Field Report on
Rubber and Sugarcane Markets in Northern Laos
August - September 2003

Socio-Economic Research Component

Lao Swedish Upland Agriculture and Forestry Program
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1. Itinerary

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<td>August 30-31</td>
<td>Travel to Luangprabang and to Oudomxay.</td>
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<tr>
<td>September 1</td>
<td>In the morning: meeting with Mr. Sykham, head of DAFO.</td>
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<td></td>
<td>In the afternoon: meeting with the district governor of Namor district.</td>
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<tr>
<td>September 2-3</td>
<td>Working with village headman and village cabinet in five target villages of LSUAFRP for village characterization of HH.</td>
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<td>September 4</td>
<td>In the morning: travel to Luangnamtha and meeting with PAFO.</td>
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<td>In the afternoon: meeting with district governor of Namth district and then meeting with PAFES and DAFO. After that visit Hadyao village and interviewed village headman and rubber growers. Then travel to Sing district in the evening time.</td>
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<tr>
<td>September 4</td>
<td>In the morning: meeting with DAFO of Sing district and go to Phiyer village and interviewed village headman and sugarcane growers. In the afternoon: travel to Mengla district of Yunnan province, China</td>
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<td>September 5</td>
<td>In the morning: visiting the rubber factory, rubber wood sawmill and sight seeing of rubber plantation area. In the afternoon: meeting with the owner of rubber factory who bought rubber from Luangnamtha province.</td>
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<tr>
<td>September 6</td>
<td>In the morning: visiting the sugar factory, which bought sugarcane from Namor district of Oudomxay province and Bounneua and Bountai district of Phonsaly province. In the afternoon: travel back to Oudomxay province.</td>
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<tr>
<td>September 8-19</td>
<td>Interview the selected HH in five target villages of LSUAFRP for HH diagnostic survey.</td>
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<td>September 20-21</td>
<td>Travel back to Luangprabang and to Vientiane.</td>
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2. Purpose of Fieldwork

This fieldwork focused on two aspects of the current workplan of the Socioeconomic Unit:

- **Market research**: To find out the information about sugar and rubber market.
- **Village and Household Level Diagnostic Survey**: To follow up on the village level diagnostic survey conducted at the beginning of the field research programme in Namor and to develop a deeper understanding of the livelihood systems, problems, coping mechanisms and opportunities of the different kinds of households in the research villages (stratified by multiple criteria).

This report focuses on the market research fieldwork only. It is a preliminary field report which is being gotten out quickly in order to contribute to the current discussion, not a full analytical report on rubber and sugarcane markets. The results of the household survey work will be reported separately, after the analysis is completed.
3. Information on Rubber and Sugarcane from Different Sources

3.1 DAFO and Governor of Namor district

From discussion with the district governor and Mr. Sykham, head of DAFO, the issues of rubber and sugarcane were uncovered with district plan on planting rubber in research area of LSUAFRP and other area in Namor district. The rubber plantation is booming in Namor and the other northern provinces such as Oudomxay and Luangnamtha.

For sugarcane, which was planted in Namor, the district had made the agreement with the sugar factory in Mengla district, Yunnan. There is no crucial problem of selling sugarcane to China according to follow the agreement. The more supply of sugarcane from Namor is needed. Sugarcane growers only claimed about getting money in 60 days after selling sugarcane. They want to get money earlier. This issue will be discussed and negotiated with sugar factory in the annual meeting between the district and the sugar factory in October this year.

3.2 PAFO Luangnamtha

Our team arrived at Luangnamtha nearly at noon. So we hurried to see PAFO to tell them the objective of this field activity.

PAFO began by relating the story of rubber plantation in Luangnamtha, as part of the government plan for poverty reduction and stopping of slash and burn cultivation in the mountainous area. However it is hard to expand paddy field because of limited...
lowland area. After hearing that Chinese people succeeded in rubber planting, and since some Chinese wanted to invest in rubber plantation in Laos, especially in Luangnamtha. Luangnamtha, farmers also were willing to plant rubber. The province promoted rubber plantation as its first priority for increasing farmers’ income.

PAFO also told the research team about their concerns about the quality of seedlings of rubber planted in Luangnamtha and about their ability to sell rubber to China when, in future, there is a lot of rubber supply from Luangnamtha.

3.3 PAFES Luangnamtha

The information from PAFES begins in 1994 when PAFO staff went to train in rubber plantation in Mengla district, Yunnan. Seed was taken from there to plant in Namtha district and a buying agreement of rubber between Namtha district and Department of Business Management of Mengla (BBMM) district was made.

After concluding an agreement with DBMM on rubber plantation, PAFES was responsible for leading target farmers to train for 20 days on the planting and harvest process in Mengla. Then PAFES invited a Chinese Technician to introduce and train farmers (more detail about who or which organization supports training and how collaboration between Chinese Technicians takes place with PAFES and farmers in Luangnamtha will be made clear after the next fieldwork).

Information was also obtained concerning plantation process in Luangnamtha. Despite significant limitations on farmers’ capacity for investing in rubber planting and the lack of knowledge and technical experience, people were nevertheless willing to do it. The province gave support by hiring technicians from China to carry out preparation and plantation activities. The expenditure was around 6,200,000 kip/ha. Then the province gave the right of rubber field to farmers and credit in the form of a loan at 2% interest with 8-10 years for the farmers to repay.

The total area of rubber plantation in the whole province is 985 ha. In Namtha district the area of 335 ha is at a harvestable age and latex is being tapped. By 2010 it is expected that 10,000 ha of rubber will have been planted.

3.4 DAFO Namtha District

Luangnamtha province selected rubber planting as its first priority for poverty reduction (not only rice planting) and the province has some budget for promoting rubber plantations by providing loans to farmers through the Agricultural Promotion Bank (APB). This year the province allocated a budget for 203 ha of rubber plantation and last year it was 400 ha, providing for 1 ha per household.

The Chinese entrepreneur proposed to invest in planting rubber in Namtha district by hiring Lao labor, but the district disagreed because Lao farmers wouldn’t own the rubber plantation, just get salary. The Chinese also proposed to make seed plantations here and they planned to invest in a rubber factory in Laos.
The problems mentioned by DAFO were:

- The main objective of the PAFO and DAFO by promoting poor farmers to plant rubber is to reduce poverty, but the poor people have not much land. The land that is suitable for rubber planting mostly belongs to rich people.
- There is also conflict of land area between villages because many farmers want to plant rubber, so they need land.
- The district has a limited budget for promoting rubber plantation.

