the district government has decided to relocate the village to the closest pathway for better accessibility. Phadheng is to be relocated this year by the end of the rice harvest period. Financed by the Lao Government, the project’s proposal covers school allocation, access road construction, and providing fresh water supply.

In Muangmuay, the settlement was relocated to its current area along the national road. This movement progressively occurred from 1990 to 1994.
3.2.1.2. Shifting Cultivation Stabilization-Elimination and Opium Eradication

Bestari et al. (2006) states that GoL has several strategies for stabilizing shifting cultivation, including:

- Promoting sedentary agriculture on sloping lands through crop diversification;
- Developing market access for communities through road development and market information delivery;
- Promoting land use zoning based on land capability and slope;
- Promoting rural savings and credits provisions; and
- Implementing land use planning and land allocation.

In the study site, the eradication of rice crop shifting cultivation is a prominent issue which is being undertaken by providing alternative agricultural systems to support farmer’s sources of living with industrial crop plantation projects such as maize, pigeon pea, sesame and eagle wood, production woods and livestock projects with goats and other animals.

The policy not only promotes alternative agricultural activities, it has also applied land use planning and land allocation in the study site. Land use planning and land allocation was implemented at different times in the study site. This policy has been implemented especially in Bouammi and Muangmuay since 2006 supported by a foreign project which aimed to eradicate opium plantations.

Land use planning and allocation are undertaken through functional area classification as well as the allocation of three or four fixed plots to each family. With the fixation of plots and land zones, the agricultural areas are reduced as can be seen in the previous chapter. Even though there are fixed plots, this program is not being implemented by villagers because of the lack of control by local authorities. In Bouammi and Phadheng, even though they declare that there are fixed plots, the reality is that the upland rice crop area is still on fallow more than three years decisions are still taken at the village level through collective management.

In line with shifting cultivation stabilization, opium eradication was one of the GoL policy programs to reduce poverty. The opium eradication policy on the trade and cultivation of opium wiped out a traditional occupation which was practiced by generations of farmers.

In northern Laos, year 2001 was the last year that opium plantations were tolerated and in late 2002 many opium crop were destroyed just before they flowered (Lyttleton 2004). The policy was directly sponsored by the Lao Government or in collaboration with a project, such as the Lao-American Project in 2004—2006, especially in Muangmuay and Bouammi. In Phadheng, opium eradication was sponsored by GoL in the early 2000s.

The policy relating to opium eradication was applied in the three villages, even though not all of the villages grew opium. Historically, Phadheng was the only village where the inhabitants cultivated opium due to the village’s suitable altitude, topography and land. Bouammi and Muangmuay were merely the villages where the crop’s marketing traders were located.

In both Muangmuay and Bouammi villages, the ‘apparent’ eradication was done through alternative agricultural projects and the supply of farming facilities. Whilst in Phadheng, the policy undertook to eliminate all the opium plantations, providing a
rehabilitation program for addicted inhabitants, and ongoing regional monitoring and security patrol.

Decentralization has commenced in Lao PDR, giving the district government a major role in the central to local government mutual relationship. For this, the district government has the dominant role in the implementation of each national policy including development projects or central government policies which are to be undertaken in their territory.

The relationship between the district authority and the villages does not have the same intensity. Muangmuay has a closer relationship with the district authority, and Phadheng the least close. In reality, if there is implementation of policies—including development projects, Muangmuay has better access to these.

### 3.2.2. Perception of Local People and Prospective Land Use Systems

As introduced in the methodology chapter, the inhabitants’ perceptions of the future are classified into: future ideal conditions perception; preferred living activities; and the identification of their demands and constraints. Based on the collated data from focus groups and individual interviews, most inhabitants would like to not be farming slash and burn rice crops but using the land predominantly for industrial and timber plantations such as teak, eaglewood, maize and pigeon pea. This finding is especially the case in Muangmuay and Bouammi.

People in Phadheng meanwhile viewed their ideal land occupation as having proper conditions for the basic slash and burn rice crops in the upland with sufficient area for livestock and forest commodities. They also had a preference for better facilities and accessibility.

Among the three villages, the comparison of the ideal state can be combined as: (1) desire for better facilities and accessibility; (2) the presence or absence of slash and burn rice crops; (3) the availability of cash crops and perennial plantations; and (4) the description of preferred future activities. These are the prominent points to distinguish the ideal description for each village.

The eradication of slash and burn rice cropping, sufficient land for industrial and timber plantations, and more livestock are the ideal states for Bouammi and Muangmuay inhabitants, whilst Phadheng residents would prefer to continue slash and burn activities.

It is an interesting fact that the preferred activities or crop types are those which have already been recognized in the village or pioneered in the surrounding district, either through the residents’ own knowledge or introduced by a project. The industrial and timber plantations that have recently been planted have been done without proper methods or sufficient technical knowledge nor commercial security. This high tendency towards speculative activities was found with trial cultivation of eagle wood, pigeon pea and teak plantations.

In terms of the village’s identified demands and constraints, the pooling of results showed the desire for more national or foreign development projects and policies. Through such support, the villagers are hopeful of gaining technical support, getting funds to vary their livelihood activities and that public facilities and crop marketing security will be introduced.

By observing local perceptions about their village and its changes, there appears to be a tendency for policies to influence the way of thinking. For example, the villagers described the villages’ land use in the same way as it was documented by the land allocation program.


3.2.3. Conclusion

Government policies have influence locally on the land use and livelihood changes in the study sites. The village relocation and consolidation, stabilization of shifting cultivation, eradication of opium and land use allocation policies have been implemented in the study site and contribute to the landscape dynamic through differentiation of livelihood systems.

