Final Report

Laos Resource Mapping and Farmer Input Market Studies of the Vietnam-Laos Bamboo Feasibility Study

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Executive Summary

This study is the first attempt to provide background information on the bamboo sector in Laos in general, and in Houaphan and Xiengkhouang Province in particular. Furthermore we try to analyse the socio-demographic profile of the host communities in the study area as well as analyze different income sector including bamboo sector of farm household in the study area.

The study was conducted in two provinces, namely Houaphan (District: Viengxay and Xiengkhor) and Xiengkhouang (Districts: Phaxay and Kham). 12 villages in the two provinces were chosen for the field study.

Data gathering involved 134 respondents consisting of farmers (115), village heads (12), trader (1), DAFO staff (4), and PAFO staff (2). In addition, group discussion was done in each village in the two study provinces. The number of the group discussion (7-35 participants) was 24 for the two study provinces.

Here we have tried to quantify the different income sectors including bamboo sectors by using data from household surveys, group discussion and key informants interview and by looking at the income situation of the farm household in the two provinces.

We employed a multi-method approach, namely participant observation, individual depth interviewing, group interviewing, and documentary research. The advantage of this method is that it can benefit from triangulation, which involves choosing different methods based on their individual strengths and compatibility (Fontana and Frey, 1998; Huberman and Miles, 1998; this study). Moreover, used in combination, these methods can help strengthen the consistency and validity of the data, improving their reliability and contextual value (Denzin and Lincoln, 1998; Huberman and Miles, 1998). As Robert Yin (1989) pointed out "with triangulation, the potential problems of construct validity can be addressed, because the multiple sources of evidence essentially provide multiple measures of the same phenomenon".

By decomposing different methods for income estimation, we are able to find out the income situation. This method of moment's technique allows us to construct the income sheets for households in the two provinces.

The study of the bamboo survey in Houaphan Province found that the total bamboo areas in Viengxay District are approximately 54,382 ha in the upper mixed deciduous forest (UMD) and 1,140 ha for the pure bamboo forest. (PB). In contrast, the total bamboo areas in Xiengkhor District are 17,920 ha for UMD and 10,059 ha for pure bamboo forest. As a consequence, by quantifying the average number of culms per hectare (from sample plots analysis), the total numbers of culms in PB in Viengxay is 4.6 million, while those in Xiengkhor are 40.7 million. For UMD, the numbers of culms in Viengxay District are 496 million, and those in Xiengkhor are 163 million in UMD. By looking at the overall result of the Houaphan Province, it becomes clear that the total bamboo area in UMD is

508,368 ha which consists of 4.6 billion culms, while that in pure bamboo forest is 17,870 ha that consists of approximately 72.4 million culms in the province.

Similar to the situation in Houaphan Province, the analysis of Xiengkhouang shows that the total area of the upper mixed deciduous in Phaxay District is 21,304 ha. As a consequence, by quantifying the average number of culms per hectare combined with the bamboo area per district, the total numbers of culms for Phaxay are 65,989, 000 in UMD. Pure bamboo forest does not appear in Phaxay District. By looking at the overall result of the province, it indicates that with the total bamboo area in upper mixed deciduous in Xiengkhouang Province of 461,737.00 ha, it consists of 1.4 billion bamboo culms, while in pure bamboo forest of 1,337 ha, it consists of approximately 5.4 million culms.

The study found that the most commonly cultivated species are Bamboo Loung, and Bamboo Phang (Bamboo   D. lonoifimbriatus) in Xiengkhouang and Houaphan Province. The purpose of the planting is only for domestic use. From the analysis of the sample plot 3 and 4, it is obvious that the average number of culms that farmer can realize is 2,832 culms per ha.

The calculations in Table 13 show the land value (land rent) in agricultural farm productions from the standpoint of the households in the Houaphan region. If one tried to find out the profitability of these sectors from the standpoint of the households by running calculations for different farm sectors, in case that the households use the cost of labor from outside, one might only end up with negative land values or the land values (the profit) is not desirable for farmers, meaning that it would be more profitable to let the land lie idle or transfer it to some other uses. However, most of the farm households in this region used their own labor and input in the production process, while others used the labor from their relatives. Recalculations by considering their own labor cost, and own inputs to production process reveal that the farm households in this region are faced with positive land values.

In addition, one of the surprising findings found that the cash income that derived from the bamboo sector has contributed the highest part of the total cash income of the average household in Viengxay District after that from livestock sector.

The calculations in Table 13 also indicate that the income from the upland rice sector (Shifting cultivation) is not desirable for the farm households in the Houaphan region. This problem has to be mentioned here, since rice is the main food intake of the rural households in Laos in general and Houaphan Province in particular. The rice yields are extremely low due to the enforcement of the shifting cultivation stabilization program enforced by the government which allows the shorter fallow of the rotation. This leads to the cause of degraded soil. The empirical investigation shows that average farm household of five people produces less than 1000 kg of rice p.a. while they consume about 1500 kg p.a. (Foppes J., Ketphanh, S. 1997). Therefore, a majority of the households in this region have not enough rice for basic consumption. Usually, the time of rice shortage begins from late January on wards after a month of rice harvesting in November. In order to get enough rice for their basic consumption in one accounting year,

they have to produce more income from selling their livestock, bamboo harvesting in Viengxay District, and crop farming (corn, soybean, etc.) in Xiengkhor District, and these are used to trade for rice to alleviate annual food shortages.

From the analysis in Table 16, it shows that the families of Viengxay District have more free time than those of Xiengkhor District. While the families of Viengxay District spend their time on harvesting bamboo from natural forest for cash income, those of Xiengkhor spend their time on shifting cultivation, corn and bean cultivation for their cash income.

The average income of the Viengxay household is approximately 10 million Kip per year, whilst that of the Xiengkhor household is relatively higher, making up over 14 million kip per year. The analysis also found that the biggest part of the average farm household income from the two districts derives from livestock productions, which consist of cattle raising, pigs, poultries, and fish raising. As mentioned above, it is an interesting finding that the average cash income of the family in Viengxay District from bamboo harvest is ranking second, while that in Xiengkhor District from Bamboo harvest is zero due to the fact that there is no trade of bamboo in this region. Bamboo is only used for domestic consumption. Some farmers slashed and burn the pure bamboo forest in order to establish their crop farming because of the income incentives from them. No doubt, the proportion of the bamboo forest will decrease substantially. Therefore, it is recommended that relevant authorities should consider this problem carefully. Perhaps, a possible solution could be making efforts to create the management plan for the sustainable use of the bamboo resources in the region. Such required efforts are to start with providing the awareness on the importance of the bamboo resource, and especially getting the households involved in the decision making during the land allocation process.

One important finding of this study found that the economies of Kham District in Xiengkhouang Province relies heavily on the paddy rice sector (non-cash income), and farm garden sectors, i.e. garlic, banana, vegetable, and watermelon garden. This result is a further confirmation of the empirical study of DAFO report (2005). As can be seen clearly from the household analysis of the study (Table 27), the proportion of the income from the paddy rice sector is the largest and is on average one third of the total household income of Kham District region.

Though the result of the analysis has proved that the bamboo sectors in Viengxay District in particular and in other regions in general has high potential for increasing the income condition of the Viengxay region, there are some constraints which hinder its extension. On one hand, the majority of the households in the region have relied only natural bamboo forest without proper management intervention from PAFO or DAFO, and on the other hand, their holding size of bamboo plantation is very few. Therefore, it is very important for the central government to carefully think about the over exploitation of bamboo resource in the natural forest that might exist. A possible solution could be providing policy incentives for enlarging the bamboo plantation. However, this matter should be carefully solved, since there are many factors involved in enlarging the plantation of the farm household. For instance, the credit capital is one of the most important means to enlarge the plantation. In addition, there should have the

opportunities for farm households to have special educational programme, such as training courses, or study tours in other regions that have experiences with this subject matter.

One of the key findings from village studies and the self-assessment of Project field teams found that the majority of the farmers are willingness to invest and enlarge their bamboo plantation, especially the local farmers in Viengxay District in Houaphan Province. However, they are still concerned with problems mentioned above. The entry points for overcoming the constraints are provision of the capital credit, management of bamboo resources, skills training, marketing and diversification of products.

In this study, we have not touched on the input market studies (services, goods or materials that are used by bamboo producers as necessary part of their faming/business activities, i.e., Agro chemicals/fertilisers, transportation, storage, processing equipment, etc.) since in Laos in general and in the study areas in particularly, the bamboo sector is still in the iniate stage, and the market inputs have not existed yet.

In a concluding remark it is tempting to say something about the importance of the kinds of our analyses. Such empirical investigation does not show whether a prevailing or contemplated central government policy is wrong or right, but how political measures work, and what their economic rewards are. Even though such kind of analysis is the first attempt in Laos in general and Houaphan and Xiengkhouang region in particular, it is hoped that the relevant authorities should consider or base their decisions upon these findings.

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Abbreviations

ADB   Asian Development Bank
Ban   Village
DAFO   District Agriculture and Forestry Office
PAFO   Provincial Agriculture and Forestry Office
DOF   Department of Forestry
GOL   Government of Laos
Ha   Hectare
HH   Household
IUCN   World Conservation Union
Kg   Kilogram
Kip   Laos currency (1 US$= 10.400 Kip in December 2003)
Km   Kilometers
NTFPs   Non-timber forest products
P.A.   Per Annum
PB   Pure Bamboo Forest
UMD   Upper Mixed Deciduous Forest

1 Introduction

1.1 General Background

The Lao PDR is located in the heart of the Indochinese peninsular, in Southeast Asia, latitude 14 to 23 degrees north and longitude 100 to 108 degrees east. Laos is a landlocked country. It shares a 505 km border with China to the north, 435 km of border with Cambodia to the south, 2,069 km of border with Vietnam to the east, 1,835 km of border with Thailand to the west, and a 236 km border with Myanmar to the northwest. The country stretches for 1,700 km north to south, with an east-west width of over 500 km at its widest, only 140 km at the narrowest point.

The Lao PDR covers a total of 236,800 square kilometers, three-quarters of which is mountains and plateaux. The country has 18 provinces which are distinguished into three distinct regions namely northern, central and southern part. Of these, Houaphan and Xiengkhouang Province are two of 18 provinces that located in the northern Laos which shares the border with Vietnam.

Houaphan and Xienkhouang Province

Figure 1: General map of Lao PDR and surrounding countries.

1.2 Bamboo Resources in Context of Laos

Bamboo plays an important role to the populations in Laos in general and in rural area in particularly. About 80 percent of the Lao populations live in remote area. They collect bamboo for use as a building material, and its shoots for consumption and selling. Houses in rural areas are often mainly constructed using bamboo, with bamboo roofs, wall partitions, panelling, mats, ladders, blinds and furniture. Bamboo is also used in the production of certain fishing tools, paper and is sometimes used to make musical instruments such as the flute, angklang and khene (Soydara and Ketphanh, 2000).

Bamboo is a fast-growing and regenerating species, which can be found in the upper mixed deciduous forest and pure bamboo forest. Bamboo is an ideal non-timber forest product for sustainable development. Bamboo's physical properties are similar or superior to wood. In Laos, the bamboo sector is still weak, since there are only local use and result

in slightly process in the development of bamboo sector. However, China has achieved great progress in the development of bamboo sector. Many products from bamboo from China appear in the international markets. For instance, new products based on bamboo charcoal, vinegar and extracts of bamboo leaves, including medicinal products, natural pesticides, beverages, daily toiletries etc., have great development potential. Bamboo shoots have huge market potential as natural, high-fiber food.

Concerning to the bamboo situation in Laos, many bamboo resources were harvested and exported to the neighbouring countries, especially Vietnam with a very little return to the Lao local people.

Moreover, there have been very few studies which have been investigated in the bamboo forest in Laos. Therefore, it is an imperative to conduct this study.

1.3   Purpose of the Study

The Study is the initial Phase of an envisaged multi-year initiative to support the development of the bamboo sector in Vietnam and Laos. The longer term objective is to develop a diversified bamboo based economic sector in the Vietnam-Laos cross-border mountain areas, centred around the provinces of Thanh Hoa and Nghe An in Vietnam, and Houaphan and Xieng Khouang in Laos, and bringing economic, social and environmental benefits to the poor communities, and to expand this idea to other areas in the region.

The specific objectives of the Study are to:

1   To evaluate the potential of the bamboo sector in Laos
2   To identify the scale and scope of the sector and the likely benefits accruing to sections of the value chain, including the various targeted poor groups of Laos;
3   To develop and evaluate sector development scenarios through the mapping of opportunities, risks and constraints;
4   To develop plans for subsequent stages of intervention, including priority interventions and their nature and scale, and a proposed scoping and staging of subsequent phases of the bamboo sector development.

1.4   Project Members of NUOLs

1. Dr. Latsamy Bouapha   Project Team Leader
2. Mr. Somvang Phimmavong   Vice-Project Team Leader
3. Mr. Somphone Nedthongsavanh   GIS expert and survey specialist
4. Mr. Oudone Sichalern   Survey Specialist
5. Mr. Metmany Soukhavong   Survey Specialist
6. Mr. Phongsong Wangneng   Survey Specialist
7. Joost Fooppes   Project senior supervisor

2   Methodology

2.1   Triangulation

This study utilised a multi-method approach. The main quantitative methods used were focus groups meeting, individual depth interviewing, group interviewing, and documentary review. It is rather evident that in many circumstances multi-method approaches benefit from triangulation, which involves choosing different methods based on their individual strengths and compatibility (Fontana and Frey, 1998; Huberman and Miles, 1998, Somvang Phimmavong, 2004).
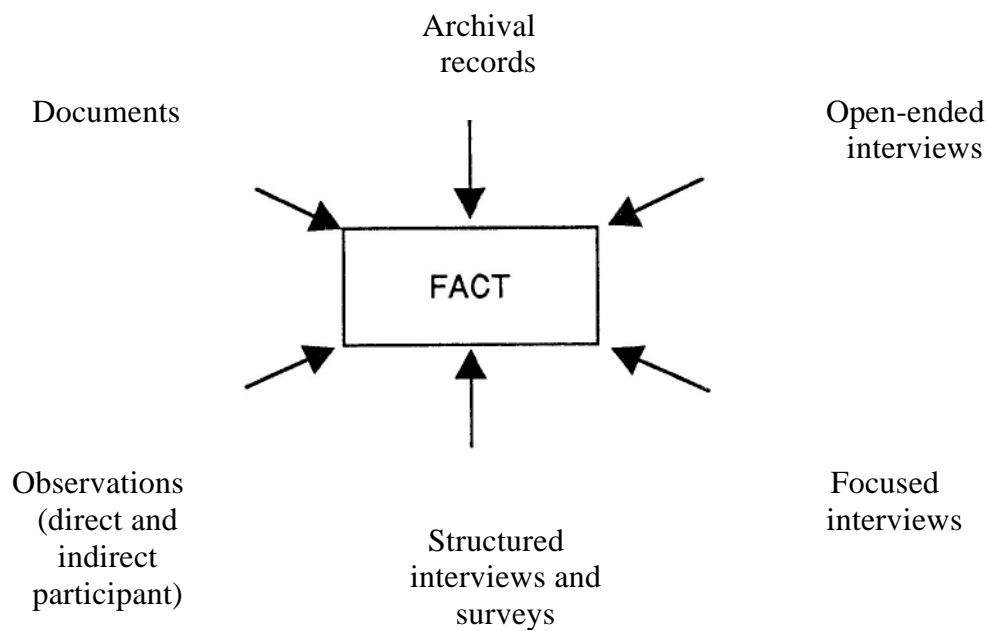
Source: Yin, Robert K. (1994) 93 pp.

