RUBBER PRODUCTION IN NORTHERN LAOS: GEOGRAPHIES OF GROWTH AND CONTRACTUAL DIVERSITY

Miles Kenney-Lazar
miles.kenney@gmail.com

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Fieldwork Report

WORK IN PROGRESS, PLEASE DO NOT CITE WITHOUT PERMISSION OF AUTHOR

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ABBREVIATIONS AND ACRONYMS

District Agriculture and Forestry Office	DAFO
District Planning Office	DPO
Foreign Direct Investment	FDI
Gross Domestic Product	GDP
Hectare	ha
Human Development Index	HDI
Lao People's Democratic Republic	Lao PDR
Ministry of Agriculture and Forestry	MAF
National Agriculture and Forestry Research Institute	NAFRI
National Poverty Eradication Program	NPER
New Economic Mechanism	NEM
Non-governmental organization	NGO
Non-Timber Forest Products	NTFPs
Provincial Agriculture and Forestry Office	PAFO
Provincial Planning Office	PPO
United Nations Development Program	UNDP

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INTRODUCTION

A GDP per capita of US$350 and a ranking on the HDI index of 135 out of 147 countries makes Lao PDR one of the least developed countries in Asia as well as the world (Sithong and Thoumthone 2006). According to a 2001 UNDP, 38.6% of the population lives below the UNDP-defined poverty line (Ibid.). Geographically, poverty is strongest in the north and south, and less so in the central region near to the capital. This concentration of poverty is in part due to the physical geography of the country. Not only is Laos landlocked, but 80% of the land area in the country is mountainous (Thongmanivong and Fujita 2006). These mountainous areas remain the poorest in the country due to their isolation. Out of all of the mountainous provinces in the country, the most northern ones retain the highest rates of poverty, especially in remote, upland areas with limited access to infrastructure, markets, and social services, such as education and health care. The lack of development in the country can also be partly explained by the fact that 83% of the population lives in rural areas, out of which 66% rely on subsistence agriculture. In addition, the national economy is highly dependent upon the agricultural sector, which makes up 47% of the national GDP and 80% of the labor force (Manivong and Cramb 2007). The industrial sector is relatively small and is mostly located in the surrounding areas of the capital.

Lao PDR is the least densely populated country in Asia and has long been remote and isolated from the rest of the continent (Ibid.). This role has only recently begun to change. The geographic location of Laos between the booming economies of Thailand, Vietnam, and China has led to the perception of Laos as a potential crossroads of the tightly integrated GMS an organization promoting trade, tourism, and development between countries through which the Mekong River runs. However, as Bouahom *et al.* (2004) point out, this is a role it has been somewhat reluctant to accept.

It has become clear that Laos is changing at a rapid pace even as the ramifications of such changes are not fully understood. Nevertheless, the country will continue to follow this path of development as long as it continues to yield economic growth. Yet what does such a path of development entail and how will it play out in the future? Thus far, the Lao government has conceived the development of the agricultural sector as a crucial part of the country's overall economic development. For the government, this has meant a push to transform the agricultural sector from one that is based on production for subsistence to one that focuses on production for the market. While many of the crops already grown in Laos are marketable, this has also meant the introduction of new cash crops. Most prominent among these has been rubber due to soaring prices over the past few years as well as its potential for smallholder development. Although rubber development has the potential to fulfill promises of poverty alleviation and economic development, its rapid expansion has created a number of problems for farmers. As investment from Chinese companies in the form of growing contracts has spurred the growth of rubber by a majority of villages and farmers, problems have begun to abound. The wide variety of contractual types has had varying socioeconomic effects on farmers entering into them. A loose regulatory environment has allowed investors to use contracts to exploit the land and labor of poor farmers in order to produce rubber in a cheaper and less risky manner. This report examines how this has happened using both a secondary literature review and firsthand fieldwork data. The first section is a background of the historical-geographical development of rubber as a cash crop in northern Laos, examining its origins in China and its transnational transfer across the border to Laos. The second section outlines the methodological framework employed during the fieldwork and afterwards when analyzing the data. The third section, entitled "Geographies of Growth", looks at spatial trends of rubber growth throughout the region

over time. The fourth section makes up the body of the report. This section uses contractual types and the diversity between and within them as a lens of analysis. Through the different contractual and growing types issues of social relations between different actors and resulting socioeconomic effects can be understood. Section five concludes the paper by offering policy suggestions and recommendations to help mitigate negative effects on farmers.

HISTORICAL-GEOGRAPHICAL BACKGROUND

Rubber was first introduced to Laos by the French during in the 1920s in Champasak province, southern Laos (Manivong and Cramb 2007). Yet since that time, rubber has been able to thrive in many different types of terrains and climates throughout the rest of the country (Ketphanh *et al.* 2006). The largest expansion of rubber farming has occurred since the 1990s. Among cash crops introduced to Laos it has grown the most rapidly. In Luang Namtha province, the area of rubber increased from 120 ha in 1994 to 2,950 ha in 2004 and the rate of increase in planting rubber has more than doubled between 2002 to 2004 (Sithong and Thoumthone 2006). A visual representation of this growth can be seen in *Fig. 2* below. Due to the speed at which rubber is expanding throughout northern Laos, as well as the rest of the country, the MAF has not been able to account for how much has been planted thus far.

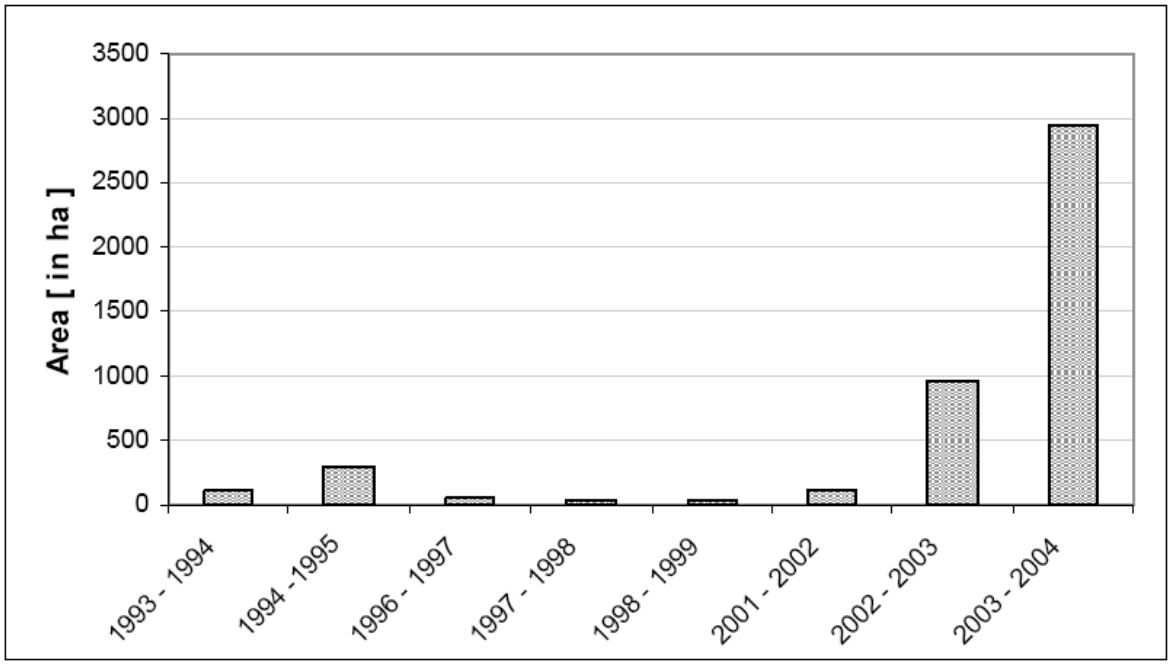

Fig. 2: Rubber Plantation Area in Luang Namtha Province
Source: Sithong and Thoumthone 2006

The rapid expansion of Lao rubber planting since 2003 has been the result of an increased flow of FDI. Today, most provinces in Laos are either planting rubber or planning to in the near future (Ketphanh *et al.* 2006). Most of the investment in Laos has been into regions adjacent to the country or origin of investment. For example, Chinese companies have invested in the north, Thai companies in the central provinces, and Vietnamese companies in the south. Despite the large amount of growth in rubber production throughout Laos, most of the current plantations, as well as those planned for the future, are located in the northernmost provinces. Luang Namtha currently has the most area under cultivation, but other northern provinces, such as Udomxay, Phongsaly, and especially Bokeo, are quickly catching up. An explanation of such rapid expansion throughout the north can partly be attributed to the geographical proximity of the region to southern Yunnan province, China, one of the largest sources of rubber investment, technical transfer, and marketing in the greater Mekong region. In fact, all factors of rubber production in northern Laos originate from China and all latex produced returns to markets in China (Alton *et al.* 2005). Therefore, to understand why the expansion of rubber has occurred in northern Laos, the development of the rubber industry in southern China must first be analyzed.

Rubber was first grown in northern Laos in 1994. A few villages that began to grow this year, the most famous of which is Ban[1] Had Nyao, due to its ability to successfully profit from rubber growth and sale. The area of rubber plantations has greatly taken off in Luang Namtha between 2003 and 2006. This expansion has been characterized by a surge in smallholder planting met by a large increase in foreign investment (Shi 2008). This rubber boom in northern Laos can be explained by economic developments on both a regional and global scale. In recent

[1] *Ban* means village in the Lao language.

years there has been an increase in global demand for natural rubber, which has in turn pumped up rubber prices making it a lucrative cash crop. From 2003 to 2006, the international price of rubber has tripled, turning rubber production a priority among farmers and governments of developing countries (Joshi *et al.* 2006). High global prices mean that farmers can earn more money growing rubber for international markets than most other cash crops, excluding opium (Ketphanh *et al.*2006). The main reason behind this increased demand for natural rubber has been the rapid expansion of the Chinese economy, especially that of its automobile industry. Furthermore, there has been much speculation and rumor concerning the growing demand for rubber from China, which has created a degree of speculation concerning the continued rise in latex prices (Diana 2006).

The increase in commodity prices associated with economic growth since 2002 led to a simultaneous increase in the price of natural rubber and the price of oil, making natural rubber more competitive than synthetic rubber which derives from oil, and thus boosting further the demand for natural rubber. In 2005, the global demand for natural rubber was greater than its production levels and although global demand and production of synthetic rubber was much greater than natural rubber that year, its growth rate was much smaller. Recently, both the supply and demand of natural rubber increased. From 1999 to 2005 the supply ratio of natural to synthetic rubber increased from 40% to 42%, while the demand ration increased from 39% to 42%. Such an increased demand for rubber in China has been a main factor behind the search for more lucrative growing areas outside of the country.

According to Manivong *et al.* (2003), only 30% of latex consumed in China is grown domestically, emphasizing the high demand that has led companies to look for sources abroad. The inability to expand production domestically is largely due to the limited amount of tropical

land within China. Furthermore, a high percentage of the rubber trees of Yunnan are no longer producing latex (Manivong *et al.* 2003). Chinese companies have chosen Laos as a recipient of their investment for a number of reasons. The most obvious is geographical proximity, which provides a number of advantages, such as cheaper transportation costs and a similar growing climate, which is necessary to grow the same strand of rubber tree. Chinese companies are also able to take advantage of cheaper and more exploitable labor in Laos.

