

CHAPTER 4

Transformation of shifting cultivation to rubber plantation

4.1 General context of the study area

Oudomxay province is hilly region of the country with low population densities, low incomes, and low access to inputs (NAFRI, et al. 2005). Rice is an important element and source of nutrients of Lao people, generation an income for smallholder farmers and national socio-economics. Its production is low potential that caused to deficit in upland rice for consumption. In addition, the upland rice and paddy rice play importance roles in food supply for rural livelihood and taking place of local markets. People in Oudomxay rely on their rice production for daily consumption. Rice is an important food sources, income and social welfare for many rural households in Northern Province of the Lao PDR. Therefore, they are also the source of food security.

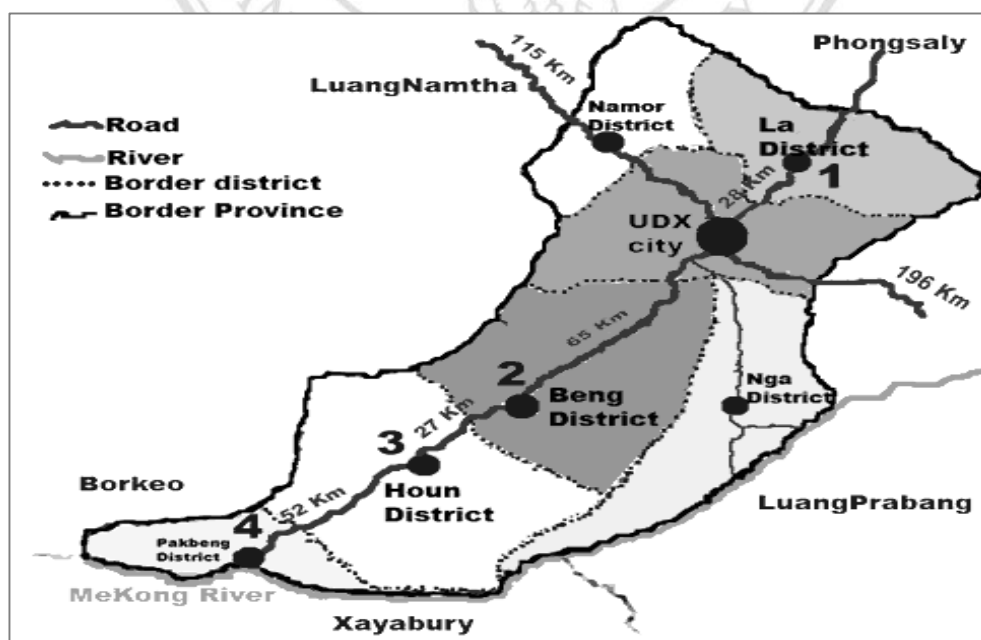


Figure 4.1 Geography map of Oudomxay province

Source: PAFO (2014)

The same time, agriculture practice and system in the Northern part has been changed. Vonvilay (2007) found that particularly the rubber plantation had increased and changing into mono cropping system in the upland.

The protection areas of forests and non-timber forest products (NTFPs) were found on the altitude above 1,000 to 1,500 m of sea level. The rubber plantation, maize, job's tear and other cash crops were found on the altitude above 500 to 1,000 m of sea level. The cultivating of rice production and growing of vegetables were found on the altitude above 170 to 500 m of sea level (Figure 4.2).

