Interdisciplinary Land Use and Natural Resources Management

Thailand 2011

Final Report - Group 3 – Ban Huay Tao Ru, Province of Chiang Mai

INTENSIFICATION OF AGRICULTURE AND DEAGRARIANIZATION

Authors:

Anne Rehder
Camille Brigitte Marthe Déhu
Marco Rogna
Mohammad Kamrul Hasan
Sara Klinke Wæver
Teweldebrehan Tesfay Gebremedhin

(12.709 words) March 2011

Abstract

Promoted by the Thai government, the establishment and expansion of cash crops have been transforming the landscapes and livelihoods of the mountainous Northern Thailand for the four past decades. If it has permitted, first, to slow down the deforestation rate caused by the traditional slash-and-burn practices and improved the living standards of many farmers, this process of intensification of agriculture is now questioned for its long-term effects on the environment and the socioeconomic conditions of farmers. Soil fertility decline, increasing need of inputs, vulnerability to market prices fluctuations are some of the main negative elements associated with intensive agriculture and one set of indirect causes contributing to explain the deagrarianization processes going on in many rural areas of the world. In this report, we investigate, through the livelihood framework of Ellis, the nature of these instabilities and the diversity of strategies employed by the inhabitants of a Hmong community of North Thailand to cope with these new conditions. In addition to these difficulties, we analyse how –as a sub-village and located in a protected watershed – the community has also to adapt to a complex institutional and administrative context. Consequences on environment, livelihood and social relations are our focus points. Furthermore, we examine in which way intensification of agriculture and deagrarianization are interlinked processes. Indeed, in addition to on-farm strategies, many villagers are also investing in off-farm activities and the education of their children to respond to present and future instabilities, both processes pushing part of them out of the border of the village.

Foreword

This report is the result of a fieldwork conducted in the Hmong village, Ban Huay Tao Ru (BHTR) in Northern Thailand, on 28th February- 9th March 2011 as part of the university cooperation on Sustainable Land Use and Natural Resource Management (Sluse). Fieldwork was carried out in four villages by four groups in the Mae Lor Watershed with the overall objective to analyse processes of deagrarianization. Prior to the research in BHTR we chose to focus on the environmental consequences of intensive agriculture, which was indicated as essential for the village in the knowledge we were given beforehand.

Later we found that the information we were given about the village was influenced by a dominant narrative of the Hmong people as forest destroyers and cause of environmental degradation. In the field we tried to take this in to account, while still finding intensive agriculture a relevant focus. It is of high importance to us to give a more complex picture of the livelihood situation of the Hmong people, instead of contributing to the narrative of them as forest destroyers.

Acknowledgement

This report is dedicated to the people of Ban Huay Tao Ru who gave us the best reception and opened their community to us. We hope that the community will be able to face their challenges and encounter a more sustainable development in the near future. A special thank you to our gatekeeper Chanachai, the assistant headman, our interpreters: Pi Ben and Naya and the Thai counterparts: Noppadon Kreiharaen (X) and Banjerd Sapanya (Jerd).

Index

Tables and illustrations

1. Introduction

> There is something to the rumour [Hmong using a lot of pesticides, which have a damaging impact on the environment], - it is partly true. Of course the Hmong people don't just pour pesticides in the water, but they use pesticides as a part of their agriculture so that they can sustain their livelihood. The Hmong people likes to do agriculture and trade. If they don't use chemicals nobody will buy the vegetables or the litchi. People want perfect vegetables. (Field notes from the interview with the assistant headman of BHTR)

During the last decades, rural areas and livelihoods have gone through profound changes in Northern Thailand. The sharp decline and degradation of forest in this mountainous and vital ecological area of Thailand (Walker 2002, Suraswadi et. al. 2000) have caused many conflicts of interests (Rigg 1993), and environmental and social problems which continue to disturb the sustainable development of the region. Population growth combined with inadequate agricultural practices, timber logging and governmental policies have been identified as major causes of these environmental problems (Vanwambeke et.al. 2007). Before 1960, the rather huge area of land available for a relatively low population density allowed farmers to practise slash and burn cultivation without causing any serious problems with degradation of soil fertility or biodiversity. Since 1960s, a steep population growth (41.3 to 61.6 million inhabitants in Thailand between 1975 and 2001) and a rising concern about the environmental situation, led to the introduction of protected areas by the Royal Forest Department (RFD) (de Almeida 2006).

To help the rural populations cope with these measures, and to abandon the now-convicted cultivation of opium (widespread in Northern Thailand and among the Hmong people), many policies and programmes have been employed to encourage farmers to shift from extensive to a more intensive and modern form of agriculture (de Almeida 2006, Delang 2002, Forsyth & Walker 2008). However, instead of resolving the environmental and social problems, these new measures have led to other kinds of social, economic and environmental insecurities. In 2002, more than 460.000 families were still living in areas titled as conservation forest, where they have no possibility of obtaining land documents. In agricultural areas, the policies of modernization have generated some successful results by e.g. improving farmers' profit, but also caused many problems in the long-term. One side effect of the introduced intensive form of agriculture is the use of agrochemicals, which may lead to decline of the soil quality. Further, the volatility of market prices of both agricultural inputs and outputs create income insecurity for the farmers.

Alongside these insecurities, hill tribe farmers are faced with accusations by rural and urban population in lowland areas, of degrading the natural environment by using pesticides. Accusations against the Hmong hill tribe was firstly created around their traditional cropping system and now by the use of intensive agriculture (Vanwambeke 2007, Forsyth & Walker

2008). From the lack of alternatives, farmers have no choice but to increase the use of inputs (chemicals, water, etc.), to maintain their land productivity or seek other sources of livelihood (UNDP 2009). The statement above from an interview with the assistant headman of BHTR is a response to the recurrent narrative perceptions of the Hmong people as destroying the natural environment in the mountainous areas, which illustrates this dilemma.

Thus, in a context of reduced access to resources, where human capital is the only production factor in excess, off-farm activities and education become central aspects in future possibility of development for many households (Rief, Cocharane 2011). To counter some of these difficulties, many rural households choose to diversify their sources of income. This diversification of rural livelihood, first conceptualized by Franck Ellis in his book *Rural Livelihood and Diversity in Developing countries* (2000), to which we will refer frequently in this report, is now a well-known process, identified in many rural areas of the world, including Thailand. In 2004, only one third of farming households' income was supplied by agriculture (more than ½ in 1976) and in 2007, around 9% of total income of rural populations in Thailand came from remittances (UNDP 2009).

The deagrarianization process – the movement away from strictly agricultural-based modes of livelihood (Bryceson 2008), that is taking place in the area, can both have beneficial consequences (e.g. relief on land pressure and boost to economy), but can moreover be a factor of impoverishment, if it takes place haphazardly, in an untimely fashion and in the absence of rural food security (de Almeida 2006, Bryceson 2000). Thus, having drawn the context of the village of our research focus, the community of BHTR, we will now give a more localised introduction to the village.

1.1 Field of study: the village of Ban Huay Tao Ru

Ban Huay Tao Ru (BHTR) is a sub-village of Ban Mae Ka Piang (BMKP), composed by approximately 31 households, from the Hmong tribe and prevalently related to the Seventh Day Adventist Church. The village is located in Mae Lor Watershed, in the province of Chiang Mai. According to our informants in the village[1], the first inhabitants of BHTR (approximately 15 households) arrived in the beginning of the 1970's, after a process of relocation from the upland village of Ban Prabhat Si Roy, operated by the government[2]. They were allowed to clear a piece of vegetation and turn it into agricultural land, but were prohibited from continuing with slash-and-burn practises and to expand their land further.