The policies have not been implemented the same way in the three villages due to their differing accessibility which affects relationships with the district authority. This explains why there is a differentiation in application period and intensity.

The policies which have been implemented also affect the way of thinking of inhabitants with regard to identifying their problems and desired conditions for the future. Their future ideal activities and conditions are declared the same as the policies and therefore politically correct.

Different conditions push the inhabitants to cope with their situation. These can be described by the differentiation and dynamics of farming system as a main part of livelihood strategies in the study sites. The next sub-chapter will deliver the farming systems differentiation.

3.3. Differentiation of the Farming Systems

In Laos, livelihood strategies combine different on-farm and off-farm activities with animal husbandry and forestry in order to cope with multiple environmental and economic uncertainties. The study in Muangmuay, Bouammi, and Phadheng Villages found that livelihood systems are dependent on forestry, NTFP collection and other off farm activities (See Appendix 29 and 30 for some activities). The farming systems in the study sites show a tendency towards change, from subsistence-based agricultural production to more households engaging in the market economy.

The results show increasing pressure on the land and livelihood options available to households under the traditional agrarian system, up to a point where farmers have to convert their farming systems to cope with the changing (biophysical and policy) environment. The changes in land use systems were introduced earlier and the way households cope with these changes is described in the next section. An actual typology of farming systems has been identified through the different types of production activities and livelihood strategies in each village.

3.3.1. Farming System Typology

Based on fieldwork observation and interviews, various combinations of household activities were identified. The farming system typology was organized based on the following basic questions: (1) What is the share of rice production in the overall household income (?) or What share of the overall household income is rice production?) How is the rice production revenue part from the overall farm’s revenue?, (2) Is there capital accumulation in the system?, (3) Does farming fulfill daily needs? If not, how do families cope with this?, and (4) Does the system include farm diversification? And how is this applied?
Using these questions as a guide, the farming systems in the three villages were classified into four types:

1. Rotational rice-based shifting cultivation farming system
2. Rotational rice-based shifting cultivation farming system with capital accumulation in livestock
3. Rotational rice-based shifting cultivation farming system with crop diversification
4. Farming system based on cash crops and perennial tree plantations

The A-type is the traditional upland rice-based system practiced by new farmers who came more recently to the area or new farms that were commenced by families who acquired land from the village board or their parents. Cultivated land used to be smaller in size. Although it varies in each family, generally the farmers in this category fit the following profile.

- Family-based farming systems.
- Rice production as the majority of their total agricultural revenue.
- Very limited livestock production, only small numbers of pigs and poultry.
- Annual agricultural income below minimum daily needs.
- With no savings and full dependency on family members in terms of labor force, the continuity of this system is uncertain. In many cases, farmers leave the village looking for off-farm jobs such as daily workers in construction or transportation companies, and other occupation to meet daily household needs.
- The family used to sell its labor force to other farms, gather NTFPs, fish, and practice crafts works such as weaving in Bouammi and rattan furniture crafting in Phadheng.

This type is reclassified in each village based on the variation of the rice crop system. Three farming system types can be identified within the type A. These types are: rice crop with seven years of fallow in Bouammi; rice crop with three years of fallow in Muangmuay; and rice crop with cassava crop and three years of fallow in Phadheng.

The B-type (slash and burn upland rice-based production system with capital accumulation in livestock) uses investment in livestock as a savings strategy, with buffalo, cattle and goat the most common livestock. This type was found in all the villages with characteristics as follows.

- Higher agricultural revenue than type A with combined rice production and animal husbandry.
- Still dependant on rice production with farmer’s predominantly self-sufficient in rice.
- Use of family members as labor force with very little reliance on labor from outside.

The C-type, called ‘rotational rice-based shifting cultivation farming system with crop diversification’ is a system requiring more capital than A and B types. Farmers classified in this farming system are those who are informed by village organizations and have the capital to invest. These households are able to take the risk of diversifying with crops and perennial
plantations that are more integrated into the market, such as sesame, teak, pigeon pea and agar wood. The crop diversification enables households to secure individual land ownership. This type is typical in terms of the following.

- Higher agricultural income than the types A and B with additional income from rice production, livestock, and non-rice plantations.
- The majority of farmers are self-sufficient in rice.
- Family labor is used with periodic short term annual outsourcing.

The last system, D-type (farming system based on cash crops and perennial tree plantations, comprises a minority of farmers in Bouammi and Muangmuay who no longer grow rice. With income from non-rice crops, they buy rice for their daily consumption. Most of the agricultural revenue from this type of system comes from fruit, wood and cash crop plantations as well as off-farm activities. Generally, the farmers in this type are those who have had significant capital since the early stages of land occupancy and those with long experience in farming. The typical characteristics of this type are as follows.

- Do not produce rice.
- Require upfront capital, including labor during planting and harvesting seasons, and can exist on revenue which is earned in the long term.
- Short term income is earned from non-agricultural activities such as rice mill rental or small shop.
- Family labor is used with periodic short term annual outsourcing.

The composition of each type is different in the three villages studied due to a range of factors. The gradients of the villages and their histories create a different situation for farming systems in each village. The dynamics of farming systems and differentiation process is described in the next section.