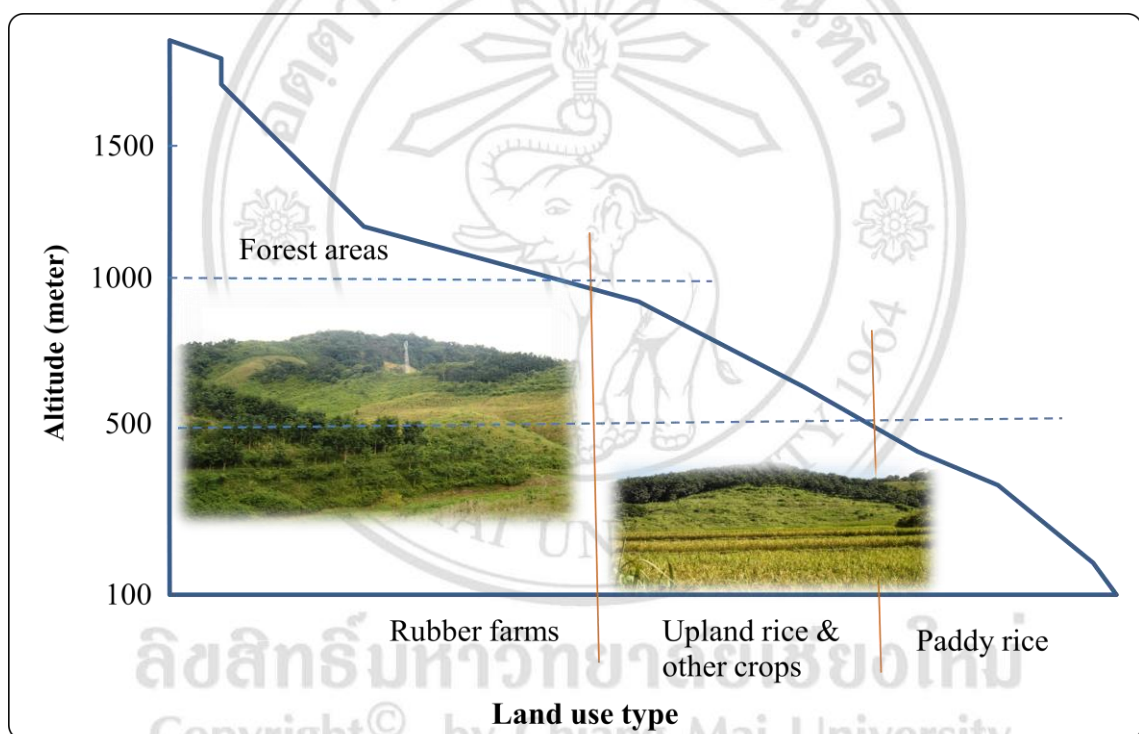


Figure 4.2 Agriculture land boundary in Oudomxay province, Lao PDR

Source: Field survey (2014)

4.1.1 Background and historical of the study areas

The land use type in Oudomxay province has upland areas 87 percent and lowland areas 13 percent. The majority of crops cultivation in Oudomxay province was upland rice, maize, job's tear and some cash crops. The many of agricultural land were on mountainous areas. The differences of crop cultivating pattern were found in the many

upland farming practices. The people used these crops production from their farms to sell as profitability for their households' incomes and food crop production for supporting the household food consumption and household expenditures.

Rubber plantation was promoting in Namor and Xay district whereas the benefit of rubber plantation could bring the sustainable agriculture practice and improve the rural social-economic at the villages levels. However, these villages were poor people and low income. The livelihoods were depended on the upland agriculture practice and collecting the non-timber products (NTFPs) for maintained their household food security and food expenditures. The upland rice cultivation still was a necessary crop as stable food for consumption in many households and used as household food security due to occurred the drought and flooding periods.

The ethnic majority in Namor and Xay district was Lao-loum, Khmu and Hmong people. These people have lived in the mountainous areas that had hilly terrain land and cultivate their crops only on the rainy season. The education level and health status was quite low which the most people had an insufficiency the income to supporting their children to school or buying medicine for their families. Therefore, many villages were difficulty to access to the main road and market in the district. Subsistence traditional cultivation or shifting cultivation has been remaining an important role on the upland farming practice for many households.

The rubber plantation was promoted under the sustainable agriculture farming practice policy. Oudomxay province was one of many provinces in Lao PDR that were successively on the rubber plantation in the upland areas. The benefit of rubber plantation could bring the sustainable household income and improve the household livelihoods at village levels. Nevertheless, rubber plantation still was an alternative upland farming practice for many farmers in Oudomxay province. The historical of introducing the rubber plantation, which the southern part was promoted by Thai rubber company group and northern part was introduced by Chinese company. Upland rice and fallow land were replacing by rubber plantation about 20,000 ha (4,530 plants species) in Oudomxay province alone that large area of rubber plantation was found in Namor and Xay district. These districts were introduced by Chinese's rubber company who became the buyer from farmers. Since in 1990s, the existing of traditional upland rice

farming system was popular for cultivation in this province. After year 2003 to current year, rubber plantation had expanded planting areas into many villages in Namor and Xay district.