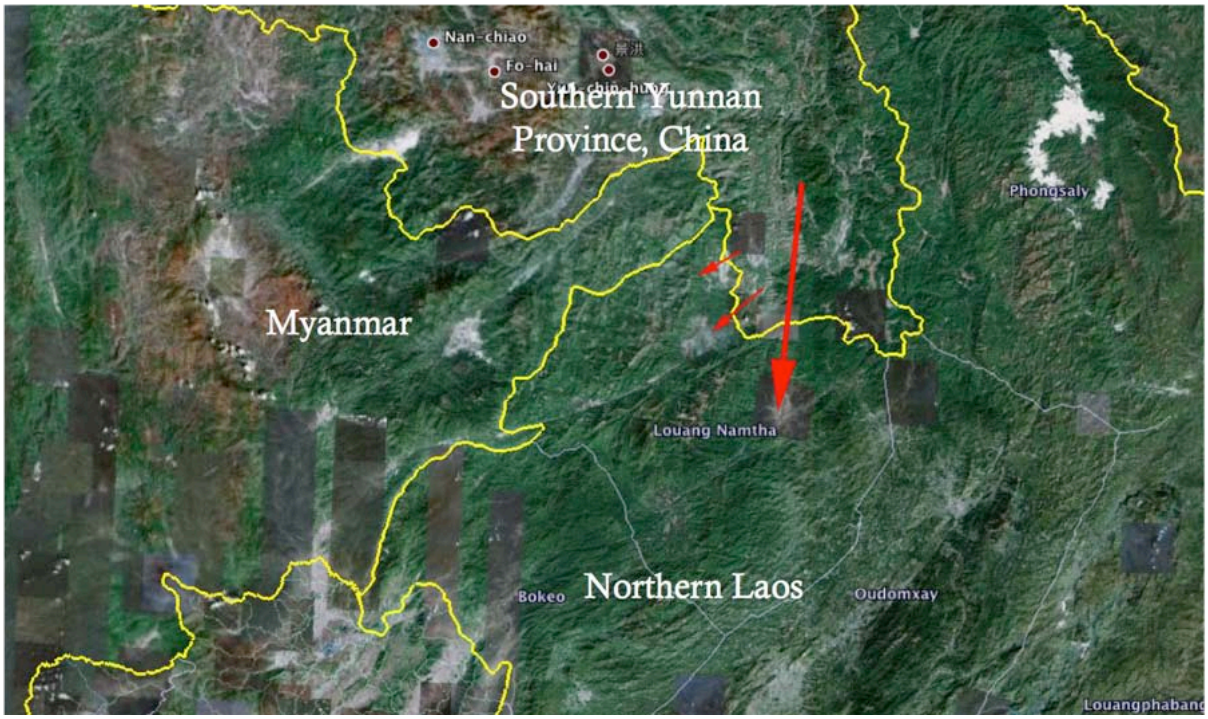

Fig. 2: Cross-Border Rubber Transfer

The profound growth of the Chinese rubber industry and its rapid transfer to northern Laos, which can be seen in *Fig. 2* above, can be partially explained by China's growing need to meet domestic consumption. In 2002, China passed the US as the largest consumer of rubber and some projections predict that by 2020 China will be consuming as much as 30% of the world's rubber (McCartan 20067). According to this prediction, China will annually require 11.5 million tons while only annually producing 4 million (Ibid.).

CHINESE RUBBER PRODUCTION

The history of rubber in China goes back to 1906, when the first rubber trees in the country were planted on Hainan Island, which has remained the center of rubber production in China. While the growth of rubber trees in Yunnan province eventually took off at a remarkable pace, the growing climate for rubber on Hainan Island has always been much more favorable and yielded a higher latex productivity than in Yunnan (Alton *et al.* 2005). It was not until the 1950s that rubber was first grown in Yunnan and since then it has been centered on Jinghong city and the three surrounding counties of Xishuangbanna Dai Autonomous Prefecture, the southernmost part of the province (Chapman 1991). The increase in rubber production began in the 1950s partially because of the restriction of imports of natural rubber by the US due to a trade embargo at the time. Additionally, the Chinese government saw the promotion of rubber as a means to ethnically control an area of the country that used to be almost completely dominated by the Dai ethnic group, an ethnicity closely related to those of northern Thailand and Laos (Ibid.). The economic opportunities directly and indirectly associated with the booming rubber industry represented a governmental strategy to promote the in-migration of Han Chinese and solidify political domination over the area (Ibid.).

The rubber industry of Yunnan was created by the state with priorities of technical efficiency and high productivity. Yunnan's state farms used the plantation model of Malaysian and Indonesian rubber farms. However, unlike those plantations, Chinese farms were not primarily concerned with economic efficiency. The success of rubber in southern Yunnan was largely due to the strength of government support and the socialist planned economy, which controlled land, wages, and prices, as well as China's national determination to increase domestic production of natural rubber in order to reduce dependence on imports as demand

escalated (Ibid.). Furthermore, the industry was successful in a region that was not economically competitive. This was because it was initiated while there was strong state support before the agricultural reforms of the late 1970s. It is important to understand that as China's rubber industry was developing, exports were not its top consideration, the industry was fully protected, and domestic prices for latex were much higher than those on the world market. This point must be kept in mind when evaluating the potential of rubber for economic development in Laos, which has little state support in comparison to that of China's rubber industry when it was taking off.

The 1960s and 70s saw the continued expansion of rubber growing as state farms and village-level communes of Yunnan province moved into rubber production (Ibid.). After the changes in agricultural policy of 1978, which once again allowed family farming in China, many villagers who had previously worked in communes became rubber-planting smallholders. In 1979, the Household Responsibility System was implemented, giving households decision-making power in terms of what, where, and how much to plant, thereby creating greater incentives for households to produce cash crops (Wenjun *et al.* 2006). By 1985, Chinese domestic production of rubber was sixty times greater than its 1960s levels. Guangdong province, which included Hainan Island at the time, was producing 82% of China's domestic natural rubber at the time while Yunnan province produced 17%, and most of China's rubber was still coming from well-funded, technically efficient state farms. By 1988, smallholdings had greatly increased in relation to state farms and had become the predominant model of rubber growth (Ibid.).

Nearly as important, though, is the cheaper, more abundant, and more ecologically suitable land. In northern Laos there is still an abundance of both forest and non-rubber

producing land. The more suitable growing climate allows rubber to be grown throughout all of Lao PDR, unlike in China where it can only be cultivated in specific parts of the southern provinces. An assessment made in 2004 by NAFRI concluded that 62,000 ha, or 6.7% of Luang Namtha's provincial land area is appropriate for rubber tree plantation while only 4.7% of this suitable area was being cultivated for rubber (Sithong and Thoumthone 2006).

LAO GOVERNMENTAL PROMOTION

As important of a catalyst of the rubber boom as Chinese investment has been Lao governmental policy, which encouraged the influx of foreign investment. Since the economic reforms of the NEM in the 1980s, all economic sectors of Laos have changed dramatically, but perhaps none more than agriculture. The government believes that a number of goals can be achieved through the promotion of cash cropping, ranging from economic growth and poverty alleviation to forest conservation and the elimination of opium production. Although economic reforms have allowed for an increase of the national GDP and a reduction of poverty at the macro level, most of this growth has remained concentrated within the industrial sector in urban areas, exacerbating regional inequality. Not only has regional inequality increased, but so has income and wealth inequality as material consumption by the poorest 20% has continued to decrease over the past ten years (Pettersson 2007). Nevertheless, the government views the commercialization of agriculture as one of the best ways to address poverty alleviation in rural areas. Orienting the agricultural sector towards the market, however, required creating links to the regional and global economy and improving physical infrastructure to allow agricultural goods to reach markets outside of the country. The NPER, supported by regional and international assistance directed towards the GMS, seeks to develop basic infrastructure in the

northern provinces and link them to the regional economies. The most prominent example of this type of trade promoting infrastructure buildup is the recently completed Route 3 running from Kunming, China through Luang Namtha and Bokeo provinces to Bangkok, Thailand (Fuller 2008). Without such infrastructure development there would be little viability for the export of rubber, which helps to explain why some Chinese companies invest in infrastructure in order to access certain villages or influence villages to allow for company concessions of village land.

Out of all promoted cash crops, the government has viewed rubber as one of the most effective in terms of its ability to increase the incomes of smallholding farmers. The government has seen rubber as a way in which to integrate farmers into the national economy and lead the region on a path of economic development mirroring that of southern Yunnan province (Diana 2006). The Luang Namtha provincial government has promoted rubber growth as a top priority for alleviating poverty and in 2006 there was even a provincial regulation to provide every family that is not growing paddy rice with one hectare of rubber, though this has yet to occur (Shi 2008). Yet the Lao government has not been the only public force towards rubber development in Laos. The Chinese government has also encouraged investment in the resource sector abroad, providing subsidies for companies that invest in rubber production in Laos (Ibid.).

ETHNIC AND SOCIAL NETWORKS

Equally as important to Chinese investment and governmental policy has been the social and ethnic networks that have led to the spread and expansion of rubber throughout the region. This is especially pertinent with respect to the cross-border nature of the transfer of rubber between Yunnan and Luang Namtha provinces. As Laotian farmers have learned of how rubber has improved their relatives' livelihoods across the border they have been enticed to grow

themselves (Ketphanh *et al.* 2006). Indeed it was this spontaneous initiative of Lao farmers along the border that facilitated the introduction of rubber into northern Laos before the onset of Chinese investment (Diana 2006). Not only has word of mouth led to the spread of rubber, but also the physical movement of people across the border and the resources, knowledge, and connections that they bring with them. Shi (2008) finds that this cross-border influence epitomizes the rubber investment in Luang Namtha. Not only do the investing companies come from China, but much of the small, individual investment comes from recent settlers, former state farm workers, and other businesspeople from just across the border in China. The establishment of rubber in some of the first villages to begin growing was led by intense exchanges of knowledge, technology, and expertise between Lao and Chinese farmers. The establishment of rubber in Ban Mom and Ban Buak Khu of Sing district, Luang Namtha province is largely due to cross-border inter-ethnic social links which. As Diana (2006) argues, these connections have in some instances proven to be more effective than Lao governmental policies in providing technical knowledge concerning rubber establishment and management, as well as finding financial resources. Farmers have been able to use this knowledge and capital received from across the border according to their own needs. Additionally, the Chinese economic model of smallholders has also crossed the border and become the preferred model by Laotian farmers. Although existing social networks most frequently connect small, individual investors, these linkages have become necessary for the operations of larger, formal investors, namely for subcontracting, securing labor supply, as well as bridging cultural and linguistic gaps (Shi 2008). Sithong and Thoumthone (2006) further argue that the success of rubber growing villages such as Ban Had Nyao have been just as influential as Chinese investment for the spread of rubber through northern Laos.

In short, the expansion of rubber farming in northern Laos has resulted from the confluence of an increase in Chinese demand for rubber and subsequent investment; market-oriented governmental policies that encourage FDI; and social-ethnic networks that facilitated the transfer of capital, knowledge and technology across the China-Laos border. The general trend from subsistence-based rice farming towards market-oriented cash cropping, particularly of rubber, has had varied effects upon rural farmers, however. Land use reforms and new exposure to the market have forced rural farmers to adapt and change their livelihoods (Fujita 2006). Instead of having the same effects across the region, however, such changes have resulted in a variety of effects upon local livelihoods.

METHODOLOGY

This research project was conducted as a continuation of an independent literature review, written during the spring semester of 2008 under the supervision of Dr. Claudio Delang of the Geography and Resources Department at the Chinese University of Hong Kong. The fieldwork was funded by the University of Miami's "Beyond the Book" Scholarship, which was created to encourage undergraduate students to conduct independent research during summer breaks. The fieldwork also served as empirical data for my undergraduate senior honors thesis in the Department of Geography and Regional Studies at the University of Miami. However, this research was also intended create this report, which will hopefully provide an analysis of rubber growth that will be useful for government researchers, development practitioners, NGOs, and academics involved in this particular issue or the more general issue of development in Laos.

RESEARCH QUESTIONS

The questions that guided this research can be categorized into three the two main focuses of this report:

- Geographies of Growth
    - How has the physical, built, economic, political, and cultural geography of Luang Namtha and Bokeo provinces affected the spread of different forms of rubber growing?
    - How do geographic and temporal factors work in combination with one another to affect growing trends throughout these two provinces?
    - How are Chinese investment patterns affected by earlier independent rubber growing trends?
    - Are there any relationships between village proximity to the Chinese border and rubber growth?
    - How does time and place of rubber growing affect farmers socioeconomically?

- Contractual Diversity
    - What are the different types of rubber growing contracts? How do they differ from each other? How do they differ within their respective categories?
    - Why is there such a wide variety of contracts?
    - Which type of contracts are the most variable? Why?
    - What are the different effects of each contract type upon farmers/ livelihoods?
    - How does the wide diversity of contracts affect farming livelihoods?

- How might the diversity of contracts affect income and wealth distribution in the area throughout the coming years?
- What are the different degrees of access to agricultural inputs necessary for entrance into each growing type?

STUDY AREA

This study was based on fieldwork conducted with the help of a research assistant/translator during June and July of 2008. The report was written periodically between November of 2008 and May of 2009.

The study site included all five districts of Luang Namtha province, two out of the five districts of Bokeo province, and one outlier district of Udomxai province. In total, interviews were conducted at 72 villages. At 41 of the 72 villages, household interviews were conducted, which totaled up to 129 household interviews, or an average of three to four interviews per village where household interviews were conducted. At the other 31, interviews were conducted only with the village head. While Luang Namtha was the main focus of the study, Bokeo provided an inter-provincial comparison useful for determining how widespread the results from Luang Namtha are throughout other northern provinces. Additionally, the comparison was useful for examining the role of geographic factors in the spread of rubber across a greater distance. The one village interviewed in Udomxai province was only interviewed because it was thought to be located in Luang Namtha province at the time and only later found to actually be just across the provincial border.

DATA COLLECTION METHODS

Semi-structured interviews were the main type of data collection. Interviews were conducted at a number of different levels. At the provincial levels they were conducted with PAFO officials; DAFO officials at the district level; village heads and deputy heads at the village level; and household heads at the household level. A core set of both quantitative and qualitative

questions were asked at each level. These questions allowed for comparative analysis among districts, villages, households, etc. As this was an explorative study, the qualitative questions created somewhat of a ground-up approach, leading to a continual revision and addition of questions throughout the research project. The semi-structured format of the interviews also allowed for inquisition into certain issues that were particular to a certain village or households or that were unexpected. In addition to interviewing government officials further data on rubber growth, demographics, and land use were collected from these offices. This governmental data has been used to provide certain aggregate data that could not be collected from interviews. One Chinese and two Lao rubber companies were also interviewed. However, more Chinese companies were unable to be interviewed because of language barriers and the companies' discomfort with being interviewed.