### 3.5 District Governor of Namtha District

In China, rubber can’t be grown in the north, only in the south and in the next ten years, many rubber trees will be felled in China because that are old. So there will be high demand for rubber from Laos.

Not only Chinese entrepreneurs, but also Thai and Japanese entrepreneurs are interested to invest in a rubber-processing factory here.

The district has a plan to expand the rubber plantation in all areas of Namtha district and other suitable areas. The district will promote rubber planting (not only rice planting) to eradicate poverty.

The obstacle is that the farmers lack funds, labor and experience about planting rubber, so at first the province let the Chinese invest and do all the work. Lao only provided the land. Because this was the first time, Lao farmers didn’t know the process of rubber planting, so Chinese workers slashed the forest and dug the land. After that Lao farmers looked after the trees until it was time for harvesting latex. Harvest of the first plantings came in 8-10 years, but the farmers interviewed now say that the new variety of rubber can be harvested in 6 years, and this is confirmed by the interview at the Chinese factory in Mengla district. Now farmers want to slash and dig the land and plant by themselves, but they lack money to buy seedlings (seedlings are 8 Yuan/tree).

In 2002 the area of rubber plantation was 206 ha and 203 ha more was planted in 2003. Some farmers who had funds bought seedlings and planted about 100 ha by themselves, but some of the rubber trees died. This is because farmers lack technique and experience in planting rubber. Now about 335 ha of rubber plantation have reached tapping age in Luang Namtha.

The total cost of planting rubber is about 6,200,000 kip per ha (including seed and labor). When the latex is harvested, 5 kg of latex can be gotten per tree per year. Price of latex is 3 Yuan per kilo. One ha has 450 trees. The exchange rate is 1 Yuan = 1,300 kip. Total revenue in one year of one ha is $5 \times 3 \times 450 \times 1,300 \text{ kip} = 8,775,000 \text{ kip/ha}$.

The district proposed some points for next assistance from the government:

- Rubber plantation techniques: PAFO/DAFO should be trained on planting rubber at least three months. Then farmers will be trained (slash the channel, dig the hold, take latex)
- Fund for providing and promoting rubber plantation: now farmers are likely to plant rubber, but province has limited budget. They want long term credit (8-10 years loan)
3.6 Hadyao Village, Namtha District

In 1994 some farmers, PAFES and DAFES staff from Luangnamtha province were trained on rubber plantation in Mengla district, Yunan and after that rubber was planted in LNT in five villages. Hadyao is the one village of the five that was successful, while the other villages were not. The reason is that people in Hadyao village made a very strict rule: if a villager doesn’t take care or his/her rubber, his/her rubber will be transferred to the another villager. The villagers who made these rules are Laosoung who used to live in the mountains and work hard in planting opium. Rubber planting is similar to opium in that it is hard work and requires much labor.

In 1994 the number of 12,000 rubber trees were planted which is equal to 26.6 ha (1 ha = 450 trees). Two kinds of seed (“Ithiyi” and “Luperhouse”) came from China. The former kind gives much latex but it can’t resist disease. The latter gives less latex but it can resist disease.

In 2002 processed latex was harvested and sold to China at the price of 2.5-4.5 Yuan/kg (depending on the world market). Farmers transported their rubber to sell to China at the border. There is high demand for rubber from Laos now because the rubber from Luangnamtha is considered good quality and fresh because people did not mix with other things.

In Hadyao village, for harvesting the latex people who have no rubber plantation were hired by giving them 50% of the latex for the first year of harvesting. Now the owner gets 70% and the people who harvest the latex get 30%.

Rubber trees will be felled and sold as timber when they are 35-40 years old. The Chinese have said they would buy the trees.

Rubber plantation is difficult in slashing and preparing the land, taking care of the trees and tapping the latex. At the normal plantation spacing, during the first three years crops can be planted with rubber, then during the fourth to eighth years, when rubber has grown older, crops can not be planted with rubber. So during this period rubber farmers will face difficulty. At this time it is not known what the possibilities
for shade tolerant crops might be after year eight. It is also not know what other spacing systems and agroforestry intercropping might be possible.

The technique of planting is that the rubber was planted using two-part grafted seedlings.

The market situation of rubber is that now there is no problem with marketing because in Luangnamtha the rubber plantation area has not yet become very large. Another factor is that in China the rubber trees are old already and nearly ready to be cut down, so Chinese people have to find a substitute source. What will happen in future we don’t know. This case needs careful consideration.

There is also a problem of uncertainty about the quality of different varieties. Farmers have low knowledge on rubber. They can not identify which one is the best so they need help from the high expert to recommend and make clear about this.

When people buy seed from Chinese people they are afraid of getting a bad variety because up to the age of six months it is hard to identify whether it is the good type of seedling or not. Only an expert can identify which are the good ones.

3.7 Small Rubber Factory in Mengla District, Yunnan

This factory buys both raw latex and processed latex and they make rubber blocks to sell to manufacturers to produce many kinds of things.

The price of block rubber is 10-12 Yuan/kg, 3.5-4 Yuan/kg for processed latex, and 2.5-3 Yuan/kg for raw latex.

The factory capacity is 10 ton of block rubber per day (if there is sufficient latex supply). Three tons of raw latex can yield 1 ton of block rubber, and 2 tons of processed latex can yield 1 ton of block rubber. In Mengla there are about 200-300 factories of this size.

The rubber tree itself is valuable, being sold for a price of 80-100 Yuan/tree (1,200 Yuan/m³ of processed wood). The tree is used for making furniture.

3.8 The owner of Rubber Factory in Mengla who bought rubber from Hadyao Village, Luangnamtha Province

We are very lucky that we can interview the owner of rubber factory who buys rubber from Hadyao village, Namtha district of Luangnamtha Province.
We also had an opportunity to see a new variety of rubber tree, which was just planted two years ago. This new variety (called “74”) can give latex after six years of planting, give more latex, and produce taller trees compared with the old variety. But the price of seedlings of the new variety is higher (8 Yuan/seeding) and requires a new planting technique which uses a plastic bag to supply water to each tree. The plastic bag is used to help the rubber tree grow well. The rubber planted previously in Luangnamtha didn’t use this technique. The price of 1 plastic bag is 1 Yuan.