They started by cultivating upland rice and maize as they did in their previous village, but

[1] The information about the village and the evolution of agriculture practises mentioned in this chapter are mainly taken from a timeline exercise and other interviews with villagers during our field study.
[2] The overall reason for this re-location was presented rather vaguely to us at several occasions, but because of the comprehensive efforts to eliminate the widespread production of opium in the area in the same period, we can suspect that this can be one of the factors behind.

in 1975, they began to invest in cash crop and agrochemicals with the production of lychee. In the 1990s, after the construction of the road to the village, they also started to cultivate vegetables, intensifying the cash crop system. In 1992 the Forest Restriction Agreement between the RFD and several villages of the watershed, was created. According to the people of BHTR, in this process, their original agricultural area was reduced by up to 50%. Additionally, it is important to note that, today, none of the villagers have title deeds to their land, as the village is located in a conserved area and a zone prohibiting all agricultural activities according to the Thai water legislation (Mingtipol et al. 2011).

The community of BHTR currently has to face multiple environmental and economical instabilities and limitations related to their farming activities (e.g. increasing need and prices of agrochemicals, volatile prices of fruits and vegetables), pushing them to also invest in other activities.

1.2 Problem formulation and research questions

In this study, we investigate and analyze the different livelihood strategies adopted by the inhabitants of BHTR to face limitations and instabilities associated with intensified agriculture. To conduct our analysis, we will mainly use Ellis' understanding of the livelihood concept (Ellis 2000). He argues that to understand the concept of livelihood, it is necessary to analyze not only what people do to maintain or improve their living standards, but also the characteristics of these choices and the broader context in which they make their decision and build their strategies. This requires analyzing the assets (or "capitals"), activities (and expected outcomes) of a particular population and the factors capable to influence these elements: the policy and institutional context (laws, government, political regime, etc.) and also the economic and social patterns in the studied area.

Following this introduction, our problem formulation is therefore:

How is the community of Ban Huay Tao Ru coping with economical and environmental instabilities and limitations associated with intensified agriculture?

To answer this, we will investigate three main research questions:

1. *What main environmental and economical limitations and instabilities do the community of BHTR face?*
2. *What main strategies do the inhabitants of the community apply in order to maintain or improve their livelihood within this context?*
3. *How are the strategies related to deagrarianization?*

1.3 The structure of the report

After introducing the methods used before, in the field and after, we will identify the economical and environmental limitations and instabilities. Then, we will analyze the main strategies applied in the community to cope with the instabilities, both at the household (on-farm and off-farm) and community level. Finally, we will discuss the consequences of the strategies applied, the perspectives for the future, and how this is interlinked with deagrarianization.

Field talk Chinese radish field

2. Methodological reflections (Sara)

Due to our participatory and context based methodological approach, we chose and adjusted our methods to be aligned with the village context and to ensure that we got the data needed. In this chapter we will describe our methodological approach, the methods applied and the reflections on the validity of the data. Finally, we will describe the processing of data.

2.1 Methodology

To answer our problem formulation, we applied a methodological approach characterized by interdisciplinarity, triangulation and participation. We employed methods of natural sciences in combination with social sciences, to obtain a broad and precise range of data, both on the environmental consequences of intensive agriculture and the strategies, perception and expectations of the villagers to maintain their livelihood. Thus, in order to ensure reliability and validity of our knowledge, we tried to triangulate our data by mobilizing multiple methods and different respondents (Mikkelsen 2005). This also helped reduce misunderstandings caused by difficulties related to translation and communication in the field. Because of the small size of the village, we found it useful to supplement the quantitative approach with a qualitative approach to ensure in-depth knowledge. Thus, we had the opportunity to talk to the vast majority of the villagers and participate in their daily activities. Furthermore, we used a participatory approach to secure the involvement of the villagers and obtain better insights in the community.

2.2 Applied methods

In this section, we will give a short outline of the most important methods used. For further details, an overview and a precise description of all the methods we used in the field is to be found in appendix II.

When we arrived in the village (28/02/2011), we introduced ourselves and our project to the assistant headman, but as he was unavailable the following days we were lucky be welcomed by the farmer and committee member, Chanachai. He offered his time and knowledge, and became our gatekeeper by introducing us to different households and spreading the word of our activities. He showed genuine interest in our project and ended up playing an invaluable role for our time in the village. After a first map overview and transect walk with him and another farmer, we decided on sampling method for the *questionnaire interview.* For this, we tried to visually assess the economical and spacious differentiation in the village in order to cover different types of households. We then chose households from availability, trying to cover as many as possible. We conducted questionnaire interviews with 18 of the 31 households (01/03-07/03/2011) with the criteria that the informant should be an adult and active representative of

the household. By household we mean "*a group of individuals that contribute to **and** benefit **with frequency** from a common pool of resources administered in a housing unit*".[3] We consider the physical and residential place as important, but due to a spatial extended livelihood practice, we also include people visiting or staying in the house regularly (e.g. young people studying outside but supported by their parents or people working in town but coming back during the weekend). However, we do not include people that contribute by sending remittances but do not consume the household resources.

Questionnaire

Our principal aim with the questionnaire survey was to investigate the factors enabling or hindering the generation of income in the households' livelihood strategies. We combined our extensive survey with informal conversations and small interviews on interesting points raised during the questionnaire (for more information see appendix I and II). Proceeding this way permitted us to identify subjects to investigate further through other methods.

To receive more in-depth knowledge, we conducted *10 semi-structured interviews* and nine *informal interviews* in the village. The informants were purposively selected based on their experience and knowledge. The most extensive interviews were with the assistant headman (04/03/2011) and Chanachai (01/03/2011). Furthermore, we participated in interviews with officials from the Tambon Office (07/03/2011), the Land Department (11/03/2011) and the Royal Forest Department (01/03 and 10/03/2011). As a supplement, we spent time in the field area talking with farmers or participating in their activities, observing their working practices and the

[3] Inspired by the reflections of Frank Ellis on the limitations of defining "household" as a solely familiar or co-residential unit (Ellis 2000:18-20), we decided first to consider members of the households as "*all people contributing **or** benefiting to the income of the households*". But, we met some challenges afterwards to have a clear idea of the composition of each household in the village. Indeed, some households were receiving important remittances from relatives (children or other) that they clearly did not consider anymore as members of their household. On the contrary, others were considered members of the households, even contributing only occasionally to cash income or living (permanently or temporary) outside the village, because they were still visiting and helping regularly the households

general environmental conditions.

Focus group with farmers

To ensure the involvement of the villagers and capture agreed upon and conflicted narratives, we carried out four *focus groups* facilitated with inspiration from *participatory rural appraisal techniques* (PRA) (Mikkelsen 2005). The focus groups were all organized differently, based on the particular group in focus and the type of knowledge we wanted to access. In the first *focus group on the village timeline* (02/03/2011) we invited some of the old people in the village to discuss crucial events and development in the history of BHTR. To get a detailed overview of the agricultural system in the village, a *focus group with farmers* was conducted (05/03/2011). We also had a *focus group with young people* (06/03/2011) trying to grasp their dreams, aspirations and expectations for the future, and a *focus group with members of the housewife group* (03/03/2011) to get information about the group and gender roles in the village.

In order to assess eventual environmental instabilities associated with intensified agriculture, we conducted *soil and water sampling*. Seven plots were chosen by stratified random sampling[4] combined with the existing crop types for soil sampling (01/03/2011). A number of representative soil samples were collected and mixed thoroughly to make composite samples[5] (02/03/2011) (soil sample map, appendix III). In order to have a better understanding of the results afterwards, careful observation was systematically made (see table 1) and the coordinates were marked with GPS.

[4]Stratified sampling as stated by Crepin and Johnson, in Carter (1993) is used to analyse each stratum and to increase the precision of estimates over the whole area.
[5]Composite sampling is appropriate to use when only an average value of the soil property is needed and it can also be used in combination with stratification (Crepin and Johnson, in Carter, 1993).