Figure 2: Convergence of Multiple Sources of Evidence

Moreover, used in combination, these methods can help strengthen the consistency and validity of data, improving their reliability and contextual value (Denzin and Lincoln, 1998; Huberman and Miles, 1998).

In this study, the researchers followed the advice of Yin (1989) strictly. They believed that "With triangulation, the potential problems of construct validity can be addressed, because the multiple sources of evidence essentially provide multiple measures of the same phenomenon".

2.2   Quantitative Evaluation

2.2.1   Sampling Framework

The study was based on two provinces of Northern Laos, namely: Houaphan and Xiengkouang. Two districts from each province were chosen for the field study, namely Viengxay, Xiengkhor in Houaphan, and Phaxay and Kham District in Xiengkhouang Province
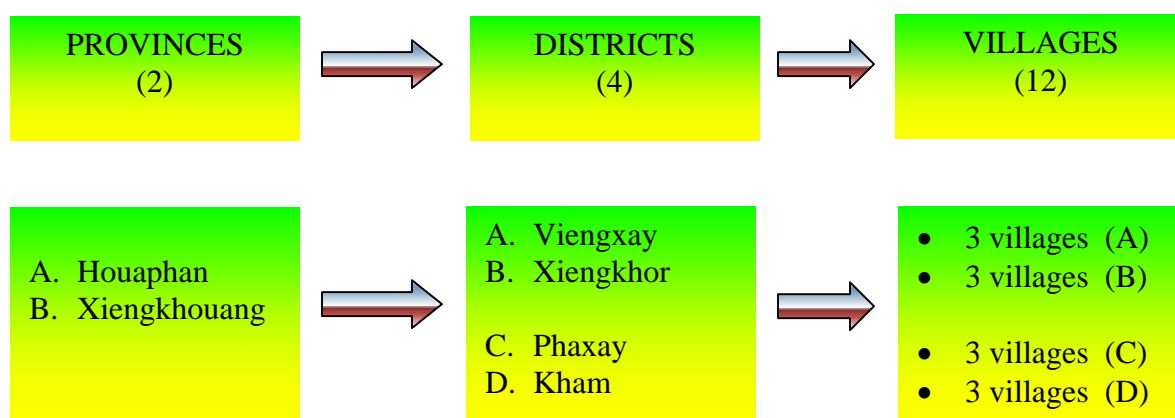
Figure 3: Sampling Framework

In designing the survey, twelve villages were chosen from the two provinces by using selective samplings. The survey was conducted by the researcher team from Faculty of Forestry, National University of Laos with the help of the local staff of Provincial Agriculture and Forestry Office working as Research Assistants (RAs). Based on the lists of households from the headmen of each village, a simple random method was used to select the respondents, 10 farm household out of the total households from each selected village was picked at random. The detail of the sampling appears in Table 1.

Primary data was collected through the questionnaires. There are approximately 115 farmers which were interviewed in the two provinces. Besides the farmer interviews, the staff of Provincial Agriculture and Forestry Office (PAFO), District Agriculture and Forestry Office (DAFO), traders were interviewed during the field investigation.

The questionnaires used in this study were modified from GRET model, however a major adaptation was changed in order to reflect the reality of the situation in the Lao PDR.

The greatest proportion of the respondents is from Ban. Thoum (33 per cent), whereas the smallest proportion is from Ban. Hap (6 per cent). After excluding the missing values, the

total sample size amounts to 115 households with equivalent to 13 per cent of the total household. A total of 5 observations are excluded, most of which had missing values.

Table 1: Sampling for Farmer Survey in Houaphan and Xiengkhouang Provinces

Province	District	Villages selected	Total number of households	No. and (%) of households sampled
HOUAPHAN	Viengxay	Phoun Mai	59	10 (17)
		Deui	95	10 (11)
		Naphoung	35	10 (29)
	Xiengkhor	Sobxay	78	10 (13)
		Hap	156	10 (6)
		Sobsan	145	10 (7)
XIENGKOUANG	Kham	KhongOm	66	10 (15)
		Viengkham	94	10 (11)
		Phiengkob	51	10 (20)
	Phaxay	Naphia	49	10 (20)
		Nasome	56	10 (18)
		Thoum	30	10 (33)
Missing Values				5
Total			914	115 (13)

Note: Figure in parentheses denote percentages of total household numbers

Source: Field investigation 2006.

Data on the cost of labor, management costs, and other input costs of different household income sectors from paddy rice, upland rice farm and non-timber forest products (NTFPs), livestock, bamboo sectors, etc. were collected from group discussion by using working calendar of all farm activities, and the household observation. The price of wage and the farm products were obtained through local market.

The data used to develop the representative natural bamboo forest was derived from a field investigation by establish sampling plot in each District. The size of sampling plot is 20 x 20 m. The data of the sample plots namely number of clumps, diameter, lengths, thickness, etc. were collected through the data form.

The last input data of bamboo survey was calculated by using Microsoft Excel program, then continuous analyzing and setting Land use map separated by District.

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2.2.2   Data Processing and Analysis

All calculations of household income were based on price and costs that were prevalent in 2005-2006. The currency "Lao Kip (Kip)" is used in the analysis and is not converted to US$ because of the different purchase power with same US$ in different countries, Laos, USA or other countries. In addition, all the data in this study is in constant Kip of 2005 and all the monetary terms occurred in before 2005 are converted in Kip in 2005 using average inflation rate.

All the financial data processing is applied using various statistical and non-statistical tools. Statistical packages, mainly Microsoft Excel for Windows, available at the Faculty of Forestry Computer Centre are used in this process. Thanks to the facilities of Excel Workbook, the calculation of different income sectors could be repetitive and allows keeping track of the operations.

3   RESULTS

3.1   Geography of the Study Area, Houaphan Province

3.1.1   Geographical location and Bamboo Resource

Houaphan is one of the northern provinces of Laos (See figure 4). This province shares the borders with Vietnam in the north, the south and the east, with Xiengkhouang and Luangphabang in the west. The total land area of the province covers about 1,750,566 ha. (National Statistics, 2004). The distance between Houaphan and Vientiane is approximately 650 Km. Twelve ethnicities makes the province's population of approximately 280, 780; among them Thai Khao, Thai Deng, Thai Dam, Thai Lu, Phuan, Khamu, Hmong, Lao phong, Sila, Mien, Punoy, and Vietnamese (Census, 2005). The province has 8 District, which consist of 784 villages. The total number of households in the province is 43,288 household with the average of 6.5 people per household. In Viengxay, there are approximately 130 villages (5753 households) with the population of 35,272, while in Xiengkhor, there are only 62 villages or 4253 households with the population of 26814. The districts selected for the present investigation are Viengxay and Xiengkhor District. These two Districts have border with Thanh Hoa and Nghe An Province of Vietnam.

3.1.2   Result of Bamboo Survey in Viengxay District

Viengxay District lies within the longitude of 104° 03' and 104° 43' E, and the latitude of 20° 08' and 20° 42' N. The elevation is from 700-1250m (See figure 5). Approximately 80% of the district area is mountainous. The District shares the border with Vietnam in the east, with Sopbao and Vietnam in the north, with Xamneu on the west and south western with Xamtay District on the south. The total area of Viengxay is 165,499.88 ha, which was classified into the different 10 land use types, namely Upper Mixed Deciduous, Coniferous Forest, Mixed Broad-Leaved and Coniferous, Unstocked Forest, Ray, Schrub, Rice paddy; Grass land and Water. Of these, the bamboo shares the proportion of 0.69 per cent of the total area.

Table 2: Land use type of Viengxay district

Land Use Type	Area (ha)	% Area
Upper Mixed Deciduous	54,382.34	32.86
Coniferous Forest	111.30	0.07
Mixed Broad-Leaved and Coniferous	204.19	0.12
Bamboo	1139.60	0.69
Unstocked Forest	76126.14	46.00
Ray	16006.98	9.67
Schrub	2180.22	1.32
Rice Paddy	7489.72	4.53
Grassland	7840.27	4.74
Water Bodies	19.13	0.01
Total	**165,499.88**	**100.00**

Source: Lao National Forest Inventory Data Base, DOF, 2004
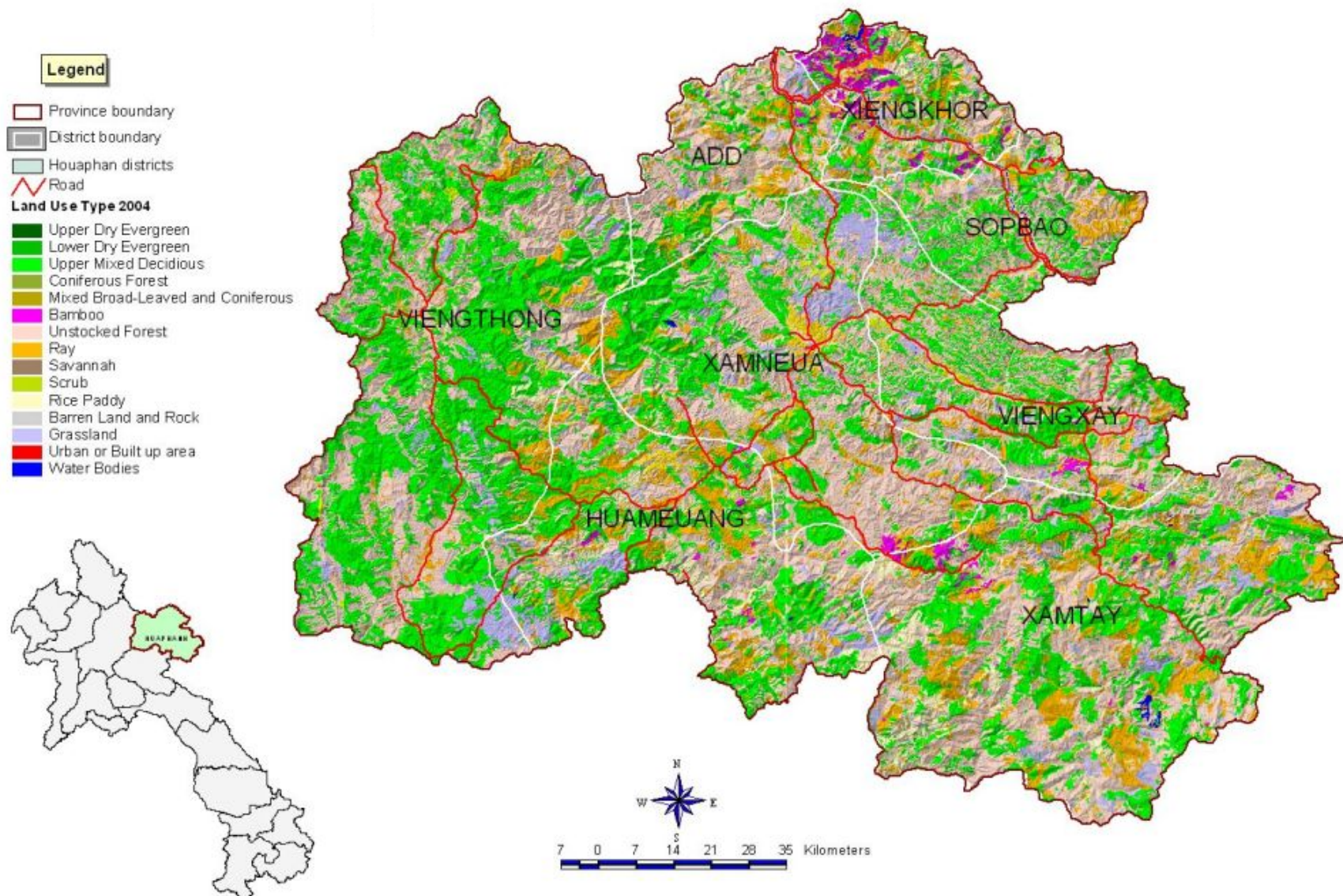
Figure 4: Land Use Map of Houaphan Province
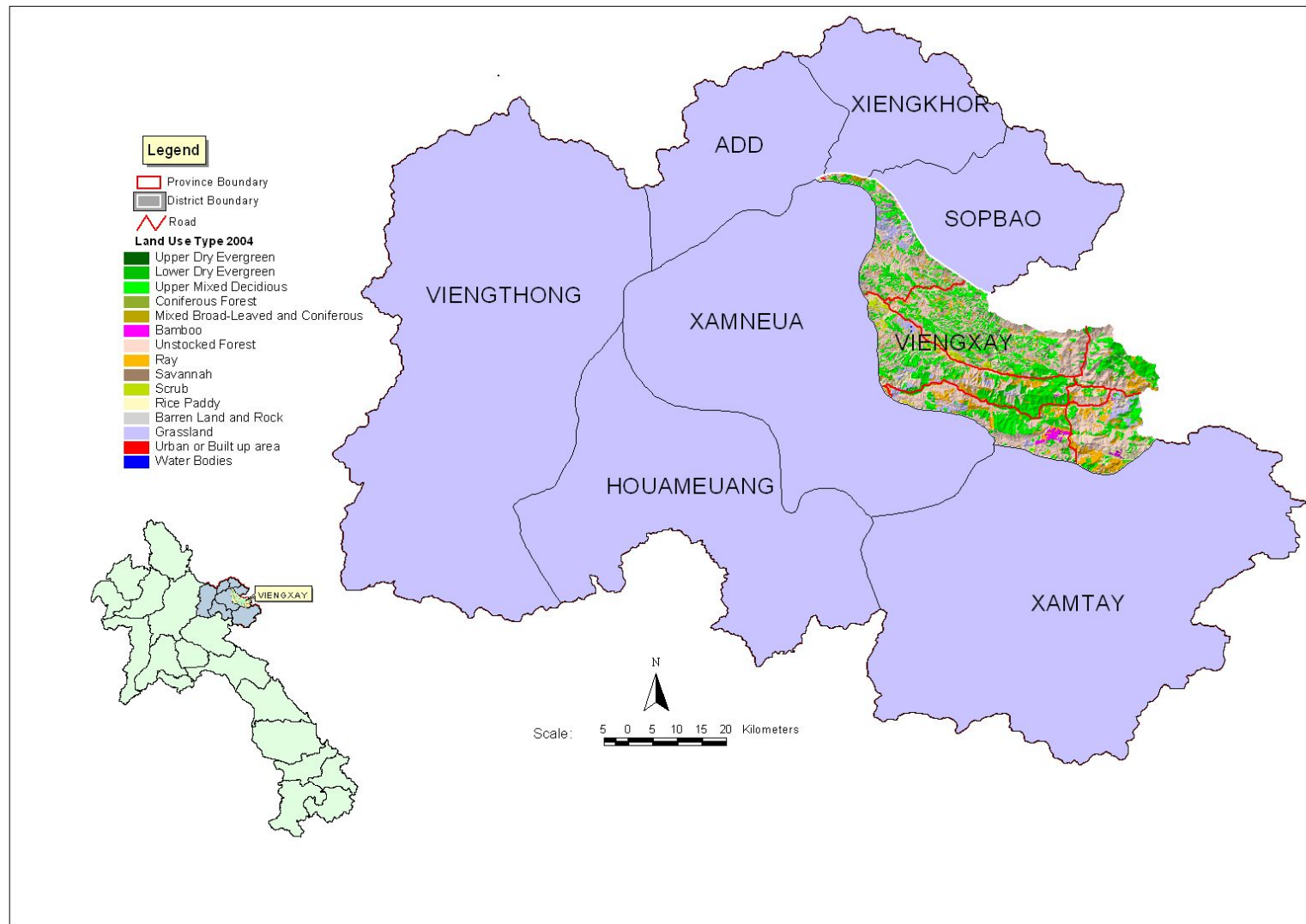
Figure 5: Land Use Map of Viengxay Houaphan Province

In designing the bamboo survey, 4 sample plots were selected in Viengxay District. Of these, two plots are natural bamboo forest, and others are plantation, which is cultivated by the local villagers near their house and farm land. The sample plots for natural bamboo forest are 400 square meters (20m x 20m), which are located in the upper mixed deciduous forest in the south of Viengxay District in Houaphan Province. The detail and the result of the analysis are as follows:

A.   *Sample plot No. 1*

The sample plot is about 4.5 kilometers from Phounmai Village, which is about 100 meter from the main road to the east. The sample plot lies within the altitude of 720 m, and the slope of 55%.