There were a few factors that were used to choose which villages to interview. Sometimes villages were chosen because of their interesting growing situations. Other times they were chosen to ensure that all type of rubber growing within a district had been interviewed. This approach was clearly not a rigorous sampling method, nor were enough villages interviewed in each district to be statistically sound enough to provide a complete understanding of growing types throughout the provinces. Nevertheless, it is still suggestive of trends on a macro-level.

GPS coordinates were recorded at almost every village[2], which were then used to create the village points as seen in *Fig. 2* on the next page. Coordinates for all of the village points in *Fig.* 2 can be found in the appendix. The polygons demarcating district and provincial boundaries of the map were digitized from scanned land use and feature maps, which were collected from DAFO and PAFO during the fieldwork. Before digitizing the maps, they were referenced to the UTM coordinate system, zone 47.

[2] Signals were unable to be obtained at a few villages.

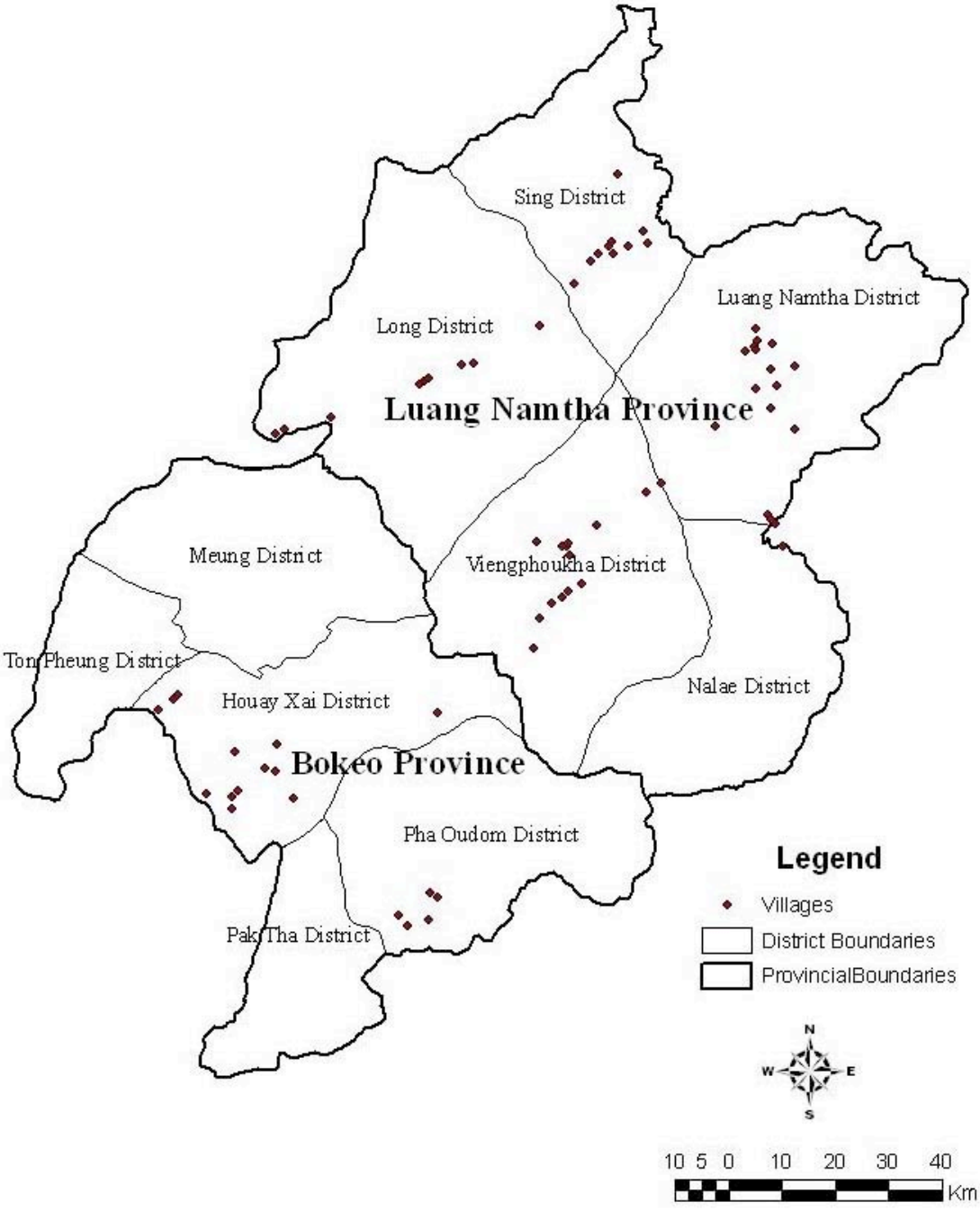

Figure 2: Map of Interviewed Villages

LIMITATIONS OF THE STUDY

It is important to discuss some of the limitations of the data, in order to put the accuracy and relevance of the findings in context. One such limitation was the study's attempt to examine a wide variety of rubber growing forms in a wide variety of geographic locations. This did not allow for a detailed focus on a small number of villages in a smaller geographic area, which would have given a greater understanding of the situational intricacies within a village, a village cluster, or a district.

Another limitation was the inability to verify certain data obtained during the interviews. While attempting to quantify agricultural inputs, such as land, labor, and capital, it became clear how inaccurate some of this data might be. Some of the most unreliable data was the data concerning the amount of land that a village or household owns. This was especially troublesome at the village level interview since the head of the village often did not know the aggregate figures of land use in the village, and if he did know it was likely to come from DAFO data that can be outdated inaccurate. Sometimes village and household heads were honest and admitted that they did not know the answers to certain questions. Other times they admitted they were guessing, yet other times it could not be known how confident they were in the numbers they gave. The other most difficult agricultural input to quantify was capital. Deciding upon the best way to quantitatively measure capital was a constant difficulty throughout the fieldwork, largely because what defines available capital in a rural village can be quite complex. The most consistent and reliable indicators of available capital that were settled upon were income per year, animals available for sale, and whether a household had enough food to feed itself throughout the whole year.

Another difficulty encountered was that since we conducted the fieldwork during the wet season, most farmers in the visited villages went to the fields during the day and were only available for interviews at night. Although this was a challenging situation, it presented an opportunity as well. At night, there was enough time to interview the village head as well as anywhere between two to six households. During the day, we visited between one to three villages before finding a village head that was available. Most days, such a village head was able to be found allowing for one village to be interviewed during the day and another at night. The advantage of this situation was that a large number of villages could be interviewed during a short amount of time, yet a high degree of detail could still be retained from interviews with households at night. If a village was interviewed during the day with a particularly interesting rubber-growing situation, it could be returned to at night for more detailed household interviews.

GEOGRAPHIES OF GROWTH

Luang Namtha and Bokeo provinces of northern Lao PDR are relatively remote compared to many areas of the world. They are more accessible from both southern China and northern Thailand than they are from Vientiane due to the newly finished transnational Kunming-Bangkok Expressway. This highway is one of the few paved roads of the area, the others being the main roads of district and provincial capitals, as well as a road between the capitals of Luang Namtha and Sing districts. Luang Namtha and Bokeo are two of the poorest provinces of the nation. The regional economy is almost completely dependent upon agriculture, with rice, maize, sugarcane, and rubber as the main crops. Until the advance of rubber as well as other cash crops, such as maize and sugarcane, villages mostly produced crops and gathered NTFPs for subsistence. The villages that were visited ranged in size from approximately 35 households to 180 households, with an average of 100 households. The villages were anywhere from a few to 15 kilometers apart from each other, most often on dirt roads that are not fully usable during the rainy season. There is a wide diversity of ethnicities within northern Laos and most villages visited were of ethnic minorities, most prominently Hmong, Akha, Khmu, Tai Leu, and Tai Dam. Villages of Lao ethnicity were most often located within or near the district and provincial capitals.

By analyzing the way in which the location of a village and the year it began growing are interrelated, much can be learned about the way in which households within that village will grow rubber and thus how their livelihoods may potentially be affected by particular growing types. In terms of temporal differentiation, rubber growing in the two provinces can be separated into two categories. The first can be termed the initial rubber growing phase, ranging between 1994 and 2003, when only a small number of villages had begun growing. No companies had

begun investing at this time and the only villages that grew were growing independently. The second is the rubber boom phase, between 2003 and 2008, when most of the villages that now grow began growing. 2003 marks the first year of investment by Chinese companies, which led to the spread of rubber at an unprecedented pace through both provinces. This division can be seen in *Table 1* below, along with other aggregate data on rubber growing in each of the districts.

Province	District	Total Number of Villages*	Number of Villages Growing Rubber*	Percentage of Villages Growing Rubber (%)	Amount of Rubber Grown* (ha)	Year Started Growing Rubber
Luang Namtha	Luang Namtha	78	65	83.33	3,100	1994
	Sing	95	90	94.74	4,066	1996
	Long	82	45	54.88	2,576	2003
	Viengphoukha	46	26	56.52	1,267	2003
	Nalae	72	30	41.67	1,558	2004
Bokeo	Houay Xai	110	110	100.00	2,899	2003
	Pha Oudom	94	48	51.06	3,182	2003
	Total:	577	414	71.75	18,648	-
	*From DAFO data					

Table 1: Regional Rubber Growing Data

The distribution can also be seen visually in *Fig. 3* on the following page. What is most notable about the distribution of villages in the map is that Luang Namtha and Sing districts are the only two districts where villages began growing between 1994 and 2002. After 2003 villages began growing in all of the districts where interviews were conducted. In the map, the time period between 2003 and 2008 was divided in half to see whether there is any difference in distribution between the first half of the rubber boom phase and the second. However, it can be seen that there is little difference and that there is actually a relatively even spatial distribution of villages that began growing between 2003 and 2005 and those that began between 2006 and 2008. The real difference is between the initial rubber growing phase of 1994 to 2002 and the rubber boom phase of 2003 to 2008.

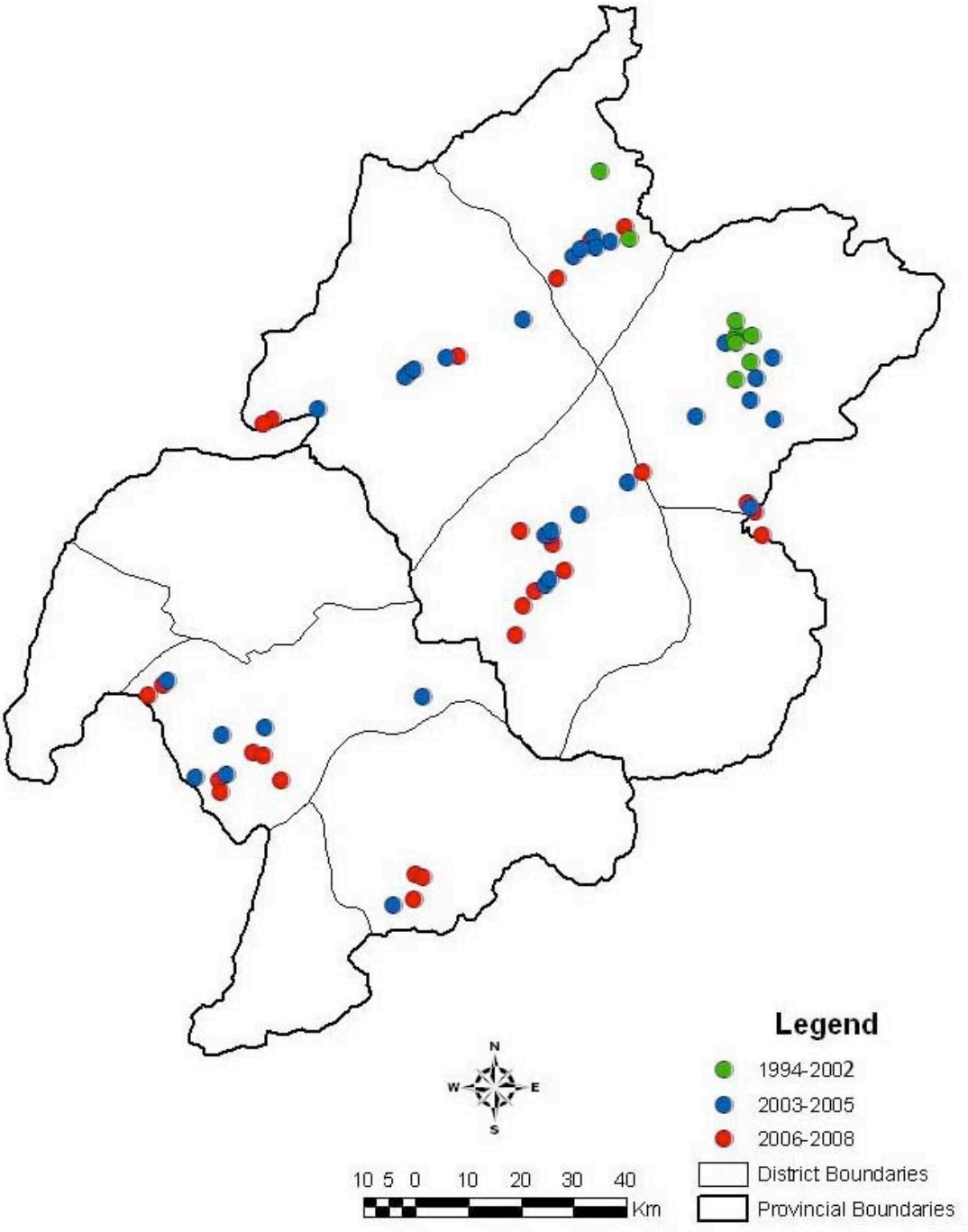

Fig. 3: Distribution of Villages by Growing Year

During the initial phase, the lack of investment by companies meant that rubber was spreading at a slow pace and only to villages in the districts closest to the Chinese border, the source of technology, seedlings, and growing knowledge. Farmers that began growing during