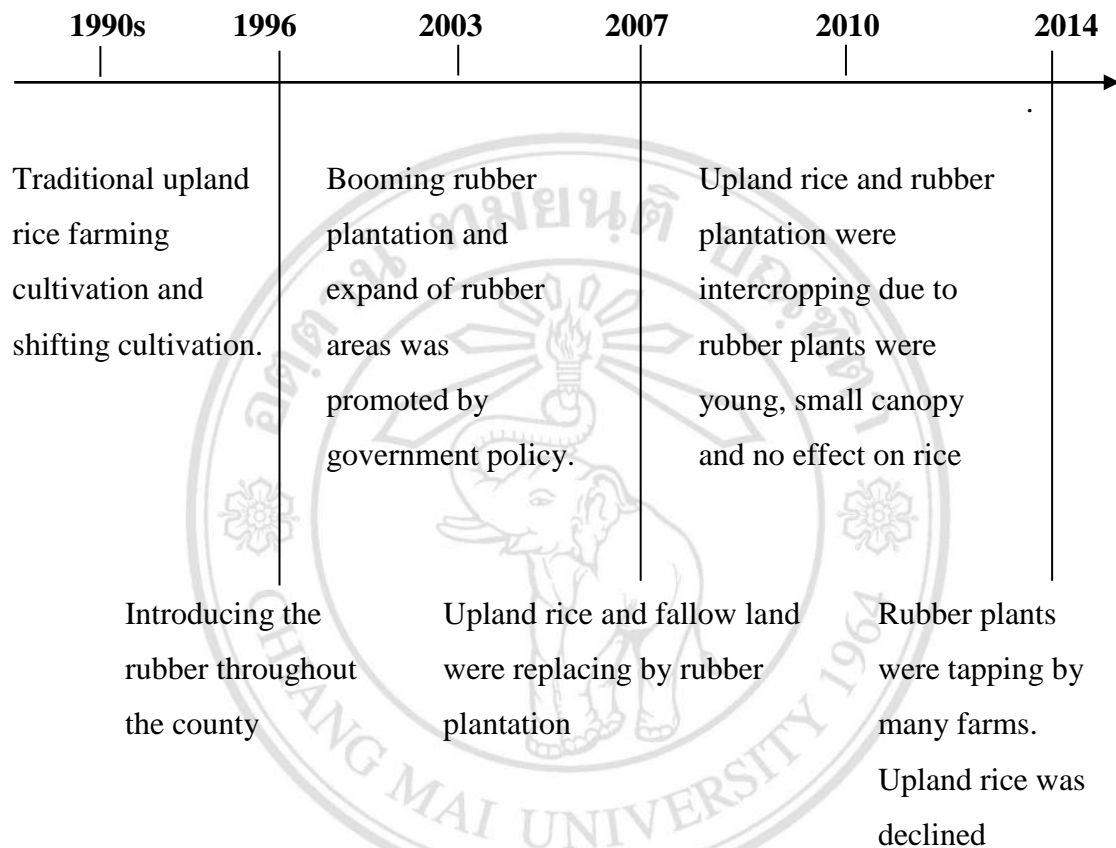


Figure 4.3 The historical of transformation from shifting cultivation to rubber plantation in Oudomxay province

Source: Modified from PAFO (2014)

4.1.2 Demographic

This study also found that the young group (age 15-30 year olds) shown in the upland rice subsistence farming system (UR) 35percent, upland rice with rubber plantation (URRP) 20 percent and rubber plantation (RP) 10 percent that data was shown in table 4.1. Second group was adult between age 31-50 year olds that found in UR 46.7 percent, URRP 58.3 percent and RP 55 percent. The highest of aging of farmers was between 50 to above 70 year olds showed in RP 35 percent, URRP 21.7 percent and UR

18.3 percent as respectively. The second group was the age between 31-50 year olds. Gender issue was shared usually the working on farm by mother, father, daughter and/or son when the household labour available (Table 4.1).

Household size was categorized in three levels from small size (2-3 people), medium size (4-5 people), and large size of people per household (above 6 people). The household member found that largest member of female was above 6 people per family in RP farm type. The medium size of household member was in URRP farm type about 4-5 people per family. The UR farm type was smallest of household size about 2-3 people (20 percent) of total of farm household in this farm type. The almost of households of UR farm type was about 4-5 people (80 percent). The three farm types were shown similarity working force per family. At least 2-3 people was involved daily in their farm fields that the main labour was mother, father and daughter or son. The URRP and RP was larger number of household member 4-5 people and above 6 people in respectively.

The people on working in UR and URRP were required higher labours for working on farm. Because of rubber plantation was needed more people to maintain the planting, control weeding, and tapping latex of rubber plants. The member in household play a role for working and key decision for crop production of their far field that could bring more opportunity of labours and support the food crop production (rice) for household consumption and productivities on farms. In contrast, few members in family had also less opportunity to use them such as labour for working in the farm field that also affected to a scale of farm production in the farm field.

The education levels of people from this survey were classified in three categories: 1) primary school levels, 2) secondary levels and 3) high school levels. The results from based survey found that education levels above secondary school were found in URRP 80 percent and RP 86.7 percent. The education of most people in upland rice farming system was attempted to secondary school only 55 percent. The highest education levels were in URRP 80 percent and RP 86.7 percent when compared with UR only 50 percent (Table 4.1).

Table 4.1 Demographic characteristics of three farm types

Demographic characteristics	(A)UR (n=60)		(B)URRP (n=60)		(C)RP (n=60)	
	No.	%	No.	%	No.	%
<i>Range of farmer's age(years)</i>						
15- 30	21	35.0	12	20.0	6	10.0
31-50	28	46.7	35	58.3	33	55.0
51=>70	11	18.3	13	21.7	21	35.0
Total	60	100	60	100	60	100
<i>Household size(people)</i>						
2-3 people	12	20	-	-	-	-
4-5 people	48	80	56	93.3	-	-
6=> people	-	-	4	6.7	60	100
Total	60	100	60	100	60	100
<i>Education level</i>						
Primary school	20	33.3	7	11.7	-	-
Secondary school	33	55	48	80	52	86.7
High school	7	11.7	5	8.3	8	13.3
Total	60	100	60	100	60	100

Source: Field survey (2014)

However, despite of farmers attended in secondary school was shown slightly higher education levels in RP 86.7 percent and URRP percent, and Lowest level of education found in UR 55 percent in respectively (Table 4.1). From this field survey found that RP and URRP farming systems were slightly better education and larger of household size. Farmers were oldest people in RP about 51-70 years old (35 percent). In UR had slightly younger people about 15-30 years old (35 percent of total farmers in this farm type).