The bamboo in this area was harvested and exported to Vietnam in the last 2 years, thus the present bamboo culms are not very big. The result of the analysis appeared in Table 2 shows that the dominant bamboo species found are only Bamboo Kouane, which covers 100 per cent of the total area of the sample plot. The result also illustrates that there are 85 clumps, which consist of 811 culms in the sample plot. Of these, the bamboo age one year old consists of 90 culms, while age 2-3 years old 721 culms.

The bamboo in Laos in general and in Houaphan Province in particularly is almost sympodial with the average distance between clumps measured of 1, 46 m on an average. The average diameter of clump is 95 cm, which varies from 30-250 cm. Similar to their lengths; the study found that the average length of bamboo culms measured is almost 7 m with the standard deviation of 159. In addition, stem diameter varies from 1.5 to 6 cm with the standard deviation of 0.97. The average section length is 63.50 cm with the maximum of 80 cm and the minimum of 43 cm. The bamboo thickness is on average 0.37 cm, which varies from 0.2 to 3.5 cm.

B.   *Sample plot No2*

The sample plot is approximately 2 kilometers away from Deui Village, which is about 100 meter from the main road to the east. The sample plot lies within the altitude of 511 m, and the slope of 20 per cent. Bamboo Koune is the only dominant species in the Plot. Unlike Plot 1, this plot is quite high density.

The overviews in Table 3 shows that the number of clumps in Plot 1 is greater than that of Plot 2. Likewise, the number of culms in plot 2 is 580, which slightly smaller than that of Plot 1. The average length of the stem in this Plot is 2,040 cm with standard deviation of 848, which is much longer than those of Plot 1. The stem diameter of Plot 2 doubles that of Plot 1, while the thickness of Plot 2 is 0.54, which is much thicker than that of Plot 1.

By looking at the overall result of two natural bamboo sample plot, it becomes clear that the quality of bamboo resources in Plot 2 is much better than those in Plot 1. This might

owing to the fact that there are no any logging activities in Plot 2 whilst the logging in Plot 1 did exist in the last two year.

Table 3: Summary of average data of the sample plot in Viengxay and Xiengkhor District, Houaphan Province.

Plot No.		No. of Clumps	No. of Culms		Total No. of Culms	Distance Between Clumps (Cm)	Clumps Diameter (Cm)	Length (Cm)	Stem Diameter (Cm)	Section Length (Cm)	Thickness (Cm)
			1 year	2-3 year							
		Natural Bamboo Kouane in Mixed Deciduous Forest in Viengxay District									
1	Mean	85	90	721	811	146	95	695	3.3	63.79	0.37
	Maximum	-	-	-	-	400	250	900	6.00	80.00	3.50
	Minimum	-	-	-	-	40	30	60	1.50	43.00	0.20
	Std.	-	-	-	-	64	52	159	0.97	9.95	0.35
2	Mean	15	80	500	580	231	311	2040	6.30	77.08	0.54
	Maximum	-	-	-	-	800	600	2260	6.85	78.25	0.70
	Minimum	-	-	-	-	50	100	0	5.73	76.00	0.40
	Std.	-	-	-	-	187.42	143	848	0.56	1.13	0.15
		Bamboo Loung (Plantation) in Viengxay District									
3	Mean	3	17	67	82	816.67	433	1423	11.0	40.0	1.40
4	Mean	10	27	79	131	810.00	430	1424	9.04	40.0	1.40
		Natural Bamboo Xang in Pure Bamboo Forest in Xiengkhor District									
5	Mean	9	25	137	162	444	316	800	3.50	40	0.35

Source: Own team investigation, 2006

C. Sample plot No 3

The sample plot 3 is a bamboo plantation, which is located in the north east of Deui Village. They were planted around paddy field, along Phoun River. The Elevation of the plot is 391 m with the slope of 3 per cent. The sample plot is 22 x 22 m. The local name of this species is Mai Loung. Local villagers use them for making a house and garden fence. Some sold them and exported to Vietnam in the last few year. In this plot, the number of clump is only 3 with the total number of 82 culms. There are 17 culms for bamboo age 17 and 67 for bamboo age more than 2.

The average distance between clump is 8.16 m, and the average diameter of clump is 4.33 m. This species are the biggest culms of all sample plots with the average length of 14.23 m. The average diameter is also large measured 11 cm. While the average length of section is 40 cm, its thickness is approximately 1,4 cm.

D. Sample plot No 4

The sample plot 4 is also located in Deui Village. The plot size is 16.5 m x 20 m. The species planted is Bamboo Loung, which were planted in hilly area with the slope of 50 per cent, and the altitude of 466 m. There are 10 clumps which consist of 131 culms. The average distance between clumps is about 8 meter with the average diameter of clump of 4.30 m. The average length of the stem is 14.24 m with the average diameter of stem of 9.04 cm, and average length of section is 40 cm. The thickness is exactly the same size like Plot 3.

3.1.3   Result of Bamboo Survey in Xiengkhor District

The bamboo resources in Xiengkhor District are dominantly covered by pure bamboo forest, which cover approximately 12.34 per cent of the total land use. From the finding of NAFRI bamboo cover about 45-60 per cent in UMD (NAFRI, 2004). Likewise, the land cover in Xiengkhor was classified into the different 10 land use types, namely Upper Mixed Deciduous, Coniferous Forest, Mixed Broad-Leaved and Coniferous, Unstocked Forest, Ray, Scrub, Rice paddy; Grass land and Water (See figure 6).

Table 4: Land use type of Xiengkhor District

Land Use Type	Area (ha)	% Area
Upper Mixed Decidious	17919.74	21.98
Coniferous Forest	127.38	0.16
Mixed Broad-Leaved and Coniferous	106.20	0.13
Bamboo	10058.64	12.34
Unstocked Forest	26619.46	32.65
Ray	17662.78	21.67
Rice Paddy	5209.45	6.39
Grassland	2757.28	3.38
Water Bodies	1059.08	1.30
Total	**81520.01**	**100.00**

Source: Lao National Forest Inventory Data Base, DOF, 2004
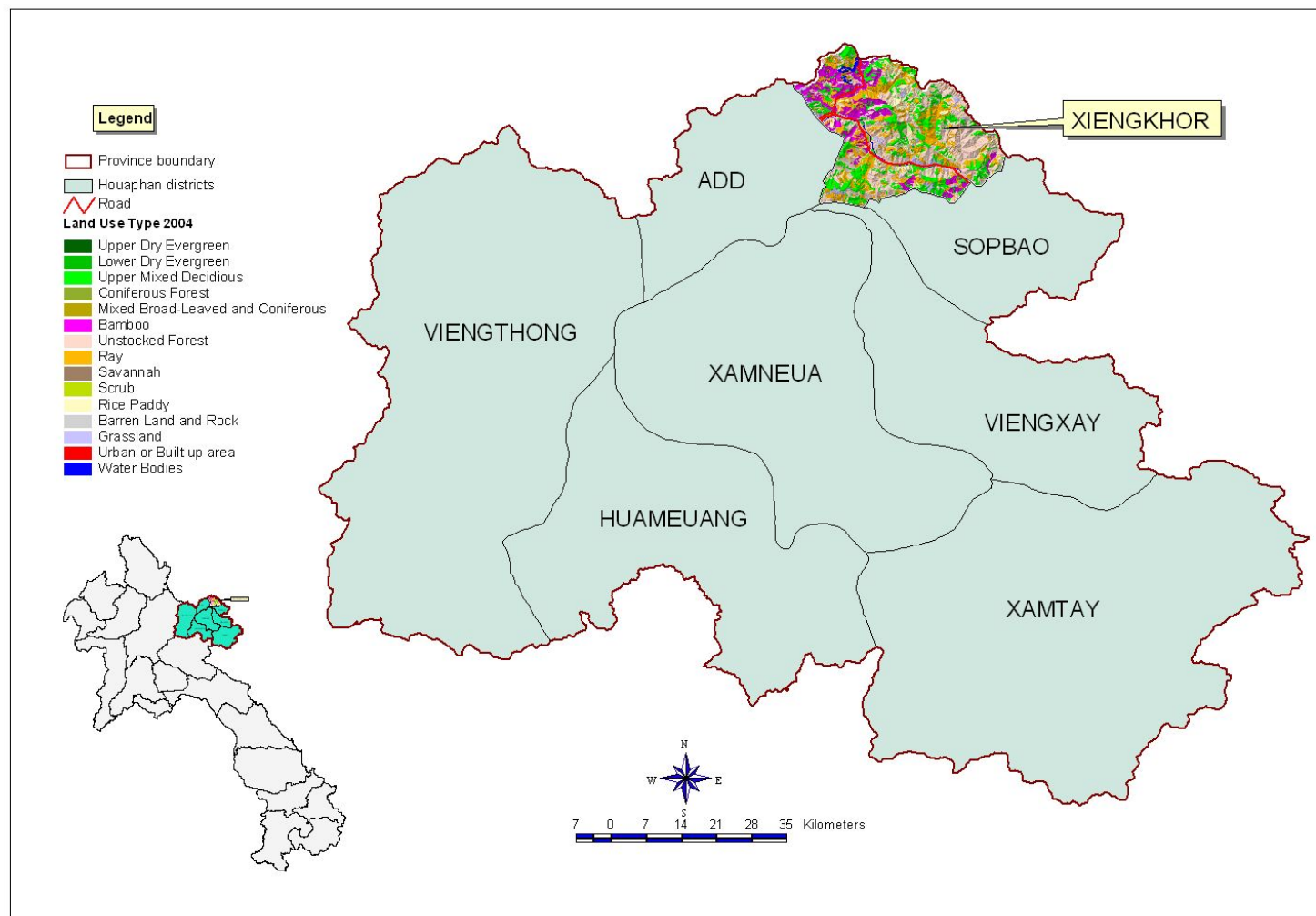
Figure 6: Land Use Map of Xiengkhor District, Houaphan Province

E. Sample Plot No 5

Plot 5 is situated in the pure bamboo, which is far away from Hab village to south west about 4 kilometers. The distance from the main road is approximately 3 km with the altitude of 697 m and the slope of 60 per cent. The sample plot is 20 x 20 m. B. *striata Lodd. ex Lundl.* (B. vulgaris) found is the only dominant species in this area. The local name is Mai Xang. The result indicates that there are the total numbers of 9 clumps which consist of 162 culms. Of these, 25 culms were one year old, while other 137culms are 2-3 years. The average distance between clumps is 4.4 m with the clump diameter of 3.16 m. The length of this species is 8 m with the average stem diameter of 3.5 cm. It is noticeable that the average length of section of this plot is the same dimension as the plot 3, and plot 4. However, thickness of this plot is the smallest measured only 0.35 cm.

3.1.4   Estimation of Bamboo Resources in Houaphan Province

3.1.4.1   Bamboo Plantation

The most commonly cultivated species are Bamboo Loung, and Bamboo Phang (Bamboo D. lonoifimbriatus) in Xiengkhouang and Houaphan Province. The purpose of the planting is domestic use. For instance, farmer uses bamboo round poles for house construction, fencing, etc. Table 5 shows the estimation of the density of bamboo plantation in Viengxay District in Houaphan Province. From the analysis of Plot 3 and 4, it is obvious that the average number of culms that farmer can realize is 2832 culms per ha.

By comparing the two sample plot, it shows that the number of culms in Plot 3 is fewer than that in Plot 4 due to the fact that the local villagers harvested some bamboo poles for their domestic consumption.

Table 5: Estimation of the density of bamboo plantation (Bamboo. Loung)

Description	*Sample Plot No. 3*	*Sample Plot No. 4*	Estimated Average Culms per Ha
Plot area (m^2)	484	330	
No. of culms in the sample plot	82	131	
Total culms per ha	**1694**	**3970**	**2832**

Source: Own investigation, 2006.

3.1.4.2   Natural Bamboo Forest in Houaphan Province

Table 6 summarizes the bamboo area, average number of culms per ha, and the estimated volume of bamboo resources in Houaphan Province. For bamboo area of each District in Houaphan Province, the results are estimated by using the data analysis from Bamboo survey during the field together with using the data base from Forest Inventory and Planning Division, DOF (2004).

The analysis shows that the average number of culms per ha in the upper mixed deciduous is 4 times greater than that in the pure bamboo forest in Viengxay and Xiengkhor District in particular, and in other districts of Houaphan Province in general. As a consequence, by quantifying the average number of culms per hectare combined with the bamboo area per district, the total numbers of culms in Viengxay are 4.6 million (PB), and 496 million (UMD) while those in Xiengkhor are 40.7 million (PB and 163 million (UMD).

By looking at the overall result of Houaphan Province, it becomes clear that the total bamboo area in UMD is 508,368 ha which consists of 4.6 billion culms, while that in PB is 17,870 ha that consists of approximately 72.4 million culms in the province.

Table 6: Bamboo Resources in all Districts in Houaphan Province

Province	District	* Bamboo Area per district (ha)		¶Average number of culms per ha		Total number of culms (1000 Culms)	
		Upper Mixed Deciduous	Pure Bamboo	Upper Mixed Deciduous	Pure Bamboo	Upper Mixed Deciduous	Pure Bamboo
HOUAPHAN	Houameuang	73,802	1,614	17388	4050	673,700	6,537
	Xamtay	111,445	3,716	17388	4050	1,017,319	15,049
	Xamneua	80,759	1,173	17388	4050	737,207	4,750
	Xiengkhor	**17,920**	**10,059**	**17388**	**4050**	**163,579**	**40,737**
	Viengxay	**54,382**	**1,140**	**17388**	**4050**	**496,426**	**4,615**
	Viengthong	140,434	114	17388	4050	1,281,941	461
	Sopbao	29,626	55	17388	4050	270,436	223
Total		**508,368**	**17,870**	**-**	**-**	**4,640,608**	**72,372**

*Note: * the result is based on the data base from Lao National Forest Inventory, 2004. Bold lettesr refer to the study location*

Source: Field Investigation, 2006.