No.	Sample site	Description
1	Cabbage field	Crop-cabbage, mature stage, gentle slope land, irrigation facilities
2	Egg plant plot	Crop-egg plant, over mature and ripen fruits, slope land, terracing, irrigation
3	Corn field	Crop-corn, mature stage, moderate slope, terracing, irrigation
4	Chinese raddish field	Chine raddish vegetable, vegetative stage, steep slope, terracing, irrigation
5	Paddy rice field	Harvested paddy rice field, leveled/gentle slope, terracing, irrigation
6	Cut flower field	Chrysanthemum flower, moderate slope, terracing, irrigation
7	Litchi orchard	Litchi tree, flowering stage, steep slope, irrigation

Table 1:Soil sampling plots
Description of plots where the soil sampling was conducted

Each sample was taken with an auger from the top soil (about 0-20 centimeters depth) and labeled, air-dried under shade and ground into uniform size before sent to the laboratory for nutrient analysis. The parameters analyzed were pH, Electrical Conductivity, Organic Matter Content, total Nitrogen, available Phosphorus and exchangeable Potassium.

Five water samples were also conducted on five locations along the BHTR streams (03/03/2011). The sites were marked using GPS (see table 2 and water sample map appendix IV). Water testing kits with a combined pH, Dissolved Oxygen and conductivity meter were used on site to measure some of the parameters, while other parameters were analyzed in laboratory at Chiang Mai University. In addition, three sediment samples, one from the base of the stream (upstream) and rest from sites 4 & 5, were collected to analyze pesticides residues. The main parameters analyzed for water and sediments are: pH, temperature, total dissolved solids, electrical conductivity, dissolved oxygen, nitrates and phosphates.

No.	Location	Description
1	Upstream	Headwater/main source in the forest, both for consumption and agricultural purposes
2	In the village	Junction, intensified agriculture, forest area
3	In the village	Junction, intensified agriculture, cabbage field
4	In the village	Outlet, intensified agriculture, vegetable zone
5	End of the village	Outlet from Ban Huay Tao Ru village, agriculture, fruit orchard and forest area

Table 2:Water sample locations
Description of plots where water samples were taken.

2.3 Reflections on methods and the validity of data (Anne)

In this part, we will present some of the central reflections we had while obtaining and analysing the data: reflection on the validity of the data, the degree of participation and the challenges we faced.

2.3.1 Participation and challenges

It was important for us to get a relation of trust with the villagers and be present and visible in the village to strengthen our participatory approach. In general, they were very welcoming, interested in our project and willing to help us. A pavilion in the village called the *sala* soon became our base. We conducted both interviews and focus groups there, and its central and open location enabled us to evoke curiosity and attract more participants.

Our key informants, the assistant headman and especially Chanachai were a very big help and helped us get a close relation to many villagers, but we may have relied too excessively on him. This meant that many people we talked to and who participated in our focus groups were primarily people who had been living in the village for a long time and often family or close friends with Chanachai. At the same time, we did not feel that we were hindered by this in talking to whoever we wanted. As the village was spatially differentiated with some of the households on the outskirts, we were less visible to them. We tried to take this into account by talking to as many different people as possible in the village. However, we failed to interview a young single mother, who seemed somehow excluded from the community, as we did not have our interpreters with us when she came to us.

The participants in the timeline focus group had been part of the settlement and were central villagers in the community. Their narratives about the community history are therefore seen from the centre of the informal community structure and we are aware that there may exist other opinions that we did not capture. Another challenge during this focus group was to include all the participants. This was partly due to language difficulties and to the fact that the two male participants were offering strong informative stories, but also because of our facilitation, on which we reflected and modified afterwards. Therefore, during the focus group with the Housewives, which started as an interview with almost all questions answered by the leader of the group (or with her recognition), we decided to change the focus and asked them to draw the gender roles in the village. The fact that everybody then participated helped us realize the importance of using visual and participatory methods (see appendix II) to include all the participants and get a more collective knowledge and broader range of perceptions. In trying to have a broad range of representatives participating, we asked different people to join and tried to include people just passing by the *sala*. We made an effort to make the workshop with the young

a safe space by asking them individually to express their dreams and expectations, which can be sensitive in a mixed group of young people. This gave us some honest answers and a concentrated atmosphere. In contrast, we ended the session with a collective exercise that was dominated by the eldest guy, which made some young girls hold back.

Focus group young

2.3.2 Language difficulties

Working with interpreters gave us some challenges, because we were all new to working with interpreters. Further, the interpreters were not professionals and had a first natural reflex to sum up the answers instead of translating directly. This meant that we were partly detached from the conversation and hindered from getting the details of the answers. Talking to the interpreters about this helped rectify to some degree.

Another challenge was the native language of the community. Some of the old villagers - especially the women – only spoke Hmong, a language that our interpreters did not understand. At least three households could not be part of our questionnaire survey for this reason. This also caused trouble during the focus group exercises when the villagers had the tendency to change into Hmong when the excitement was at its highest. This generally told us that they were engaged and interested, but also had the inconvenient consequence that we could not follow the discussion. To keep the dynamic, we gave room for these discussions in Hmong, but would afterwards ask them to explain what they discussed. Because of these languages difficulties and our incapacity to catch the real words of our respondents, we decided to reduce our use of quotations. When done, it is made from our field notes and confirmed by all the members present during the specific talk.

2.3.3 Difficult numbers

We faced challenges in getting precise data on the household income. When asked, some

informants did not know, others answered so quickly that we can question the reality of the precise amount. In our analysis we both use the raw numbers we got from the questionnaire and the numbers combined with the knowledge on income from different crops explained during the farmer's focus group (more on this appendix II). Even though it was a challenge for them to make the calculations, they tried hard to provide exact information. Further, in our questionnaire we did not ask specifically about the expenses of each household, and therefore we do not have a full overview of how expenses influence the income. However, in the farmer's focus group they gave us an estimation of the expenses in the agricultural production. Regarding the water and soil sampling, the main challenge is that we only have soil samples from the period we were there, which gives us a limitation in analysing the principal trend over time.

2.4 Processing of data

In the field, we each wrote field notes trying to capture as much information as possible as well as the first hand impression. We continuously met to try to align our use of methods to the context and share the data and preliminary findings. We all went through all of our fieldnotes to ensure nuanced data. We made a matrix in which we entered our data from the questionnaire to get an overview, cross our different information and elaborate graphs. In this report, we combine quantitative and qualitative analysis of the data to transcribe the complexity of the situation. Because our area of research is such a small village, we attach importance to villagers' individual narratives, ideas and suggestions, and use their stories as examples of the life in the village.

Water sampling

3. Economical and environmental instability and limitations

In this chapter we will identify the economical and environmental instabilities and limitations influencing the villagers' livelihood. By *instabilities* we mean internal and external factors, marked by excessive or/and unpredictable fluctuations, that the villagers and the community cannot easily and directly control and which place them in vulnerable situations. By *limitations*, we refer to stable factors that drastically reduce the households' range of choices and possibilities. We assume that both will have determinant implications on both household and community strategies. Firstly, we present an overview of the general economic situation of the household, and then analyze the different factors of instabilities and limitations.

3.1 Economic insecurity and inequalities in BHTR (Tesfey)

Economic instabilities cause many worries to the villagers of BHTR. The household survey showed that 15 (83%) of the 18 households surveyed are stressed economically, as shown in the Illustration 1. Most of them indicated their concern to face the rising and/or fluctuating regular expenses (cited 14 times) – mainly related to education (4), agriculture (3) and basic consumption (3) - of the household. Even though education is mostly free, they have to pay for transportation, as all the children go to the school in BMKP and in the city for high school and higher education.