4.1.3 Weather and climatic conditions

Weather data in 2013 from Oudomxay provincial agriculture and forestry office (PAFO) shown that rainy season had begun from May to September, the average of

rainfall has about 50 mm to 320 mm per month (Figure 4.4). The temperature has average from 16°C to 28°C through year round (Figure 4.3). There is a large variety of agro-climatic conditions with two seasons: wet and dry.

The dry season lasts from October to April every year. This period has low temperature from the end of October to the end of March and is favorable for vegetable production and non-timber products (NTFPs) such as wild vegetables, bamboo shoot from forest areas near by their villages.

The wet season starts from May to October and has average of annual rainfall from 50 to 330 mm. During this period is suitable for the cultivation of upland rice, maize, job's tear, other cash crop and rubber plants.

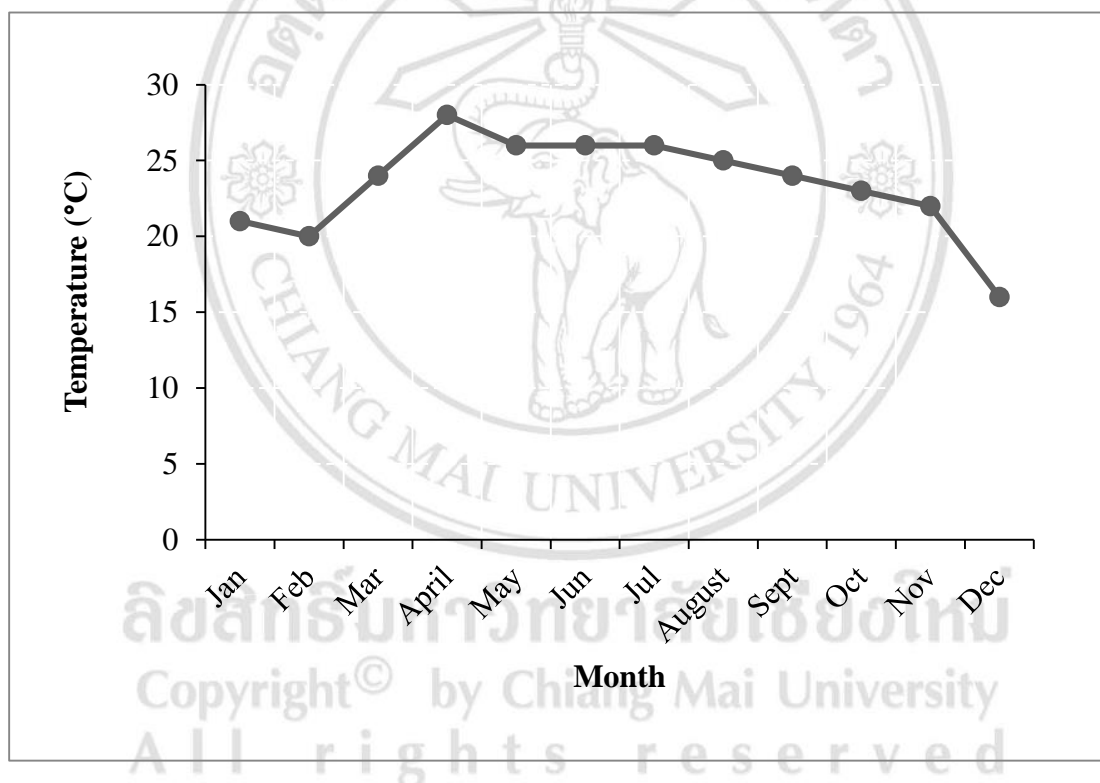


Figure 4.4 The monthly average of temperature (°C) in year 2013

Source: PAFO (2014)