Rubber grows well in the dry season (in China it was planted in March or April). In a year latex can be harvested over a period of ten months. Maize is planted as a second crop between the rubber trees.

In China 15 varieties of rubber have been planted, only 5 of which have been planted in Mengla (2 new varieties: “74” and “75”).

The processed latex from Luangnamtha is carried to the border and sold at a price of 4 Yuan/kg without tax between Laos and China because Chinese and Lao governments have a policy to help poor people. Last year 120 tons of processed latex was sold to this factory. They still need more from Laos because the latex from Laos is pure, not mixed with other material like rock, sand, water, and the transportation cost is less than alternative sources. The factory owner used to buy latex from Thailand, but the cost of transportation and tax was high so he stopped buying from Thailand. 70% of the latex is imported from Thailand, Malaysia and other countries. Only 30% of Chinese latex is produced in China.
In the future Chinese entrepreneurs want to build seed garden of rubber and plant rubber in Laos (Namor district). In the next ten years the area of rubber will be increased to 1,000 ha. They also have planned to construct a rubber factory in Laos.

3.9 DAFO Sing District

Sing District is an area of Luangnamtha where a lot of sugarcane is grown. DAFO informed that in 1997-1998 the Chinese traders failed to buy many tons of sugarcane that the farmers were expecting to sell them. Many farmers harvested their sugarcane (about 50 tons), but the Chinese did not come to buy sugarcane. Farmers did not know where to sell their sugarcane. So this is the reason many farmers stopped growing sugarcane at that time. The reason this happened is that the Chinese entrepreneur had a limited budget for buying sugarcane from Sing District. Some farmers whose sugarcane was bought did not get the money. Chinese came with their trucks and carried sugarcane to China and weighed it in China. They left receipts for the sugar with the farmers. After that they disappeared and the farmers received no money.

In 2000 the district made an agreement with a big Chinese company for buying sugarcane. The sugarcane is now weighed in Sing district and farmers are paid there, so there is no longer any problem like what happened in the past.

In 2002 a sugarcane area of 533 ha was planted, and 147 ha were planted in 2003. So the total area is 680 ha. However, DAFO does not encourage farmers to grow more sugarcane because they are not sure about the situation of the sugar factory in Yunnan, which will be changed in status from state enterprise to private enterprise. DAFO is worried about whether the policy on buying sugarcane from Laos will be the same or not.

Sugarcane has been planted in two areas by two ethnic groups in Sing district. The first is the Ikor ethnic group who live in the upland area and used to do slash and burn cultivation. The second is Leua ethnic group who live in the lowland and have paddies.

Concerning the rubber planting, farmers planted by themselves about 30 ha for 4-5 years. They took seedlings from China, but they did not get assistance from DAFO because DAFO staff has no experience on rubber planting.

Two Chinese entrepreneurs proposed to invest in planting rubber in Sing District, but the district has not approved it yet.

This year the district has a plan to plant 50 ha of rubber plantation, but the district could not allocate the budget for this so the plan has been postponed.

The District Plan focuses on three different development areas
1. Xay-Xiengkhean village area (upland area): raising livestock
2. Mom village area: planting rubber, expanding padi rice, raising small livestock
3. Meuang Sing area (lowland area): growing cash crops, raising small livestock
**3.10 Phiyer Village (Ikor ethnic group), Sing District**

Chinese invested in sugarcane plantation for the farmers. Farmers have debt and will pay it back after sugarcane can be harvested.

The cost of planting sugarcane is 170 Yuan/ton. Farmers applied fertilizer at a rate of 15 bags of fertilizer per ha (1 bag per 1 ton of sugarcane planting). The price of fertilizer is 75 Yuan/bag (50 kg).

One ton of sugarcane planted will yield 18-20 tons over a 3-4 year harvesting period. Sugarcane is sold at the price of 100 Yuan/ton.

**3.11 Sugar factory in Mengla District, Yunnan**

This factory is medium size, but the largest in Mengla. The capacity of the factory is 1,800 ton of sugarcane per day, but the factory can actually process only 1,500-1,600 tons of sugarcane per day because of raw material limitations. 10 tons of sugarcane yields 1 ton of sugar.

Last year this factory got 70,000 ton of sugarcane supply from China, while 26,000 tons came from Laos (Namor/Oudomxay, Bounneua and Bountai/Phongsaly). The factory wants to get sugarcane and produce sugar from November to June, but in fact they get sugarcane for only three months, from November to January, because of the inadequate supply of sugarcane.

The factory borrowed money from the Agricultural Bank of China. When they produce sugar, they will give sugar to the bank and the bank will find a market for it.

The factory has its own electricity generator to produce electricity for its own use. Not only do they produce sugar, but they also use the waste of sugarcane for producing medicinal alcohol and fertilizer for rubber plantations.

In Laos 1 ton of sugarcane planting will yield 5-7 tons per year when harvested, but in China farmers can get about 10 tons per year. This is because of Lao farmers don’t take care of their sugarcane so well and there is disease, so the yield is low.

The sugar factory in Mengla District and Namor District made a three-year agreement. The factory will buy the sugarcane from Namor at the price of 155 Yuan/ton although the market price is changeable.

The farm gate price is the factory gate price (155 Yuan/ton) minus the transportation cost (including the truck’s profit). For example in Namor farmers get 100 Yuan/ton.

Concerning the transportation arrangements, the factory contacts independent truckers to get the sugarcane. They send out their money to buy sugarcane. They pay the truckers the factory gate price of 155 Yuan/ton. How much money farmers get depends on the transportation cost. The factory also pays 5 Yuan/ton to the district.

As regards DAFO’s concern about the changing status of the sugar factory in Yunnan from state enterprise to private enterprise, the following viewpoint was the opinion
expressed by the senior staff of the sugar factory (not official source). He said that in Yunnan there are about 140 sugar factories. There is a plan to have one big company, which has lots of money, to own and run the business of these sugar factories. This will give the sugar factory stronger capacity and will reduce the problem of price competition among the big and small factories. The policy and agreement with buying sugarcane from Laos will be the same.