this period in the districts of Luang Namtha and Sing were able to grow namely due to their cross-border ethnic and social connections as well as some through direct governmental promotion of villages as testing grounds of rubber as a cash crop. Such governmental promotion during the initial phase only occurred in Luang Namtha district, likely because the capital of the province is seated there. Four out of the six villages interviewed in Luang Namtha district that began growing during the initial growing phase learned of rubber growth through direct promotion by the government. The government sent village representatives from three of these four villages to China for rubber growth training. The remaining two learned of rubber growing and the associated technical knowledge from relatives across the border in China. In Sing district, all three of the interviewed villages that grew during the initial growing phase also learned of and how to grow rubber from relatives in China. It can also be noted that within the district, the villages that began growing during the initial growing phase are closer to the Chinese border than most of the other villages interviewed. This shows that geographical proximity during this time period was not solely associated with governmental promotion.

As rubber became a widespread cash crop throughout northern Laos, especially during the rubber boom phase, access to rubber growing technique and know-how did not play as direct of a role in determining which villages and households grow rubber and in what growing type. During the initial growing phase, technical knowledge was a much less common commodity. The first villages to grow in Namtha and Sing districts were in part able to do so because of their ethnic and kinship ties to farmers across the border who not only helped them to buy seedlings but also taught them how to properly grow trees. One of the best examples of how such cross-border connections can foster the spread of rubber growth without governmental promotion or foreign investment comes from Ban Lormeu of Sing district.

Beginning in 1985 a number of households from a few different nearby, but remote villages began moving to Ban Lormeu, due to its proximity to roads and markets as well as higher quality agricultural land. What is most fascinating about this village is that the markets that villagers wanted to be closer to were not in Laos, but in China. It was actually faster and more convenient for villagers to cross the border and travel to China in order to purchase goods than to the nearest market in Laos, which is in the capital of Muang Sing. In fact, one of the borders of the villages was also Lao PDR's national border with China. Due to the fact that the villagers purchased all of their goods in China, their village was much more economically connected to China. In fact, the currency used most frequently in the village was the Chinese RMB rather than the Lao Kip.

Such proximity to and connection with China led the village to become one of the first rubber growing villages in the district, as well as in the province when they began growing in 1996. Although a company began growing with the village in a "1+4" contract as of 2008, all households had grown independently until that year. Due to the frequency of villagers' trips to China they often saw Chinese farmers growing rubber and were also able to buy cheap seeds and seedlings as well as learn technique from those that they bought them from. Some even know farmers across the border well enough that they were able to take those farmers' extra seeds for free. This village did not learn of rubber growing through connections, but due to how incredibly close and connected they were with Chinese markets and farmers. Although this village's situation, along with those of a few others nearby, is quite unique it nevertheless exemplifies how the spread of rubber as a new crop slowly began to infiltrate villages of Sing and Namtha districts before the rapid expansion brought on by Chinese investment.

Between 2003 and 2008, the spread of rubber was much faster and widespread, which can be attributed to the influx of Chinese investment. By dividing the distribution of villages in this period in half in the map, it can be seen that there is essentially no difference in distribution between villages that grew from 2003 to 2005 and those that started growing between 2006 and 2008. This shows that there was no spatial limit to the investment of Chinese companies once they began investing in 2003. It can be seen in *Fig. 3* that there are villages in the 2003 to 2005 period (represented by the blue points) near the border of Thailand, which is as far as a village can be from the Chinese border within these two provinces. And in the 2006 to 2008 period (represented by the red points) there are villages quite close to the Chinese border. What this shows is that once Chinese investment was introduced, rubber spread in a manner that was indiscriminate to proximity to the Chinese border, which is radically different from how it spread before the investment. Thus, there must be other forces at work, which dictate which villages began growing during the rubber boom period. One possibility could be that for villages growing in contract with companies, it all depends upon where PAFO and DAFO direct companies to invest. Another possibility is that as a large number of companies began to invest in the region each successive company began looking for areas where other companies had not yet begun to operate which then led them to further districts of Bokeo province. Then, after all of the districts of these two provinces had a number of companies operating within them, the companies began working with all villages that had not yet begun growing rubber, which would explain why some villages of Namtha and Sing districts, as well as the other districts of Luang Namtha province, did not begin to grow until between 2006 and 2008. Although not all of the villages that began growing during the rubber boom phase grow in contract with a company, the influx of investment is still significant because it was this investment that spread the technical knowledge,

capital, and seed/seedling markets necessary for farmers to grow independently or individually invest in other villages.

CONTRACTUAL DIVERSITY

Rubber growing types, especially those involving contracts, vary to such a degree that to attempt to make generalizations can be rather problematic. The contracts within the rubber growing landscape of northern Laos are not only unique to the region; there is actually a high degree of differentiation among them throughout Luang Namtha and Bokeo provinces. Such internal differentiation can be linked to the wide range of investors, varying socioeconomic circumstances of villages, as well as a lack of regulation and enforcement of standardized contracts by the government. Yet the importance of such variation lies in the range of socioeconomic effects that different growing and contractual types have upon villages and households. Certain growing types can yield profits and alleviate poverty if problems of production and marketing are not encountered, while others have the potential to leave farmers in greater poverty and their livelihoods dependent upon a contract, which indirectly appropriates control over their land and labor. Variations within growing types can even turn contracts that supposedly fit within the category of an advantageous type of contracting into one that is exploitative of farming households' land and labor. There are a few different ways of creating a typology to categorize the many different types of rubber growing. The typology that Shi (2008) created made the division along the lines of the size of the investor, with sub-categories depending upon whether the investor is granted a concession, employs a "2+3" contract, or a "1+4" contract. For this report I have made the dividing lines among the type of contract rather than the type of investor. However, similarities abound considering that the type of investor often

dictates the type of contract. A summary of this typology can be found in *Table 2* on the following page.

	Agricultural Inputs	Splitting	Analysis
Independent	- Farmer provides all inputs - No other parties are involved	- Farmer takes all profits	- Requires the most capital - Most profitable, yet has the greatest production risks
"2+3" Company Contracts	- Farmer provides land and labor - Company provides capital, technique, and market	- Returns from latex split when tapping - Most common splitting percentage is 65% for the farmer; 35% for the company	- Farmers must have enough income or food security to support themselves for 7-10 years - Greater profits than "1+4" type, but higher production risks as well
"1+4" Company Contracts	- Farmer only provides land - Company provides labor, capital, technique, and market	- Land is most commonly split - Split occurs one to four years after seedlings are planted - Most common splitting percentage is 30% for the farmer; 70% for the company	- For farmers unable subsist for 7-10 years without a wage - Wage labor reduces risk but also leads to lower profits
Individual Investor Contracts	- Farmer provides land - Investor provides capital and technique - Both provide labor - Each party is responsible for marketing	- Land is most commonly split - Split occurs sometime between planting and tapping - Most common splitting percentage is 50/50	- Most variable and informal contracts; contracts are often oral - Written contracts are not signed by the government and therefore not subject to government regulation - Farmers are vulnerable to land appropriation by investors
Company Concessions	- Company provides all inputs - Land is owned or rented by the company - Villagers sometimes work on the company's land for a wage	- Company retains all profits	- Company land 'given' away by the government and often previously belonged to villagers - Besides possible wage labor, farmers receive no benefit

Table 2: Rubber Growing Typology

The five growing types seen in the summary above are independent, "2+3" company contracts, "1+4" company contracts, individual investor contracts[3], and company concessions. The division of these contracts is based upon two factors: the difference of agricultural input provision and the ways in which the land, latex, or returns from latex are split. It must be noted that these two factors are inherently related considering the division of input and labor provision dictates how and how much of the agricultural product or pre-product is split. The literature on northern Lao rubber growing (Alton *et al*. 2005; Shi 2008) identifies five agricultural inputs[4] that are necessary for the successful growing and sale of rubber. These are land, labor, capital, technical knowledge (also referred here to as technique), and market access. The typology of the rubber growing used in the analysis is based upon which party provides each of the five inputs. The most important for the purpose of this study are those involving contracts, as they provide insight into the ways in which farmers are (self-)exploited. Furthermore, an examination of the variations within different types of contracts helps to further understand these processes. Variations occur even within what the government says are standardized company contracts, the most notable being differences of splitting percentages, which usually deviate from the standard in favor of the rubber company. Additionally, the material that is actually split between the two parties may vary. Most often, it is the total monetary value of the latex sold to the company. However, some contracts divide the land upon which the rubber is grown, while other contracts divide the trees. Furthermore, the land or trees that are split can be split at anytime between planting and tapping. While latex returns must be split at the time of tapping, land or trees may be divided as soon as the trees are planted or just before they are tapped.

[3] Individual investors are usually other Lao farmers who have enough capital to grow, yet not enough land and thus seek out poorer land-owning farmers, usually through ethnic, social, or kinship networks.

[4] It should be made clear that these inputs are not unique to Laos and are necessary for the sale of many cash crops worldwide.

When looking at the spatial distribution of growing types, the map in *Fig. 4* can be useful. Yet before analyzing any sort of pattern it must first be noted that the map greatly simplifies the growing situation of the villages. While in some villages all households might grow in the type that is designated on the map, this is not true for most villages. Most villages have households growing in a variety of forms. For example, some of the households might grow independently while others grow in contract with a company. In this map, villages were assigned to different growing type categories based upon which type the majority of the households were growing in. If 40 households grow independently but 50 grow in a "2+3" company contract, then the village would be counted as growing in the "2+3" category. While this method obscures the complexity of village growing situations, it allows for a visual representation of the distribution of growing types. As can be seen from the map, villages with a majority of households growing independently are the most prevalent and exist in all of the visited districts.