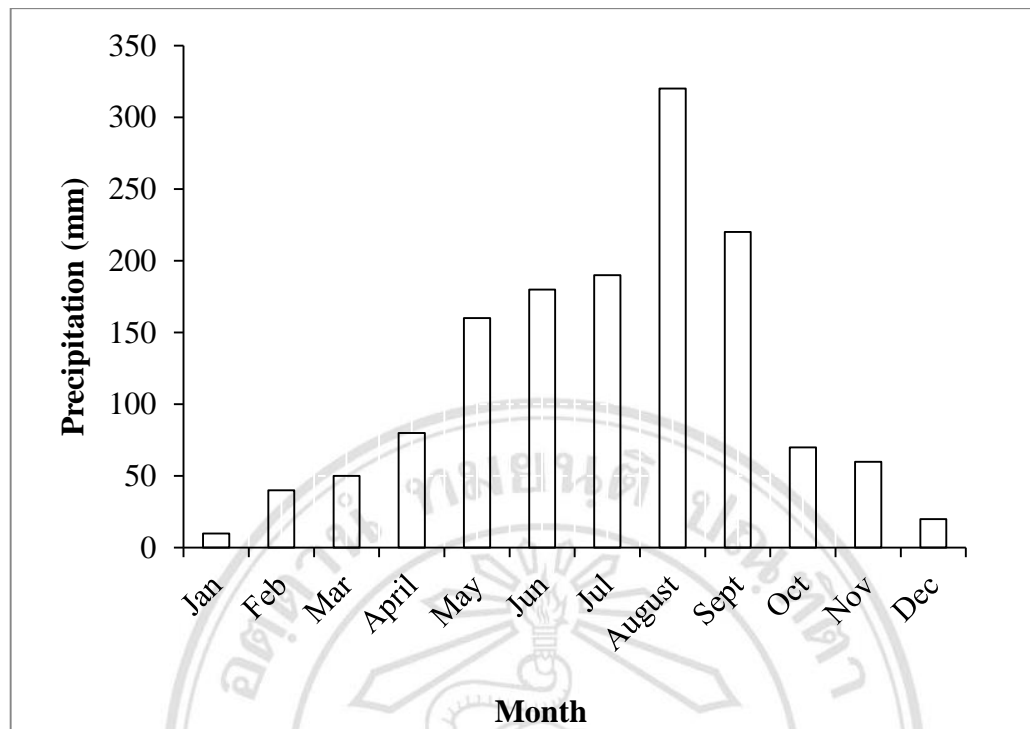


Figure 4.5 The monthly average of rainfall in year 2013

Source: PAFO (2014)

4.2. Socio-economic

The country's current state of development and strategy were essential achieving food security and poor alleviation, particularly in rural areas. The economy and Lao people's livelihoods were highly dependent on the agriculture, especially for food, shelter, medicines and energy. The other importance, agriculture accounted for over 32 percent of total GDP in 2008 and for over 36 percent of Oudomxay province in 2008. Over 80 percent of the labor force is employed in the agricultural sector.

There was a large variety of agro-climatic conditions with two seasons: wet and dry. Agriculture accounted for over 36 percent total GDP in 2008 of Oudomxay province. The majority of agricultural production in this province was rice, maize and job's tear. Rubber plantation has been considered for recovering shifting cultivation and improving household livelihoods as well as household farm-income in the upland. Rubber plantation had two types of farm such as: small-holder farmer within small scale of rubber plantation and larger scale of rubber plantation. However, upland rice production

was dramatic decreasing year by year in this province. In many households were cultivated rice productions as main crop for subsistence food crop for their households.

4.3 Land use and cropping systems

4.3.1 Land use features

Upland farming systems are complex and diverse. Farmers have different characteristics of the practices farming systems from slop land paddy fields to upland fields. Upland farming systems and livelihood strategies are under concerned by local policies on land allocation, and land area development. The aimed of these policies are and emphasize to reducing poverty and stabilizing farming systems. The agriculture system changes a rapid transition from subsistence based systems to commercial farming systems and improving agricultural production to meet regional demand needs at domestic market (Table 4.2).

Crop production had been changing over time through the year 2011 to 2013 in Oudomxay province. Upland rice production areas were slightly decreasing from 2011 around 39 percent, 2012 around 38 percent and 2013 around 23 percent in respectively. Corn production areas were steady increasing from 2011 around 20 percent, 2012 around 37 percent and 2013 around 44 percent. Rubber plantation areas were also increasing from 2011 around 31 percent, 2012 around 33 percent and 2013 around 36 percent in respectively. The area of job's tear production was fluctuating that had influence from price and demand in the markets. Upland rice production was also decreased over time from 2011 around 38 percent, 2012 around 34 percent and 2013 around 28 percent in respectively. This issue could bring the long term problem on household food security and insufficient food consumption to household (Table 4.2).

The risk of agricultural farming systems is influences by several factors (seasonal, drought, flooding and damaged from pest and disease occurring) which affects to rural livelihood and insufficiency on food security. The ranking on problems of rural livelihood and farming systems found that highest to lowest concerned is affected from drought and flooding.

Table 4.2 Crop production and rubber plantation areas in Oudomxay province

Crop production	Year 2011				Year 2012				Year 2013			
	Areas		Production		Areas		Production		Areas		Production	
	ha	%	ton	%	ha	%	ton	%	ha	%	ton	%
Rice	25,026	33.2	84,365	48	24,615	27	77,021	33.1	14,494	16.4	62,760	25
Corn	14,955	19.8	71,400	41	28,195	31	130,200	56	33,400	37.8	157,930	62.9
Job's tear	1,180	1.6	2,610	1.5	2,640	2.9	5,910	2.5	1,545	1.8	6,175	2.5
Vegetables	3,915	5.2	17,345	9.9	3,750	4.1	19,425	8.4	3,580	4.1	24,130	9.6
Rubber plantation	30,296	40.2	-	-	32,396	35	-	-	35,256	39.9	-	-
Total	75,372	100	-	100	91,596	100	-	100	88,275	100	-	100

Source: MAF (2013)

The land holding of three farm types showed differences of farm size, which the largest farm size was upland rice with rubber plantation (URRP) 1.60 ha/household, upland rice with other crops (UR) 1.43 ha/household and smallest farm size was rubber plantation alone (RP) 1.08 ha/household (Figure 4.6). The available land areas for upland rice had been decreasing over time that farmers had to divide their available for planting rubber plants and cultivate more cash crops such as corn, job's tear and some vegetables. Another factor was the availability of household labours and farmer's knowledge that could maintain their productivities in the farm fields. Therefore these factors were influencing to indicate the household farm size and ability to produce more crops in their farms.