Concerning the problems which occurred in the past, a senior staff member of the sugar factory in MengLa commented that during the previous years the factory also had difficulty with farmers (Namor in Oudomsai, Bounnuea and Bountai in Phongsaly) about the purchasing and settlement process. At that time there were three parts: factory, farmers and middleman (a company which was responsible for purchasing from farmers and transporting to the factory). When this company got money from the factory to pay for farmers, sometimes they used it in others way and some farmers did not get paid. So farmers were not satisfied and they made claims to the factory. Then the factory and Lao governor made an agreement to cut off the middleman and let the factory or farmers themselves transport the sugarcane to the factory, which paid the farmers directly. At the present time there are still some problems with settlement, but it is mainly concerning misunderstandings arising from the procedure. The factory pays the trucker, but a truck can have two or three owners and sometimes when the factory comes to give the money the one who has the account is away, so they don not know how to pay how much for each. If they pay to the one who is present at the time, to let them divide it among themselves, it sometimes happens that sharing is not suitable for the quantity sold. It takes time to sort out these problems. Therefore, sometimes farmers are late in getting their money.

Sing District during 1997-98 District had a contact with a Chinese company to locate in Sing district and invest in sugarcane. This company provided seed and land preparation. The company was too small so it had not enough money to invest. They showed farmers how to borrow money from the APB for land preparation and fencing; then company would provide seed. Some farmers who have the capacity used their own money to invest. After finishing land preparation, the company did not provide seed, and told these farmers there was not enough seed. Only some were able to plant, and at that time more than 100 ha of potential plantation was lost. Farmers who had money were able to buy seed for themselves.

Then, when the harvest time arrived the company had only 5 trucks to load and they loaded only in areas that were near and easy to access. Far away from road they left the crop uncollected and sugarcane was lost.

4. Reporting to DAFO and the Governor of Namor district

This field activity of our research team is a preliminary investigation of the rubber and sugar issues. The result of this field activity will be to come up with information for discussion with other research components in order to prepare for further research in greater depth. The following preliminary findings were reported to the district officials in Namor at the end of the fieldwork:

Rubber planting is hard work and requires much labor, so there is a question of exactly how much labor is needed for 1 ha, whether the labor in our research area is
enough or not, and which ethnic groups can plant and take care rubber sufficiently. These are questions for future research.

The cost of rubber planting is quite high, but poor farmers have no access to credit. So identifying a source of finance is very important for smallholder investment in rubber plantations.

Another question is which variety of rubber is most suitable for planting in Laos (with high quality of latex and high market demand). There is an opportunity for seedling production in Laos instead of importing seedlings from China as in the past.

At this point in time, there is high demand for rubber from Laos. The reason is that the rubber planted in China will be soon be cut down because the trees are very old and in need of replacement. So demand for rubber from Laos is very high. However, other markets (not only China) should be considered when the Lao rubber plantation area becomes big and there is a large supply of rubber.

The most important issue for future research should be which crops are suitable for planting with rubber and in what kinds of agroforestry systems, so that farmers do not have a long period of little or no income while waiting for the rubber trees to mature. Even after maturity it would be good if there were shade tolerant crops or animals that could be raised under the rubber trees (perhaps planted on a wider spacing), so that the production system can be diversified and made less risky. The next research activity should be done in collaboration with the Farming Systems Research and Land Management Components of LSUAFRP.

5. Other sources of information

The information gotten from the fieldwork in Lao and China seems mostly to be positive about rubber growing, but other sources of information found on the internet revealed some negative aspects. It is best to take all the information into account so that a wrong decision can be avoided. One important study was done by Roland Cheo, National University of Singapore, and published on the internet with the title “An Evaluation of the Impact of Rubber Trees in China on the Rural Economy with Specific Focus on Xishuangbanna, Yunnan and Hainan Island.”

This article is an example of good information telling what really happened in China and from it we can understand more about the experience of rubber plantations in China. The study is very useful for understanding the issue of rubber planting in Laos, because the rubber planted in Laos (so far mostly in Luangnamtha) is in fact transferred from Mengla, which is one district in Xishuangbanna, Yunnan on which the study has focused. So the study is directly relevant to decisions about rubber plantations in Laos and should be considered “must reading” for anyone involved in such decisions.

In view of the importance of this study, selected excerpts have are reproduced in Annex 1. The main points of the study are summarized by the author as follows:

From the above evaluation, we can see that clearly Hainan Island has received most of the benefit from cultivating rubber trees in the last 40
years while, Xishuangbanna, Yunnan, has not been as successful. As a result of soil erosion and unfavourable climatic conditions, current productivity cannot be maintained without continual high investment in fertilisers as well as research and development into newer higher yielding rubber seedlings. If the regression model for Xishuangbanna identified in Table 6 is predictive, then the coming years will not be profitable for rubber tree growers. Other more profitable alternative crops will need to be identified and a smooth transition will need to be effected for current growers such as agro-forestry and then later possibly the felling of trees as timber to make way for better cash crop selection.

6. Discussion

What does this mean for Laos?

It at least means that Laos should proceed cautiously with rubber plantations. What the China study shows is that it is cheaper for China to import both natural and synthetic rubber than to grow it themselves. World natural rubber production and its price are declining as world synthetic rubber is increasing. This suggests that synthetic rubber is gradually replacing natural rubber. By encouraging Laos to grow rubber to sell to the Chinese market, the Chinese are certainly "exporting a problem" of their own.

However, this does not necessarily mean that Laos would be importing China’s problem if it decided to produce rubber for the Chinese market. It is not possible to draw a firm conclusion based only on this article. There are many factors to consider. What is a problem for China is not necessarily a problem for Laos. China has different opportunities, and it appears that its opportunities concerning rubber are mainly in the manufacturing sector. In this situation it makes sense for China to buy rubber from Laos and other exporting countries (mainly Thailand, Malaysia and Indonesia). Even if Lao rubber is sold at a lower price than what it costs to produce rubber in China, it may still be a good price and a good opportunity for Laos, *IF* there are no better opportunities at the moment.

It makes sense that the Chinese are promoting rubber growing in Laos. Malaysia did the same thing for rubber in Southern Thailand during the “boom years” in the Malaysian economy when the emphasis shifted from rubber and other natural resource-based industries to high-tech manufacturing. What is important is that Laos should not automatically believe everything that is said about rubber by the Chinese promoters. All the facts should be considered critically before Laos makes up its mind about whether rubber is a good crop for the country. Xishuangbanna has been advised to look for better cash crops than rubber. Perhaps Laos should also give longer consideration to other cash crop possibilities before jumping on the bandwagon for rubber.