3.1.4.3   Description of the Study Villages in Viengxay and Xiengkhor District

Some characteristics of the study villages are shown as Table 7. Some of key finding from village studies and the data analysis of project field teams can be summarized as follows:

Table 7: Characteristics of the Study Villages in Houaphan Province

	Viengxay District			Xiengkhor District		
	Ban. Phoun mai	**Ban. Deui**	**Ban. Naphoung**	**Ban. Sobxay**	**Ban. Hap**	**Ban. Sobsan**
Settlement	1969	Over 200 years	1935	Over 200 years	Over 200 years	Over 500 years
Attitude	472 m	393 m	494 m	297 m	248 m	259 m
Access/Season	All year, Paved road 6	Paved road 6, 8 Km from Nameo border	2 Km unpaved road from main road	All year round, Paved road 6	All year round, Paved road 6	All year round, Paved road 6
District Centre	Viengxay, 1 hour by car	Viengxay, 1.5 hour by car	Viengxay, 2 hour by car	Close to the district	Close to the district	Close to the district
Population (HHs)	328 (168 female)	554 (260 female)	190(102 female)	472 (235 female)	-	689 (368 female)
Ethnicity	Tai deng[1]	Tai deng[1]	Tai deng[1]	Tai kao (Buddhism)	Tai kao (Buddhism)	Tai kao and tai dam[1]
Education	Completed primary school	Completed primary school	Completed primary school	Completed primary and secondary school	Completed primary and secondary school	Completed primary and secondary
Health	Sickness common	Sickness common	Sickness common	Better off	Better off	Better off
Facilities	Medecines Viengxay Hospital or in Vietnam	Medecines Viengxay Hospital or in Vietnam	Medecines Viengxay Hospital or in Vietnam	Close to hospital	Close to hospital	Close to hospital
Cultivated land	1.1 ha/HH	0.75 ha/HH	0.77 ha/HH	1.7 ha/HH	1.15 ha/HH	1.34 ha/HH
Rice production	3.75 ton/ha (paddy rice)	2.96 ton/ha (paddy rice)	2.00 ton/ha (paddy rice)	3.13 ton/ha (paddy rice)	2.68 ton/ha (paddy rice)	3.95 ton/ha
Rice deficit	Some HH	Some HH	Some HH	No	Very Few HH	Few HH
Bamboo species occurred	Mai Kone, Loung, D. lonoifimbriatus, Schizostachyum, B. tulda Roxb., G. albociliata Munro & Kurz, etc.	Same as Phounmai	Same as Phoumai	B. striata Lodd. ex Lundl. (B. vulgaris), D. brandisii Kurz, B. nutans Wall. ex Munro, etc	Same as Sobxay	Same as Sobxay

Sources : Faculty of Forestry, NUOLs, 2006.

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[1] Tai deng, tai dam, and tai kao are the sub ethnic groups of Lao-Tai Language Family (Department of ethnics, 2005)

3.1.5   Resource Endowments

3.1.5.1   Labor

Household Size

One of the most important criteria of the farm households' method of farm operation in the study area is their size, i.e. the number of persons who procure family subsistence directly from the farm operations. Table 8 highlights an overview of the average number of family members in the selected villages in Viengxay District and Xiengkhor in Houaphan Province. Accordingly, 58 households were surveyed (10 per cent of all households).

Table 8: Size of the surveyed households in the selected villages in Houaphan Province

District	Villages selected	Total number of households	No. and (%) of households sampled	Average number of members per household		
				Mean	**Max.**	**Min.**
Viengxay	Phoun Mai	59	8 (17)	7.63	13	5
	Deui	95	10 (11)	6.7	12	4
	Naphoung	35	10 (29)	6.8	11	4
Xiengkhor	Sobxay	78	10 (13)	6.8	12	5
	Hap	156	10 (6)	6.6	10	3
	Sobsan	145	10 (7)	4.4	7	2
2 Districts	**6 villages**	**568**	**58 (10.2)**	**6.4**	**-**	**-**

Note: Figure in parentheses denote percentages of total household numbers

Source: Own investigation (2006)

It becomes clear that on average 6 persons are living in each household. There is only a small difference between the average sizes of the households from different villages. The number of household members, however, varies from 2 to 13 persons. The minimum size in Phoun Mai exceeds that of the other villages as households of this village have more children than those of other villages.

Working Capacity of Households

Working capacity is the second most important feature of the farm households. It is expressed in terms of the number of labor (workforce) and depends on the size and composition of the households. The total working capacity of the households results from family members and the external laborers. Family members form the main source of working forces of the household. It is imperative to ascribe a distinct labor unit or

equivalent to different family members in order to determine household working capacity. The result of the interview illustrates that the average own workforce of the surveyed households is 2.4 labor unit.

Table 9: Labor unit of the interviewed households in the selected villages in Houaphan

District	Villages selected	Average labor units per household		
		Mean	Max.	Min.
Viengxay	Phoun Mai	2.7	6	1
	Deui	2.4	4	2
	Naphoung	3.6	6	2
Xiengkhor	Sobxay	2.3	4	1
	Hap	1.8	3	1
	Sobsan	1.9	3	1
2 Districts	**6 villages**	**2.4**	**-**	**-**

Source: Own investigation (2006)

There is significant difference between the average numbers of households' labor units in the six villages. In Viengxay District, there are more average labor units per household than in Xiengkhor District. The biggest number of labor unit is almost 4 in Naphoung village, and about 3 in Phoun mai village. In contrast, the number of labor unit in Xiengkhor District is less since their family members were out for working outside the region (Based on the result from the group discussion, 2006).

3.1.5.2 Land Use

The holding sizes of the families vary with the size of the family, the time period of settlement and the availability of arable or potentially cultivable land in the village. The size of farmlands per household has been summarized in Table 10 below. The analysis shows that the average holding size of a household is 1.1 ha.

Table 10: Total areas of the surveyed farms in the selected villages in Houaphan Province

District	Villages selected	Average farm area per household (ha)		
		Mean	Max.	Min.
Viengxay	Phoun Mai	0.8	1.7	0.3
	Deui	0.7	2	0.1
	Naphoung	0.8	1.5	0.4
Xiengkhor	Sobxay	1.7	3.3	0.1
	Hap	1.2	2	0.5
	Sobsan	1.3	2.6	0.1

2 Districts	6 villages	1.1	-	-

Source: Own investigation (2006)

The families of the Sobxay village posses the biggest farmland area on average. Furthermore, it reveals that the holding sizes of the household in Xiengkhor District is greater that those of Viengxay District on an average since this is attributed to the fact that the households of Xiengkhor District have more area in connection with the corn, soil bean farm, which were introduced in this District recently.

The use of the available land area varies from village to village, from family to family, and from district to district. (see Table 11). It becomes evident that the biggest proportion of the holding size in all the selected villages is dedicated to paddy rice. Garden, and planted forest is ranking second. Due to the enforcement of the shifting cultivation (upland rice) stabilization program enforced by government, Naphoung Village does not have upland rice area any more, whilst other areas remain practicing upland rice.

Table 11: Land use proportions of the interviewed households

District	Villages selected	Proportion of farmland area per household (ha)					
		Paddy rice	Upland rice	Aquaculture	(Garden, planted forest)	Corn and bean	Others
Viengxay	Phoun Mai	0.32	0.14	0.006	0.31	0	NA
	Deui	0.27	0.18	0.014	0.29	0	NA
	Naphoung	0.59	0.00	0.012	0.19	0	NA
Xiengkhor	Sobxay	0.42	0.92	0	0.34	0.33	NA
	Hap	0.56	0.20	0	0.37	0.36	NA
	Sobsan	0.56	0.30	0	0.37	0.19	NA
2 Districts	**6 villages**	**0.45**	**0.29**	**0.01**	**0.31**	**0.15**	**NA**

Source: Own investigation (2006)

While the families of Viengxay District dedicate a small portion of their land areas to fish pond, those of Xiengkhor do not practice at all. In contrast, the families of Xiengkhor District cultivated corn and bean as the cash income, which is exported to Vietnam, whilst those of Viengxay District do not have at all. The entry 'Others' refers to the size of fallows, grazing land (unplanted land) owned by each family, in this analysis, it is not really evaluated. However, from the village head interviews, it is estimated that each household own these kinds of land more than 1 ha.

3.1.6   Bamboo Luong Plantation

The bamboo plantation in Houaphan Province is generally simple in nature, small scale,

and not well organized for the market. The purpose of the plantation is the domestic consumption by using bamboo round poles and the bamboo handicraft. From the analysis of Table 12 below, it reveals that the average holding size of bamboo plantation of the families in Houaphan Province is 247 m^2 per household with approximately 18 clumps per household. The families of Deui village have the biggest holding size of bamboo plantation on average. It is obvious that the number of bamboo clumps per household in Deui Village double that of bamboo clumps in other surveyed villages. As mentioned above, the purpose of plantation is only for domestic consumption, however only in Deui village, bamboo Loung were sold to Vietnamese trader for exporting to Vietnam last year,

District	Villages selected	Bamboo Luong				
		Bamboo area per household (m2)	Number of bamboo clumps per HH	No. of culms sold per HH per year (culms)	No. of culms consumed per HH per year (culms)	Average of culms harvested per ha
Viengxay	Phoun Mai	218.00	17.60	0	14.10	634.10
	Deui	373.20	31.10	19.00	20.70	593.10
	Naphoung	198.00	16.10	0	11.80	646.90
Xiengkhor	Sobxay	212.80	13.30	0	5.60	271.32
	Hap	235.20	14.70	0	5.90	249.18
	Sobsan	246.40	15.40	0	6.10	240.35
2 Districts	**6 villages**	**247.27**	**18.03**	**3.17**	**10.70**	**439.16**

however in this present year, villagers refused to sell their bamboo since the price is too low for them.

Table 12: Bamboo Luong Plantation (production) of the interviewed households

Note: HH refers to Household.

Source: Own investigation (2006)

It is estimated that if the average farm household in the surveyed villages have area of 1 ha bamboo Luong plantation, about 439 culms could be harvested from their plantation.

3.1.7 Financial Analysis of Farm Households: Earning, Cost, Economies of Viengxay District, Houaphan Province

Table 13 summarizes the revenues and costs for different income sectors of the households, which is called "the household income sheet". This income sheet represents the income formation of the average farm household in Viengxay District, Houaphan Province. All prices reflect 2005 costs, harvesting outputs, and so forth.

For paddy rice, upland rice farm sector, their gross revenues are estimated on the quantities of rice produced each year combined with the rice price that exists in the local market of the region. Similar to livestock and the NTFPs[2] sector, they are calculated on a basis of the quantities produced combined with the local market price. It should be noted the price of bamboo is the price that villager selling to Vietnamese trader excluding the village tax. Furthermore, the wage price, which is obtained through the employment sector, is not really evaluated but fixed at 20,000 Kip per day as an average, which is what a farm household could earn from both the local wage market.

The analysis shows that among the item 'gross revenues' from different sectors, Livestock (cattle, pigs, poultries, and fish) have contributed the greatest portion, which cover almost half of the total gross revenue (5,063,000 Kip p.a.), whilst Upland rice farm the lowest part making up only 3 per cent of the total gross revenue. It is noticeable that the gross income from selling bamboo culms to the Vietnamese trader is also significant (16) making up 1,667,000 Kip of the entire income, most of which is cash income. In addition, the proportion of the total gross revenue from paddy rice, NTFPs, and employment sectors brings in 19 per cent, 9 per cent, and 4 per cent to the total gross revenue of each sector, respectively.

Since the majority of households use their own labor for the production of all sectors, as explained earlier, the cost of labor[3] is estimated on the basis of labor requirement combined with prices of the regional labor market for each sector. The labor requirement for farm production was scrutinized during the field research, i.e. the calendar of farm production was used in group discussion in order to generate the number of workload of each farm sector. The result shows that the labor requirement for paddy rice, upland rice farm are identical to each other.

 The total labor required for producing all income sectors amounts to 2,397,000 Kip per the average household p.a. Of these, the proportion of labor requirement for paddy rice is

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[2] NTFPs income sheet are demonstrated carefully in Table 7
[3] The investigation of the cost of labor requirement for each farm sector was based on the consultation with the member of Faculty of Forestry, NUOL (cf. Xayvongsa, 2001), and the researcher's investigation in the case study.

the highest part of the entire cost, whilst that for collecting NTFPs[3] is the highest part after paddy rice. Since the household spends much more time p.a. on producing income from this sector than from other sectors, and another reason is that collecting NTFPs is usually high time consuming. In contrast, the proportion of labor requirement for the upland rice sector is the least, and is on average less than 12% of the entire labor cost because of its small holding size of farmland. In the analysis, the costs of labor incurred in the production process of livestock sector, i.e. the cost of labor raising, feed inputs to livestock were ignored due to its complexities and difficulties to derive values. Similar to the cost incurred in bamboo and employment sector, they are ignored in the analysis.

Table 13: Income sheet of an average household unit in Viengxay District in Houaphan Province.

Items	Average Revenue and Cost per Household (Kip per year)						
	Paddy rice (Kip/0,40 ha)	Upland rice farm (Kip/0.08 ha)	Bamboo	Livestock®	Employ-ment§	NTFPs	Sum
Gross Revenue	1,939,000 (19)	276,000 (3)	1,667,000 (16)	5,063,000 (49)	386,000 (4)	953,000 (9)	10,284,000 (100)
Labor	1,228,000 (51)	284,000 (12)	- (0)	- (0)	- (0)	885,540 (37)	2,397,000 (100)
Seeds	32,000 (78)	9,000 (22)	0 ()	0 (0)	0 (0)	0	41,000 (100)
Land tax (livestock tax)	20,000 (29)	4,000 (6)	0 (0)	44,000 (65)	0 (0)	0	68,000 (100)
Capital costs	243,000 (79)	56,000 (18)	0 (0)	10,000 (3)	0 (0)	0 (0)	309,000 (100)
Balance (Land rent)	416,000 (6)	-77,000 (-1)	1,667,000 (22)	5,013,000 (67)	386,000 (5)	67,460 (1)	7,472,000 (100)
Income*	1,919000 (19)	272,000 (3)	1,667,000 (16)	5,013,000 (49)	386,000 (4)	953,000 (9)	10,220,000 (100)
Sum¶ (Σ)	1,939,000 (19)	276,000 (3)	1,667,000 (16)	5,063,000 (49)	386,000 (4)	953,000 (9)	10,284,000 (100)

Note: Figures in parentheses denote percentages. §employment means the income of households from temporary jobs during off-farm season. *means that income of the average household, which represents the net calculated income including the cost of land rent, own labor and own capital, and Sum¶ is the sum of all costs. ® means the summary of income and cost from cattle, pigs, poultries, and fish. (Exchange rate: 1 US. Dollar = 10,400 Kip on November 2006)

  Source: Own calculation based on data from field research, 2006.

The costs of seed is estimated by the quantities of rice used for each sector combined with local price of rice (1 kg of rice =2,000 Kip). It reveals that almost all of the households in the region use their own seed for the farm production.

The cost of farmland tax is indicated as entailing the same cost for both paddy rice and upland rice farm. Similar to Livestock sectors, cattle tax is only levied at a rate of 18,000 Kip per head per year, with the rest of the livestock exempted from tax. Bamboo tax is levied at the cost of 5 Kip per 1 kg of splitting bamboo. This tax income goes directly to the village development fund.

The capital cost or 'a normal return to the capital' is calculated on the basis of the total capital combined with the interest of the borrowing rate of 19 per cent p.a., which is obtained from Agriculture Promotion Bank The analysis shows that the capital cost of paddy rice sector is the highest part (79%).

According to the model calculation, the entries under 'balance' or net income represent the land values or the income streams from each sector. It is shown that from the standpoint of the average farm household, the income streams from paddy rice, bamboo, livestock, employment, and NTFPs sectors are 416,000 Kip, 1,667,000 Kip, 5,013,000 Kip, 386,000 Kip, and 67,000 Kip respectively, while only that of upland rice sector is faced with negative land rent, owing to the fact that the labor for this production is relatively time consuming. It is surprising that the proportion of the bamboo sector's balance (net income) is the highest part after livestock sector.