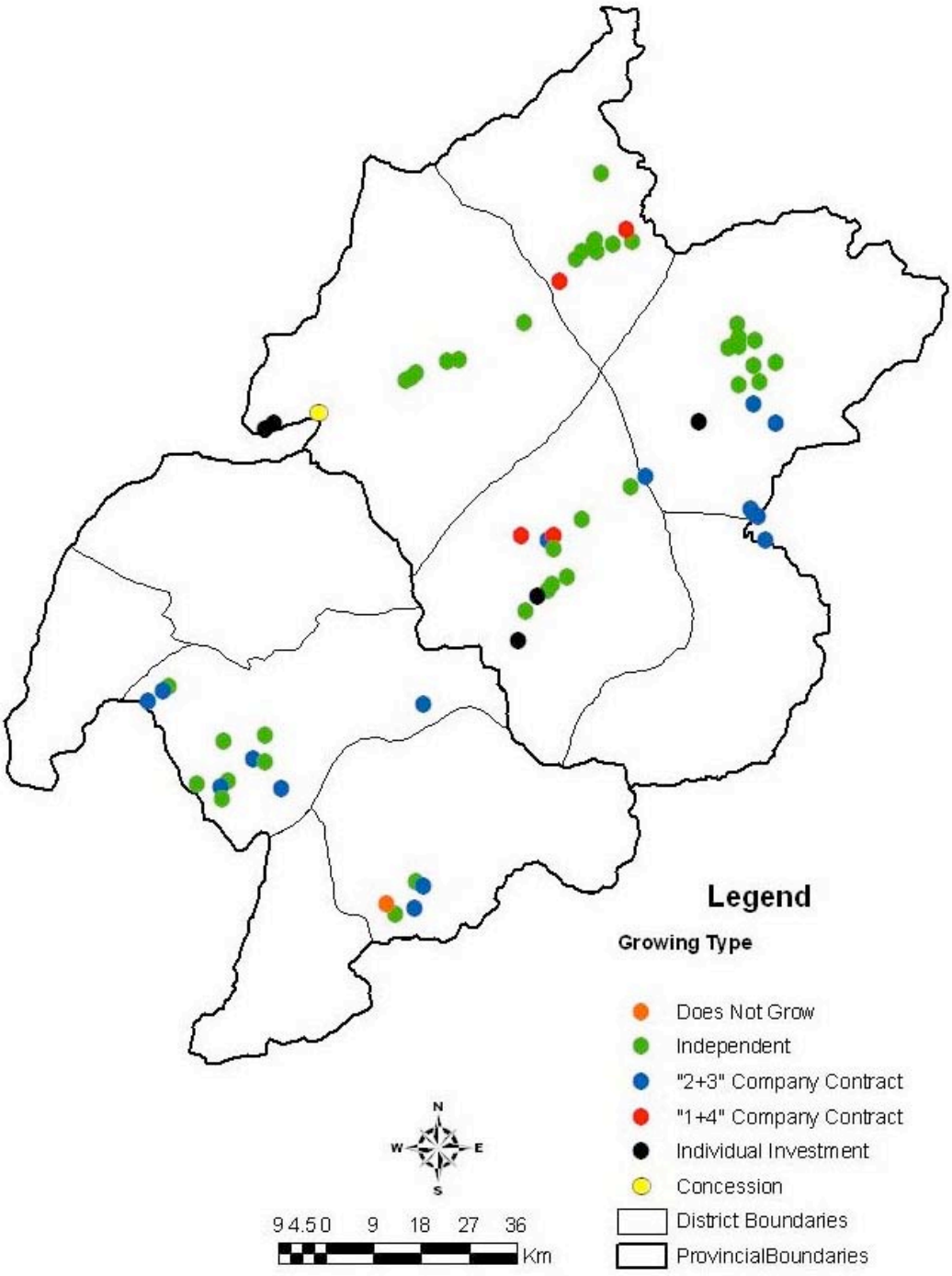

Fig. 4: Spatial Distribution of Growing Types

The breakdown in table form can be seen in *Table 3* on the following page.

Province	District	Number of Villages Interviewed	Independent	"2+3" Company Contract	"1+4" Company Contract	Individual Investor Contract	Company Concession	Not Growing
Luang Namtha	Luang Namtha	15	11	3	0	1	0	0
	Sing	11	8	1	2	0	0	0
	Long	9	6	0	0	2	1	0
	Viengphoukha	14	7	3	2	2	0	0
	Nalae	3	0	3	0	0	0	0
Bokeo	Houay Xai	14	7	6	0	0	1	0
	Pha Oudom	5	2	2	0	0	0	1
Udomxai	Na Moh	1	0	1	0	0	0	0
	Total:	72	41	19	4	5	2	1

Table 2: Number of Villages in Each Growing Type by District

The map in *Fig. 4* also obscures the distribution of non-independent contracting types, which is of particular interest for this study. Independently growing households are certainly the majority of growing households out of the villages interviewed, yet it cannot be known from this study whether they are a majority among all growing households throughout the two provinces. To get a better understanding of how contracting types are spatially distributed throughout the area, households growing independently were not counted in *Fig. 5* on the next page. In that map, villages with a majority of households growing independently were categorized by the type of contract that is the next biggest majority within the village. Any villages that only have households growing independently were removed from the map. This map reveals some interesting results helping to understand macro-trends and reasons why villages may enter into different contracts or growing types. Firstly, it can be seen that the "2+3" contract is the most prevalent and exists in all visited districts except Long district. Also, there are no villages with a majority of "1+4" or individual investment contracts in Bokeo province.

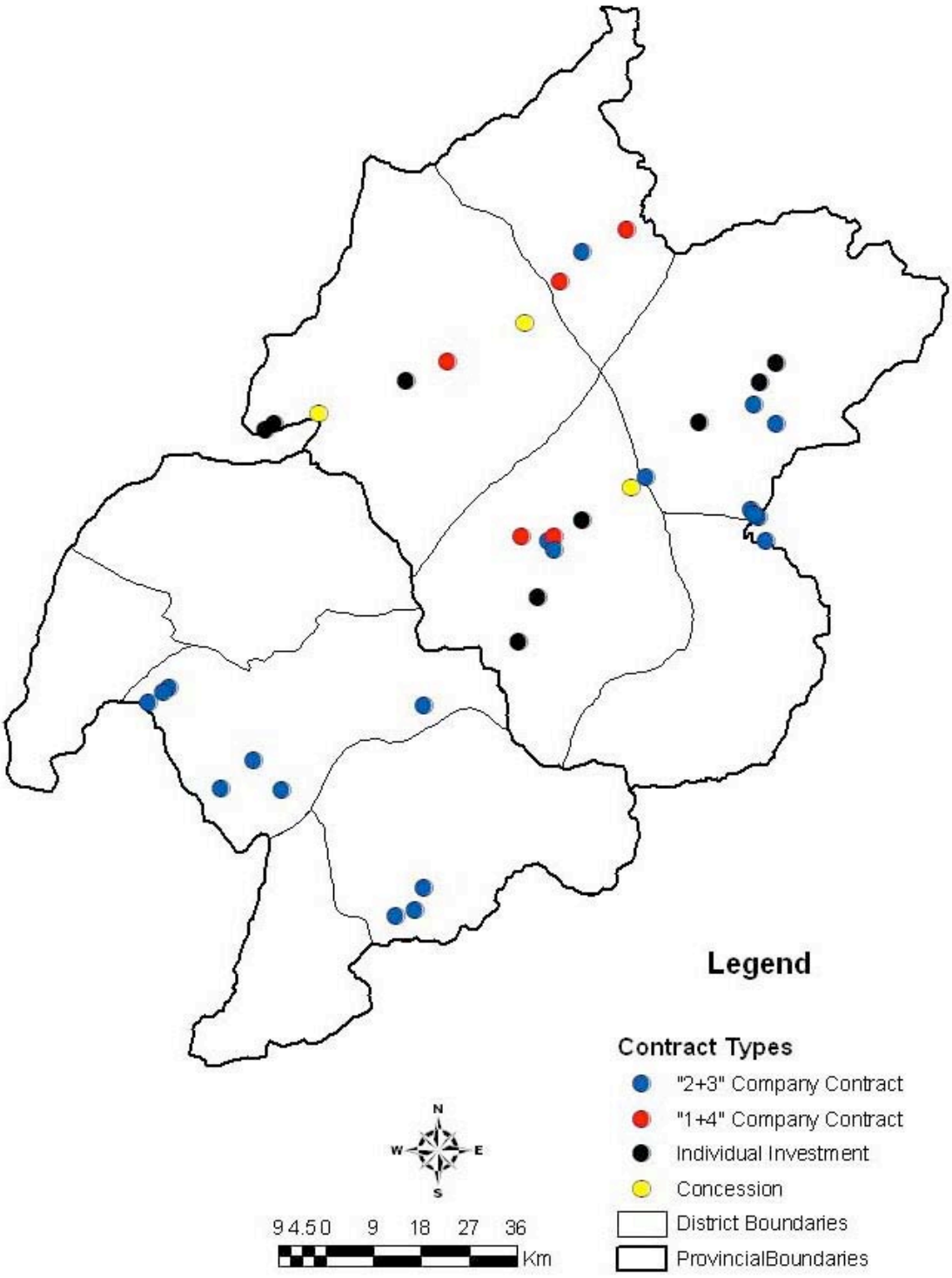

Fig. 5: Spatial Distribution of Contracting Types

INDEPENDENT GROWTH

In relation to social relations, independent growth of rubber is the least complex of all five growing types. However, results from this study show that it is the most common Out of the 72 villages interviewed, 41, or approximately 57%, have a majority of households that grow independently. Out of the 3,430 households that grow rubber in the interviewed villages, 2,462, or approximately 72%, grow on their own. These numbers are in comparison to the second largest type of growth which is "2+3" company contracts. The number of villages with a majority of households growing in "2+3" contracts is 19, or approximately 26% of all interviewed villages. The number of households from interviewed villages growing in a "2+3" contract is 624, or approximately 18% of the total number of growing households. While the sampling method and size of this study might not make these numbers statistically relevant enough to generalize at the level of all villages throughout both provinces, it is clear that the number of households growing independently is significant and most likely a majority. Thus a serious discussion and analysis is warranted.

Farmers who grow rubber on their own provide all of the five necessary agricultural inputs and therefore do not engage with investors in the way that contract-signing farmers do. Of course, these farmers are still operating within the same broad social, economic, and political context as contract farmers and therefore engage in economic interactions with investors and companies, which can illustrate a great deal about the ways in which the advance of rubber growth is affecting Laotian farmers of the region. For example, independent farmers must purchase seeds or seedlings from companies or individual traders, to whom they must also sell their latex. Sometimes marketing contracts are signed whereby the farmer is obligated to sell to a certain company in exchange for a constant price. This exemplifies how the term "independent" can be problematic considering such farmers are not as independent as they seem at first.

However, the fact that such farmers have not signed contracts gives them much more control than farmers with contractual obligations. Sometimes independent farmers are aware of the many traders and companies purchasing latex and therefore are able to search out the highest price. However, this relationship between independent farmers and companies, investors, and traders is minimal in comparison to that which contracted farmers experience. Most importantly, however, is the degree to which independent farmers can profit in comparison contracted farmers. Apart from latex taxes and any transportation fees paid to the purchasing companies, independent farmers are able to retain all profits from their sale of latex, as has happened in Had Nyao village.

Yet to grow independently requires access to all five agricultural inputs in some form or another, which many farming households do not have. The agricultural input that most farmers are lacking in is capital, which is essential to be able to purchase seeds or seedlings, fertilizer, tools, etc. In fact, control over and access to all of the other inputs can to some degree be acquired by farming households if they have a sufficient amount of capital to do so. Households lacking in enough land to grow rubber upon or who do not want to convert land that is being used for other crops to rubber have a few options through which they can acquire land. They can directly purchase it from poorer households that have extra land, they can rent land from other households, or they could invest in rubber production through an individual investment with households that desire to grow but do not have the enough capital. If a household does not know the proper technique to grow it can pay an experienced rubber farmer, who are often times Chinese traders, to teach them or even to do the more technically difficult aspects of the planting process for them. Although rare, there was one instance of an investor paying to have the latex taken to market.

While there are a large variety of cases of farmers or investors using their access to capital to overcome deficiencies in other aspects of production, the most interesting one comes from Ban Bolek village of Houay Xai district, Bokeo province. This household began growing in 2007 and only had one 1.5 ha field of rubber. The family was quite small and there was no one in the household available to labor in the fields, including the head of the household who was too old to work. The head of the household wanted to grow on his own but did not have enough capital to pay for the seedlings, tools, pesticide, etc. as well as labor to work the land. To solve the problem, he signed a contract with Lao-Jinxu Rubber Company, a Chinese company which works with a number of villages throughout Houay Xai district. Instead of providing his own labor, like most farmers who grow in contract with a company, he hired a laborer. Therefore, his costs were reduced since he did not have to pay for seedlings and other materials, and only had to pay for labor, which is only what he had enough capital to pay for anyways. What this case study is an example of is the creative strategies that Laotian farmers employ in order to improve their livelihoods.

Yet if households almost have enough capital to grow independently, but are just short of the necessary amount, greater access to other inputs can help to overcome their capital deficiency. This is most true for households that have access to the technical knowledge necessary for growing seeds from scratch. Most households purchase seedlings from Chinese traders, companies, or other villages. However, seedlings are much more expensive than seeds because they have already been grown for two to three years and the growth of seedlings is one of the most difficult and precarious aspects of the rubber production process. One household reported that it bought seeds for 5,000 kip per kg, each kg containing approximately 250 seeds. If about 40% of those seeds survive and are able to be grown into seedlings (which was reported by

another household to be the amount that does survive) then 100 seedlings can be grown from 1 kg for 5,000 kip. Using the data from the interviews, 5,000 kip could at most purchase two seedlings and that is when they are at their lowest price. However, there is another cost when growing from scratch, which may explain why many still do not do so. Starting with seeds will add another one to three years onto the length of growing, which already takes between seven to ten years. This would be another one to three years of labor without economic benefits, which many households cannot afford.

Of course it cannot always be assumed that if households do not have enough capital they automatically must grow with a company. Although companies have a great deal of power over farmers and there are many instances of farmers and villages being coerced into manipulative and exploitative contracts, farmers have agency and the power to negotiate the terms of their contracts and engagements with companies, especially when done so in solidarity with each other. An example of such comes from Ban Name Yone Mai of Houay Xai district, Bokeo province. Ban Name Yone Mai was relocated to Houay Xai in 1973, at which time they acquired land along the Mekong river. Such high quality land for development has led to a number of attempts in the past couple of years by investors to purchase village land. However, the village leadership has been steadfast to ensure that no villagers sell their land and they have created a village rule only allowing the renting of land to investors.