One factor that should be considered is whether the climate and other environmental conditions in Laos are somehow better than those in Xishuangbanna. Do the Chinese think so? It is hard to tell, because maybe they only want to export their problem. However, since Chinese entrepreneurs seem willing to invest in rubber seed gardens
and processing centres in Laos, perhaps they really do believe it is possible to have a sustainable supply of rubber from Laos for their factories in China. Whatever the Chinese promoters might think, this is a question for Laos to decide on its own.

The “sustainability” issue is key to any such decision and it should be considered in the light of the government’s policies about watershed protection and reduction of shifting cultivation. According to the article from Singapore, monocrop rubber plantations lose soil at 42 times the soil loss rate of natural forest. This statistic is directly relevant because in Laos it is natural forest that is being cut down to make space for rubber plantations. This makes no sense as a watershed protection strategy, but it does make sense as a fertility strategy for the narrow objective of growing rubber, at least for the early years.

The same applies to sugar growing in Namor, where it is forest that is being cut for new sugar plantations precisely because the Chinese entrepreneurs want to exploit the high fertility of these newly cleared forest soils. According to a previous interview with the sugar factory operators in Mengla, sugar can no longer be grown in Xishuangbanna unless large quantities of fertilizer are used. Does sugar offer a substitute for shifting cultivation? Not likely. With current technology, once the fertility is used up the sugar grower has no choice but to look for another patch of forest to clear. This sugar-based shifting cultivation may be actually more destructive of forest than the traditional rice-based shifting cultivation.

If Laos is going to continue to develop rubber and sugar plantations for the Chinese market, NAFRI should put a major effort into developing sustainable cropping systems for these commodities. Fortunately, it does not have to start at square one. There is already a lot of international experience with rubber-based agroforestry systems, and even, to some extent, with more sustainable sugar rotations.

Apart from the “biological sustainability” issue there is also the “economic sustainability” issue. The Xishuangbanna case shows that rubber production may not always be economically sustainable, and it is a fact known worldwide that sugar production areas are often associated with severe poverty. In the Philippines this is referred to as “the bitter-sweet taste of sugar.”

It might still make sense for Laos to get into a diversified rubber-based agro-forestry system by developing possibilities for intercrops as the young rubber trees are growing, shade tolerant specialty crops or animal forage in mature plantations with modified spacing, and final harvest of a valuable timber crop at the end of the rotation. This has not been tried in Xishuangbanna, so the Singapore study doesn’t say much about this except that “agroforestry” seems like a good idea. It is the economics of the total production system, and the spreading of outputs over the entire life of the rotation, that is the true measure of sustainable economic value. If Laos is going to go into rubber plantations in a big way, it should be this kind of system that it promotes for its farmers. This implies a whole programme of Farming Systems and Socioeconomics research, based on careful Land Use Planning studies to ensure an approach that is consistent with the Government’s poverty-reduction and watershed protection policies.
Another aspect of economic sustainability is “market sustainability.” Prices for world commodities always fluctuate. Laos has to be prepared to accept this if it wants to participate, but it is always a good idea to avoid a situation where you are producing a product that has only one buyer. If China starts dropping the price too low, Laos might also sell its rubber to Thailand, which is a member of the world’s largest rubber cartel (along with Malaysia and Indonesia). However, the fact that Thailand already has huge stockpiles of unsold rubber from its own rubber industry may mean that it is not in the market for more rubber from Laos. So it is not so clear that Laos would have more than one buyer.

Thailand has been advised that it should reduce its own rubber production in order to keep the price of rubber from falling. Thailand can do this because farmers there can produce many other crops and need not be completely dependent on rubber. It might mean that Thailand, like China, might also find it convenient to simply buy cheap rubber from Laos. That would mean that Laos might then have two buyers for its rubber. This would not be a bad situation to be in as long as rubber growers in Laos are able to make a decent living selling “cheap” rubber slightly below the world market price. Then it would only have to compete with synthetic rubber.

In any case, if Laos does decide to go for rubber, it would be advisable to keep more of the profit in Laos by doing at least some of the processing here as well as undertaking the mass-production of rubber seedlings in Laos. However, this is not a simple matter. As learned in the fieldwork, raw latex from Laos now enjoys a reputation as being “high quality” because it is not mixed with other things. Would the same quality perception apply to rubber blocks produced in Laos? Maybe, maybe not.

Concerning seedling production, Laos is now dependent upon the rubber research station in Mengla for its entire stock of improved seedling varieties. Would the Chinese research station continue to bear the cost of rubber research if it could no longer sell large quantities of seedlings to Laos? Is Laos ready to take on the commitment of establishing its own rubber research station? It would be highly irresponsible of the Government to promote rubber plantations in a big way without the support of a rubber research station. It is not only a question of maintaining high quality plantation stock but also of controlling disease and developing rubber-based agroforestry systems that do not cause massive deforestation and soil loss. Perhaps some kind of partnership between NAFRI and rubber researchers in China is what is needed, but NAFRI would still have to make a serious commitment to developing a strong cadre of highly qualified rubber research scientists.

All of these issues require additional research and careful consideration. From a marketing point of view, perhaps the most important issue is this: If Laos wants to develop a stable economy, if it wants to become a “price maker” rather than always just a “price taker,” then it needs to develop a diversified basket of products rather than always hoping for big single-product solutions.
References

Annex 1: Excerpts from relevant secondary sources of information on rubber

Excerpts from

“An Evaluation of the Impact of Rubber Trees in China on the Rural Economy with Specific Focus on Xishuangbanna, Yunnan and Hainan Island”

The Practical Difficulties of Growing Natural Rubber in China

1. Examining direct and indirect costs
2. Examining lost productivity and quality of NR

1. Direct Costs and Indirect Costs

In studying the economic impact of growing rubber in China, it is important to be acquainted with the concept of direct and indirect costs. As the geographical location of Chinese natural rubber is much further north than the usual production regions, between 18° and 24° N. latitudes. Its main growing district are Hainan island and the Xishuangbanna Prefecture in Yunnan. Generally experiencing less idle climate for the growth of NR normally lengthens the immaturity period of young rubber from the usual 5-6 years to 7-8 years, this is especially the case with Xishuangbanna, which also has less than ideal terrain for the growth of rubber trees. Infrastructure linked to the industry is generally poor in all growing areas and transportation to consumption points in other parts of China is expensive.