### 3.3.2. The Dynamics of Farming Systems and Differentiation Process

The population migrations and the demographic growth, together with biophysical factors and household condition, have contributed to household differentiation in farming systems. The interviews and historical land use change analysis revealed that rice cropping using the slash and burn technique in upland areas is the main productive activity within the three villages. Prior to, and before the 1960s, through collective village management, each family could occupy all the available land to the limit of their available labor force. This was based on the ratio between productive and non-productive members of household which varies during the household’s life cycle. The comparative number of active and inactive household members determines the capacity of a household to farm the necessary surface area to fulfill the minimal household needs. The household food security is assured mainly by shifting cultivation with long fallow periods and combined with NTFP gathering, fishing and hunting activities.

The different biophysical conditions and ethnicity create specific characteristics in this main activity. The Khamu and Lum ethnic groups, found in Bouammi and Muangmuay, practiced shifting cultivation and then rotated with a long period of fallow. Lum used to cultivate paddy rice in the alluvial plains. The Hmong ethnic group in Phadheng that live at a
higher altitude, practiced shifting cultivation on less dense forest, combined with opium plantations for several years on the same plots.

Household activities were not secure during the American war in the early 1970s. The inhabitants had to escape to the forest more or less two years. The farming activities receded as villagers abandoned the settlements along with livestock. Rice cropping was done but with minimum work and poor yields. During this period, the daily food needs were fulfilled mainly by hunting, gathering in the forest and fishing. When the war ended, the villagers resettled again and also there were a number of migrations. After resettlement, the inhabitants continued activities as before the war.

The availability of family labor force is the prominent factor in the type of farming system practiced, provided that land access is not a constraint. Those who could not manage to accumulate savings remained shifting cultivators while others with more non-productive aged family member could accumulate rice and then purchase livestock. These farmers transitioned into the rice and livestock farm combination system, commonly after the war period in the 1970's. This system however is also risky due to the possibility of disease epidemics, as happened with pig and goat breeding in Muangmuay and Bouammi, and cattle disease in Phadheng.

The farmers are integrated into the market through the economic opening of the country to monetary transactions. The farmers exchanged or sold their livestock, opium (for Phadheng village), hunting products, NTFPs or collected gold to earn money or purchase basic daily needs such as oil, soap and clothes. Certain families that could save more than other families usually invested it in livestock animals. Market integration was reached earlier in Muangmuay and lately in Phadheng due to the different gradient of accessibility.

Recently, once the population had grown and land regulations introduced (early 2000s), there has been a tendency to diversify into cash crop-perennial plantations or paddy field and shorter fallow cycle periods, and also in relation to the way land is managed. Decisions about the land are less collective than before, especially in Muangmuay, where there are only some groups of households working together on shifting cultivation or paddy field.

The differentiation happened after the introduction of cash crops and perennial plantations in Bouammi and Muangmuay. The farmers who could accumulate capital during the previous period (rice surpluses and livestock savings), started to diversify into plantations of cash crops and perennial trees; shifting from type B to type C farming system.

The diversification did not occur for all households within the village. The livelihood systems are always based on the food security of the farmers who don’t have any other way to access individual land ownership. On other hand, the policy allows farmers (especially those who are well informed by village organizations and who have the capital) to invest and take the risks involved with land security and investing savings in cash crops or perennial plantations combined with the other cropping systems and other activities which secure regular revenue.

In Muangmuay, the biophysical environment has enabled the development of paddy fields. However, with limited land access - as almost of the plain area has become someone’s property - the incoming farmers or new families can rarely engage in this occupation. The paddy field activity in Muangmuay is also an investment for farmers who have land appropriate to this activity which has been introduced by incoming migrants of certain Lao Lum families and supported by the Vietnamese project. The rice field activities are managed in groups of several households. Thus the paddy rice, with the higher productivity to labor
than the upland rice, is one way households can affording self consumption needs, gain capital and sell to the market.

Even though there is diversification of farm activities by several farmers, rice-based activities always form the basis of food security for most farmers in the study sites. Through land allocation and demographic pressure, the agricultural area has decreased and the fallow period shortened. Moreover, the fixed number of plots (three to four per household) leads to the decrease in fallow period, even though this is not yet fully applied in the three villages.

The last system involves those who have capital savings and regular income outside their agricultural production. These farmers tend to stop shifting cultivation and rely on livestock and perennial plants. This system accumulates more capital than the other existing farming systems.

Within the typology of farming systems, there are households who tend to return to former production systems when obliged to. For example, they may sell their livestock in circumstances such as a bad harvest or sick person in the family. Because of decreased capital, one farming system can change to another which has lower capital. The dynamic of farming typology for Bouammi is shown in Figure 23.

![Figure 23: Dynamics of farming systems in Bouammi Village](image)

Based on the survey results, the diverse rice crop typology is found to be greater in Muangmuay and Bouammi than in Phadheng. The comparison of the distribution of farming systems types in each village is shown in Figure 24 below.
3.3.3. Economic Differentiation within Farming Systems

As mentioned before, farming is a major component of the livelihood system for most of the households in the study site. To quantify and compare the performance of each land use system, and also agricultural income in each farming system, an economic evaluation was made.
Based on individual interviews conducted in the villages, an economic evaluation is made for each cropping and livestock system and also for each farming system (See Appendix 31—34). A technical-economic analysis of the cropping systems has been generated by comparing the land productivity (GVA/ha) and the labor productivity (GVA/man day). In addition, the agricultural income is compared across the farming systems.

### 3.3.3.1. Cropping and Livestock Systems Performance

The farming systems in Muangmuay, Bouammi and Phadheng villages include rice production, perennial plantations and cash crops. The first (rice production) comes as the premier agricultural item as almost all the interviewed households are still producing rice to fulfill their family needs. The cultivation systems are classified into two methods: slash and burn on the slopes and paddy fields in the lowlands.