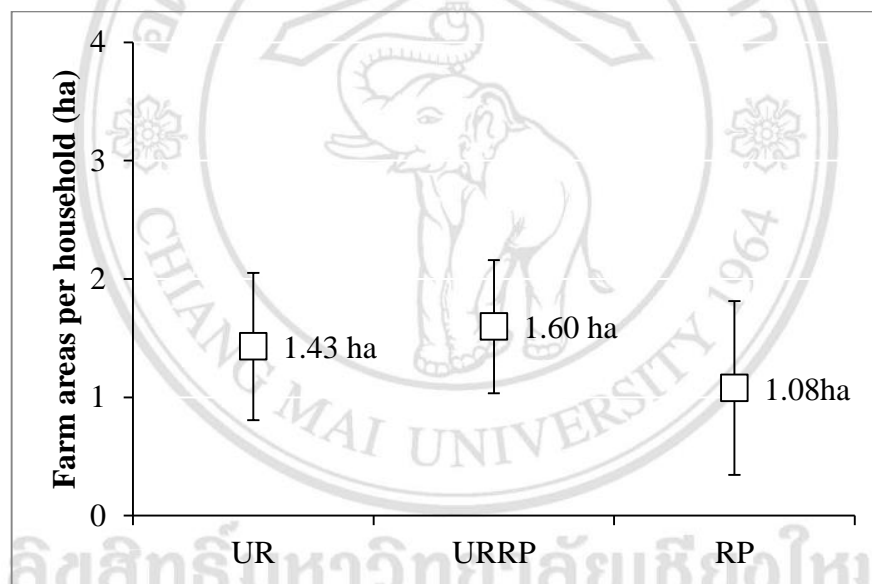


Figure 4.6 Land holding size per household (ha) of the three farm types

Source: Field survey (2014)

4.3.2 Cropping calendar

A) Upland rice farming systems

Shifting cultivation practice was usually cultivation main crop such as upland rice and paddy rice within rotation by cash crops (maize, job's tear and other crops). Upland rice yield has very low when compared with paddy rice. Another hand, the upland cropping pattern systems played an importance role for farmers to cultivate the cash crops

production (maize, job's tear and vegetables) and mixed with raising livestock. Firstly, upland rice and paddy rice was cultivated during the rainy season period, while half of the farm's land was occupied by rice production. This rice production was only for their household consumptions. Secondary crops such as maize and job's tear were main source farm income that they used farm income for support the household expenditure such as purchasing food, rice and clothes for their families. The job's tear was cultivated due to demand from market available and pricing of this crop. Many farmers had best benefit in some fiscal years. Vegetables were grown in dry seasonal during the cold weather and low humidity. The dry season with cold weather was also suitable growing of non-timber forest products (NTFPs) such as several wild vegetables, and local bamboo shoots that it also sprouted in this period of time. Vegetables were used only for household consumption as well as for their vegetables home gardens. Bam shoots was popular wild vegetable for collecting in the protection forest areas near by the village. The bamboo shoots and some mushrooms were collected for household consumption and also for selling to get their off-farm income for supporting their household expenditure on food during the rice deficit in dry seasonal.

Table 4.3 Cropping pattern in (A) Upland rice with other cash crops

Type of crops	Month												
	1	2	3	4	5	6	7	8	9	10	11	12	
Upland rice with maize						Upland rice							
						Maize							
Upland rice with job's tear						Upland rice							
						Job's tear							
Upland rice with vegetables						Upland rice							
						Vegetables							
Non-timber product (NTFPs)	NTFPs												

Source: Focus group discussion (2014)

B) Upland rice farming with rubber plantation farming systems

The same as upland rice farming system. But cultivated land is differences at high level of the altitude, rubber plant were planting in high levels. Firstly, upland rice and paddy rice was cultivated during the rainy season period, while half of the farm’s land was occupied by rice production. This rice production was only for feeding their families’ households. Secondary crops as rubber was occupied late half the land and during the one to three years of rubber growing while farmer had no any profit for rubber plantation. The reason, why farmers had remained their upland rice cultivation in their farm fields that for having enough rice for feeding in their families’ households through the year.