The item 'income' means the real income of the average farm household including their own labor, own inputs to the production. In the study area, almost all of the farm households used their own labor for farm production (paddy rice, upland rice farm, etc.), while others use labor from their relatives. Additionally, very few hired other poor farmers in the region. Therefore, in this analysis, the income of the average household is therefore:

Labor cost + Seeds + Capital costs + Balance = Average Household Income (AHI)

As can be seen under the entries 'income', the average household is faced with positive land values for all sectors. Of these, most of the income is derived from the livestock sector, which takes over half of the total income. The average household procures 16 per cent of the total income from bamboo sector, while the income from the upland rice and employment sector plays a slightly important role for the entire income formation of the average farm household, since the enforcement of land and forest allocation policy, which prohibit the farm household to practice the shifting cultivation (upland rice).

It is also important to mention that rural households in the region have very small proportion of farmland size, and moreover, the rice productivity is not desirable due to lack of technology, i.e. poor method of soil improvement, pest attack. As a consequently, almost households in this region have not enough rice for their own family consumption. Usually, the time of rice shortage begins from late January on wards after a few months

of rice harvesting in November. In order to get enough rice[4] for their own consumption in one accounting year, they have to produce more income especially from Livestock and bamboo sector and other sources in order to exchange or sell it for rice.

Income formation from non-timber forest products

The income sheet of the NTFPs sector is demonstrated in detail in Table 15 owing to the fact that its values are very complex and difficult to understand. To quantify the revenues and costs incurred in the production process (collecting NTFPs), different methods were utilized in the study, namely group discussion, participant observation, household interviews as well as interviews with key-informants.

Table 14 shows the top four NTFPs, which are currently produced (collected) by all of the households in Viengxay District on a daily basis. In fact, rural households produce much more different income sources from NTFPs than those mentioned here; however, it is impossible for the researcher to investigate all sources of NTFPs due to the time and financial constraints. Therefore, the researcher has narrowed and selected only the most collected NTFPs (Top 4 NTFPs) as rendered in Table 14.

Criteria used and discussed by villagers for ranking NTFPs are importance as a food resource, income source, or other inputs to the household. The study shows that the average household spends about one day (8 hours) to catch one and a half kg of fish, equivalent to 187 grams (g) per one hour only in the rainy season. However, the figure is lower in the dry season, with about 0.8 kg produced per day, equivalent to 100 g produced per hour as shown in Table 4 below:

Table 14: Quantities of NTFPs collected by an average farm household

Practices	Ability of household to collect NTFPs in one day or 8 hours (kgs)	
	Rainy season	**Dry season**
Fish, frog, aquatic insects, etc.	1.5	0.8
Cardamom	4	6
30 branch root climb	5	5
Wild Vegetable	7	4

Source: Own calculation based on data from Household Survey, 2006

Table 15 presents the income sheet of NTFPs sector of an average household in Viengxay District. The revenues of the NTFPs were estimated on the basis of the quantities of NTFPs produced combined with the prices that could be found in the local market (Viengxay market). Due to the fact that this region is located along a Lao PDR Highway (Street number 6 north), most of quantities of NTFPs could be sold and exported to Vietnam. It should be noted that in the analysis, the costs of the NTFPs sector are

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[4] *Rice is the main food intake of rural farm households in Laos in general and in Viengxay district in particular.*

measured non-cash while those of revenue are measured in cash income that received after the selling of NTFPs. The analysis shows that the average household spends about 6 hours per week in the rainy season and 5 hours per week in the dry season to catch fish, frogs, and other aquatic insects. As a consequence, by quantifying the abilities (quantities) of a household to collect NTFPs (Table 14) combined with time spent for collecting, he would able to produce about 5 kg of fish per month during the rainy season and over 2 kg during the dry season.

Table 15: Revenue and cost of the NTFPs sector of an average household

Description	Time spent collecting NTFPs in hours per week		NTFPs collected in Kgs per month		Annual Cost (Kip)	Annual Revenue (Kip)
	Rainy Season a	Dry Season b	Rainy Season	Dry Season		
Fish, frogs, aquatic insects, etc. (Aver. 1 kg = 16,000 Kip).	6.1	4.87	4.575	2.435	387,540	638,720
Wild Vegetable (Aver. 1 kg = 1000 Kip).	12.4	3	24.8	6	498,000	166,000
30 branch root tree (Aver. 1 Kg = 4,000 Kip)	NA	NA	NA	NA	-	66,000
Cardamom (Aver. 1 Kg = 7,000 Kip)	NA	NA	NA	NA	-	82,280
Balance					67,460	
Sum					953,000	953,000

Note: a, b means that there are 5 months in the rainy season from May until September and 7 months in the dry season during the rest of year. NA = Non-applicable.

Source: Own calculation based on data from Household Survey, 2006

In one accounting year, the cost of fish collecting is calculated by time consumed p.a., combined with the wage price[5] of 16,000 Kip per day as mentioned above, and the result shows that the average household spends a total of 378,000 Kip/year in order to realize the annual fish revenue of 638,720 Kip p.a.

The revenues from collecting wild vegetables are three times lower than the costs of producing them. This is because collecting these two kinds of NTFPs are extremely time-consuming, and the prices are relatively low. In addition, the revenues from cardamom and 30 branch roots are calculated which is based on the quantities produced by an

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[5] Wage price of collecting NTFPs are taken from the local wage of the region, fixed at 20,000 Kip per day

average household combined with the purchase price in the local market. Both productions are cash income for the farm household in this region. Their revenues amount to 66,000 Kip p.a. and 82,000 Kip per household respectively.

The entry under 'balance' means the income streams obtained through the NTFPs sector. It is obvious that the average household faces low positive income land rent, since the cost of labor is relatively high. Nevertheless, the household uses its own labor in the production. Therefore, AHI would be equal to the sum of the cost of labor and the income balance, as written below:

AHI = 378,000 + 498,000+ (67,000) = **953,000 Kip per year** (non cash and cash income)

It is now obvious that the contribution of NTFPs to the total income of the average household is the slight part (10%).

3.1.8   Summaries of Working Calendar of all Farm and Off-farm sector of Viengxay and Xiengkhor District

Table 16 illustrates the summaries of the holding size, net income, and working calendar of all farms and off-farm sector of the average farm household in Viengxay and Xiengkhor District, Houaphan Province. The analysis shows that the number of man days spent per household in July is the highest for Viengxay District, whereas in October for Xiengkhor District.

From the analysis, it shows that the families of Viengxay District have more free time than those of Xiengkhor District. While the families of Viengxay District spend their time on harvesting bamboo from natural forest for cash income, those of Xiengkhor spend their time on shifting cultivation, corn and bean cultivation for their cash income. The average income of the Viengxay household is approximately 10 million Kip per year, whilst that of the Xiengkhor household is relatively higher, making up over 14 million kip per year. The Table also shows that the biggest part of the average farm household income from the two districts derives from livestock productions, which consist of cattle raising, pigs, poultries, and fish raising. As mentioned above, it is an interesting finding that the average cash income of the family in Viengxay District from bamboo harvest is ranking second, while that in Xiengkhor District from Bamboo harvest is zero, but labor selling is ranking second.

Table 16: Summaries of average farm household income and Working Calendar of all Farms and Off-farm sector of Viengxay and Xiengkhor District.

	Activities	Aver. Farm area (1000kip)	Av. Income per day per HH (1000kip)	Months (Number of man days each month)											
				1	2	3	4	5	6	7	8	9	10	11	12
Viengxay	Rice-field	0.40	1,919	0	0	0	4	4	8	22	4	2	12	12	16
	Upland rice	0.08	272	0	2	2	1	3	2	2	2	2	6	1	0
	Bamboo harvest*	NA	1,667	4	4	3	3	3	4	3	3	4	4	4	4
	Collect other NTFPs	NA	953	8	4	4	4	4	4	4	4	0	4	4	4
	Livestock	NA	5,023												
	Labor selling	NA	386	2	2	2	2	1	2	1	2	1	1	1	2
	Sub-Total	**0.48**	**10,220**	**14**	**12**	**11**	**14**	**15**	**20**	**32**	**15**	**9**	**27**	**22**	**26**
	Sub-Total Labor per HH	**2.93**	**NA**	**88**	**88**	**88**	**88**	**88**	**88**	**88**	**88**	**88**	**88**	**88**	**88**
Xiengkhor	Rice-field	0.51	2,981	0	0	0	5	5	10	28	5	3	15	15	20
	Upland rice	0.54	1,710	0	16	11	8	21	14	12	12	12	43	5	0
	Corn farm	0.07	281												
	Bean farm	0.22	961	4	4	3	3	3	4	3	3	4	4	4	4
	Collect NTFPs (incl. bamboo shoot)	NA	1,616	8	4	4	4	4	4	4	4	0	4	4	4
	Livestock	NA	4,430	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Labor selling	NA	3,646	2	2	2	2	1	2	1	2	1	1	1	2
	Sub-Total	**1.34**	**15,625**	**14**	**26**	**20**	**22**	**34**	**35**	**48**	**26**	**20**	**67**	**30**	**30**
	Sub-Total Labor per HH	**2.00**	**NA**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**	**60**

*Note: * income from selling bamboo to Vietnamese trader is 38,640 Kip per day on average. HH= household; NA= Non-applicable*
Source: Own Investigation, 2006.

3.2   Geography of the Study Area, Xiengkhouang Province

3.2.1   Geographical Location

XiengKhouang province is located in the Northeastern part of the Laos with a population of 196,000. The province is a rugged mountainous province (See figure 7). The Provincial capital, Phonsavanh is located some 500 km by road from the national capital of Vientiane. Administratively the province is divided into seven 8 districts: Phaxay, Khoune, Phonsavanh, Nong Hai, Kham, Mork, Phou Koud, and Thathom District. The former chief-city was Phouane, now called Khoune. The total land area of the province covers about 1,391,581 ha (Lao National Forest Inventory Data Base, DOF, 2004). The distance between Houaphan and XiengKhouang is approximately 400 Km.

The Districts selected for the present investigation are Phaxay and Kham District. Kham District has border with Vietnam while Phaxay District has border with the Special Zone Xaysomboun.

3.2.2   Result of Bamboo Survey in Phaxay District

Phaxay District is situated in western part of Xiengkhouang (see Figure 8). It lies within the longitude of 102° 50' – 102° 22' E and Latitude of 19° 06' – 19° 28' N. The elevation varies from 820-2050 m. About 70 per cent of the total area is mountainous area, which is the peak of the Lao PDR. The District has the border with Khoune District in the east, with Pek in the north, with Phoukout in the east, and Vientiane and Borikhamxay Province in the south. The total area of Phaxay is 99163.49 ha . According to the classification of land use type in 2004, it was classified in 11 types namely Upper Dry Evergreen, Upper Mixed Deciduous; Coniferous Forest; Mixed Broad-Leaved and Coniferous; Unstocked Forest; Ray, Scrub, Rice paddy; Grass land and Water. The detail appears in Table 17 below.

Table 17: Land use type of Phaxay district

Land Use Type	Area (ha)	% Area
Upper Dry Evergreen	1550.26	1.56
Upper Mixed Decidious	21303.93	21.48
Coniferous Forest	484.43	0.49
Mixed Broad-Leaved and Coniferous	703.36	0.71
Unstocked Forest	50363.96	50.79
Ray	732.90	0.74
Savannah	27.66	0.03
Rice Paddy	5470.29	5.52
Other Agriculture Land	138.96	0.14
Grassland	18376.00	18.53
Swamp	11.74	0.01
Total	**99163.49**	**100.00**

Source: Lao National Forest Inventory Data Base, DOF, 2004

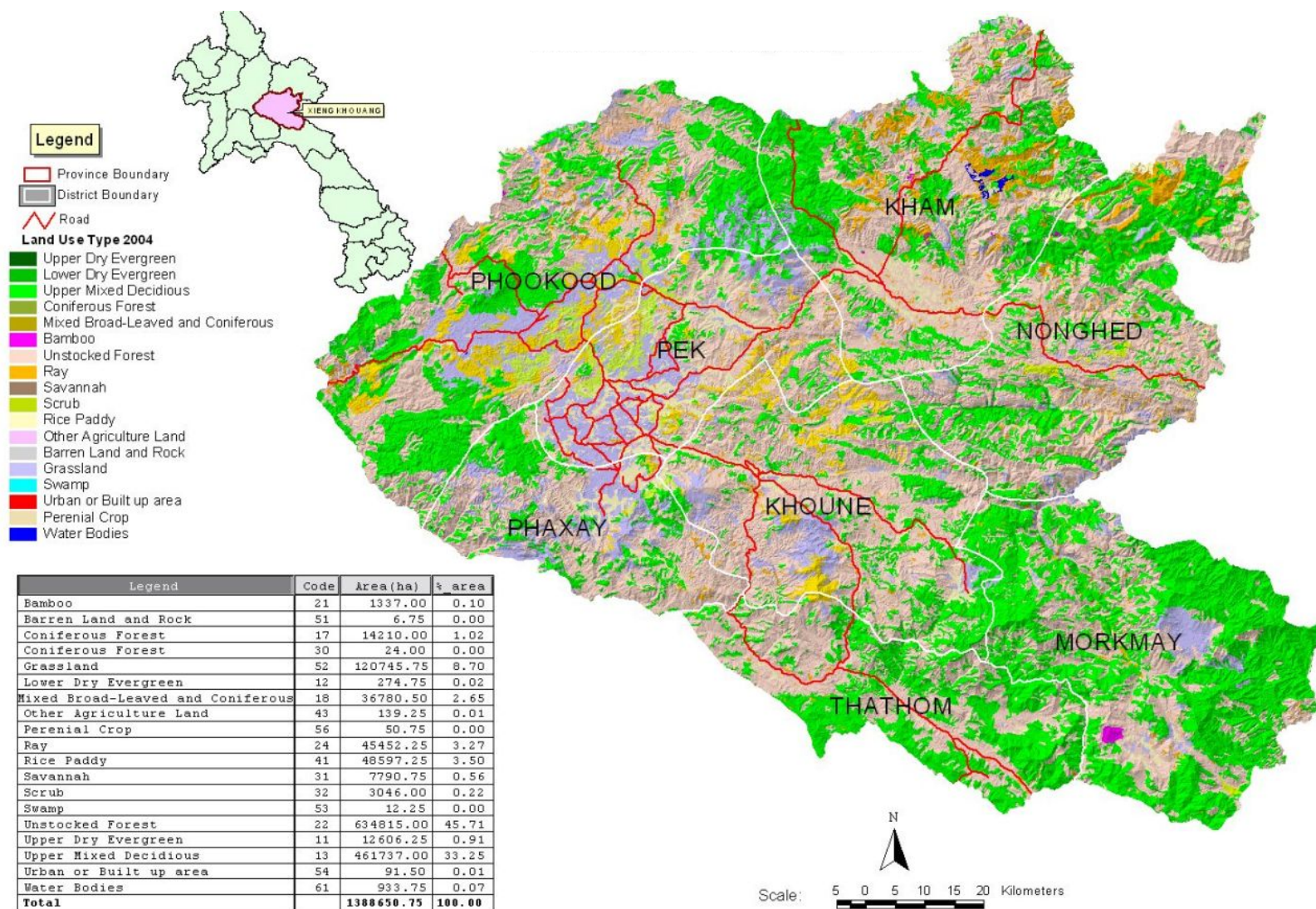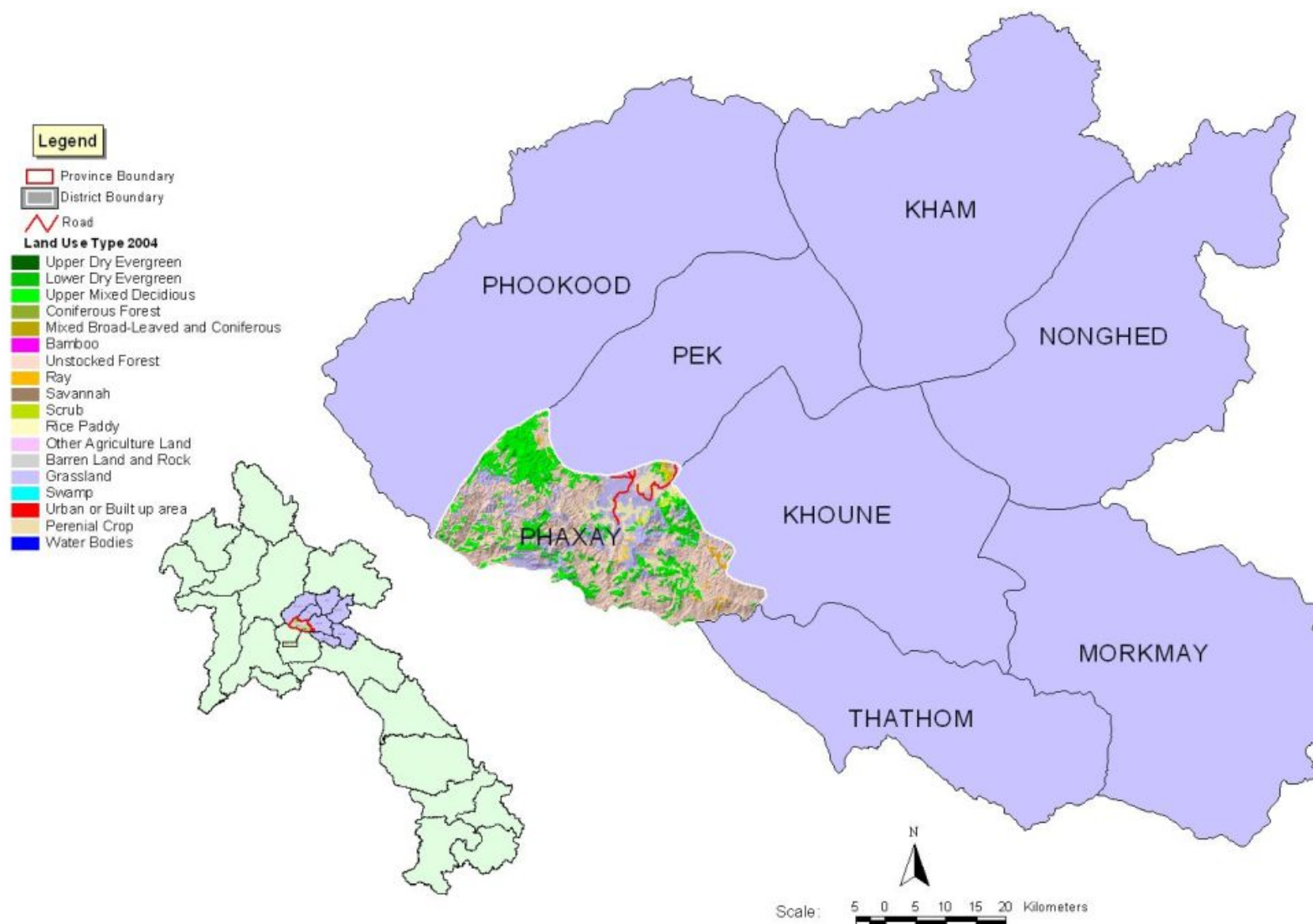| Legend	Code	Area(ha)	% area
Bamboo	21	1337.00	0.10
Barren Land and Rock	51	6.75	0.00
Coniferous Forest	17	14210.00	1.02
Coniferous Forest	30	24.00	0.00
Grassland	52	120745.75	8.70
Lower Dry Evergreen	12	274.75	0.02
Mixed Broad-Leaved and Coniferous	18	36780.50	2.65
Other Agriculture Land	43	139.25	0.01
Perenial Crop	56	50.75	0.00
Ray	24	45452.25	3.27
Rice Paddy	41	48597.25	3.50
Savannah	31	7790.75	0.56
Scrub	32	3046.00	0.22
Swamp	53	12.25	0.00
Unstocked Forest	22	634815.00	45.71
Upper Dry Evergreen	11	12606.25	0.91
Upper Mixed Decidous	13	461737.00	33.25
Urban or Built up area	54	91.50	0.01
Water Bodies	61	933.75	0.07
Total		1388650.75	100.00