Thus, in 2007 when the Wan Vi Ko rubber company came to the village intending to grow rubber with villagers in a contract that had a splitting percentage of 60% for the households and 40% for the company, the village head was ready to negotiate a deal. He had no intention to let farmers from his village sign such a contract with the company. In fact, the village head told the company that if latex profits had to be split with the company then they would not grow with

the company at all. Since some households had already been growing with investors from a wealthier village nearby, the company knew that this was not a bluff and that farmers had other growing options if they so chose. Therefore, they opted to provide seedlings to the village in exchange for buying rights to all of the latex produced by signing households at the time of production as well as repayment for the cost of the seedlings. This case study shows how companies do not have complete control over villages when negotiating contracts and how important it is for villages to protect their most vital resources: land and labor.

The most famous village for growing because it was one of the first and most successful is Ban Had Nyao. This village also grew completely independently and the way in which it did so fascinating concerning how households can work together within a village to overcome some of the difficulties that rubber production presents. Ban Had Nyao is a small village near the capital of Luang Namtha province and its ethnicity is mostly composed of White Hmong. The village was established in 1975 after it moved from an area that is now part of Bokeo province. The village began growing 1994 and between that time and 2008, the village had planted 834 ha of rubber in total. Had Nyao was one of the first target villages by the government for the reduction of shifting cultivation, yet rubber was not the first attempted substitute. First, a village elder was sent to a workshop in Thailand that was promoting the growth of corn and ginger. Next, the he was sent to a workshop in China on rubber, which he believed to be a more viable and productive substitute to rubber. Both DAFO and PAFO were in agreement with this decision and helped the village secure a 46 million kip loan. One of the reasons that the village was so successful was because of the way in which the households worked together and organized their rubber production. The 56 households that wanted to grow in 1994 were divided up into four groups of 13 to 14 families each. Each group had a leader and three to five of the village elders

supervised all of the groups and settled any of the problems that the groups had. There was also a committee of three villagers whose role was to survey the groups and ensure that each group was doing a good job. All of the families within each group would go to one family's plot of land each day to work together on it.

COMPANY CONTRACTS

Out of the two company contracts, the "2+3" contract is much more common, partly because it is officially sanctioned and promoted by the Lao government. Out of the 25 villages interviewed that had signed contracts with a company, 20 had signed a "2+3" type contract. The numbers of the "2+3" contract refer to the division of the agricultural inputs: the "2" stands for the inputs of land and labor that the households provide, the "3" for the inputs of capital, technique, and market access that the company provides. The official terms of the contract advocated by the government are that the latex is sold to the company after it has been tapped and after the total cost of the latex based upon weight is calculated[5]. 65% of that return is paid to the farmer and 35% to the company. While this splitting percentage is the most common, it must be noted here that there are variations that occur within this contract, as in all other contracts. The company determines splitting percentages in the contract before the contract is signed, and there is rarely any avenue for debate over the terms of the contract. Latex prices are also determined by the company, but done so at the time of tapping. Such control over production and marketing of latex exemplifies the power that the companies have over both the villages and the government. After being approached by a company that offered a splitting percentage of 60% for the farmers and 40% for the company, one village of Luang Namtha province complained to

[5] Latex can begin to be tapped seven to ten years after the seedlings are planted, depending upon conditions of soil, climate, and growing care.

DAFO about what they believed to be an unfair contract in comparison to better contracts they had heard about. DAFO relayed this to the company and after a long negotiation was only able to alter the percentage by one point to 61% for the farmer and 39% for the company, thus showing the powerlessness of the government to dramatically change the contracting terms. Industry Rubber Company, a Lao rubber company that grows in Houay Xai, Pha Oudom, and Pak Tha districts of Bokeo province, has an interesting policy towards splitting percentages. For the first field that a household grows with the rubber company the splitting percentage will be 70% for the household and 30% for the company. However, if the household chooses to grow with the company again in another field the splitting percentage will jump to 80% and 20%, respectively. If they decide to grow for a third time it will increase once again to 90% and 10%. This may seem like an extreme step to try to attract farmers to grow with the company. However, in Pha Oudom, where we learned of this splitting percentage arrangement, more than one company may grow in one village. In fact, they are encouraged to by DAFO in order to promote competition among the companies, which will hopefully provide better contracts for the farmers as well as ensure that the latex is bought when tapping[6]. Industry Rubber Company has had to compete in more than a few villages with a much larger Chinese company, Jia Fung Rubber Company. Jia Fung has done its part to make its contracts look more attractive, considering their lower splitting percentage of 60% for the household and 40% for the company. The company pays 500 kip per hole that is dug when planting the rubber seedlings as an incentive to start growing with the company. It also provides free corn seeds to intercrop with the rubber during the couple of years[7] and if villagers are strapped for cash during the growing years they can take out a small loan

[6] Part of the reason that Pha Oudom DAFO uses such a technique is because of a bad past experience they had with a corn company that monopolized corn growing in the district, bought the product for below-market prices, and in some cases did not buy the corn when the contract said it was supposed to.

[7] The length of time that crops can be planted between the rows of rubber trees is between 1 and 3 years depending upon the intercrop and how fast the rubber trees grow, since the increase of shade is the determining factor

from the company to be paid back when tapping. One household we interviewed in Houay Koum village of Pha Oudom district was growing with both companies in order to compare the two. After 2 to 4 years of growing, he said he would decide which company he liked better and grow his next field with that one.

Another interesting case of a strange splitting percentage comes from Senzinghua Rubber Company, which operates in Viengphoukha district. Senzinghua grows with villages in both "2+3" and "1+4" contracts, but most of its contracts are in "2+3". In its "2+3" contracts all of the splitting percentages are 61% for the household and 39% for the company, which we thought we misheard when the first village told us this. Reports from both village heads and DAFO confirmed that when the company first started growing in the district the splitting percentage for the households and the company was 60% and 40%. However, the first villages that the company started working with were not satisfied with such a splitting percentage and complained to DAFO to get the percentage changed. So DAFO tried to get the splitting percentage to 65% and 40% but the company would not budge. They then tried 64% and 36%, 63% and 37%, and 62% and 38%. It was not until they asked for 61% for the households and 39% for the company that the company finally agreed a minimal difference from the original contract but perhaps symbolic enough to satisfy the villages that complained. This shows the power relations between the local government and the rubber companies, yet perhaps more interestingly that the farmers too have power. The local government's desire to retain investment within its district allows for the company to have a certain degree of power.

According to the "1+4" company contract, the farmer only provides land while the company provides all other inputs. In contrast with "2+3" contracts, the material that is most often split is land. In other words, one to four years after the tree is planted, a certain percentage

of the land is given to the company for management. Before this split of land, the company pays the farmers for their labor on all of the land. After the split, the company only pays the farmers for their labor on the company's 70% of the land, while the labor on their own 30% is unpaid. If there is not enough labor within the farming household to work the company's land, other villagers from that village or nearby villages may be hired. In the case of "1+4" contracts, this percentage is most typically 30% for the household and 70% for the company, a vast difference from the "2+3" contract. The payment of wage labor in the "1+4" type can be accounted for as the reason for the large difference between splitting percentages. Nampaman village of Viengphoukha district is a perfect example of all of these factors coming into play to convince the village to grow rubber in a "1+4" contract. Before 1997 the households had lived in the uplands far from one another with no village center. They mainly survived from gathering NTFPs as well as some degree of shifting cultivation. In 1997 the government forced them to move to a new location so that the houses could be grouped together and that they could cultivate more land in the government's attempt to alleviate poverty in the village. In 2007, DAFO came with Senzinghua Rubber Company and convinced the village to grow with the company in a "1+4" contract in order to reduce shifting cultivation in the village. Nampaman village became 1 of 2 villages in the district to grow in "1+4" while all of the rest that grow with Senzinghua grow in "2+3". DAFO cited the reason as a lack of labor within the village, which is certainly part of the explanation considering there were only 22 households within the village. Just as important may have been the poverty of the village. Located far from the district capital in the uplands and dependent upon shifting cultivation and the gathering of NTFPs as its only means of subsistence, this is not the type of village to be able to withstand using most of its labor capacity to grow rubber instead of rice without being paid for seven to ten years.

Before comparing the two company contract models, it is important to discuss the implications of risk for both the company and the farmer. While the arguments thus far have focused on the risk that the farmer takes on, it should be noted that the companies also take on a degree of risk. Farmers may not take care of the trees properly or they may even sabotage them if angry over the terms of the contract. However, it must be noted that all capital investment involves some degree of risk, and two points must be made concerning how this particular circumstance (as well as other contract farming situations) differs. Firstly, the contract is a way in which many risks, most notably those of production and price stability, are passed on to the farmer. Yet perhaps more important is the difference in terms of the degree and nature of the risk that each party assumes. For the companies, their investment in rubber production is diverse and therefore problems with production in one village will not hurt the overall investment. Even if enough production is disrupted for the company to take on a loss, such a loss is much different in form and severity than that which a farmer would experience due to production problems. The investment that the farmer has made is one of land, labor, and time, all of which are necessary for the survival of the household. If latex is unable to be tapped from the trees or sold for a decent price after committing seven to ten years of labor and land, which used to be devoted solely to the growth of food crops, the farmer will face a tremendous loss.

The comparison of the "2+3" and "1+4" contract types shows that the "2+3" type is much more beneficial for farming households on a long-term basis. The advantage of the "1+4", of course, is the wage that it provides. This is especially important during the seven-to-ten growing years when the rubber cannot yet be tapped. Food security is especially fragile at this time because fields where less capital, labor, and time intensive crops were grown for subsistence have been converted to rubber and such crops can only be intercropped with rubber for one to

three years. However, it must be kept in mind that this is not a consistent wage throughout the year. Oftentimes, the payment is for an amount of specific activities that have been completed. For example, farmers are often paid per hole they have dug, per tree they have planted, or per hectare of land they have cleared. Most of these activities occur when planting, while maintenance work of weeding and ensuring that the tree is growing properly is necessary two to three times per year. Although interview responses indicated that farmers found the wages paid to be adequate and up to par with other working wages in the area, their part-time nature makes it hard to believe that they make up for the food security that the land converted from growing food crops to rubber used to provide. Additionally, farmers that are entering into "1+4" contracts are usually poorer because they need the wage to survive throughout the years without their full set of subsistence crops, meaning their food security situation is more precarious than most.

The main concern of effects on farmers, however, is not with short-term ameliorative effects. Rather, it is with the long-term effects and whether the type of contract that farming households enter into will improve their livelihoods or leave them in greater poverty and dependent upon the company for survival. In this respect, the "2+3" contract has a much greater chance at increasing the income for farmers in the long run due to its higher splitting percentage of latex returns. However, the pitfalls of the "2+3" contract run deeper than a lack of working wage. Both contracts represent a loss of control over the means of production. Farmers in both contracts are dependent upon the company for the success of their household enterprise. Any problems with production (besides faulty seedlings when first planting) are the responsibility of the farmer, and a low productivity in latex when tapping will lead to a meager income after seven to ten years of growth. The same can be said for risks of market fluctuation and commodity prices, especially rubber, have always been highly volatile. Although rubber prices had been

increasing dramatically throughout the years leading up to the fieldwork as well as during the fieldwork, the global drop in commodity prices associated with the recession since the fall of 2008 exemplifies how quickly and abruptly farmers' investments of time, money, and labor can turn unprofitable. It is uncertain how rubber prices will change in the future, but it is fair to predict that they will not remain at a high price or, to be more precise, at a *stable* price[8].

The "1+4" contract is more exploitative than the "2+3" in a few ways. Firstly, farmers entering into the "1+4" are of the poorest class of farmers and thus can be manipulated in a number of ways. Interviews with villages that signed "1+4" contracts resulted in a greater number of reports of company abuse of the contract, in some cases where the company refused to pay or was late in paying wages. Secondly, the split of land is problematic for farmers in the long term. Although the land is technically only rented by the company, it must be kept in mind that this period of rent can be between 42 to 50 years, when considering both the length of growing and tapping periods. While these contracts often include a clause saying that the land will return to the farmer after the tapping is finished, it is possible that this will not occur after the company has managed the land for such a lengthy amount of time.

If this type of growing contract is so unfavorable for households, why do some households enter into such a contract? While a need for a wage labor to survive during the growing years has already been discussed as one cause, another key factor is a lack of labor. Lowly populated villages or villages with heavily young and old age structures may not have the labor necessary to grow or tap rubber, which can be very labor intensive. Perhaps, more importantly, however, is the monopolistic power that companies have over villages. Most often, PAFO and DAFO find "appropriate" villages for the companies to work with, meaning that the

[8] To the best of the author's knowledge, there are not any rubber growing contracts in northern Laos that guarantee selling prices when tapping.

governmental agencies control which villages work with which companies. Despite the exception of one district of Bokeo province, DAFO ensures that no more than one company goes to each village. This creates a monopoly over which types of growing contracts that a village has the option of entering into. Furthermore, it is likely that a degree of coercion to convince the village to grow with that company occurs. It is very difficult to determine how much coercion actually takes place, but many farmers that entered into either of the company contracts reported that they did not have a choice of which contract type to enter, nor did they have the option of not growing at all.