The first mode was found in all the three villages which is distinguishable based on the fallow period and rice variety: (1) glutinous rice intercropped with maize on three years fallow (R-M//3F) in Muangmuay; (2) glutinous rice crop intercropped with maize on seven years fallow (R-M//7F) in Bouammi; and (3) non-glutinous rice intercropped with maize in the first year and cassava for three years with three years fallow (R-M//3C//3F) in Phadheng. The second method was found in Muangmuay with two existing systems: (1) mechanized paddy field during the rainy season and a combination of vegetable gardens during the dry season (Ri(m)/G); and (2) non-mechanized paddy field just during the rainy season (Ri).

Of the entire rice crop, as the main intended plantation system, the irrigated-mechanized paddy field is the most productive and efficient method. For the slash and burn upland rice cropping with long fallow period (three to seven years), the cropping systems tend to enlarge the cultivated area extensively. Longer fallow periods means lower productivity per hectare than shorter periods, as the fallow is considered a non-productive stage of the cultivation cycle, while this system provides better labor productivity (Figure 25).

Though the paddy field crop provides good prospects, in terms of land and labor productivity, the crop is not affordable to all villagers as it requires proper irrigation system development, plain area, and land ownership. This is the same situation for plantation land, where the initial investment of land and capital are required to secure the land ownership.

In the early period of paddy field management in Muangmuay, farmers’ groups used to combine cultivation in both rainy and dry seasons. This double cropping was discontinued due to animal damage, water shortages and degradation of the irrigation canals as the maintenance was not managed collectively.
Even though the irrigated paddy plantation is the most intensive method for the yield and work productivity, this system is still less effective compared to perennial plantations such as teak and eaglewood (Figure 26) based on calculation estimating. Even tough there is a long delay from plantation and harvest, Teak and Eaglewood plantations have the highest productivity among all the identified cropping systems, both in yearly productivity per land area and the working productivity with short labor time and good market price.
The orange plantation system has also been more productive compared to the annual crop, even though the work productivity is lower than for other perennial plantations such as teak and eaglewood. Cash crop systems such as sesame and pigeon pea are more productive than rice and less productive and effective than perennial plantations and irrigated paddy field due to their intensive labor requirement. The animal husbandry systems identified within the study site are poultry, pig, goat, and buffalo. To compare the animal husbandry systems performance, the yearly gross value-added per productive female was calculated for each system as shown in Figure 27.

Figure 26: Land and work productivity of non-rice annual cash crops and perennial plantations
Poultry and pigs are the most common animals raised in the villages, as each household raise these animals around the residential area. Aside from domestic consumption, poultry and pigs are used as a medium-term saving to be sold at any time required. Large livestock such as buffalo, cows, and goats are also intended for saving capital. The extensive system of livestock management in open forest, with minimum workload per day, is interesting in terms of labor productivity, but it requires a higher initial investment than smaller animals. Families usually start livestock breeding once they have sufficient savings from rice crop production.

An economic comparison between breeding systems shows that the buffalo breeding system has the highest yearly productivity thanks to better reproductive performance and better resistance to diseases than cattle. Except for poultry and pig, all the large animals are left roaming in open forests, which tends to be a very extensive animal husbandry system. The following table shows the comparison of cattle numbers with the non-cultivated area in each village.

Table 10: Comparison of total number of animals per non-cultivated area

<table>
<thead>
<tr>
<th>Village</th>
<th>Buffalo</th>
<th>Cattle</th>
<th>Goat</th>
<th>Buffalo+Cattle+Goat (equivalent on large ruminant unit*)</th>
<th>(B+C+G)/non agricultural area (animal/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muangmuay</td>
<td>256</td>
<td>21</td>
<td>104</td>
<td>297.8</td>
<td>0.14</td>
</tr>
<tr>
<td>Bouammi</td>
<td>66</td>
<td>0</td>
<td>21</td>
<td>70.2</td>
<td>0.02</td>
</tr>
<tr>
<td>Phadheng</td>
<td>122</td>
<td>77</td>
<td>60</td>
<td>211</td>
<td>0.05</td>
</tr>
</tbody>
</table>

* One goat is equivalent to 0.2 large ruminant units
Muangmuay has the highest density of livestock compared to the other villages. Due to the number of open breeding livestock and agriculture activity in Muangmuay, there have been many conflicts between. With a shortage of grazing areas, the animals frequently break through fences and damage paddy fields which had led to the cessation of paddy field during the dry season and protection fences being built around the plots.

**3.3.3.2. Economic Evaluation on Farming Systems**

The calculation of economic evaluation comparison was undertaken on each examined model and directly from each interviewed sample. The Gross Value-Added composition shows the contribution of each crop and livestock system which influences the system’s income (Figure 28).

![Figure 28: Gross value-added elements of different farming systems](image)

Note: 1 US$ equivalent 8,600 kip

Legend:
- A. Rotational rice-based shifting cultivation farming system (A: rice crop with seven years of fallow in Bouammi, A1: rice crop with three years of fallow in Muangmuay, A3: rice crop with cassava crop and three years of fallow in Phadheng)
- B. Rotational rice-based shifting cultivation farming system with capital accumulation in livestock
- C. Rotational rice-based shifting cultivation farming system with crop diversification (C: rice crop with seven years of fallow-perennial plantation-cash crop in Bouammi, C1: rice crop with three years of fallow-cash crop-plantation-paddy field in Muangmuay)
- D. Farming system based on cash crops and perennial tree plantations in Bouammi

The contribution of rice production to the income of rotational rice-based shifting cultivation farming systems in three villages (type A, A1, and A2) is higher than for the ‘rotational rice-based shifting cultivation and livestock capital accumulation’ farming system (type B), where rice surpluses are reinvested in livestock. The contribution of rice production to the overall household income declines when moving from A and B to C and D systems.