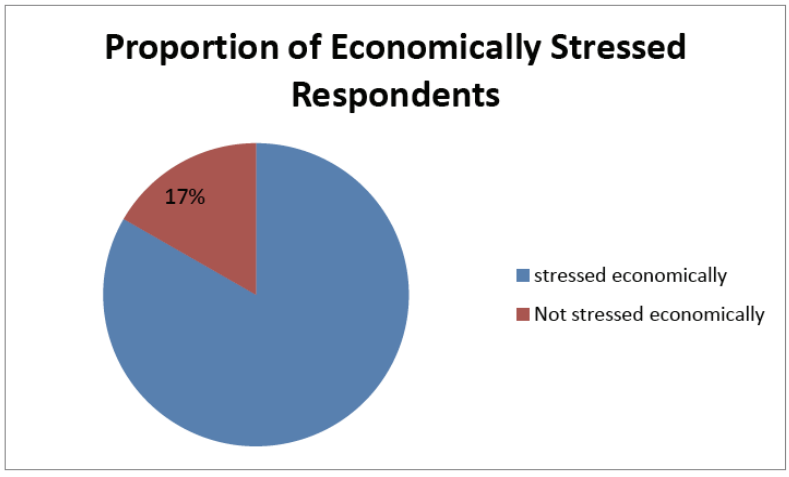
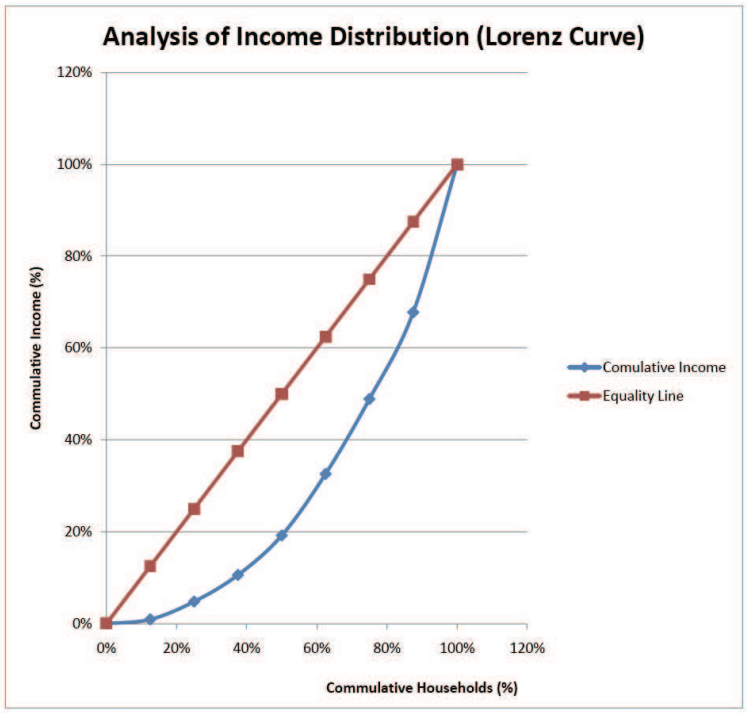


Illustration 1:Pie chart

Six households mentioned that their worries had increased or were caused by the variation of market prices, in relation to agricultural input/output or food, as well as the instability of the productivity of their farming activities or by political problems (e.g. the non protection of agricultural prices by the government in times of market surplus supply). Besides, many villagers

mentioned that the low production of lychee this year will have a big impact on their income. Analysing our data, we noticed that if we compare the reasons of economical worries and the different economical statuses of the households, the poorest households worried more often about small expenses. For example, a poor farmer, who had no land of his own, was very stressed about the payment for the school bus, which is negligible expense for most households.



Indeed, there is a great disparity in income generation in the village, and the economic instabilities are therefore unevenly distributed. We observed disparity in the economic status of the villagers from the differences in houses and other assets they possess[6] (For a detailed table on the distribution of income in the surveyed households se appendix XIII). In an attempt to show this disparity, we analyzed the surveyed income data using the Lorenz curve, relating the cumulative proportion of income units to the cumulative proportion of income received when units are arranged in ascending order of their income (Kakwani 1977). If each household had an equal income, the income distribution curve would be the straight red line in the graph. However, in our case, the poorest 25% earn 4.8% of the annual income, while the richest 25% earn 51.1 % of the annual income, estimated on the 16 households who informed us about their annual income.

Agriculture is the main source of income in the village (62.1% of household income) and restrains in access to land can therefore be a source of instability and explain the disparity in income among households. The access to land is much differentiated, both when it comes to the

[6] As mentioned in the methodology chapter, we believe that there can be some errors in our data regarding income generated in the survey due to different factors. Some households found it difficult to answer; others answered really quickly a rounded amount. But still, these data can be used to get an overall impression of the income in the village and inequalities.

amount of land that people own, and the land they borrow or rent. The illustration 3 shows how income is related to the access to land whether it is owned, rented or borrowed for the surveyed households. In spite of our presupposition that income disparity could emanate from differences in access to land of households, the scatter plot shows that income and access to land are hardly related.

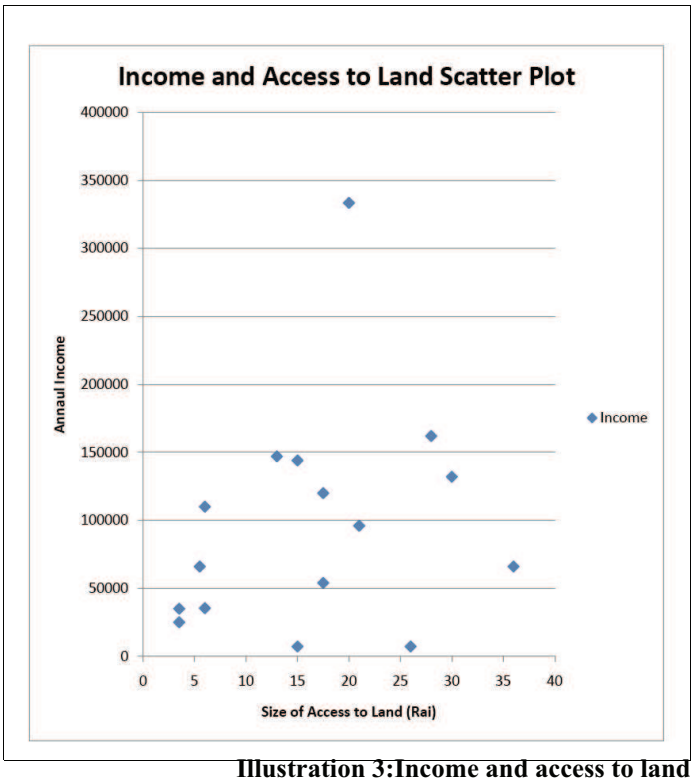


Illustration 3:Income and access to land

Therefore, the reason of such big disparity in annual income of households could be due to differences in non-agricultural income. Among the seven households in the upper income strata (earning above 100.000,00 BHT), the majority have and/or complement with non-agricultural income, whereas the seven households in the lower income strata (earning below 100.000,00 BHT) mainly rely on agriculture. This will be analyzed further in chapter on other household strategies.

Analyzing the assets of households, eight of 18 have car/truck and five among the owners of car/ truck are on the upper income strata. Similarly seven of 18 do not have refrigerator and among these five belong to the lower income strata of the village. Thus, households who mainly rely on agriculture for their livelihood generate lower income and possess lesser assets than households who combine agriculture and wage job in the village.

3.2 Limitations and factors of instabilities

According to the results of our study, we could identify one principal limitation – the limited access to resources – and three main factors of instabilities: first, general soil and environmental conditions, second, the impact of the volatility of the market, and last, the instabilities linked to

the political situation.

3.2.1 Limited access to resources

In BHTR, the average land endowment is 11.39 rai per household. Considering that two households (with 28 rai or more) are sharply influencing this number, the amount of land per household can be considered as far below the average farmland size (23.18 rai) in North Thailand (Wannamole 2008). BHTR is located in a legislative restricted area, and therefore, none of the households hold title deeds for their land. The assistant headman of the village asserted that the villagers do not risk losing land, if they refrain from expanding.