Figure 7: Land Use Map of Xiengkhouang Province

Figure 8: Land Use Map of Phaxay District

In this province the sample plot was conducted in Thoum village in Phaxay District. The sample plots for natural bamboo forest are 400 square meters (20m x 20m), which is located in the upper mixed deciduous forest in the south of Phaxay District. The detail and the result of the analysis are as follows:

F.   Sample plot No. 6

The sample plot is about 5 km away from Thoum village to south direction. The distance from the road is about 50 m. The plot lies within the altitude of 1200 m and the slope of 55 per cent.

Table 18: Summary of average data of sample plot in Phaxay District, Xiengkhoung Province.

Plot No.		No. of Clumps	No. of Culms		Total No. of Culms	Distance Between Clumps (Cm)	Clumps Diameter (Cm)	Length (Cm)	BB Diameter (Cm)	Section Length (Cm)	Thickness (Cm)
			1 year	2-3 year							
1	Mean	85	29	206	236	246.25	248	1406	7.66	35.8	1.88
	Max.	-	-	-	-	350	500	1600	9.5	37	2.1
	Min.	-	-	-	-	100	80	1250	7	35	1.7
	Std.	-	-	-	-	82	135	127	0.83	0.69	0.14

Source: Own team investigation, 2006

The result of the analysis appeared in Table 18 shows that the dominant bamboo species found are only Mai Hok (D. *brandisii Kurz*), which covers around the total area of the sample plot. The result also illustrates that there are 85 clumps or equivalent to 246 culms in the sample plot. Of these, the bamboo age one year old consists of 29 culms, while age 2-3 years old (206 culms).

The average distance between clumps measured is about 2.5 m with the standard deviation of 82. The average diameter of clump is 248 cm, which varies from 0.8 to 5 m. Similar to their lengths; the study found that the average length of bamboo culms measured is almost 14 m with the standard deviation of 127. In addition, the stem diameter varies from 7 to 9.5 cm with the standard deviation of 0.83. The average section length is 36 cm with the maximum of 37 cm and the minimum of 35 cm. The bamboo thickness is on average 1.88 cm, which varies from 1.7 - 2.1 cm.

3.2.3   **Bamboo D. *lonoififmriatus* Plantation in Phaxay and Kham District**

The bamboo plantation in Xiengkhouang Province is generally simple in nature, small scale, which is slightly bigger than in Houaphan, and it is not well organized for the market. Similar to the situation in Houaphan, the purpose of the plantation is the domestic consumption by using bamboo round poles and the bamboo handicraft. From the analysis, it reveals that the average holding size of bamboo plantation of the families in Xiengkhouang Province is 264 m^2 per household with approximately 20 clumps per household.

The families of the Nasom village have the biggest holding size of bamboo plantation on average. It is also obvious that the number of bamboo clumps per household in Nasom Village double that of bamboo clumps in other surveyed villages.

It is estimated that if the average farm household in the surveyed villages have 1 ha of bamboo D. *lonoififmriatus* plantation, about 661.1 culms could be harvested from their plantation.

Table 19: Bamboo D. *lonoififmriatus* Plantation (production) of the interviewed households

District	Villages selected	Bamboo D. *lonoififmriatus*				
		Bamboo area per household (m^2)	Number of bamboo clumps per HH	No. of culms sold per HH per year (culms)	No. of culms consumed per HH per year (culms)	Average of culms harvested per ha
Phaxay	Thoum	260.4	21.7	0	26.9	1109.9
	Naphia	236.4	19.7	0.0	18.0	621.3
	Nasom	326.00	27.2	0	22.4	617.0
Kham	KhongOm	280.8	23.4	0	29.0	1129.0
	Viengkham	235.20	14.7	0	5.9	249.2
	Phiengkob	246.40	15.4	0	6.10	240.4
2 Districts	**6 villages**	**264.2**	**20.4**	**0.0**	**18.1**	**661.1**

Note: HH refers to Household.

Source: Own investigation (2006)

Land Use Map 2004 of Kham District
Xiengkhouang Province

Legend

- Province Boundary
- District Boundary
- Road

Land Use Type 2004
- Upper Dry Evergreen
- Lower Dry Evergreen
- Upper Mixed Decidious
- Coniferous Forest
- Mixed Broad-Leaved and Coniferous
- Bamboo
- Unstocked Forest
- Ray
- Savannah
- Scrub
- Rice Paddy
- Other Agriculture Land
- Barren Land and Rock
- Grassland
- Swamp
- Urban or Built up area
- Perenial Crop
- Water Bodies

PHOOKOOD

PEK

KHAM

NONGHED

PHAXAY

KHOUNE

MORKMAY

THATHOM

N

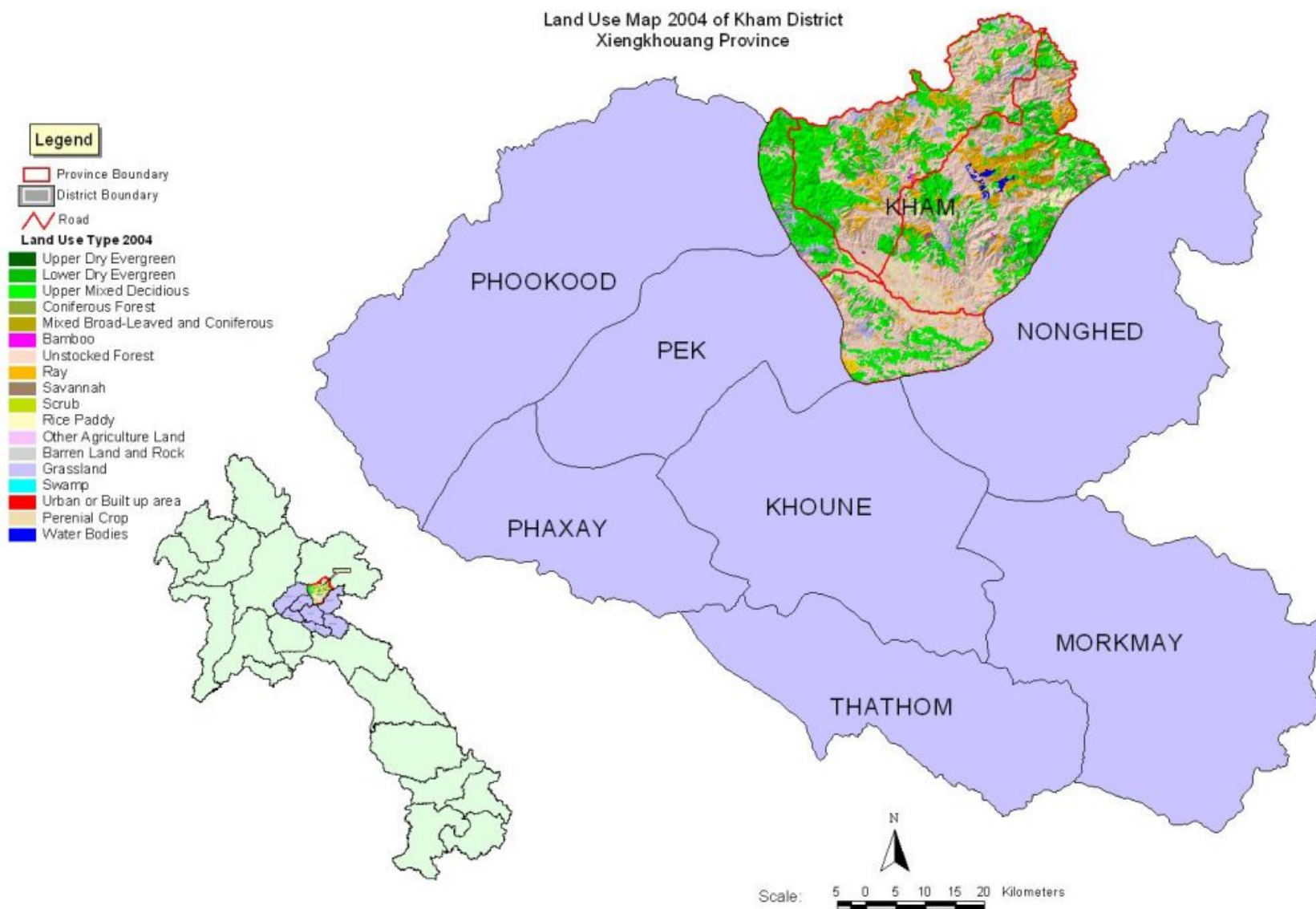Scale: 5 0 5 10 15 20 Kilometers

Figure 9: Land Use Map of Kham District

3.2.4 Estimation of Bamboo Resources in Xiengkhouang Province.

Similar to the situation in Houaphan Province and other region of Laos, Bamboo resources in Xiengkhouang are found in both UMD and the pure bamboo forest. As can be seen from Table 20, with the total UMD forest of 461737, the minimum bamboo density varies from 45 per cent to 60 per cent. Pure bamboo forest shares only 0.1 per cent or equivalent 1,337 ha of the total land area.

Table 20: Land Use Type of Xiengkhouang Province

Land Use Type	Area (ha)	% Area
Upper Dry Evergreen	12606.25	0.91
Lower Dry Evergreen	274.75	0.02
Upper Mixed Decidious	461,737.00	33.25
Coniferous Forest	14210.00	1.02
Mixed Broad-Leaved and Coniferous	36780.50	2.65
Bamboo	1,337.00	0.10
Unstocked Forest	634815.00	45.71
Ray	45452.25	3.27
Coniferous Forest	24.00	0.00
Savannah	7790.75	0.56
Scrub	3046.00	0.22
Rice Paddy	48597.25	3.50
Other Agriculture Land	139.25	0.01
Barren Land and Rock	6.75	0.00
Grassland	120745.75	8.70
Swamp	12.25	0.00
Urban or Built up area	91.50	0.01
Perenial Crop	50.75	0.00
Water Bodies	933.75	0.07
Total	**1388650.75**	**100.00**

Source: Lao National Forest Inventory Data Base, DOF, 2004

Table 21 summarizes the bamboo area, average number of culms per ha, and the estimated volume of bamboo resources in Xiengkhouang Province.

The analysis shows that the total area of the upper mixed deciduous in Phaxay District is 21,304 ha in Phaxay District. As a consequence, by quantifying the average number of culms per hectare combined with the bamboo area per district, the total numbers of culms for Phaxay are 66 million in UMD. Pure bamboo forest does not appear in Phaxay District.

By looking at the overall result, it becomes clear that with the total bamboo area in upper mixed deciduous in Xiengkhouang Province of 461,737.00 ha, it consists of 1.4 billion bamboo culms, while in pure bamboo forest, the number is 1,337 ha, which consists of approximately 5.4 million culms.

Table 21: Estimation of Bamboo Resource in Xiengkhouang Province

District/Province	Average Area of Bamboo Resource (ha)		Average number of culms per ha		Average number of culms per District Area (1000 Culms)	
	Upper Mixed Decidious	Pure Bamboo	Upper Mixed Decidious	Pure Bamboo	Upper Mixed Decidious	Pure Bamboo
Phaxay	21,304	0	5900	4050	65,989	-
Xieng khouang	461,737	1,337	5900	4050	1,430,230	5,415

Source: Field study, 2006.