As an additional source of food and revenue, NTFP gathering activities are should also included in economical calculation of each system, because of time limit, the calculation self consummation of NTFP did not conducted. Based on study conducted by Bounthong, Raintree and Douangsavanh (2003), NTFP account 40—60% of annual household income and reaching up to 80% in extremely poor areas. For the quantity of NTFP sold, the research finding shows that the monetary income from NTFP selling is higher in Muangmuay than Bouammi and Phadheng. Each production system affects the intensity of gathering activities due to the demand and available spare time outside farming.
One method to compare the performances of different production systems is to compare their productivity per hectare with their labor productivity as shown in Figure 29 (See Appendix 35—41 for the economic calculation). From the above figure, the C1 (Muangmuay diversified rice crop-irrigated paddy field) and D systems are intensive per surface unit which have the highest income on smaller cultivated areas than the other systems, though they require higher capital investment.

In all villages, the A type farming systems are close to this survival line. With rice base production at Bouammi, this system could fulfill the needs of one active worker and one dependent. In Muangmuay’s A1 system, the production is not sufficient to cover food needs which is the same situation in Phadheng’s A2 system, although this is slightly higher than for Muangmuay.

The comparison of each system’s revenue to the United Nations classification of the poverty line (those with less than $1 daily revenue) shows that the C and D systems are not classified as below the poverty line. However, they depend on the transportation system and market access and their income is therefore slightly overestimated as the marketing and transportation costs should be deducted according to the distance to market. Although systems C and D are classified above the poverty line, but the perennial system (as an important part on agricultural income) is a long term capital return. It must wait several years until the plantation produce the income.

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**Figure 29:** Agricultural income per hectare per active household member in the village study sites
4. DISCUSSION

The research identified that several major drivers of changes in land use in the study site. The gradients of accessibility corresponding to the three villages explain the different land uses within the villages. These land uses depend on biophysical and human environments as internal factors; policies and development projects as external factors.

The biophysical conditions within the village could be characterized by altitude, hilly topography, hydrographic network, micro climatic condition and also remoteness. These gradients create the different opportunities to grow certain crops, the agricultural techniques and activities, the accessibility to markets, social and health facilities, and also access to information and development projects.

Among all village study sites, Muangmuay, the village with the best road access, has the best access to information and to development projects among the other village study sites. The biophysical conditions of this village allowed the development of paddy rice cropping systems which are more productive in terms of land and labor productivity than shifting cultivation systems. These biophysical assets attracted different ethnic groups in search of land they could transform into paddy fields. They were eager to settle close to the road to benefit from better access to basic services such as education, health care and market. As a consequence the village developed as a complex multi-ethnic community.

The basic differentiation of internal factors among the villages is the demographic density, social organization structure and ethnicity. Phadeng has the lowest population density (approximately seven inhabitants per km²). The village can maintain shifting cultivation with a long fallow cycle, while in Muangmuay the density of more than 23 people per km² no longer allows for shifting cultivation with a long cycle of fallow (Dufumier 1996, Staver 1989). Moreover, population density and ethnicity affect the different social organization structures found in the study sites. In Phadeng and Bouammi, which have lower population density and strong social linkages, there is the potential for equal access to information or opportunities with land decisions inclusive of all inhabitants.

Land use change is also affected by external factors such as government policies and often supported by development projects. Several government programs implemented in the three villages under the general objectives of development and conservation, contributed to the differentiation of livelihood systems. Village relocation and consolidation, stabilization of shifting cultivation, eradication of opium and land use planning have been implemented in the study sites with different intensity according to the period of implementation. The policies implemented also affect the way of thinking of inhabitants when identifying their problems and considering conditions for the future. Their future ideal activities, as revealed by the visioning exercise, are very much in line with government policies and villagers’ expectations were always politically correct.

The research found that, by attribution of drivers of changes, two major land use changes are found in the study site. The first major change is the tendency towards land privatization in relation to fixed plots related to land allocation and demographic pressure. Marking the land with plantations of perennial trees and cash crops using bamboo fencing are ways to identify land propriety in the study sites. The second major change identified was the transition from annual to perennial plantations and also the change from food to cash crops. Due to the market value of cash crop products, there is an interest in marking land ownership, and there is also higher land productivity per surface unit. The farmers are producing cash food crops, such as pigeon pea and sesame. Based on those condition, recently, the farming system analysis in the three villages shows that the majority of households are still dependent
on shifting cultivation (as they have been for generations) combined with other activities such as gardens, hunting, fishing, and gathering to fulfill their family needs.

Those findings about land use change confirm the previous researches. Although the research was conducted in just three villages in Viengkham District, Luang Prabang Province as a case study and as a part of the project, the results of the research show similar trends in land use change in northern Laos and in northern mountainous mainland Southeast Asia. There is rapid transformation from subsistence and shifting cultivation to sedentary agriculture in cash crops and perennial plantations (Fox and Vogler 2005; MAF 2008b; Thongmanivong and Fujita 2006).