During the village timeline exercise, participants indicated that restrictions of the use and expansion of land were introduced in 1992. They claim that the agricultural land of the village was reduced by approximately 50% of the original size, when officers form RFD came to demarcate agricultural land from forest. At that time, 50% of the village's agricultural land was in fallow and the officers demarcated it as forest. Since then, the area they are allowed to use is marked with GPS for the officials to keep track, and can by no means be expanded. Another limitation, indicated by the villagers, is the shortage of water in the dry season. 17 of the 18 mention problems related to water for agriculture, whereas 13 specified this as shortage of water in the dry season.

3.2.2 Soil and environmental conditions and use of chemical inputs (Kamrul)

According to our questionnaire survey, only one household does not use pesticide in BHTR. Serious pests and diseases problems as well as market requirements seem to be at the roots of this general use. Several farmers, the assistant headman and a former elected member of community of BMKP told us that intermediates allocate lower prices or even refuse vegetables or fruits damaged by insects or disease, even when proper for consumption. Farmers consequently feel forced to apply pesticides. Further, the same 17 households use chemical fertilizers and manure to increase or maintain the productivity of their crop production.

Besides the simple and expected observation that the vast majority of farmers use agrochemicals in BHTR, we discovered that they apply an increasing amount while the cultivated lands remain the same. Eight of the 12 households who informed us about the variation in use of pesticides expressed that they have to apply more pesticides now than before. In relation to fertilizers, it appears that nine of the 14 households, who answered, use more chemical fertilizer than before, and nine out of 12 use more manure.

This increasing use of agrochemicals can be explained by several hypotheses and can have significant consequences on the economic and environmental stability of the village. One of these hypotheses is related to the degraded conditions of the soil in the area. According to the

results of the soil analysis (Table 4), it appears that the percentage of soil organic matter (SOM) is considered low in comparison with international standard value, in five of the seven composite[7] samples (cabbage, egg plant, corn, radish and cut flower). These low levels of SOM (from 0.72 to 1.14 in these five plots) constitute an important indicator of soil use intensity and degradation (Aumtong et al, 2008), and can be explained by an intense and almost exclusive use of agrochemicals. The poor conditions of the soil in the area are confirmed by the results of other indicators investigated, e.g. the pH level in the six of the seven soil samples are considered from very strongly acid to moderately acid (USDA, 1998). These pH values – generally considered suitable for soils carrying intensively cropped vegetables (Tindall et al, 1990) – can be natural or due to the kind (mainly *urea*) and the continuous application of chemical fertilizers (Prasad & Power, 1997), as done by the villagers for 20 years. Further it can affect the availability of nutrients – especially macronutrients- in the soil[8].

Only the content of exchangeable Potassium (K) is considered moderate in average (155.43 ppm)[9] while the average percentage of total Nitrogen (N) (0.067) and the levels of available plant Phosphorus (P)[10] of five of the plots studied are considered very low (Table 4). These results are not surprising, even in the case of heavy use of chemical fertilizer, as the samples were taken from harvested (rice) or matured crop fields, which at that stage do not require N or P fertilizer. Nevertheless, these results, combined with the low content of organic matter mentioned above, are signs of low soil fertility. This result contrasts sharply with the problem ranking realized with the farmers (see table 3) where the problem of soil fertility degradation was placed far below the three top problems.

However, it appears that, if specific soil conservation techniques are not applied (except for application of manure, only two households use conservation techniques) and the use of chemical fertilizers continue to increase in quantity and in relation to organic fertilizer, the soil conditions could worsen and create problematic situations.

---

7 The results of the soil analysis showed that the percentage of SOM was high (2.69%) in the paddy rice field and moderate (2.28) in the lychee plot. This can be explained by the presence of plant residues or leaves on the ground.

8 Another reason for this depletion can be the amount of basic cations removed by the last crops, since normally all plants take up exchangeable bases during their growth. When the plants are completely or partly removed from the land the net result is loss of some amount of bases from the soil, and this leads to the development of soil acidity.

9 This moderate content might be due to the nitrogen supply; since from the questionnaire and semi-structured interview villagers said that in the crop fields they mainly apply inorganic fertilizers like urea, phosphorus and potassium. Sometimes if nitrogenous fertilizers are applied to a soil with only just enough available potassium, a potassium deficiency can result (Ahn, 1993).

10 The low content of available P in soil might be due to the unavailability of Phosphorus in organic compounds present in the fields such as the grass residues in the slope fields and also Phosphorus fixation in this soils; it is because the pH level in this soil is strongly acid that contributing to rapid Phosphorus fixation. The Phosphorus becomes available after organic compounds mineralization (Ahn, 1993). The low concentration of Phosphorus indicates that crops growing in these soils will have high response to phosphate fertilization. Optimum concentrations of Phosphorus in the soil solution for many crops are believed to be between 46-71 ppm, depending partly on soil texture (Heckman, 2006).

The increasing use of pesticides can also cause and be caused by environmental degradation. Indeed, by weakening the microfauna of the soil and insects, the use of pesticide can interfere in the natural processes of decomposition, essential to the fertility of the soil (Bourguignon, 2008) or to pollination. Also, besides natural causes, environmental disequilibrium, like the direct or indirect elimination of beneficial insects or the lack or excess of some nutrients in the soil can increase the occurrence of pest and disease (Chaboussou, 1987). The importance and perception of the problem was confirmed by the participants of the focus group with six farmers, where "pests and diseases" was ranked as their main problem as seen in the table below.

LIST OF PROBLEMS	GRADE
PEST AND DISEASES	**21**
COST OF INPUTS	17
PRICES OF OUTPUT	16
SOIL FERTILITY DEGRADATION	3
SHORTAGE OF WATER	1
QUALITY OF WATER	0

Table 3:Problem ranking by the farmers

When asked about possible causes, through the *problem tree* exercise, they only mentioned climate factors such as climate change (warmer temperature) and rainy season. However, as learned through interviews and the timeline exercise, the villagers seem to be aware of the potential negative impact of an increasing use of agrochemicals on soil and water quality.

Despite analyzing the water and sediments samples taken to know the physical and chemical properties of the water in BHTR, we are not able to precisely describe the extent of the impact of the agricultural system and the use of agrochemicals on water quality. Indeed, our results concerning water pollution by excess of nitrate, phosphate or pesticide residue can be questioned due to the period when we did our tests and the scarce amount of samples. The low level of precipitations and the restraint use of irrigation in the dry season reduce significantly the run-off, erosion or water leaching into the streams. Even if the highest levels of nitrates (NO_3^-) and phosphates (PO_4^-) were all found in the lower zones of the village, no pesticide residue was detected in our samples[11] and all concentration of NO_3^- were lower than the standard value (Table 5).

Even concerning the value of PO_4^-, which was higher (average of 2.64 mg/l) in all samples compared to the Thai Governments standard value ($\leq$ 0.03 mg/L), it is still difficult to establish direct causes. However, the accumulation of nutrients in the soil and then in the aquatic ecosystems could confirm a negative effect of the intensive use of fertilizers in the village

[11] This also can be explained by the sandy texture of the sediments which cannot stock heavy metals and so increases nutrient leaching.

(Carpenter et al, 1998). Additionally, it could be caused by household activities (Heath, 1995).

According to the Table 5, regarding the rest of the test, the pH and total dissolved solids (TDS) of the water were considered normal as the electrical conductivity is higher in most of the sites (average 300μs/cm) while the value upstream can be considered normal. Since EC stands for level of salinity, high values may result from agricultural run-off and express a lower water quality (Michaud, 1991).