INDIVIDUAL INVESTOR CONTRACTS

Individual investor contracts are much less common than company contracts. Compared to 29 of the 72 villages we interviewed that had at least one household growing with a company, only 14 villages had at least one household growing with an informal household and four villages had at least one household investing in another village. Individual investments are often between households of two different villages. However, they can sometimes occur between two households of one village (usually relatives) and there are a few examples of larger investments by wealthier individuals who often reside in the provincial or district capitals. Such individuals attempt to make a significant profit from investing in rubber without creating a formal rubber company; hence I refer to the contract or investment in this case as "informal". The investments between villages are often between relatives, households of the same ethnicity, or good friends. Except in a few rare cases, there is usually some sort of network that exists between the two households from different villages to allow the informal investment to occur. When larger individual investors are determining which villages and households to invest in, they will sometimes go through DAFO to determine the most appropriate village. Sometimes, however,

they will also independently visit a village where they do not know anyone and ask who would like to grow with them. The smaller[9] investors usually only invest in one or two other households in one other village and sometimes do so to help out their relatives; the larger investors will usually invest in a number of households in one or more villages.

Although there is a high degree of variation among individual investor contracts, some generalizations can be made. In almost every informal investment land is split rather than money. The land can be split any time between just after the seedlings have been planted to just before the trees are to be tapped. However, land is most commonly split at some point of time between one to three years. The most common splitting percentage is 50% for each actor, yet contracts can give up to 70% to the investor and 30% to the original land-owning household.

A number of questions arise from the examination of individual investor contracts, which cannot be answered without a comparison to company contracts. For example, why is it that land is most typically split in informal contracts and "1+4" contracts while it is money that is split in "2+3" contracts? In general, it is more favorable to split land than money for investors. After the split of land is made, the investor has less contractual obligations to the landowner. Any problems that would have occurred with the contract would have been taken care of in the first years before the split. If there are problems with payment for labor after the split, it would be easy for the investor to find someone else to pay to work the land. Companies using "1+4" contracts are already growing with villages that are poorer and have less labor available. Therefore, such villages would be easier to convince or coerce into splitting land rather than money. For informal investments, the reason why land and not money is split may be a little different. Investors may desire to split the land, especially during the first couple of years, in

[9] "Smaller" means that investments are only made in one plot of land in one village, usually under two or three hectares, while "larger" means that investments are made in a number of plots and often a number of villages

order to have as much freedom as possible. They want the contract to be the least binding between the two farming households as possible. This would help reduce the possibility of contractual problems such as payments when tapping or failed production due to insects and disease.

The most exploitative aspect of individual investor contracts is that when land is split in a contract, it is not just during the seven-to-ten growing years, but for up 35 to 40 years of tapping. This effectively places the land that originally belonged to households within the village under the control of investors and rubber companies. To make things worse, the ownership of the land once tapping has finished after 35 to 40 years often lies in question. Even when there are signed contracts that explicitly state that the land returns to the original landowner, there is the possibility that the land will not return to the farmer after the trees have been tapped. Regardless of what a contract says, 35 to 40 years is a long time for an investor or company to have control over a plot of land, after which they are supposed to return it. Even more precarious is when a contract has not been signed or nothing in the contract says anything about whether the land will return. In some situations, it says in the contract that the land will stay with the investor. Therefore, splitting land, which is a key part of "1+4" and informal contracts, will possibly be very damaging to original landowners in the future, leaving them with less land than they entered the contract with.

With such potentially negative socioeconomic effects, why would households choose to grow with individual investors rather than in more beneficial "2+3" contracts? As with "1+4" contracts there is the strong likelihood that households do not have much choice as to who they grow with. An informal investor may have been the only one to come to their village inquiring whether any farmers would like to grow rubber with them. In situations where villagers have a

choice between an investor and a company they may choose to grow with the investor because they are more familiar with the investor than with a foreign company. This logic shows the degree to which local entrepreneurs are capable of using social-ethnic networks in order to exploit poorer farmers to their advantage. The following case study looks at a unique situation that may help to explain particular instances when farmers choose individual investment contracts over company contracts. In Ban Nam O of Viengphoukha district most households grow independently, some grow in a "2+3" contract, while others grow with individual investors, some of which are bigger than others. Each investor offers a different type of contract creating a diverse amount of growing possibilities for households, thus making for a an interesting case study to examine why households choose certain growing types and contracts over others. When asked in the interviews, most households responded that either the contract they chose was the most beneficial or that they felt most comfortable to grow with a particular investor, especially if that investor was a relative or friend.

However, one household had a particularly interesting situation and possible logic for choosing an investor to grow with. This household grows in contract with a relative of his. This contract is similar to other individual investment contracts, in which the land is split after one year and 50% goes to him while 50% goes to his relative. Before the split, he provides the labor. This household chose this contract in contrast to a "2+3" contract that split 61% of the latex when tapping for the farmer and 39% for the company. The response that this household gave when asked why he chose to grow with his relative was that he already grew rubber on a plot of land that is 0.5 ha did not have enough labor to grow on a 2 ha plot of land. If he was to grow with the company he would have to provide labor for that the whole 2 ha for seven to ten years. However, when he grows with his cousin, after splitting the 2 ha of land after one year he only

needs to provide enough labor for 1 ha. Why, then, does he not grow on a 1 ha plot of land with the company? Although, he did not give a clear response to this question, his decision seems to be quite economically rational. The issue is that if he was to grow 1 ha of land with the company, he would only get 61% of the profits from that 1 ha of land, or in other words only would receive money from trees on 0.61 ha. Yet if he grew with his cousin on 2 ha and split it down to 1 ha, he is able to receive profits from trees of 1 ha of land.

This case study has a few implications. One is that farmers often make very economically rational decisions and are able to plan financially for the future. The other is that farmers with more land than they are able to provide labor for (whether from their own household or through hiring) may opt for contracts that split land rather than latex when tapping, which is what many "1+4" company contracts and individual investment contracts provide. What this shows is how different contracts have different advantages for different farmers based upon their access to and control over varying levels of agricultural inputs. Different contract types must thus be evaluated within a more nuanced light that examines them with relation to the farmers that enter into them.

COMPANY CONCESSIONS

Company concessions are the fifth type of rubber growing. They occur when companies are able to buy or rent large plots of land to use in some sort of productive capacity. In this case, the concessions are plots of land used to grow rubber. According to McCartan (2007), concessions that are over 100 ha must be arranged with provincial officials while those under 100 ha can be done so with district officials. However, as the fieldwork revealed, concessions may include any large purchase or lease of land for rubber growing, even when arranged at the

village level. Out of the 72 villages interviewed, there were only seven that had concessions granted on their land or on land nearby, of which the ownership was debatable. The concessions encountered ranged in size from 35 to 400 ha.

Concessions are clearly one of the most damaging and exploitative forms of rubber growing, especially the concessions granted through the government. Even if the land that is being granted to the company does not clearly belong to the nearby village, more often than not the village has been growing crops on that land and the granting of that land to the company to grow rubber on diminishes their livelihoods. Many times the land does belong to the village, yet it is still granted to the company. Most of the time villages are not consulted about the concession and sometimes the companies just show up and start growing on the land. Sometimes villages are warned but they have little choice but to agree to the concession. Ban Phouvantai of Houay Xai district, Bokeo Province, provides a case study of a company concession occurring on village land without even warning the village of the situation. One farmer had been growing rubber independently on two hectares for one year. One day when he went out to his field for maintenance work he was astonished to find that his young rubber trees had been cut and holes for new trees had been dug. Apparently the company had paid laborers from other villages to cut the trees and dig the holes on the land they had appropriated because they found the technique the farmer had been employing to be of poor quality. When the village took this issue up with the company, it said that it had been granted this land by DAFO and at that point the village head realized that there was nothing that could be done if the company was in cooperation with the government. A similar situation occurred at the nearby village of Lang village with the same company. In this village, however, eight households had been working with the company for two

years when the company took over the land of six of those households because of a concession granted by the government.

A less orthodox case study of a concession which occurred at a much more local level comes from a village in Viengphoukha district of Luang Namtha province. In 2005 an investor from Namtha district came to Ban Nam Sing who presented a deal of exchanging seedlings for land. The investor gave 130 seedlings for each household to the head of the village, which for 63 households totaled 8,190 seedlings. In exchange the investor received 35 ha of land to grow rubber on. Although he does not split any of the land with the village he pays villagers for labor on that land.

Clearly, land concessions are not beneficial in any way to farmers, besides the wage labor that the company sometimes offers villagers. They are likely to increase poverty in these villages, contrary to the government discourse, and may lead to land expropriation, proving even more disadvantageous to the farmers. Fortunately, a moratorium on new land concessions over 100 ha was passed in May of 2007. However, the degree to which this will be enforced is questionable.

Transfers of land are occurring in a number of ways, such as through company concessions as well as informal investment and "1+4" company contracts, both of which were discussed earlier. However, another way, which has yet to be mentioned, occurs through the sale of land. While land sale may seem like a harmless activity, and in some cases it is, it is affecting northern Laos much more than other areas already widely engaged in the market economy, because the introduction of rubber has been the introduction of the region into the market economy. Before the rubber boom, most land was either used to grow crops for subsistence or for lesser-priced cash crops. The sale of latex, however, can retrieve a much higher profit than all

of the other previous agricultural commodities. As the agricultural products that can be grown on the land increase in price, so does the land itself. As the price of land in northern Laos increases, the temptation for poorer farmers who are unable to use their fields to grow rubber due to a lack of capital also increases. While investors from villages near or in the city who do not have the land for growing rubber often grow in contract with other villages they also will attempt to buy land if they have enough capital. While the money earned from the sale of land will be beneficial to them in the short run, the loss of their land will be much more harmful in the long run, especially as the price of their once-owned land continues to rise. Furthermore, since they likely have little knowledge of how much their land is actually worth, it will exploit their lack of knowledge and buy the land at a below market price. In order to control prevent the increase in land value from transferring land poorer to wealthier farmers, certain regulations should be set up controlling the sale of land. While in certain situations, such as emergencies when such a sale is necessary to provide food for the family or pay for medical care, the sale of land is acceptable, it should for the most part be banned to protect poorer farmers in the long run.

COMPARATIVE ANALYSIS

The chart in *Fig. 6* on the following page visually displays the potential profitability of each growing type based upon interview data. There are a number of assumptions that were made to create this chart, which should be stated upfront. The first is that the price of latex remains stable. The average price used came from an average of the price received at all tapping villages that were interviewed. That average price was 8 RMB per kilogram of latex. It is important to keep this in mind when looking at the chart because this price has dropped

dramatically since the time of the interviews. The next assumption is that all farmers are receiving the same price for latex, which is also known not to be true.

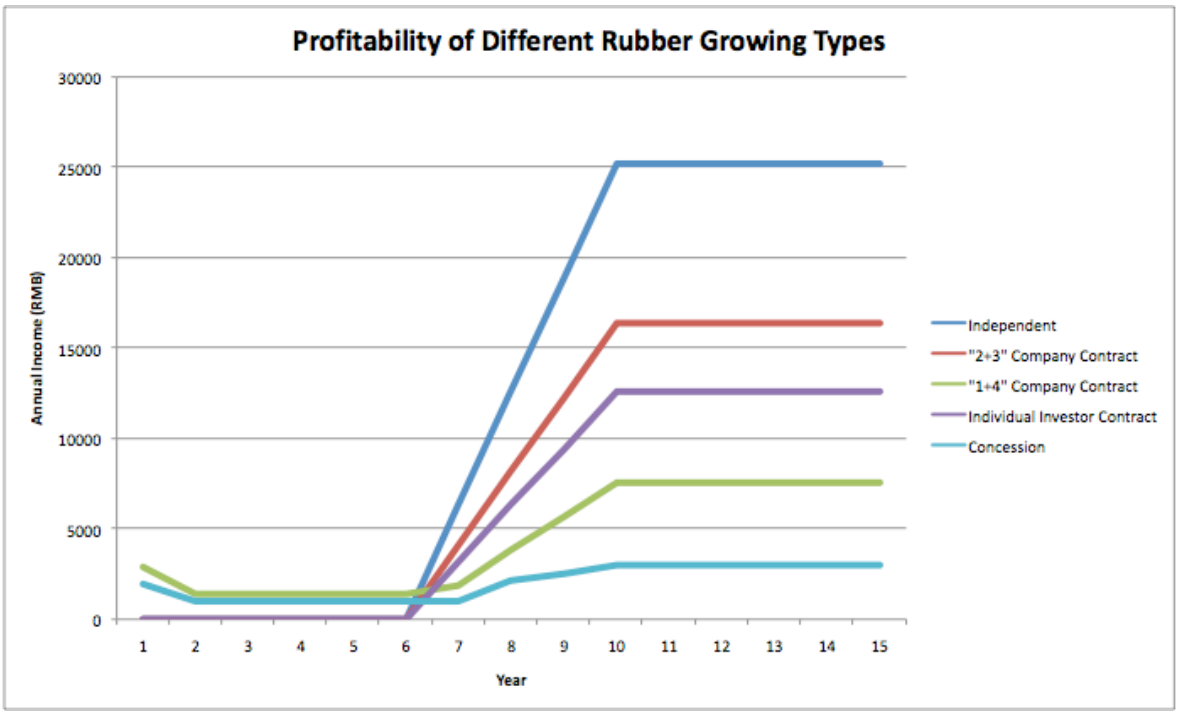

Fig. 6: Chart of Rubber Growing Type Profitability

Farmers that have greater access to independent marketing information are more likely to get better prices than those that are dependent upon the prices quoted by the companies. The other biggest assumption is that all farmers have the same amount of land, which is also known to not be the case. For the purpose of this case study, farmers in each growing type were assumed to have 1 ha of land each. An average yield was calculated using the data from villages that are tapping. This average was 7 kilograms per tree. To determine the total yield an average of 450 rubber trees per hectare of land was used. To determine the wages that farmers signing "1+4" contracts and concessions receive before tapping begins, average wage rates from villages where this data was obtained were used. The wages of concession laborers when tapping was not

known but assumed to be higher than during the rubber maturation years since more labor is required during that time period.