But the transition that is found in general in northern Laos is only found in Muangmuay and Bouammi not in Phadheng, even though there are different development patterns in Muangmuay and Bouammi due to accessibility and to development projects and policies implemented. Within the villages, some families have altered their farming practices from shifting cultivation to continuous sedentary farming. But, there are some families who could not to change farming systems because they are still dependent on shifting cultivation to fulfill their basic daily needs, do not have work and labor capital and also do not have land and information access.

The first differentiation is the accessibility to the market to sell and buy the product. Accessibility is the major differentiation factor between the villages; affecting the land use changes and evolution of farming systems and creating different opportunities for income generating activities. Improved accessibility can open up more possibilities for cash crops and perennial plantations, even though these are not accessible to all farmers within the village. In Muangmuay, the most accessible village, there are more diversified farming systems than the other two villages. The farmers who do not produce upland rice represent less than 7% of the total farmers in Muangmuay and only 1% in Bouammi. Phadheng with remoteness location, this village is difficult to develop the cash crop or perennial plantation. The possibility to market is only by commercialization the product with higher price per weight unit. More farmers in this village depend only on shifting cultivation than in Bouammi. Those farmers are living on the edge of survival and under the poverty line.

With the better accessibility, it affected the migration to the place less remoteness. As found in Muangmuay, the important number of migration occurred due to road construction. Thereof, there is more demographic pressure in this village, than the other remoteness villages.

The second differentiation is the capital accessibility—together with biophysics limitation—to invest in paddy field and cash crop—perennial plantation. The capital requirement in term in monetary and work is needed. In the study sites, only farmers who have capital and access to the information that can do those activities.

Even tough there is the different intensity of transition within the areas, the government policies were applied with the same procedures in within the country. Generally, the main objective of government policies is to reconcile conservation and development. For those purposes, Lao Government put in evidence in implementation of several policies related land reform, i.e. land use planning and allocation, opium eradication and shifting cultivation stabilization program. Land reform in Lao PDR is expected to halt deforestation (of which swidden cultivation is seen as the main cause) and to intensify agricultural production and improve government revenue from land tax. The assumption is that land in private poverty and land security encourages agricultural investment, intensive land use, and an increase in market-oriented agriculture (Evrard 2004, MAF 2006). The important questions to be
addressed are how conservation-development objectives can be achieved and how the communities’ will respond to the environmental services.

After land allocation is implemented, most forests were classified as protection, conservation or degraded forest which cannot be accessed for agricultural purposes. And then the land allocation process has commenced fixing agricultural area and it has resulted in a reduction of land access. Moreover, the plan to allocate fixed plots to each household has stimulated farmers to mark their own plots with industrial or wood plantations after rice cropping. This privatization has a tendency of social differentiation within the villagers, as found in Muangmuay and Bouammi.

With the individualization of land management, there is a risk of increasing the inequalities between farmer types depending on their relative access to land, e.g. new families and newcomers. In the study site, the farmers who have good relationships with village organizations and receive more information, and also the farmers who have been in the village for a long time, often have better land access as was observed in Muangmuay.

The newcomers and new families have access to agricultural land, but it is often the case that this land that is located far from the main village settlement. Even though there are regulations to limit the number of hamlets and the obligation for farmers to present in the main settlement regularly, it seems that this is not effective enough. The considerable distance between agricultural land and settlement results in lower productivity because of the time required for travel (Staver 1989). In Muangmuay, many hamlets consist of a few houses surrounded by agricultural land, spread away from the village to be closer to the agricultural land. This causes a more fragmented land cover in Muangmuay that the other villages.

Not only the tendency of privatization, land allocation -in order to stabilize shifting cultivation by imposing fixed plots for each household- has affected the shortening fallow period and this leads to soil degradation and weed problems. The yield is decreasing year after year compared with before when the farmers cropped older fallow lands. The problem of short fallow requires farmers to carry out more weeding (Roder 1997), or some farmers use herbicide as a solution, as found in Muangmuay and Phadtheng, where the majority of shifting cultivation is done on a shorter fallow cycle than in Bouammi.

Through the long cycle of fallow, traditional farming systems maintains soil fertility. The long fallow can restore the soil fertility (Beets 1990; Chazee 1999; Veyret and Pech 1993). Due to the demographic pressure on the land, fixed plot allocation and a reduction in agricultural land, the fallow cycle is shortened (Dufumier 1996; Staver 1989) and there is a risk that the soil fertility will not be restored, and in many areas severe environmental deterioration can result (Beets 1990). The cropping ratio should never be allowed to fall below the ratio one year cultivation and 10 years of fallow cycle, under this ratio, the ecological equilibrium breaks down (Beets 1990) because of fast decline and low equilibrium of soil organic C levels, reducing the potential rice yields, as found in the study sites, and limiting farmers for the other land use options (Roder, Phengchanh, and Maniphone 1997).

As a consequence of land allocation, there is less land available for shifting cultivation and lower labor productivity per hectare compared to paddy rice, cash crops and perennial plantations. These intensive cultivation systems require less land and the situation is now that access to land is limited. Intensification of land use per surface unit, as found in cash crops and perennial plantations, has also caused problems for maintaining soil fertility and the risk of soil erosion. With very short cycle and permanent cropping, it is much more problematic in terms of erosion than rotational upland rice crop (Velentin et al. 2008). It seems important to develop future research to find sustainable ways of farming the agricultural land, perhaps
through crop association or rotation with other plants or with a combination with livestock as a natural source of organic fertility.