In Xishuangbanna, Yunnan, seven months of the year are suitable for tapping the rubber which is two to three months shorter than that of Hainan Island. In addition to this, in the last 30 years, Xishuangbanna has been hit by harsh wintry conditions (1970-1971, 1973-1976, and most recently in 1999-2000). This effectively kills rubber trees in the early stages of their growth (around three years old or younger). This adds to the indirect costs of the industry, as a complete harvest may be wiped out by unexpected winters.

Table 1. Direct and Indirect Costs Experienced in Xishuangbanna

<table>
<thead>
<tr>
<th>Direct Costs</th>
<th>Indirect Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>• High cost of fertilisers to maintain</td>
<td>• 7-8 year waiting period for lost income.</td>
</tr>
<tr>
<td>output in a low yielding environment.</td>
<td>Lost opportunity to grow better yielding</td>
</tr>
<tr>
<td>• High cost of transporting the raw rubber</td>
<td>crop. Plus the ever present possibility of</td>
</tr>
<tr>
<td>to processing areas across mountain</td>
<td>zero returns if the crop is wiped out by</td>
</tr>
<tr>
<td>roads and to secondary industries.</td>
<td>harsh winters.</td>
</tr>
<tr>
<td>• Labour cost to maintain plantation.</td>
<td>• Lost of fertile topsoil due to soil erosion</td>
</tr>
<tr>
<td>Generally low.</td>
<td>because of mono-cropping. Leads to</td>
</tr>
<tr>
<td>• High cost of training farmers to care</td>
<td>lower yields overall and over time.</td>
</tr>
<tr>
<td>and maintain the quality of the tapped</td>
<td>• 2-3 months shorter tapping months a year</td>
</tr>
<tr>
<td>trees.</td>
<td>in Xishuangbanna compared to Hainan</td>
</tr>
<tr>
<td></td>
<td>Island. Less income of 2-3 months.</td>
</tr>
<tr>
<td></td>
<td>• Lost opportunity to save costs by</td>
</tr>
</tbody>
</table>

importing cheaper rubber from overseas and channeling money into other investment activities or more lucrative cash crops.

• Possible contamination of food crops due to the excessive use of fertilisers.
• Loss of biodiversity and native tree species. A lower potential for eco-tourism.
• Hard to maintain quality of the raw rubber due to different methods of tapping and the distances travelled.
• The overflowing of banks of major rivers: the Mekhong river, due to soil erosion.

2. Lost Productivity and Quality of NR
Currently almost 70% of the world’s rubber output goes into the manufacture of vehicle tyres, but beyond that, it is also used in the manufacture of adhesives, carpet underlays, conveyor belts, shoes, cellular and foam articles, bridge bearings, automobile components and many electrical insulation and inflatable materials.

Chart 4. Output (% growth) of Natural Rubber Industry in Xishuangbanna, Yunnan
(First 26 years of Industry)

(Source: Yunnan data: 1978-1990 figs (Yunnan Shengzhi, Book 8), 1991-1997 figs. Yunnan tongji nianjian (various years), figs before 1978 were expolated from nationally adjusted growth rates)
(Source: Hainan data: (Source: Rubber 78-97: Hainan tongji nianjian. 71-77. Applying national rubber growth rates backward expolating, since prior to 78, Xishuangbanna was virtually nonproducing)

We can see from the above graph that Hainan’s and Xishuangbanna’s output growth for NR rises rapidly in the 70s, however since the 80s, growth of the industry, though mostly positive, has seemed to lose steam. The trendline in the 90s suggest a declining one. This makes sense given the lack of low-lying flat land suitable for the cultivation of rubber plantations. The extensive felling of secondary forest to make way for rubber plantations has led to massive soil erosion.

The graph does show that though declining trends can be detected, yet the overall growth situation is positive. This could be because of central planning that allocates growth targets through the use of greater fertilisers and the allocation of more land as well as high yielding varieties of saplings. Though successful in generating greater
output, yet is this prudent planning? Especially now, in the midst of a new unfolding world situation, especially caused after the formation of the International Natural Rubber Agreement (INRA). World rubber prices have plummeted in the 90s and given the new shift towards the use of synthetic rubbers as well as the burgeoning rubber stocks held by INRA, as well as NR flooding the markets from developing countries, China’s policy of NR self-sufficiency and high state prices, is not cost-effective. Higher quality and cheaper NR can be imported bypassing local costs associated with collection, and transportation to the main manufacturing centres in China.

Table 2. Comparison of Water Runoff and Soil Erosion under Varying Vegetation - A Local Chinese Study Undertaken in Xishuangbanna

<table>
<thead>
<tr>
<th>Types of Vegetation</th>
<th>Water Runoff</th>
<th>Soil Erosion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tropical Rainforest</td>
<td>99</td>
<td>63</td>
</tr>
<tr>
<td>Rubber + Tea Plants</td>
<td>206</td>
<td>2241</td>
</tr>
<tr>
<td>Rubber Alone</td>
<td>283</td>
<td>2694</td>
</tr>
<tr>
<td>Slash and Burn Zones</td>
<td>3395</td>
<td>48697</td>
</tr>
</tbody>
</table>

(Source: 资料来源：汪汇海, 1982 ;also see (Xu 1993))

Based on a local study published in 1982, 汪汇海 estimated that soil erosion occurred at a rate 42 times greater in a rubber tree plantation versus its natural habitat of tropical rainforest. This is a worrying figure because it means that whereas a natural habitat would have taken 42 years to lose its topsoil through the natural elements, rubber plantations lose the same in 1 year. Given that rubber has had almost a 40 year history in Xishuangbanna, that is (according to the Chinese study) equivalent to 1680 years of lost topsoil. This causes siltation of the Mekhong River and surrounding rivers, leading to overflowing of banks and flooding of low-lying areas. Until now, this has not been considered a cost, but based on the regression analysis done Table 6. , this could be the major reason why the growth of Yunnan’s rubber industry seems to have negative effects on the growth of the agricultural sector. This points to the fact that year by year productivity is hampered by the loss of valuable and irretrievable topsoil. On a positive note, the study points to the possibility of biodiversity and agroforestry potential. Based on a plot of rubber and tea plants, almost 450 kg/hectare of topsoil was retained per year more than that of the single crop rubber plantation.

Quality of NR is affected primarily by its collection methods. It may be contaminated with sand or bark which reduce its strength and fatigue resistance, while wood or string may damage manufacturing machines. It may be overwashed so that naturally occurring non-rubber materials and antioxidants are removed, leading to reduced cure activity and ageing. Again, quality may not be homogeneous within given batches, being featured by uneven drying and other climatic or growing conditions, especially NR that is collected from smallholdings.