The vegetables and non-timber forest products (NTFPs) were good food crop for household consumption. Most of vegetables were grown in the home-garden. NTFPs were collected from the forest areas nearby village. Vegetable was grown under the dry season during the cold weather and low humidity period. The dry season with cold weather was also suitable growing of non-timber forest products (NTFPs) such as several wild vegetables, and local bamboo shoots that it also sprouted in this period of time. NTFPs played a role for household consumption and also generate t their off-farm income for supporting their household expenditure on food in dry seasonal. Vegetables were usually grown such as for their vegetables home gardens.

Table 4.4 Cropping pattern in (B) Upland rice with rubber plantation

Type of crops	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Upland rice with vegetables						Upland rice			Vegetables			
Upland rice with rubber plantation						Upland rice			Vegetables			
Non-timber product (NTFPs)	NTFPs											

Source: Focus group discussion (2014)

C) Rubber plantation farming systems

In Oudomxay province, mono-cropping system is alone rubber plantation, it is initiated only in Laos therefore, and it is not too late trying diversification of cropping pattern. The situation of rubber plantation in Oudomxay province has two scales of size farm: first farm size as small-holder farmer within small scale of rubber farm and second farm size within larger scale of rubber farm as well as contract farming. Rubber plantation was found initially in Namo district and then rubber plantation areas had expanded to many district of Oudomxay province. Rubber plantation farming type had limited to grow with other crops. Many farmers were laying on rubber farm income for support their families.

Another source of food crop production of this farming type was borrowing the land for cultivation rice production from relative family or neighbor in the village that they had available lands. Therefore, farmers had to borrow land for cultivation rice and other food crops for supporting the household consumption needs. NTFPs were still an important food sources for their household food security. Many farmers collected wild vegetables (NTFPs) such as bamboo, mushroom, banana and other wild vegetables from forest protection areas nearby village. NTFPs played also big role for supporting household food consumption.

Table 4.5 Cropping pattern in cultivating only (C) Rubber plantation

Type of crops	Month												
	1	2	3	4	5	6	7	8	9	10	11	12	
Rubber						Rubber							
Borrowing from relative family						Upland rice							
									Vegetables				
Non-timber product (NTFPs)	NTFPs												

Source: Focus group discussion (2014)

4.4 Vulnerability context

4.4.1 Shocks

Drought was one of household vulnerability for food production such as rice production, maize and job's tear that found in UR and URRP farming types. This problem was also caused to loss yield of the rice production, maize and job's tear. Drought was damaging on harvest loss from rice production, maize and job's tear.

The household vulnerability was effecting by drought and relied on farmer's knowledge and skilled ability to cope to their risk of farm production. Flooding was facing in some year due to heavy rains. Demand of market and pricing of crop was one key the influences to household vulnerability on food consumption and their farm income. The detail of household vulnerability context was shown in table 4.6 for these three farming types. According from survey found that UR, URRP and RP farming types had suffered a weakness to shock when drought and flooding during the near to harvesting period.

Table 4.6 The exposure to vulnerability (shocks) in different farm types

Farm type	<i>Vulnerability context (Shocks)</i>
(A) Upland rice subsistence farm (UR)	<ul style="list-style-type: none">• Drought and flooding were main affect to upland rice farming due to loss rice production and decreased rice yield• Harvesting loss due to changed in seasonal that reach to food insecurity for their households• Prices of crop varied in markets that affected on farmers to access to food availability in market
(B) Upland rice with rubber plantation (URRP)	<ul style="list-style-type: none">• Drought and flooding had caused to declined rice yield• Harvesting loss• Loss young rubber planted by drought and flood
(C) Rubber plantation (RP)	<ul style="list-style-type: none">• Drought and flooding were main problem for many rubber farms• Loss production and quality of rubber latex• Prices of latex varied in markets

Source: Focus group discussion (2014)

4.4.2 Trends

Upland rice farming types (UR), URRP farming type, and RP farming type were concerned by local policies on land allocation, and land area development. These policies were directly to reducing poverty and stabilizing farming systems in the upland areas. The agriculture farming system had been changing a rapidly the transition from subsistence farming systems (upland rice farming types UR) to commercial farming systems (RP farming type). Therefore, this goal was improving agricultural production to meet regional demand needs at domestic market and export of agricultural products. Nevertheless, rice production areas were also decreasing over time due to introducing of rubber plantation. The trend of UR, URRP and RP farming type was shown in table 4.7.

Table 4.7 The exposure to vulnerability (trends) in different farm types

Farm type	Vulnerability context (Trends)
(A) Upland rice subsistence farm (UR)	<ul style="list-style-type: none"> • Upland rice had to shift the cultivating land about 2-3 years, because of soil fertility declined and also decreased rice yield • Maize and job's tear were selected by most of farmers to rotation with upland rice (recovering soil fertility and also generates good profit from farm)
(B) Upland rice with rubber plantation (URRP)	<ul style="list-style-type: none"> • Land use for cultivating upland rice were divided in two part: 1st part for upland rice and 2nd part for rubber plant • Rubber plantation had alternative way for farmers to generate their profit from farm in future • Age of rubber plantation had 1-3 years which can cultivate with upland rice and/or other crops.
(C) Rubber plantation (RP)	<ul style="list-style-type: none"> • Rubber plantation had more high labors for maintained farm during to plant growth (planting, weeding, fertilizing and harvest latex) • Rubber plantation was mono-cropping due to plant canopy that other crops could cultivate under shading of rubber plant

Source: Focus group discussion (2014)

4.4.3 Seasonality

This survey found that seasonally for upland rice farming type (UR) and URPP farming type were started their cultivation on the wet season. Most of farmers had grown usually two crops such upland rice, paddy rice and other crops (maize, job's tear and other crops).