Table 4: Laboratory result of soil sample analysis

Sample	Parameters of soil											
	pH	**Analysis**	**EC (dS/m)**	**Analysis**	**SOM (%)**	**Analysis**	**Total N (%)**	**Analysis**	**Available P (ppm)**	**Analysis**	**Available K (ppm)**	**Analysis**
1. Cabbage	5.85	Moderately acid	0.086	Very low	1.03	Low	0.052	Very low	24.81	Moderate	120	Moderate
2. Egg plant	5.87	Moderately acid	0.041	Very low	0.72	Low	0.036	Very low	5.05	Very low	184	Moderate
3. Corn	5.31	Strongly acid	0.043	Very low	0.72	Low	0.036	Very low	2.87	Very low	113	Moderate
4. Raddish	4.85	Very strongly acid	0.104	Very low	0.83	Low	0.041	Very low	3.61	Very low	90	Low
5. Paddy rice	5.47	Strongly acid	0.021	Very low	2.69	High	0.134	Low	1.74	Very low	63	Low
6. Cut flower	4.64	Very strongly acid	0.154	Very low	1.14	Low	0.057	Very low	9.89	Very low	165	Moderate
7. Litchi	6.79	Neutral	0.081	Very low	2.28	Moderate	0.114	Low	63.78	Very high	353	Very high
Average	5.54	Moderately acid	0.076	Very low	1.34	Low	0.067	Very low	15.96	Moderate	155.43	Moderate

Source: Soil laboratory analysis for our samples, appendix IV and see appendix VI, VII & VIII for standard ranges of the quality indicators used.

Table 5: The results from water and sediment samples analyses (water test kits and laboratory analysis)

Sample sites		**pH**	**Dissolved Oxygen (mg/L)**	**Electrical Conductivity (µs/cm)**	**TDS (mg/L)**	**Available NO_3^- (mg/L)**	**Available PO_4^- (mg/L)**	**Pesticides**
Upstream	Before the village	8.10	3.0	200	100	2.34	1.46	ND
Site 1	In the village	7.76	1.8	300	100	1.45	1.29	-
Site 2	In the village	8.22	0.4	100	200	1.80	3.34	-
Site 3	In the village	8.26	0.7	300	200	3.04	2.46	ND
Site 4	After the village	8.14	2.2	500	300	3.95	3.45	ND
Average		**8.09**	**1.3**	**300**	**200**	**2.56**	**2.64**	
Standard value of surface water (Thai Government)		**6-9**	**5-7**	**≥200 (µs/cm)**	**100-500 mg/L**	**≤ 5.0 mg/L**	**≤ 0.03 mg/L**	

Source: Water quality analysis for our samples

3.2.3 Impact of the volatility of the market

Market fluctuation is an important factor in the economical instability in BHTR, as the agricultural system is small scale intensive commercial agriculture that depends on market for inputs and output. Both fluctuation of cost of inputs and price of agricultural output challenge the farmers. Through our survey and observations we learned that production mainly depends on family labour. Even though 11 of the 18 households surveyed casually employ labour, it is only few days a year during high labour demanding seasons. Thus, an upward spiral of cost of labour may not cast serious challenge in the production system of the village.

However, rise in cost of agrochemicals can have a sharp negative impact on the overall profit and any shocks to market prices of agricultural products can have serious implications. The table 6[12], made with help from farmers, portrays approximate net returns of different crops under different market and productivity conditions.

Crops	Profit per rai (BHT)			
Chinese radish	*Low price (per yield)* **650**		*High price (per yield)* **6650**	
Cabbage	*Low price (per yield)* **-3500**		High price (per yield) **14500**	
Paddy rice	*Own land* **2290**		*Rented land* **1090**	
Upland rice	**8220**			
Lychee	*Low productivity / Low price* **-688**	*Low productivity / High price* **3212**	*High productivity / Low price* **262**	*High productivity / High price* **7012**

Table 1:Profit per rai.
The table shows the profit generated by some of the main crops cultivated in the village under different conditions (high or low price, high or low productivity, own or rented land). Owing the fact that variations in price and productivity occur only for some crops they are mentioned only for them.

The table shows how huge variations generate instability for the farmers, as their income is determined by external factors such as market prices. E.g. a low market price of cabbage can cause important loss (-3.500 BHT /yield/rai) while it can also provide the household with vital profit in case of good price (14.500/yield /rai). The same observation can be done in relation to lychee, in this case depending also on the productivity.

Through interviews, villagers expressed how they witness an increasing need for inputs in their agricultural production while those inputs were increasing in cost, and a decrease of the price of their products. In the focus group with farmers, participants ranked the fluctuation of agricultural output and cost of inputs as the second and third most serious problems, respectively, next to the problem of pest and diseases.

In our questionnaire we did not ask about expenses in the agricultural production, and

[12] Upland rice seems to be among the most valuable crops and very safe (without any variation in price and yield). However, as explained by our interpreter, it can be sold at an high price because it is considered as a typical product of hill-tribes, but people buying it are very few. Shortly, it is a niche product with a very limited market, usually produced for own consumption rather than for market purposes.

therefore we can not specify and qualify the perception expressed in several interview and farmer's focus group, that farmers are now forced to spend major amounts of the profit on productive inputs[13]. A Tambon administrative officer (TAO) described that the government does not support villagers in dealing with the market volatility, except for issuing the average price of paddy rice and soya bean.

3.2.4 Lack of political and economic support (Tesfey)

An instability related to the possibilities of community development was the lack of political and economic support from the government. BHTR and BMKP are administratively seen as one village, which means that they have a common political structure with one committee and one headman, and are represented commonly in the Tambon office. But through our interviews and group discussions with committee members, the assistant headman and with the housewife group, it became clear that the community of BHTR feel restricted by their relation to BMKP. When we first arrived in the village two different informants told us the two communities had a good relationship, but we later observed a clear frustration and feeling of injustice. The women of the Housewife Group were the first to criticize the management of the whole village. According to them, the two sub-villages used to have a joint Housewife Group, where they shared the support from the government as well as the profit from orders on handicraft. But following a big order, they felt cut off from the common project, as the women of BMKP had kept the money for themselves. So, they decided to form their own group, but still expressed feelings of frustration as they consequently do not receive any help from the government.

The village committee consists of seven members in BMKP and five members in BHTR, all appointed by the Tambon, based on the suggestions from the headman. The headman appoints 3 assistant-headmen, one of them from BHTR. It seems that pragmatically most of the administration and management is split between the two communities, so that they only cooperate when necessary. Thus the five committee members and the assistant headman from BHTR take care of the sub-village. One of the committee members told us there was a huge lack of information between the two sub-villages, and described how he was appointed as responsible for education by the headman in BMKP five years ago, but that he has never been active because the headman does all the work and does not inform him. He described how BHTR suffers from being a minority, subjected to the priorities of BMKP, which causes them to be the least developed community. This perception was backed by the assistant headman, who said the village budget is not divided fairly between the two sub-villages, and as they do not agree on the investment priorities, he feels that the decisions made end up benefiting BMKP.

[13] To have an idea of the expenses related to natural fertilizers and agrochemicals for the main crops cultivated in the village see Table in Appendix XI , realized thanks to the information collected in a focus group with six farmers. For cabbage, for example, farmers spend 9500 BHT per rai, while for Chinese radish they spend 3850 BHT.

Focus group with farmers

4. Strategies

In accordance with the livelihood framework, as defined in the introduction, we will deal with strategies as choices of action that people apply to achieve their livelihood objectives, constraint by the context analyzed above. At the household and community level, we can distinguish a broad range of strategies applied to cope with the external and internal limitations and instabilities affecting the community and its environment. In the following we will firstly analyze some of the choices that farmers have made regarding their field (*on* [their] *farm*) to adapt to new conditions and improve their living standards, and then, other strategies more related to wage job and city activities. Lastly we will analyze what strategies are applied on community level.

4.1 On farm income and strategies (Camille)

Firstly, we will give an overview of the agricultural system of BHTR. Then we will analyze how farmers use diversification of the agricultural system as a strategy followed by an analysis the problematic case of lychee trees.