The monoculture cropping has effect in term of biodiversity as well. In traditional system, the landscape was diversified by the different age of fallow as land cover, combining with multi cropping in rice crop activity, the home gardens, and diversity varieties utilized in agricultural activities. While with less varied fallow age cover and development of the monoculture -monoculture specific in paddy field, cash crop monoculture and monoculture perennial plantation- the landscape mosaic is more uniform trend of land cover. With the assumption that positive correlation between more divers landscape mosaic, the habitat diversity and the biological diversity (Haila 2002).

In the study sites, the application of land use and allocation effected differently from one village to another. For that, Land Use Planning and Allocation is implemented with standardized and uniform manuals for the whole country, even though there is diversity in terms of biophysical condition and human environment.

It must be considered that environment-development problems can be solved concretely in specific places and at specific times, and people have to be involved, including managers, government and local inhabitants (Haila 2002). The land use should be applied more flexibly with location-specific implementation. It is also expected that the authorities concerned, including local government, international organizations, NGOs and researchers should pay more attention to monitoring land use change after LA implementation.

Cash crops and perennial plantations depend on demand and market price and this is unstable (Chazée 1998; Satoshi, Tanaka and Phalakhon 2006). The government should stabilize the market price and secure commercialization. The non-rice crops also demand high investment from the beginning until harvested. For perennial plantations, the farmers have to wait for several years to get cash income.

At several levels, there should be more effort taken to provide alternative technologies such as comprehensive technical support to manage the sedentary, and market information (Roder 1997; Satoshi, Tanaka, Phalakhon 2006). Local authorities have not provided any technical support for farmers, because of the limited technical skills and knowledge of the staff. On other hand, the remoteness of villages makes it more difficult to control and reach every village in the same manner (MAF 2008a). Based on field observations, the officials present more in Muangmuay than in Bouammi and the least in Phadheng.

Even though many families are categorized as poor, these farmers can fulfill their daily food needs by shifting cultivation and diversify their diet thanks to the availability of forest products, especially in Phadheng and Bouammi. The gathering of forest products is more intensive in these villages than in Muangmuay. In Muangmuay, farmers can survive with other activities such as off-farm activities, trading NTFPs and also selling their labor force to other families.
5. CONCLUSION

The research identified two major changes in land use in the study site, first land privatization and second the transition towards a diversification of farm activities with cash crops and perennial plantations. The drivers of change observed, i.e. the internal factors (biophysical and human environment) and external factors (the government policies, development projects and market demand) are affected by the gradient of accessibility. The characteristics of the biophysical and human environments to a large extent include the variety of social organization, access to information and development project, access to market opportunities, education, and several agricultural activities. Improved road accessibility between villages can stimulate these changes in land use systems. Meanwhile the skills and information required for cash crops and perennial tree plantations, and gained from development projects and social networks have changed the land use systems and tend to concentrate them close to transportation facilities, i.e. rivers and roads. Moreover, the land use planning process has designated the areas to be used for agriculture and those for forests. Access to agricultural land was not limited in the past, but with the land use planning/land allocation (LUP/LA) it became a main issue within the villages. The fixed plot allocation for each household stimulated farmer to mark their own plots with industrial or wood plantations after rice cropping.

Even though the environment policies were applied in the same procedure within the country, those influenced locally different. The policies implemented were not the same in the three village study sites because to its internal factors and accessibility.

The farming systems showed their adaptability to a changing environment, i.e. to cope with new policies. Recently, four farming systems are distinguished based on their dependence on rice production, off-farm activities and capitalization. The majority of the farmers are still fully depended to shifting cultivation.

Farmers have lived in harmony with the natural environment for generations in order to fulfill their family’s basic daily needs through shifting cultivation combined with diverse hunting-gathering activities. The government policies related to stabilization of shifting cultivation and land allocation have changed the status of forest land from an abundant resource to a scarce one, triggering a major transition in the farming systems from subsistence to market-oriented strategies.
REFERENCE


GLOSSARY

AGRICULTURAL LAND - Land which is determined to be used for cultivation, animal husbandry and agricultural research and experimentation and for irrigation.

AGRO-ECOSYSTEM - Ecological system modified by human beings to produce food, fiber and other agricultural products.

ARABLE LAND - Land under temporary crops, temporary meadows for mowing and pasture, land under market kitchen garden and land temporarily fallow or lying idle.

BIOLOGICAL DIVERSITY - Variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.

CASH CROP - Often used synonymously with “export crop”, it may be sold at home or aboard and may be either a food or non-food commodity.

CONSERVATION FOREST - Protection and conservation of animals and plant species or other entities of cultural, tourism or scientific value.

CROP DIVERSIVICATION - Increasing the number of crop production enterprises per farm.

CROP INTENSIFICATION - Growing more crops and higher output per unit area.

DEGRADED FOREST - Forests which have been heavily damaged, i.e., the land area has no forest coverage or the air is defoliated which is separated for reforestation or to assign to an individual and to an organization to use for reforestation, and to organize reforestation, permanent agro-forestry and livestock production or use for some other purpose.

DEMOGRAPHY - History of nature and social of human being, including population characteristics in limited area. It is a science in population study by its dimensions, structures, evolution, and its general characteristics in quantitative point of view.

DIRECT OBSERVATION - Observation of physical structures, social differences, behavior, action and symbols, in solitude or with others with whom observation are discussed, provide important information for posing central question.

ECOSYSTEM - Dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

FARM - Any tract of land or water consisting one or more parcels devoted to the cultivation of plants and animals under the management of the owner or a tenant.

FOCUS GROUP - Semi structural interview in homogeneous or mixed groups on specific issues or particular topic in detail. This is relevant when the dynamics of the group situation is considered to provide additional useful information.