3.2.5 Description of the study villages in Phaxay and Kham District

Some characteristics of the study villages are shown as Table 22. Some of key finding from village studies and the data analysis of project field teams can be summarized as follows:

Table 22: Characteristics of the Study Villages in Xiengkhouang Province

	Phaxay District			Kham District		
	Naphia	**Nasom**	**Thoum**	**KhongOm**	**Viengkham**	**Phiengkob**
Settlement	Over 200 years	Long times ago	Long times ago	1945	Over 400 years	1975
Attitude	1136 m	1180 m	1153 m	635 m	753 m	685 m
Access/Season	Paved road 6	Dry	Dry, poor road	Good road access	Good road access	Good road access
District Centre	Phaxay District, 1 hour by car	Phaxay District, 1 hour by car	Phaxay District, 3 hour by car			
Population (HHs)	251 (125 female)	272 (154 female)	169 (80 female)	285 (133)	656 (322 female)	395 (186 female)
Ethnicity	Tai kao (Buddhism)	Tai kao (Buddhism)	Tai kao (Buddhism)		Mon-Khmer, and tai kao	Mon-Khmer, and tai kao
Education	No schools.	Primary 1-2	Completed Primary School	Completed Primary School	Completed Primary School	Completed Primary School
Health	Sickness common	Sickness common	Sickness common	-	-	Sickness common
Facilities	Pek or Phaxay District Hosp.	Pek District Hosp.	Pek or Phaxay District Hosp.	Kham District Hosp.	Kham District Hosp.	Kham District Hosp.
Cultivated land	2.24 ha/HH	1.65 ha/HH	1.46 ha/HH	1.79 ha/HH	1.62 ha/HH	1.61 ha/HH
Rice production	4.26 ton/ha (Paddy rice)	3.59 ton/ha (Paddy rice)	4.22 ton/ha (Paddy rice)	4.03 ton/ha (Paddy rice)	2.78 ton/ha (Paddy rice)	3.75 ton/ha (Paddy rice)
Rice deficit	No	No	No	No	No	No
Bamboo Occurred (planted and natural)	D. brandisii Kurz, Mai Kone, Loung, D. lonoifimbriatus, Schizostachyum, B. tulda Roxb., G. albociliata Munro & Kurz, etc.	D. brandisii Kurz,Mai Kone, Loung, D. lonoifimbriatus, Schizostachyum, B. tulda Roxb., G. albociliata Munro & Kurz, etc.	D. brandisii Kurz, Mai Kone, Loung, D. lonoifimbriatus, Schizostachyum, B. tulda Roxb., G. albociliata Munro & Kurz, etc.	Same as Phaxay District	Same as Phaxay District	Same as Phaxay District

Sources: Faculty of Forestry, NUOLs, 2006.

3.2.6   Resource Endowments

3.2.6.1   Labor

Household Size

Table 23 shows an overview of the average number of family members in the selected villages in Phaxay and Kham District in Xieng Khouang Province. The total households sampled in two Districts are 56 (16 % of all households).

Table 23: Size of the surveyed households in Phaxay and Kham District.

District	Villages selected	Total number of households	No. and (%) of households sampled	Average number of members per household		
				Mean	Max.	Min.
Phaxay	Thoum	66	10 (15)	6.1	11	4
	Naphia	94	10 (11)	7.0	11	5
	Nasome	51	10 (20)	6.1	10	3
Kham	KhongOm	49	10 (20)	7.0	11	5
	Viengkham	56	10 (18)	7.4	10	4
	Phiengkob	30	10 (33)	7.0	12	3
	Missing values		4			
2 Districts	**6 villages**	**346**	**56 (16)**	**6.8**	**-**	**-**

Source: Own investigation (2006)

From the analysis it illustrates that on average 7 persons are living in each household. There is only a small difference between the average sizes of the households from different villages. The number of household members, however, varies from 3 to 12 persons. There is the similar average number of members per household in Naphia, KhongOm and Phiengkob village.

Working Capacity of the Households

Table 24 shows the labor unit of the interviewed households in the selected villages in Phaxay and Kham District.

The result of analysis shows that there is minor difference between the average numbers of households' labor units in the six villages. The average labor units per household in the 2 District are almost 3. Even though Thoum and Naphia villages have similar average figures, the maximum and minimum of the labor units per household are different from each other.

Table 24: Labor unit of the interviewed households in Phaxay and Kham District.

District	Villages selected	Average labor units per household		
		Mean	Max.	Min.
Phaxay	Thoum	2.5	6	1
	Naphia	2.5	3	2
	Nasome	2.9	4	2
Kham	KhongOm	2.6	4	2
	Viengkham	3.4	5	2
	Phiengkob	3.1	4	2
2 Districts	**6 villages**	**2.8**	**-**	**-**

Source: Own investigation (2006)

3.2.6.2   Land Use

Similar to Houaphan Province, the holding sizes of the families vary with the size of the family, the time period of settlement and the availability of arable or potentially cultivable land in the village. The size of farmlands per household has been summarized in Table 25 below. The analysis shows that the average holding size of a household is 1.7 ha., which is bigger than that of the household in Houaphan Province.

Table 25: Total areas of the surveyed farms in Phaxay and Kham District.

District	Villages selected	Average farm area per household (ha)		
		Mean	Max.	Min.
Phaxay	Thoum	1.5	1.8	1.0
	Naphia	2.2	7.4	0.6
	Nasome	1.6	2.3	0.8
Kham	KhongOm	1.8	4.6	0.6
	Viengkham	1.6	2.6	0.7
	Phiengkob	1.6	3.0	0.8
2 Districts	**6 villages**	**1.7**	**-**	**-**

Source: Own investigation (2006)

The families of the Naphia village posses the biggest farmland area on average (2.2 ha) with maximum of 7 and minimum of 0.6. Furthermore, it reveals that the holding size of the household in Phaxay District is as many as those of Kham District on an average. The use of the available land area varies from village to village, from family to family, and from district to district. (see Table 26). Likewise, it becomes evident that the biggest

proportion of the holding size in all the selected villages is dedicated to paddy rice, making up 1 ha per average household. It is noticeable that the family members of Phaxay District did not practice shifting cultivation due to the enforcement of shifting cultivation law.

Table 26: Farmland Use Proportions of the Interviewed Households in Phaxay and Kham

District	Villages selected	Proportion of farmland area per household (ha)					
		Paddy rice	Upland rice and Banana	Aquaculture	(Orange, Cassava farm, etc.)	Corn and vegetable, garlic	Others
Phaxay	Thoum	0.97	0.00	0.04	0.19	0.3	NA
	Naphia	1.20	0.20	0.02	0.42	0.42	NA
	Nasome	1.47	0.00	0.04	0.13	0.05	NA
Kham	KhongOm	0.99	0.31	0.00	0.17	0.31	NA
	Viengkham	0.98	0.33	0.12	0.00	0.31	NA
	Phiengkob	0.68	0.79	0.00	0.00	0.16	NA
2 Districts	**6 villages**	**1.0**	**0.3**	**0.0**	**0.2**	**0.3**	NA

Source: Own investigation (2006)

The entry 'Others' refers to the size of fallows, grazing land owned by each family, in this analysis, it is not really evaluated. However, from the village head interviews, it is estimated that each household poses more than 1 ha of fallow and grazing land (unplanted land), which is similar to the situation in Houaphan Province.

3.2.7 Financial Analysis of Farm Households: Earning, Cost, Economies of Kham District, Xiengkhouang Province

Table 27 summarizes the revenues and costs for different income sectors of the households, which are called "the household income sheet". This income sheet represents the income formation of the average farm household in Kham District, Xiengkhouang Province. All prices reflect 2005 costs, harvesting outputs, and so forth.

For paddy rice, upland rice farm sector, their gross revenues are estimated on the quantities of rice produced each year combined with the rice price that exists in the local market of the Kham District. Similar to livestock and the NTFPs sector, they are calculated on a basis of the quantities produced combined with the local market price. Furthermore, the wage price, which is obtained through the employment sector, is not really evaluated but fixed at 20,000 Kip per day as an average, which is what a farm household could earn from the local wage market.

The analysis shows that among the item 'gross revenues' from different sectors, Paddy rice with area of 0.88 ha has contributed the greatest portion, which cover one-third of the total gross revenue (6,302,000 Kip p.a.), whilst NTFPs the lowest part making up only 2 per cent of the total gross revenue. The income from livestock is ranking second. It is noticeable that the gross income from farm garden is also significant (21) making up almost 4 million Kip of the entire income, most of which is cash income. In addition, the proportion of the total gross revenue from employment, and upland rice sectors brings in 13 per cent, 8 per cent, and 4 per cent to the total gross revenue of each sector, respectively.

Similar to the situation in Houaphan Province, since the majority of households use their own labor for the production of all sectors, as explained earlier, the cost of labor[6] is estimated on the basis of labor requirement combined with prices of the regional labor market for each sector. The labor requirement for farm production was scrutinized during the field research, i.e. the calendar of farm production was used in the group discussion in order to generate the number of workload of each farm sector. The result shows that the labor requirement for paddy rice, upland rice farm, and farm garden are identical to each other.

The total labor required for producing all income sectors amounts to 7,157,000 Kip per the average household p.a. Of these, the proportion of labor requirement for paddy rice is the highest part of the entire cost, whilst that for collecting NTFPs is the lowest part. In the analysis, the costs of labor incurred in the production process of livestock sector, i.e. the cost of labor raising, i.e. feed inputs to livestock were ignored due to its complexities and difficulties to derive values. Similar to the cost incurred in bamboo and employment sector, they are ignored in the analysis.

The costs of seed is estimated by the quantities of rice used for each sector combined with local price of rice (1 kg of rice =2,000 Kip). Almost all of the households in the region use their own seed for the farm production. The cost of farmland tax is indicated as entailing the same cost for both paddy rice and upland rice farm. Similar to Livestock sectors, cattle tax is only levied at a rate of 18,000 Kip per head per year, with the rest of the livestock exempted from tax. The capital cost or 'a normal return to the capital' is calculated on the basis of the total capital combined with the interest of the borrowing rate of 19 per cent p.a., which is obtained from Agriculture Promotion Bank The analysis shows that the capital cost of paddy rice sector is the highest part (45%).

According to the model calculation, the entries under 'balance' or net income represent the land rents or the income streams from each sector. It is shown that from the standpoint of the average farm household in Kham District, the income streams from paddy rice, upland rice, farm garden, livestock, employment, and NTFPs sectors are 2,400,000 Kip, -1,124,000 Kip, 1,847,000 Kip, 4,145,000 Kip, 2,520,000 Kip, - 174,000 Kip respectively, while only those of upland rice and NTFPs sector are faced with negative land rent, owing to the fact that the labor for this production is relatively time consuming. It is noticeable that the net income from selling livestock is the highest part of the total income.

Table 27: Income sheet of an average household unit in Kham District, Xiengkhouang Province

Items	Average Revenue and Cost per Household (Kip per year)						
	Paddy rice (Kip/0,88 ha)	Upland rice farm (Kip/0.32 ha)	Farm garden[©]	Livestock[®]	Employ-ment[§]	NTFPs	Sum
Gross Revenue	6,302,000 (33)	1,464,000 (8)	3,970,000 (21)	4,261,000 (23)	2,520,000 (13)	360,000 (2)	18,877,000 (100)
Labor	3,166,000 (44)	2,111,000 (29)	1,346,000 (19)	- (0)	- (0)	534,000 (7)	7,157,000 (100)
Seeds	71,000 (17)	46,000 (11)	291,000 (71)	0 (0)	0 (0)	0	408,000 (100)
Land tax (livestock tax)	42,000 (14)	18,000 (6)	147,000 (48)	98,000 (32)	0 (0)	0	305,000 (100)
Capital costs	623,000 (45)	413,000 (30)	339,000 (25)	19,000 (1)	0 (0)	0 (0)	1,394,000 (100)
Balance (Land rent)	2,400,000 (25)	-1,124,000 (-12)	1,847,000 (19)	4,145,000 (43)	2,520,000 (26)	-174,000 (-2)	9,614,000 (100)
Income*	6,260,000 (34)	1,446,000 (8)	3,823,000 (21)	4,164,000 (22)	2,520,000 (14)	360,000 (2)	18,573,000 (100)
Sum[¶] (Σ)	6,302,000 (33)	1,464,000 (8)	3,970,000 (21)	4,261,000 (23)	2,520,000 (13)	360,000 (2)	18,877,000 (100)

Note: Figures in parentheses denote percentages. [§]employment means the income of households from temporary jobs during off-farm season. *means that income of the average household, which represents the net calculated income including the cost of land rent, own labor and own capital, and Sum[¶] is the sum of all costs. [©] *refers to the sum of income from banana, onion, vegetable and watermelon farm* [®] means the summary of income and cost from cattle, pigs, poultries, and fish. (Exchange rate: 1 US. Dollar = 10,400 Kip on November 2006)

Source: Own calculation based on data from field research, 2006.

The item 'income' means the real income of the average farm household including their own labor, own inputs to the production. In the study area, almost all of the farm households used their own labor for farm production (paddy rice, upland rice farm, etc.), while others use labor from their relatives. Additionally, very few hired other poor farmers in the region. Therefore, in this analysis, the real income of the average household is therefore: **Labor cost + Seeds + Capital costs + Balance = Average Household Income (AHI)**

As can be seen under the entries 'income', the average household is faced with positive land rents for all sectors. Of these, most of the income is derived from the paddy rice sector, which takes a third of the total income (34%). The average household procures 21 per cent of the total income from farm garden sector, while the income from the upland rice and NTFPs sector plays a slightly important role for the entire income formation of the average, since the enforcement of land and forest allocation policy, which prohibit the farm household to practice the shifting cultivation (upland rice).

The result of the analysis also reveals that the rural households in the region have larger proportion of farmland size than in Houaphan Province, and moreover, the rice productivity is more desirable due to the fact that in this region, there are support from international organization which provides support in term of technology, i.e. method of soil improvement, credit supply. As a consequently, almost households in this region have enough rice for their own family consumption, and then many families can sell their rice and livestock for cash income.

Looking at the overall result, it becomes clear that the total real income measured is 18,878,000 Kip per household or equivalent to 2,697,000 Kip ($259) per person.

3.2.8   Summaries of Working Calendar of all Farm and Off-farm Sector of Kham and Phaxay District.

Table 28 illustrates the summaries of the holding size, net income, and working calendar of all farms and off-farm sector of the average farm household in Kham and Phaxay District, Xiengkhouang Province. The analysis shows that the number of man days spent per household in October is the highest for Kham District (69 man-days). During this time, the family of Kham District spends their time in garlic, watermelon farm. However, in Phaxay, the families of Phaxay District spend their time for paddy rice sector in June, thus their main income derives from paddy rice sector.

From the analysis, it shows that the households in Kham District obtain the greatest net income from paddy rice as the non-cash return, and from farm garden as the biggest part of the cash income. In this District, the net income from Livestock sector is ranking second, while the net income from employment sector is also high, making up 2.5 million per average household. Likewise, the farmers of the Phaxay District also procure the greatest net income through paddy rice sector, and then from livestock sector. The net income from NTFPs sector is very small proportion, which is the lowest part comparing to Kham District or all study areas.

Table 28: Summaries of average farm household income and Working Calendar of all Farms and Off-farm sector of Kham and Phaxay District.