4.1.1 On farm income generation: an overview

In BHTR, income is mainly generated through intensive agricultural activities. Based on the household survey, an average of 62.1 % of the households' income originates from cultivation of own, borrowed or rented lands. Agriculture, therefore, is a central part in the life of villagers. In the village, each farmer cultivates one or, in most cases, several plots on which he grows different crops, prevalently cash crops. As we can observe in illustration 4[14], some are more dominant: first of all, lychee (only three households do not cultivate it), then Chinese radish, cabbage and, finally, rice. However, from our questionnaire and field observation we noted that they are sided by many others crops (grouped in one single category in the graph) like chilly, ginger, potatoes, Chinese vegetable, maize, wheat, pumpkins, carrots, cut-flowers, orange, etc. Some crops are used both for own consumption and market purposes, (rice, vegetables), other are meant to be sold in the markets of Chiang Mai or – more occasionally - of Bangkok (cut flowers or lychee).

[14] Summing all the crops gives as a result 104 %. This is due to the fact that four households cultivate in the same plot different crops in different periods of the year. There is the possibility that other households were doing this, but they simply mentioned in our questionnaire just the crops that they were cultivating at the moment of the survey.

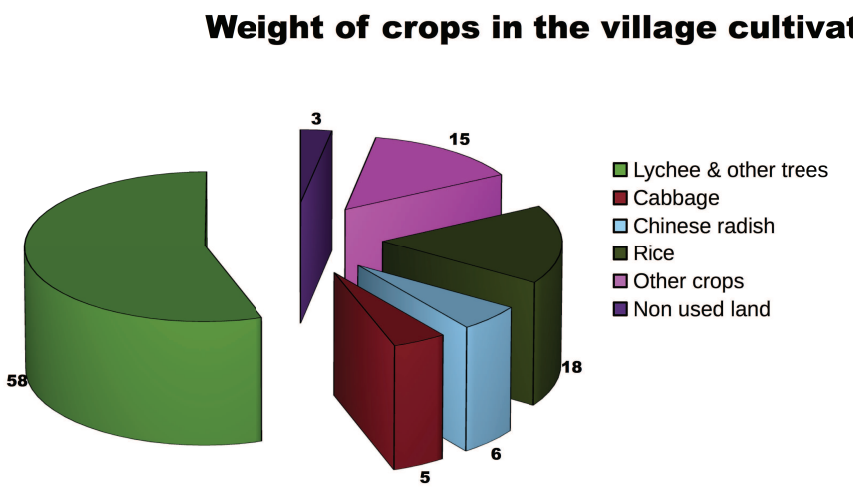


Illustration 4:Crops
The illustration shows the amount of land allocated by different crops (expressed as a percentage of the total village cultivated land).

As already mentioned, the agricultural system in BHTR is characterized by the employment of agrochemicals, both in order to maximize production and to meet market standards requirements. The use of agrochemicals and natural fertilizers varies in accordance with the type of crops. Some of them (e.g. cabbage), more vulnerable to pests or more nutrients demanding, require a higher application of agrochemicals (see table in Appendix X).

4.1.2 A diversified agricultural system

We distinguished different strategies, and will here focus on diversified agricultural system as on farm household strategy. By diversified agriculture we mean farmers cultivating a variety crops in different plots, and not multiple crops together in the same plot. We learned through the timeline exercise and our data from questionnaire and interviews, that before 1975, farmers of the community of BHTR used to cultivate only upland rice and maize. In 1975, thanks to a program of the social welfare department, they started to cultivate lychee. In the 1990s, after the construction of the road to the village, the production of vegetables became more profitable and, as the income from lychee and rice was low, they started to devote part of their plots to the production of vegetables.

A diversified system to reduce risk

Thanks to this strategy, farmers are more able to cope with the problems of market price volatility and production variability. Like we already mentioned through the table 6, crops seem to follow the general economic rule of *the most profitable, the most risky*. Therefore, the diversification of crops permits the farmer to take risks with some crops and at the same time cultivating more stable crops to reduce the overall risk.

Paddy rice, for example, is a stable source of income: the market price is always the same

and there are no significant variations in yield. Furthermore, it is low capital demanding, not requiring many inputs, according to the information provided by the farmer's focus group. However, it is far less profitable than all the other crops when they are produced under favourable condition. Cabbage, instead, is able to generate a really high profit under optimal condition, but is highly input demanding (see Table in Appendix XI) and, in case of low market price, revenues are not able to cover expenses. Summarizing, it is impossible to sort crops in accordance with their profitability without a deep knowledge of the probability of getting a determined yield and price. We did not investigate this aspect, but probably, even farmers have not a precise idea of this probability. Their choice of crops seems to correspond with an attempt to balance profit maximization with stability in a context of imperfect information and high volatility and will be determined primarily by their propensity to risk and assets' endowment. For example, in a very poor household they told us that, this year, they were growing ginger because it does not require pesticide and high amount of water.

A diversified system to adjust to calendar

When we compared the number of rai per crop and their respective contribution to the household income, we were surprised to see the disproportion between the amount of land devoted to lychee and the average income it provides to the households. This can be easily seen comparing illustration 5 with illustration 6.[15].

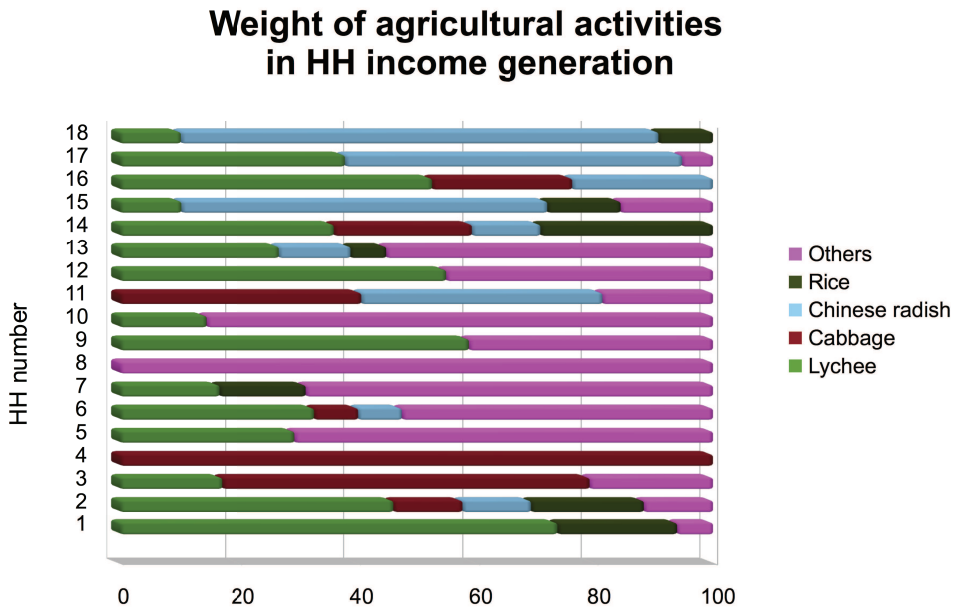


Illustration 5:Weight of agricultural activities in HH income generation
The illustration shows the weight of different crops in the HH income generation (expressed as a percentage of the total agricultural income of each household).

[15] Illustration 5presents the same problem of illustration 6 having some columns greater than 100 %. The reason is the same of the one explained in note ….