China’s Reliance of Foreign Imports of NR

Based on a 1992 study undertaken by the International Rubber Study Group, China ranks as the second largest consumer of natural rubber in the world, behind the United States. It’s total consumption in 1990 was 600000 tons while its local production only
provided 264000 tons, as such 340000 tons (57% of consumption) were imported in that year. Given that China has progressed rapidly in the 1990s with a stance of embracing a capitalistic economy, the importing of natural and synthetic rubber as raw materials, has skyrocketed as shown in the table below.

Table 5. China’s Imports of Rubber Related Products from the World in 1998

<table>
<thead>
<tr>
<th>Rubber Product</th>
<th>Total Quantity (kg)</th>
<th>Total Value (in nominal values)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Natural Rubber</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natural Rubber Latex</td>
<td>66,094,364</td>
<td>US$46,481,000</td>
</tr>
<tr>
<td>Smoked Sheets</td>
<td>180,180,442</td>
<td>US$131,017,000</td>
</tr>
<tr>
<td>Other Natural Rubber in Primary Forms/Plates</td>
<td>185,233,676</td>
<td>US$142,688,000</td>
</tr>
<tr>
<td>Total (NR)</td>
<td>431,508,482</td>
<td>US$320,186,000</td>
</tr>
<tr>
<td><strong>Synthetic Rubber</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Synthetic Rubber Latex</td>
<td>41,003,482</td>
<td>US$33,724,000</td>
</tr>
<tr>
<td>Other Synthetic Rubber Forms: Primary Forms, Plates, Sheets or Strips</td>
<td>231,938,278</td>
<td>US$203,673,000</td>
</tr>
<tr>
<td>Total (SR)</td>
<td>272,941,760</td>
<td>US$237,397,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>US$557,583,000</td>
</tr>
</tbody>
</table>

(Source: China Customs Statistics Yearbook 1998)

All in all, almost 6.7 billion yuan in 1998 went into importing rubber in its primary forms for manufacturing, of which natural rubber accounted for about 432 thousand tons (a 27% increase from the 1992 figure) and synthetic rubber accounted for 273 thousand tons (not accounting for other forms of synthetic rubber as mentioned in footnote 4). When one realises that in 1997, Xishuangbanna and Hainan Island accounted for roughly 154 thousand and 284 thousand tons of natural rubber respectively. It would seem that domestic production will fall far short of domestic needs.

Estimating the Economic Impact of NR in Yunnan, China and Hainan Island

In evaluating the economic impact of NR in China, a basic methodology was used. Using the provinces’ individual Total Productivity of Service (TPS) for agriculture, a time series model is employed based on previous year’s performance of TPS(Agri), i.e. this means that past values of TPS(Agri) should influence current values. Once this model is established, natural rubber growth rates are used as an outside regressor. If the growth of the natural rubber industry can significantly improve the accuracy of the model, a higher accuracy will be detected against actual values. Based on this methodology, the final model that was selected had to fulfill two criteria, the lowest RMSE (root mean square error) possible which is often the chief determinant of a representative model, and a forecast plot that is close to the actual plot of values. Both models, Xishuangbanna and Hainan Island are presented in the following page:

Table 6. Estimating the Economic Impact of NR in Yunnan and Hainan Island
Xishuangbanna, Yunnan
Model Chosen (sample: 1982-1997)
\[ Y_t = 0.16 + 0.46D_1 - 0.33R_{t(XSBN)} - 0.39 Y_{t-3} - 0.89 \varepsilon_{t-4} + \varepsilon_t \]
(3.41) * (10.58) (-1.02) (-1.77) (-13.81)
R-squared = 0.95
Durban-Watson = 1.66

*numbers in parenthesis are t-ratios
where \( Y_t, Y_{t-3} \) = growth rate in TPS(agri) at time t, t-3 respectively
\( R_{t(XSBN)} \) = growth rate of Xishuangbanna’s rubber Industry at time t
\( \varepsilon_{t-4} \) = shocks that happen 4 years ago
\( \varepsilon_t \) = current year’s shocks (at time t)
\( D_1 \) = the year 1992

Analysis in words
The model implies that 0.16% of agricultural growth is constant (or a natural level of growth not affected by outside variables), while the second term shows that there was a one-off shock which happened in 1992 to boost the agricultural productivity in 1992 by 0.42%. The third term relates to how 1% growth rate of the natural rubber industry in Xishuangbanna causes a 0.33% reduction in the total agricultural productivity of Yunnan over the sample period (1982-1997). The fourth term shows how a 1% growth of agricultural productivity 3 years ago will reduce the present agricultural productivity by 0.39% (and vice-versa), while the last term shows that a shock that happened 4 years ago still affects present agricultural productivity (i.e. a 1% fall in TPS(agri) 4yrs ago will result in a 0.89% increase this year, while a 1% rise 4yrs ago will result in a 0.89% decrease this year). The R-squared is a measure of how closely the model fits the real data and varies from 0 to 1 (where 1 is a perfect fit), the model’s R-squared shows that 95% of the model fits the data.

Hainan Island
Model Chosen (sample: 1983-1998)
\[ Y_t = 0.07 + 0.23R_{t(Hainan)} + 0.44Y_{t-2} + 0.96 \varepsilon_{t-1} + \varepsilon_t \]
(3.27) (4.36) (6.82) (29.95)
R-squared = 0.789
Durban-Watson = 1.96

where \( Y_t, Y_{t-2} \) = growth rate in TPS(agri) at time t, t-2 respectively
\( R_{t(Hainan)} \) = growth rate of Hainan’s rubber Industry at time t
\( \varepsilon_{t-1} \) = shocks that happen 1 year ago
\( \varepsilon_t \) = current year’s shocks (at time t)

Analysis in words
The model implies that 0.07% of agricultural growth is constant (or a natural level of growth not affected by outside variables). The second term relates to how 1% growth rate of the natural rubber industry in Hainan Island causes a 0.23% increase in the total agricultural productivity of Hainan over the sample period (1983-1998). The third term shows how a 1% growth of agricultural productivity 2 years ago will increase the present agricultural productivity by 0.44% (and vice-versa), while the last term shows that a shock that happened 1 year ago still affects present agricultural productivity (i.e. a 1% rise in TPS(agri) 1yr ago will result in a 0.96% increase this year, while a 1% fall 1yr ago will result in a 0.96% decrease this year). The R-squared is a measure of how closely the model fits the real data and varies from 0 to 1 (where 1 is a perfect fit), the model’s R-squared shows that 78.9% of the model fits the actual data. The Durban-Watson statistic is 1.96, which is close to 2, indicating no significant autocorrelation.
measures the amount of autocorrelation between the error terms in the model with a scale of 0-4. A value of 2 means that there is no autocorrelation, while values below suggest positive autocorrelation and values above suggest negative autocorrelation. Values in parenthesis are t-ratios, which measure the significance of the variables in the model. Values above 1.65 generally suggest that there is a 90% confidence level that the variable is significant. Values above 1.96 generally suggest a 95% confidence level that the variable is significant.