What this chart shows is that there is a degree of profit-based rationality behind farmers' choice of growing type. Although in many circumstances farmers do not have a choice of which growing type to enter into, when they do have the choice they may choose whichever one makes the most sense for their socioeconomic status. As discussed earlier, poorer farmers may choose a "1+4" contract over a "2+3" contract because of the wage it provides during the growing years. Or, farmers may choose to grow in a "2+3" contract rather than with an individual investor because of the higher profitability of the "2+3" contract. Or, farmers may rather grow with an individual investor who they know and trust rather than with a company who they do not have any faith in, despite the lower profitability. There are clearly different advantages and disadvantages to each contracting type and thus there must be a certain degree of rationality behind farmers decisions concerning which type to enter into.

RECOMMENDATIONS

While some solutions have already been recommended earlier in this report due to their connection to the socioeconomic effects discussed, some are not so obvious and will be presented in this section. Also, the solutions put forth in this section are not intended to cover all of the problems associated with rubber growing. They mostly focus on solutions that have received little attention or are in some way novel compared to those that have already been proposed in previous reports.

STANDARDIZATION OF CONTRACTS

The standardization of contracts is an extremely important step towards the reduction of inequality that rubber growing has and will continue to bring to the region. While inequality will

continue to crop up in various forms, by standardizing the contracts that rubber companies use, the exploitation of farmers growing in "1+4" type contracts as well as "2+3" contracts that contain poor splitting percentages will be lessened. In most villages, farmers do not have much of a choice of which company they would like to grow with. Most of the time, a company comes to the village, proposes a contract, and they are either able to grow in such a contract or not grow at all. Households do not get to choose the village with the best contract. Without such competition, it is important that all of the companies have the same, equitable contract ensuring that all villages growing rubber in contract with a company will receive the same splitting percentage. The standardized contract I propose is the most common "2+3" contract with a splitting percentage of 65% to the farmer and 35% to the company. However, standardization is the easiest part and enforcement much more difficult, exemplified by the fact that the Luang Namtha PAFO does promote a standardized "2+3" contract but it is not enforced. If such a proposal is to be effective it is crucial that only rubber companies adhering to this type of contract are allowed to grow.

MONITORING INFORMAL INVESTMENT

Although not nearly as prevalent as company contracts, informal investment can be more harmful, evidenced by its similarity to the "1+4" company contract. The problems with these contracts largely stem from the fact they mostly go undetected. The contracts that are signed are hardly ever signed by DAFO, and in many cases they are not signed at all, and are only oral. Since they are not regulated by DAFO there is a lot of room for exploitation, most importantly in the form of permanent land rental. Issues of splitting percentage are important as well and it should be enforced that splitting percentages never reach lower than 50% for each household. However, the loss of land through permanent rental can be even more damaging for farming

households and their villages in the long term. By monitoring informal investment, DAFO could ensure that all contracts in which land is split explicitly say that the land is only being temporarily rented and will be returned to the original land owner when latex is no longer able to be tapped from the trees. Although such regulation would be extremely difficult because of the informal nature of this type of investment, it is nevertheless incredibly important.

RUBBER-GROWING QUOTAS

Lastly, both households and villages should only be able to grow a certain amount of rubber. Such a policy is intended to prevent the harmful effects that overgrowing can bring. This includes a lack of food security due to growing too much rubber and not enough rice, as well as other crops. This also includes not counting on rubber as an only source of income. The price of rubber, like many cash crops, is very volatile and can drop dramatically at any time. If rubber is the only cash crop that a household is dependent upon, the household could easily face an increase in poverty in the event of a latex price drop, especially after committing so much land to growing rubber for 7 to 10 years. Although both Luang Namtha and Bokeo PAFO officials expressed that rubber growing will be reduced and eventually stopped throughout the next few years, the effectiveness of such an approach should be questioned. It is hard to conceive that the spread of such a popular cash crop can be stopped. One of the few rubber companies we interviewed said that they had not even heard of such a policy. Reducing the amount that each household and village is allowed to grow is a much more moderate and realistic approach to reducing the negative impacts of growing rubber.

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APPENDIX

			GPS (Degrees, Minutes, Seconds)		GPS (Decimal Degrees)	
Province	**District**	**Village**	**Lattitude**	**Longtitude**	**Latitude**	**Longitude**
Luang Namtha	Namtha	B. Had Nyao	21° 01' 13"N	101° 24' 41"E	21.0203	101.4114
		B. Namdee	21° 00' 54"N	101° 26' 19"E	21.0150	101.4386
		B. Hong Loi	21° 02' 29"N	101° 24' 30"E	21.0414	101.4083
		B. Nam Thoung	20° 58' 16"N	101° 26' 09"E	20.9711	101.4358
		B. Mai #1	20° 56' 23"N	101° 24' 28"E	20.9397	101.4078
		B. Xaysompoun	21° 00' 32"N	101° 24' 20"E	21.0089	101.4056
		B. Oudomsin	21° 00' 16"N	101° 24' 34"E	21.0044	101.4094
		B. Nam Chang	21° 00' 11"N	101° 23' 26"E	21.0031	101.3906
		B. Houayhok	20° 56' 33"N	101° 26' 48"E	20.9425	101.4467
		B. Chaleunsouk	20° 52' 37"N	101° 20' 02"E	20.8769	101.3339
		B. Tavane	20° 58' 37"N	101° 28' 38"E	20.9769	101.4772
		B. Sohp Tout	20° 54' 17"N	101° 26' 06"E	20.9047	101.4350
		B. Sohp Xim	20° 52' 15"N	101° 28' 33"E	20.8708	101.4758
		B. Xim Udom				
		B. Had Nyong				
	Sing	B. Lormeu	21° 18' 17"N	101° 09' 52"E	21.3047	101.1644
		B. Bouakyaxaimai				
		B. Udomsin	21° 11' 11"N	101° 13' 05"E	21.1864	101.2181
		B. Xieng Jai	21° 11' 25"N	101° 09' 05"E	21.1903	101.1514
		B. Nakham	21° 10' 54"N	101° 10' 58"E	21.1817	101.1828
		B. Nam Dai	21° 09' 27"N	101° 06' 50"E	21.1575	101.1139
		B. Nongbua	21° 10' 17"N	101° 09' 16"E	21.1714	101.1544
		B. Kangphousing (Kang Mai)	21° 10' 13"N	101° 07' 36"E	21.1703	101.1267
		B. Tamy	21° 07' 12"N	101° 05' 05"E	21.1200	101.0847
		B. Phabatnyai (Koh)	21° 12' 27"N	101° 12' 30"E	21.2075	101.2083
		B. Namkeo Luang	21° 11' 04"N	101° 08' 51"E	21.1844	101.1475
	Long	B. Xiengkok Mai	20° 53' 56"N	100° 38' 34"E	20.8989	100.6428
		B. Fate	20° 59' 07"N	100° 52' 45"E	20.9853	100.8792
		B. Doneyeng	20° 57' 34"N	100° 48' 43"E	20.9594	100.8119
		B. Donesavane	20° 57' 14"N	100° 48' 09"E	20.9539	100.8025
		B. Sohpma	21° 03' 01"N	101° 01' 12"E	21.0503	101.0200
		B. Chomcheng	20° 57' 54"N	101° 49' 13"E	20.9650	101.8203
		B. Chayee	20° 52' 45"N	100° 33' 35"E	20.8817	100.5597
		B. Hoikoum	20° 52' 24"N	100° 32' 39"E	20.8733	100.5442
		B. Chakhamping	20° 59' 18"N	101° 54' 03"E	20.9883	101.9008
	Viengphoukha	B. Nam O	20° 42' 41"N	101° 07' 08"E	20.7114	101.1189
		B. Thiao	20° 40' 37"N	101° 03' 47"E	20.6769	101.0631
		B. Nam Ngeun	20° 35' 26"N	101° 03' 22"E	20.5906	101.0561
		B. Mai #2	20° 40' 39"N	101° 03' 26"E	20.6775	101.0572
		B. Nam Sing	20° 45' 58"N	101° 12' 32"E	20.7661	101.2089
		B. Phadeng	20° 41' 01"N	101° 04' 05"E	20.6836	101.0681
		B. Phon Thong	20° 36' 04"N	101° 03' 52"E	20.6011	101.0644
		B. Prang	20° 46' 58"N	101° 14' 10"E	20.7828	101.2361
		B. Nongkham	20° 39' 41"N	101° 04' 09"E	20.6614	101.0692
		B. Pang Xai	20° 34' 50"N	101° 02' 09"E	20.5806	101.0358
		B. Nam Jri	20° 33' 20"N	101° 00' 55"E	20.5556	101.0153
		B. Nampaman	20° 41' 07"N	101° 00' 35"E	20.6853	101.0097
		B. Nam Kieng	20° 36' 51"N	101° 05' 28"E	20.6142	101.0911
		B. Phou Lan	20° 30' 18"N	101° 00' 05"E	20.5050	101.0014
	Nalae	B. Had Naleng	20° 43' 35"N	101°25' 36"E	20.7264	101.4267
		B. Mouk Jung	20° 42' 41"N	101° 26' 25"E	20.7114	101.4403
		B. Sang Ah	20° 40' 17"N	101° 27' 08"E	20.6714	101.4522
Bokeo	Houay Xai	B. Houaydinjee	20° 20' 56"N	100° 32' 26"E	20.3489	100.5406
		B. Houaysala	20° 20' 14"N	100° 27' 51"E	20.3372	100.4642
		B. Lao Luang	20° 25' 57"N	100° 21' 55"E	20.4325	100.3653
		B. Chomchouk	20° 16' 11"N	100° 28' 13"E	20.2697	100.4703
		B. Lang				
		B. Houay Xai Tai	20° 15' 55"N	100° 24' 53"E	20.2653	100.4147
		B. Saew	20° 23' 37"N	100° 49' 41"E	20.3992	100.8281
		B. Mokachok	20° 15' 36"N	100° 27' 29"E	20.2600	100.4581
		B. Bolek	20° 18' 27"N	100° 31' 04"E	20.3075	100.5178
		B. Pakhao Tai	20° 14' 22"N	100° 27' 35"E	20.2394	100.4597
		B. Phouvantai	20° 15' 26"N	100° 34' 09"E	20.2572	100.5692
		B. Nam Yone Mai	20° 24' 29"N	100° 19' 42"E	20.4081	100.3283
		B. Done Cheng	20° 25' 28"N	100° 21' 19"E	20.4244	100.3553
		B. Nam Tin	20° 18' 07"N	100° 32' 17"E	20.3019	100.5381
	Pha Oudom	B. Tampake	20° 02' 22"N	100° 46' 20"E	20.0394	100.7722
		B. Xay Oudom	20° 05' 38"N	100° 48' 43"E	20.0939	100.8119
		B. Houay Koun	20° 02' 59"N	100° 48' 29"E	20.0497	100.8081
		B. Pha Oudom	20° 05' 13"N	100° 49' 30"E	20.0869	100.8250
		B. Mouksoh	20° 03' 23"N	100° 45' 22"E	20.0564	100.7561
Udomxai	Na Moh	B. Phou Phat	20° 43' 08"N	101° 25' 52"E	20.7189	101.4311

Table 4: GPS Coordinates of Interviewed Villages