Nevertheless, many farmers have also relied on collecting the non-timber forest products (NTFPs) as well as food consumption during the dry season and cold period. The dry season was the period of deficit of household rice consumption. Upland rice had cultivated only wet-season for UR and URRP farming type. Therefore, some farmers had been facing a problem from drought and flooding during the wet season that caused to seasonal had changed (Table 4.8).

The soil fertility and soil erosion was a key problem for many farmers during the wet season. Upland rice had to shift the cultivating land about 2-3 years that because of soil fertility declined and also decreased rice yield. The changing of seasonal could cause to have a harvesting loss that reach into household food insecurity. Other key problem was a increasing of food prices in markets that affected on farmers to access to household food consumption. In UR farming type such as maize and job's tear were selected by most of farmers to rotation with upland rice. Therefore, crop rotation was best solution for recovering soil fertility and also generates good farm-income (Table 4.8).

In upland rice with rubber plantation farming type (URRP) found that some farmers had not grown rice which following next seasonal year and had to cultivate other cash crops for crop rotation. Rubber plantation farming type (RP) was also influent by changing seasonal, which could affect farmers' profits and incomes to support their household and bought food for meet their consumption needs.

The vulnerability context of rubber plantation farming type (RP) was still facing in the food security issues. Thus, the impact of RO farming type has affected on household livelihood at household level whereas many farmers were depending on harvesting rubber production (latex) and collecting non-timber forest products (NTFPs) from forestry for as their food security and income to supporting households (Table 4.9). Many farmers in RP farming type was suffering due to fluctuated of prices and demand of rubber latex in market.

However, many farmers have relied also in non-timber forest products (NTFPs), which farmer used these NTFPs as food sources during to their deficit of rice consumption and also supporting their secondary household income (Table 4.9). Vegetables were grown for home consumption by many farmers.

Table 4.8 The exposure to vulnerability (seasonal) in different farm types

Farm type	<i>Vulnerability context (Seasonal)</i>
(A) Upland rice subsistence farm (UR)	<ul style="list-style-type: none"> • Many farmers had cultivated only in the rainy season • Rainfall in the season could determine crop yield and production (cropping pattern) • In contrast, some year had enough rainfall that farmer had to harvest rice early with low yield that occurred food insecurity in their household • NTFPs (bamboo, banana, mushroom and others), which supported food for many farmers' households.
(B) Upland rice with rubber plantation (URRP)	<ul style="list-style-type: none"> • Seasonal had important key for farmer selecting proper time for rice production and also planted their rubber plantation • Rainfall within seasonal could reach to rice production for meet the household need and food availability from farm. • NTFPs were also great food sources for households.
(C) Rubber plantation (RP)	<ul style="list-style-type: none"> • Seasonal and rainfall had determined of rubber production that farmers could have good rubber production, quality latex and also good price of latex. • Price of latex was influent by seasonal, which could affect farmers' profits and incomes to support their household and bought food for meet their consumption need. • NTFPs were also necessary food source for households.

Source: Focus group discussion (2014)

4.5 Impact of cropping system on food security

The survey data was used to investigate into three objectives of this study which regarding to food security definition from FAO (2006). Farm types and periods of rubber plantation were an important element to assess the impact of the transformation upland rice field to rubber plantation. The results from group discussion and household in dept-interview were shown significant information on upland agriculture practices from past to present that it has been changing into positively and negatively way on food security in this region (Table 5.16)

Table 4.9 Household food insecurity context in differences farm types

Farm types	Food insecurity status	Impact
(A) Upland rice subsistence farm (UR)	<ul style="list-style-type: none"> • Food insecurity occurred in household, whereas farmers cultivated rice from farm that rice production enough for household was about nine to ten months • Secure food resources from other crops production 	<ul style="list-style-type: none"> • Insufficiencies of rice about one to two months
(B) Upland rice with rubber plantation (URRP)	<ul style="list-style-type: none"> • Deficit of rice production had one month before harvesting new cultivation rice • Purchase and borrow rice from relative cuisine and from villager rice funding (Interest rate 10%) 	<ul style="list-style-type: none"> • Eight to nine months • Insufficiencies of rice about two to four months
(C) Rubber plantation (RP)	<ul style="list-style-type: none"> • Purchase and buy rice for household consumption • Food and household expenditure depend on selling rubber products 	<ul style="list-style-type: none"> • Brought rice from local market and neighbors through a year • Lend a land from neighbor for cultivated rice

Source: Focus group discussion (2014)