	Activities	Aver. Farm area (1000kip)	Av. Income per day per HH (1000kip)	Months (Number of man days each month)											
				1	2	3	4	5	6	7	8	9	10	11	12
Kham	Paddy rice	0.88	6,260	0	0	0	11	12	22	18	19	3	3	35	35
	Upland rice	0.32	1,446	0	10	6	5	13	9	7	7	7	25	3	0
	Farm garden*	0.40	3,823	12	13	14	11	8	2	2	2	2	13	11	27
	Collect other NTFPs	NA	360	3	3	3	2	2	2	2	2	2	2	2	2
	Livestock	NA	4,164	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Labor selling, petty trading	NA	2,520	7	7	6	6	5	5	5	5	5	5	5	5
	Sub-Total	**1.6**	**18,573**	**22**	**33**	**29**	**35**	**40**	**40**	**34**	**35**	**19**	**48**	**57**	**69**
	Sub-Total Labor per HH	**3.00**	**NA**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**	**90**
Phaxay	Paddy rice	1.20	9,197	0	0	0	0	18	92	48	17	17	35	52	0
	Banana farm	0.22	51	3	3	2	2	2	3	2	3	2	3	3	3
	Orange, cassava farm	0.74	557	0	0	0	2	4	2	2	2	3	3	2	2
	Corn, vegetable, and fruit tree	0.77	324	0	0	2	2	3	5	5	6	11	17	0	0
	Collect NTFPs	NA	81	1	1	1	1	0	0	0	0	0	0	0	0
	Livestock	NA	5,502	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Labor selling	NA	1,336	7	7	6	6	5	5	5	5	5	5	5	5
	Sub-Total	**1.34**	**17,048**	**11**	**11**	**11**	**13**	**32**	**107**	**62**	**33**	**38**	**63**	**62**	**10**
	Sub-Total Labor per HH	**2.62**	**NA**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**	**78.6**

Note: * refers to the sum of income from banana, onion, vegetable and watermelon farm. HH= household; NA= Non-applicable

Source: Own Investigation, 2006.

3.3   Policy and Institutional Arrangements

Key issues in the village related to natural resource management are tenure and equity, particularly access and use rights of natural resources. Thrusts of government are to control logging and settle shifting cultivation through decentralization and partnership with villages (Tsechalicha and Gilmour 2000). 187,000 families (30% of the population) still depended on shifting cultivation in the mid 1990s and it remains a key and complex issue in rural villages.

A number of recent natural resource policy reviews are available (Raintree and Soydara *in press*, Tsechalicha and Gilmour 2000, Gilmour *et al.* 2000). We will therefore summarise (rather than detail) the key stages in law and policy development related to natural resource management from 1975.

Before 1975, the scope of forest policy development was limited due to the ongoing war. From 1975-1989 the government concentrated on trying, largely unsuccessfully, to restrict shifting cultivation. Nine State Forestry Enterprises were also established at this time to undertake responsibilities in logging and forest management (**Decree 74** on Forest Management, 1979). In 1980, the government declared 1st June would be National Tree Planting Day (Tsechalicha and Gilmour 2000).

In 1989 the first national forestry conference was convened and made recommendations towards a shift from forest exploitation towards forest restoration, preservation and reforestation (**Decree 117/CM** on Management, Use of Forest and Forest Land). In 1991 (**Decree 67/PM**) the government banned logging in all national forests. This was only partially effective (*ibid.*). In 1997, a '2020 vision' was developed by the Department of Forestry, with the aim of increasing forest cover from less than 47% currently, to 70% by 2020. This vision identified a number of priorities, including allocating land to rural families, developing alternatives to shifting cultivation; and it also incorporated the development of National Biodiversity Conservation Areas (NBCAs) (Ingles *et al.* 1998). The procedures for the establishment and management of NBCAs were made in 1993 under **Decree 164/PM**.

The principal current legislation dealing with the devolution of rights, management and use of forest lands to the village level are the Forest Law (1996), the Land Law (1997), the Agriculture Law (1998) and the Environmental Law (1998). These laws provide an intention to decentralise and implement participatory natural resource management (Sawathvong *undated*). The Government assigned land use rights to individuals and households through land allocation program; in which a part of production forestry lands was allocated to the villages for long-term use by local village authorities who are key persons who take care with the fixed purposes designed by the government, but they have no right to sell those lands because land is still national asset.

Regarding to the new policy has somehow encouraged people to stop the shifting cultivation (planting rice in the uphill area). As a consequence, some people stop the

shifting cultivation and start to plant corn, bean for cash income instead. In the study area, it shows that some farmers cut and burn the bamboo forest and convert them into corn, bean farm, and upland rice farm, since in these areas, bamboo resource are not economic like in Viengxay District. Even in Viengxay District, farmer slash and burn the bamboo forest which is far away from the road.

Recently, the local government of the study province has enforced the law not destroying the bamboo forest, since they aware of the economic value of bamboo resource exporting to Vietnam since 2001 and the Vietnamese investors are planning to establish the bamboo factories in Houaphan and Xiengkouang Province.

At present, bamboo forest resources are available both in bamboo forest type and upper mix deciduous forest type. They are collected at no cost from the government forest reserves. However, collectors must pay tax to the village administration, for instance in Viengxay District, the village tax cost 5 Kip per 1 kg of splitting bamboo Koune.

Under the New Economic Mechanism Reforms from 1989, greater involvement of the private sector is taking place in Laos. Privatization of all main means of production in the Lao economy was being taken in the policy arenas that are encouraging the participation of the private sectors as well as the communities to own land and natural resources including bamboo forest, and forest. In addition, the Government of Laos has tried to create a good environment for the foreign direct investment since 1989. Once such policy changes are instituted, local villagers and commercial investors will have access to resources that would enable investment in for example establishing bamboo plantations. From the study, it show that a majority of interviewed households are willingness to invest in the bamboo plantation, if the capital credit is available and there are market for bamboo sectors. With regarding to these issues, local villagers are extremely requiring the support from the both the government and internal organization in term of financial and technical support.

3.4   Market participation and Farmer organization of the bamboo sector

The market participation is that the system of Bamboo marketing firstly involves interaction from managing bodies at various levels of government (PAFO), in the process of issuing quotas, and in the management and monitoring of trade. These bodies generally do not come into direct contact with the Bamboo and so is not part of "the chain" as such. They are, however, crucial in the marketing system. Once getting the formal permission letter from PAFO with the given quota, the trader, accompanied with PAFO, and DAFO staff often coordinate with heads of the villages in order to get labor for bamboo harvesting. Usually, the head of village will get paid with the cash advance of about 3,000,000 Kip per village from the trader as the deposit. Then the head of village informs his village members regarding to the harvesting quota allowed by the government that they can harvest. Therefore, the bamboo harvesting in this district is quite competitive among the village members that result in over exploitation of the natural bamboo resources.

Farmer organization is quite informal. Villagers have formed their own structure as follows. Usually, heads of the villages are key contact persons (mediator) between harvesters/farmers (village members) and the traders. For example, in Viengxay District, there is only one trader (Le minh Chau) who came and bought the bamboo usually Bamboo Kouan from the District. The head of the village often announce the quantity of bamboo demanded by the trader when orders came in the village. The price of bamboo is 210 Kip per Kg (Price in 2005), which will go to the household income. Of these, 5 Kip will be taxed and kept in the village development fund.

4 DISCUSSIONS AND CONCLUSIONS

This study is the first attempt to provide background information on the bamboo sector in Laos in general, and in Houaphan and Xiengkhouang Province in particular. Furthermore we try to analyse the socio-demographic profile of the host communities in the study area as well as analyze different income sector including bamboo sector of farm household in the study area.

The study was conducted in two provinces, namely Houaphan (District: Viengxay and Xiengkhor) and Xiengkhouang (Districts: Phaxay and Kham). 12 villages in the two provinces were chosen for the field study.

Data gathering involved 134 respondents consisting of farmers (115), village heads (12), trader (1), DAFO staff (4), and PAFO staff (2). In addition, group discussion was done in each village in the two study provinces. The number of the group discussion (7-35 participants) was 24 for the two study provinces.

Here we have tried to quantify the different income sectors including bamboo sectors by using data from household surveys, group discussion and key informants interview and by looking at the income situation of the farm household in the two provinces.

We employed a multi-method approach, namely participant observation, individual depth interviewing, group interviewing, and documentary research. The advantage of this method is that it can benefit from triangulation, which involves choosing different methods based on their individual strengths and compatibility (Fontana and Frey, 1998; Huberman and Miles, 1998; this study). Moreover, used in combination, these methods can help strengthen the consistency and validity of the data, improving their reliability and contextual value (Denzin and Lincoln, 1998; Huberman and Miles, 1998). As Robert Yin (1989) pointed out "with triangulation, the potential problems of construct validity can be addressed, because the multiple sources of evidence essentially provide multiple measures of the same phenomenon".

By decomposing different methods for income estimation, we are able to find out the income situation. This method of moment's technique allows us to construct the income

sheets for households in the two provinces.

The study of the bamboo survey in Houaphan Province found that the total bamboo areas in Viengxay District are approximately 54,382 ha in the upper mixed deciduous forest (UMD) and 1,140 ha for the pure bamboo forest. (PB). In contrast, the total bamboo areas in Xiengkhor District are 17,920 ha for UMD and 10,059 ha for pure bamboo forest. As a consequence, by quantifying the average number of culms per hectare (from sample plots analysis), the total numbers of culms in PB in Viengxay is 4.6 million, while those in Xiengkhor are 40.7 million. For UMD, the numbers of culms in Viengxay District are 496 million, and those in Xiengkhor are 163 million in UMD. By looking at the overall result of the Houaphan Province, it becomes clear that the total bamboo area in UMD is 508,368 ha which consists of 4.6 billion culms, while that in pure bamboo forest is 17,870 ha that consists of approximately 72.4 million culms in the province.

Similar to the situation in Houaphan Province, the analysis of Xiengkhouang shows that the total area of the upper mixed deciduous in Phaxay District is 21,304 ha. As a consequence, by quantifying the average number of culms per hectare combined with the bamboo area per district, the total numbers of culms for Phaxay are 65,989, 000 in UMD. Pure bamboo forest does not appear in Phaxay District. By looking at the overall result of the province, it indicates that with the total bamboo area in upper mixed deciduous in Xiengkhouang Province of 461,737.00 ha, it consists of 1.4 billion bamboo culms, while in pure bamboo forest of 1,337 ha, it consists of approximately 5.4 million culms.

The study found that the most commonly cultivated species are Bamboo Loung, and Bamboo Phang (Bamboo   *D. lonoifimbriatus*) in Xiengkhouang and Houaphan Province. The purpose of the planting is only for domestic use. From the analysis of the sample plot 3 and 4, it is obvious that the average number of culms that farmer can realize is 2,832 culms per ha.

The calculations in Table 13 show the land value (land rent) in agricultural farm productions from the standpoint of the households in the Houaphan region. If one tried to find out the profitability of these sectors from the standpoint of the households by running calculations for different farm sectors, in case that the households use the cost of labor from outside, one might only end up with negative land values or the land values (the profit) is not desirable for farmers, meaning that it would be more profitable to let the land lie idle or transfer it to some other uses. However, most of the farm households in this region used their own labor and input in the production process, while others used the labor from their relatives. Recalculations by considering their own labor cost, and own inputs to production process reveal that the farm households in this region are faced with positive land values.

In addition, one of the surprising findings found that the cash income that derived from the bamboo sector has contributed the highest part of the total cash income of the average household in Viengxay District after that from livestock sector.

The calculations in Table 13 also indicate that the income from the upland rice sector

(Shifting cultivation) is not desirable for the farm households in the Houaphan region. This problem has to be mentioned here, since rice is the main food intake of the rural households in Laos in general and Houaphan Province in particular. The rice yields are extremely low due to the enforcement of the shifting cultivation stabilization program enforced by the government which allows the shorter fallow of the rotation. This leads to the cause of degraded soil. The empirical investigation shows that average farm household of five people produces less than 1000 kg of rice p.a. while they consume about 1500 kg p.a. (Foppes J., Ketphanh, S. 1997). Therefore, a majority of the households in this region have not enough rice for basic consumption. Usually, the time of rice shortage begins from late January on wards after a month of rice harvesting in November. In order to get enough rice for their basic consumption in one accounting year, they have to produce more income from selling their livestock, bamboo harvesting in Viengxay District, and crop farming (corn, soybean, etc.) in Xiengkhor District, and these are used to trade for rice to alleviate annual food shortages.

From the analysis in Table 16, it shows that the families of Viengxay District have more free time than those of Xiengkhor District. While the families of Viengxay District spend their time on harvesting bamboo from natural forest for cash income, those of Xiengkhor spend their time on shifting cultivation, corn and bean cultivation for their cash income.

The average income of the Viengxay household is approximately 10 million Kip per year, whilst that of the Xiengkhor household is relatively higher, making up over 14 million kip per year. The analysis also found that the biggest part of the average farm household income from the two districts derives from livestock productions, which consist of cattle raising, pigs, poultries, and fish raising. As mentioned above, it is an interesting finding that the average cash income of the family in Viengxay District from bamboo harvest is ranking second, while that in Xiengkhor District from Bamboo harvest is zero due to the fact that there is no trade of bamboo in this region. Bamboo is only used for domestic consumption. Some farmers slashed and burn the pure bamboo forest in order to establish their crop farming because of the income incentives from them. No doubt, the proportion of the bamboo forest will decrease substantially. Therefore, it is recommended that relevant authorities should consider this problem carefully. Perhaps, a possible solution could be making efforts to create the management plan for the sustainable use of the bamboo resources in the region. Such required efforts are to start with providing the awareness on the importance of the bamboo resource, and especially getting the households involved in the decision making during the land allocation process.

One important finding of this study found that the economies of Kham District in Xiengkhouang Province relies heavily on the paddy rice sector (non-cash income), and farm garden sectors, i.e. garlic, banana, vegetable, and watermelon garden. This result is a further confirmation of the empirical study of DAFO report (2005). As can be seen clearly from the household analysis of the study (Table 27), the proportion of the income from the paddy rice sector is the largest and is on average one third of the total household income of Kham District region.

Though the result of the analysis has proved that the bamboo sectors in Viengxay District

in particular and in other regions in general has high potential for increasing the income condition of the Viengxay region, there are some constraints which hinder its extension. On one hand, the majority of the households in the region have relied only natural bamboo forest without proper management intervention from PAFO or DAFO, and on the other hand, their holding size of bamboo plantation is very few. Therefore, it is very important for the central government to carefully think about the over exploitation of bamboo resource in the natural forest that might exist. A possible solution could be providing policy incentives for enlarging the bamboo plantation. However, this matter should be carefully solved, since there are many factors involved in enlarging the plantation of the farm household. For instance, the credit capital is one of the most important means to enlarge the plantation. In addition, there should have the opportunities for farm households to have special educational programme, such as training courses, or study tours in other regions that have experiences with this subject matter.

One of the key findings from village studies and the self-assessment of Project field teams found that the majority of the farmers are willingness to invest and enlarge their bamboo plantation, especially the local farmers in Viengxay District in Houaphan Province. However, they are still concerned with problems mentioned above. The entry points for overcoming the constraints are provision of the capital credit, management of bamboo resources, skills training, marketing and diversification of products.

In this study, we have not touched on the input market studies (services, goods or materials that are used by bamboo producers as necessary part of their faming/business activities, i.e., Agro chemicals/fertilisers, transportation, storage, processing equipment, etc.) since in Laos in general and in the study areas in particularly, the bamboo sector is still in the initial stage, and the market inputs have not existed yet.

In a concluding remark it is tempting to say something about the importance of the kinds of our analyses. Such empirical investigation does not show whether a prevailing or contemplated central government policy is wrong or right, but how political measures work, and what their economic rewards are. Even though such kind of analysis is the first attempt in Laos in general and Houaphan and Xiengkhouang region in particular, it is hoped that the relevant authorities should consider or base their decisions upon these findings.

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