It is interesting to note how both models give very different pictures of how the natural rubber industry has affected the local agricultural sector of both Xishuangbanna and Hainan Island. Again it is useful to pay attention to footnote 7, which places severe limitations onto the results that have been portrayed. It is not possible given the constraints on data to ascertain the definite contribution rates of the natural rubber industry to the agricultural sector, however it is definite that Hainan Island has experienced greater returns from rubber production than has Xishuangbanna.

**Chart 7. Plot of NR growth rate and TPS (Agri) growth rate in Hainan and Yunnan**

From the above graphs, we can see that in Hainan Island, greater NR growth rates correspond with higher agricultural productivity (hence an upward sloping plot), however in Xishuangbanna, no such relationship exists. Whether NR growth rates are high or low, the agricultural sector of Yunnan province is hardly affected and based on the time-series model in table 6, it is even suggested that this relationship is negative. This is a worrisome trend especially since this trend encompasses the years 1979 to 1997, which are supposedly high growth years. It would seem then that the earlier explanation of lost productivity (heavy soil erosion, a 5 year longer growth period compared to Malaysia, and a 2 year longer period compared to Hainan, shorter harvesting months) seem to be corroborated. It is also noted that with the existing
growth rate of natural rubber in Xishuangbanna petering out, this trend can only get worse.

Based on this study, Hainan Island is on the receiving end of the benefits of investment in natural rubber whereas Xishuangbanna may be experiencing diminishing returns.

**Policy Recommendations**

1. Agro-forestry in Xishuangbanna
2. Using Rubber Trees as Timber

1. **Agro-forestry in Xishuangbanna**

Agro-forestry is widely practiced in many parts of the Philippines and has been promoted in other Southeast Asian countries. Given such a widespread mono-culture cultivation of rubber trees in Yunnan, it would be feasible to practice two or three crop agro-forestry.

<table>
<thead>
<tr>
<th>Year</th>
<th>Rubber Plantation</th>
<th>Rubber + Tea Plantation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plot 1</td>
<td>Plot 2</td>
</tr>
<tr>
<td>1</td>
<td>943.5</td>
<td>835.5</td>
</tr>
<tr>
<td>2</td>
<td>826.5</td>
<td>951</td>
</tr>
<tr>
<td>3</td>
<td>855</td>
<td>993</td>
</tr>
<tr>
<td>4</td>
<td>720</td>
<td>1093.5</td>
</tr>
<tr>
<td>5</td>
<td>1165.5</td>
<td>1573.5</td>
</tr>
<tr>
<td>6</td>
<td>1609.5</td>
<td>1851</td>
</tr>
<tr>
<td>Overall</td>
<td>6054</td>
<td>7297.5</td>
</tr>
<tr>
<td>Average</td>
<td>1009.5</td>
<td>1216.5</td>
</tr>
</tbody>
</table>

(Source: 资料来源：龙乙明，1989，橡胶＋茶树群落的生态和经济效益评价; also see (Xu 1993))

Based on a study published in 1989, a controlled experiment was conducted in the Menglun Botanical Gardens, where the rubber yield between a single rubber crop plantation and two plots of dual crops of rubber and tea were observed for six years. Both Rubber /Tea Plantation Plots 1 and 2 on average yielded greater amounts of rubber than just a single crop of rubber trees. Using the chi-square test formulated by Fisher to test whether both dual crop plots of rubber yields are significantly different from the single crop of rubber trees alone, we get $\chi^2 = 77.3958358$ for Plot 1, comparing against the control crop (rubber alone) and $\chi^2 = 80.1030243$ for Plot 2 when comparing the control crop (rubber alone). The critical value for the chi-square test with 5 df is 20.52 at 0.001 level of significance. This means that both Plot 1 and Plot 2 have less than a .1% chance of being similar to the single crop rubber plantation in terms of yield rates since its test statistic is much higher than 20.52.

This suggests that the earlier analysis that the growth of the Chinese Rubber Industry has caused negative returns to the actual Yunnan agricultural growth rate because of productivity loss through the loss of topsoil and other factors is a plausible one. Having a dual crop seems to significantly raise the productivity of even the rubber
trees themselves. This points to a new direction in the reforestation efforts in Xishuangbanna: to intensify agroforestry efforts on pre-existing single crop rubber plantations. Further studies on suitable candidate types of trees can be piloted to ensure the best results.

2. **Using Rubber Trees as Timber**
Currently rubber trees are being used as timber, especially in furniture manufacture. IKEA, the Swedish furniture maker is one of the key forces currently switching away from traditional sources of timber to using more rubber trees. Having the texture and feel of pine wood, it is currently a growing market that is still at infancy.

Areas in Xishuangbanna intending to make a switch away from rubber trees have a profitable solution to this problem. Rubber tree wood as timber is a valuable commodity and the cleared land can be used to grow other profitable agricultural crops that are more suitable for the climate in Xishuangbanna, for example coffee.

**Summary**
From the above evaluation, we can see that clearly Hainan Island has received most of the benefit from cultivating rubber trees in the last 40 years while, Xishuangbanna, Yunnan, has not been as successful. As a result of soil erosion and unfavorable climatic conditions, current productivity cannot be maintained without continual high investment in fertilizers as well as research and development into newer higher yielding rubber seedlings. If the regression model for Xishuangbanna identified in Table 6 is predictive, then the coming years will not be profitable for rubber tree growers. Other more profitable alternative crops will need to be identified and a smooth transition will need to be effected for current growers such as agro-forestry and then later possibly the felling of trees as timber to make way for better cash crop selection.