FOREST LAND AREA - Areas of all land parcels which are covered by forest or the land which is not covered by forest but is determined by the State to be forest land as prescribed in the Law on Forest.

FOREST RESERVES - Forests and forest lands which are separated for the purpose of preserving species of flora and fauna, nature and other precious things in terms of history, culture, tourism, the environment, education and experimental scientific research.

GROUP INTERVIEWS - Semi structural interview providing access to a larger body of knowledge.

INTERNAL RESETTLEMENT - Systematic relocation of a community from one location to another inside a particular country. Internal resettlement is different from two other types of resettlement in Laos: Project-related resettlement.

LAND AND FOREST ALLOCATION - Developing a system of land classification according to use, improving natural resource management by demarcating forests for specific purposes, and
preventing illegal logging by provincial and district entrepreneurs by providing villagers with new management and use rights.

**LAND CERTIFICATE** - Official document attesting the provisional use right of agricultural land or forest land which is issued by the District Administrative Authority to individual or organization who acquires the right to use such land.

**LAND COVER** - The physical material at the surface of the earth, including grass, asphalt, trees, bare ground, water, etc.

**LAND REGISTRATION** - Record of data in the Land Register Book, such as: Names and surnames of the husband and wife who have received the land use right, land category, land boundaries and area, acquisition method and land location are recorded in the Land Register Book.

**LAND TITLE** - The one document which is taken as the main evidence for permanent land use right. It is copied out from the Land Register Book in one copy only and is handed over to the land owner who shall keep it as an evidence for a long period until there is a change accordingly to the conditions as prescribed in the law.

**LAND USE** - The human modification of natural environment or wilderness into built environment such as fields, pastures, and settlements.

**LANDSCAPE MOSAICS** - Complex landscapes influenced by human uses that include many different types of habitats.

**LAND-USE ALLOCATION** - Committing a given area of land or a resource to one or more specific.

**LAND-USE PLAN** - The element of comprehensive plans that designates and justifies the future use or reuse of land.

**LAND-USE PLANNING** - To create land use plans. It is the continual process of organizing the development and use of lands and their resources in a manner that will best meet the needs of people over time while maintaining maximum flexibility for a dynamic combination of desired resource outputs for the future.

**LIVELIHOOD** - Simply the way people to live.

**LOWLAND RICE OR PADDY RICE** - Rice grown on level bounded fields either irrigated or rain-fed.

**MONOCULTURE** - Growing only one crop on the land in given crop season.

**MULTI-DICILIINARY APROACH** - Approach in which several disciplines become involved in a project or program with common general objective.

**MULTIPLE CROPPING** - Practice of growing more than one crop on the same land in one year. It involves several alternative patterns of crop arrangement in space and time such as mixed cropping, intercropping, relay-cropping, sequential cropping, double cropping, triple cropping, etc.

**PARENNIAL CROP** - Crop occupying land for more than 30 months.

**PARTICIPATION** - The voluntary contribution by people in projects, but without their taking part in decision-making.

**PARTICIPATORY MAPPING** - Construction and analysis of maps and models for providing distribution information relating to limited physical space and settlement maps are drawn collectively on paper.

**PERMANENT CROP LAND AREA** - Land cultivated with crops that need not be replanted after each harvest.

**POPULATION PYRAMID** - Presentation schema to visualize the population composition: age classes and sex.

**PRODUCTION FORESTS** - Forest and forest lands which have been separated to provided for the requirements of national socio-economic development and peoples’ regular and continual daily living needs in terms of wood and forest derived products which do not seriously affect the environment.
PROJECT-RELATED RESETTLEMENT - The relocation of communities for large infrastructure projects such as roads, forest and mining concessions, or hydropower dams – this increasingly impacts indigenous communities as Laos opens to foreign investment.

PROTECTED AREA - A geographically defined area which is designated or regulated and managed to achieve specific conservation objectives.

PROTECTED FOREST - Forests and forest land which are divided for the purpose of protecting water sources, preventing soil erosion, strategic areas for national defense, prevention of natural disasters, the environment, etc.

REGENERATION FOREST - Young fallow prohibited for agriculture in order to increase tree maturity and reach a natural equilibrium.

REHABILITATED FORESTS - Young reed forests which are separated for rehabilitation and complete restoration into old natural reed forests.

SLASH AND BURN SYSTEM - Shifting cultivation in high rainfall areas where the cropping period is followed by a fallow period during which bush or tree growth is again cleared by cutting and burning.

SOCIO-ECONOMIC DETERMINANT - Factors such as marketing facilities, land-tenure system, and credit, which influence the cropping systems of a given area.

SUSTAINABLE USE - The use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations.

SYSTEM - Group of defined components from the point of view of their recurrent interaction.

TRANSECTS - Cross-sectional maps or diagrams of an area. They are constructed as a joint exercise with local information during walks through the area for observing, discussing and registering the endowments and problems of the area.

UPLAND AGRICULTURE - All forms of agriculture practiced in upland zone between 200-1000 meters of altitude, except for highland plateaus where lowland rice is grown.

UPLAND CROPS - Crops grown under aerobic soil conditions such as wheat, maize, mug bean, soybean, etc.

VILLAGE CONSOLIDATION - Combining scattered smaller settlements by resettling people into larger permanent villages, which can then be more easily administrated by the Government of Laos.

Sources:
Beets (1990); Mikkelsen (2005); Baird and Shoemaker 2005); CBD (1992); the Forestry Law No. 01-96; Law on Land No. 01/97 NA