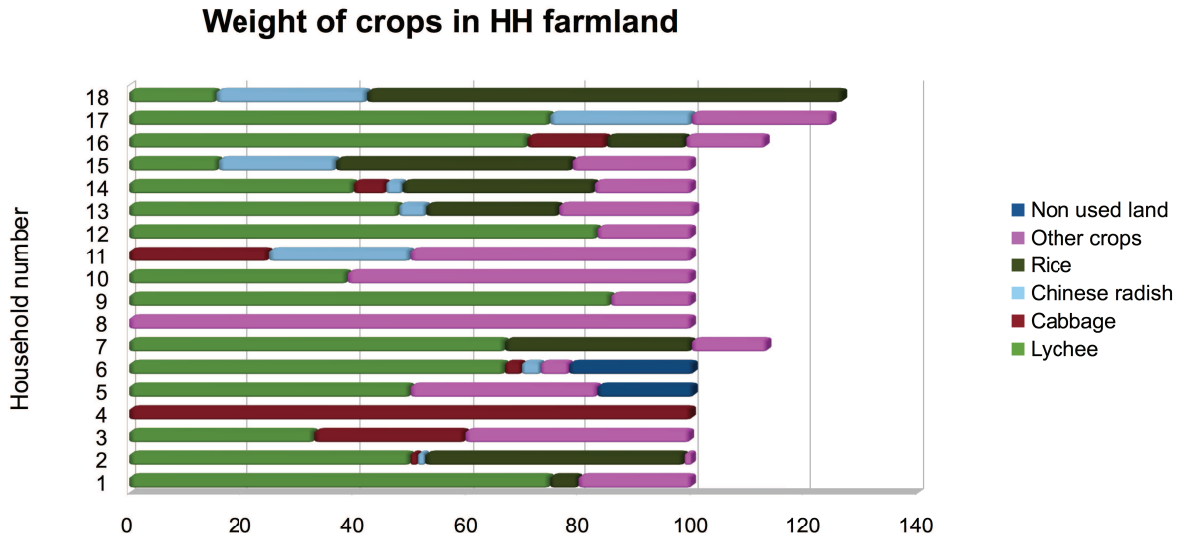


Illustration 6: Weight of crops in HH farmland

The illustration shows the amount of land allocated by each HH to different crops (expressed as a percentage of the total agricultural land area cultivated by each household).

Considering that lychee is a risky crop (farmers indicate a possible variation both in price and yield), we can wonder why more part of this land is not used for other more stable and profitable crops (e.g. Chinese radish). A first explanation could be that, even in the worst scenario, it does not cause serious loss as, for example, cabbage. When we look at the crop calendar (table 7) realized with the help of the farmers, we can see that most of the crops are cultivated between September and December, while lychee requires care starting from January until May. Indeed, the harvesting happens during the rainy season, when most of the vegetables cannot be cultivated. And while farmers will have to prepare the soil, plant, take out invasive grass, spread agrochemicals and harvest vegetables, they only need to give negligible care to trees (e.g. pruning). The topography of the land could be another possible reason why farmers keep the orchard while other crops guarantee better return. This is so because farmers cultivate lychee in the hilly and sloppy part of the village whereas cultivating vegetables require relatively plain land.

Crops	Period of cultivation / period of needed attention												Water requirement
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Lychee				*	*								medium
Chinese radish	*	*							*	*	*	*	high
Cabbage									*	*	*	*	high
Upland rice							*				*		medium
Paddy rice									*			*	high
Maize				*		*							/
Wheat				*		*							/
Rainy season			Dry season					Left * = planting			Right * = harvesting		

Table 7:Seasonal calender

A diversified system to improve food security

As another strategy, applied to not rely solely on the market, several farmers started to cultivate paddy rice, on their own field or more often in rented land in more suitable lowland areas of the watershed. Despite the fact that it requires time and money[16], especially in October-November (the two busiest months of the year), the farmers consider paddy rice as their most important crop (result of the ranking of crops), because of all its advantages: stability (price & yield), low inputs requirements and its role in the food security of the households. The cultivation of a variety of vegetables and the construction of the road, have played a positive role for access to varied food in the community.

4.1.3 Study case: lychee replacement and pest management strategies

During our field study we have heard many farmers complaining about the declined productivity of lychee trees. It is difficult to understand if it is just a temporary phenomenon or a stable trend, but the fact that some farmers were substituting them with oranges and strawberries seems to give value to the second hypothesis. The main causes mentioned for this decline are the warmer weather and the age of trees.

Two observations can be made here: the first one related to the causes identified, the second to the proposed solutions. As mentioned, according to the farmers, one of the reasons for the decline of lychee is related to the weather. Indeed, lychee requires "*short, dry and cool*" winter with maximum temperature 20-22 °C. Although lychee trees are also known for their natural irregular flowering and poor fruit retention, a poor yield can also be caused by a

[16] During the focus group, farmers said that the usual renting contract states that they have to give to the landlord 100 Kg of non-peeled paddy rice per rai, independently from the yield obtained. It corresponds in average to one fifth of the yield, as the the usual yield is 500 Kg per rai.

mismanagement of the orchard soil nutrients or pest management (FAO, 2002). The loss of diversity in the cover vegetation of the lychee fields and the overuse of pesticides may also have a serious impact on the provision of biological services (e.g. elimination of pollinators or natural enemies of pest), important to a good and sustainable productivity (Euler, et al., 2006). Through the *problem tree* exercise with farmers (illustration 7), we noticed the lack of a sustainable strategy of pest management, the most common solution being to simply increase the use of pesticide:

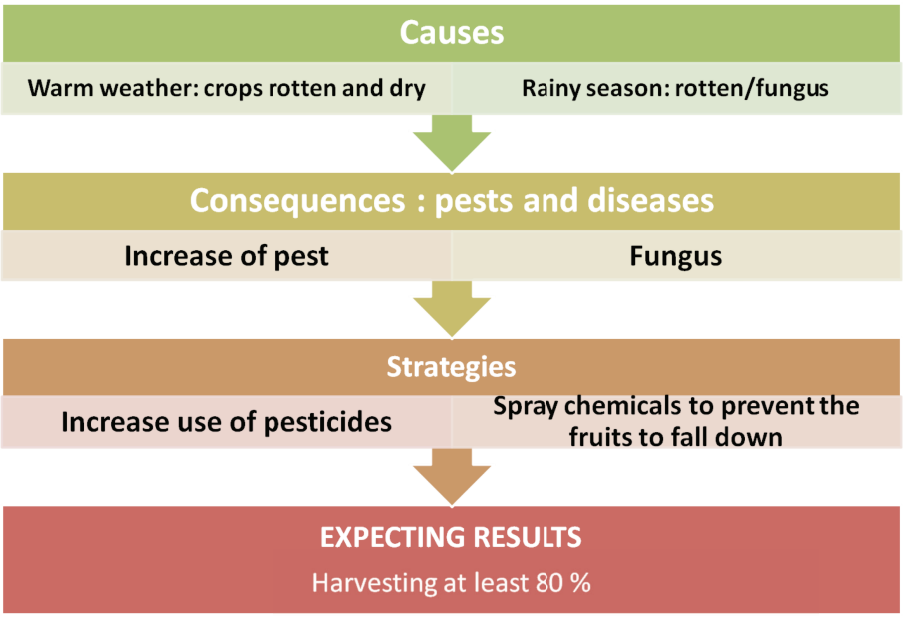


Illustration 7:Problem tree realized during a PRA with farmers

The need of more agrochemicals may constitute an increasing portion of expenses in the future. Insofar, inequality might increase due to different capabilities of buying inputs. As discussed, we suppose that the low fertility of the soil is linked to the overexploitation and inadequate application of agrochemicals, nurturing a vicious circle. Some farmers have shown an interest to escape this trap, by attending meetings about alternative practices (e.g. use of increasing part of manure or biopesticides), but it remains very isolated cases in the village. Again, differences in economic and social capital might lead to differences in the capability to face this challenge.

As we mentioned, some farmers are starting to replace lychee by orange, aware that this later is much more demanding in labour and pesticides. If this strategy is followed by more farmers and not complemented with new soil and pest management practices, it could well worsen the problems of inputs and push some of the households to seek for other livelihood strategies.

4.2 Other household strategies (Marco)

In order to reach more stable, and therefore more secure economic situations, the members of the community of BHTR, have also been investing in other areas than agriculture. Through questionnaires, interviews and participatory approaches, we could distinguish three main

strategies: first the diversification of sources of income, employment in off-farm activities as wage job or private business, in the village or in other area of the country, and the education of children.

4.2.1 The out of farm sources of income in BHTR

From illustration 8 we can observe that many households of the community seek to add other sources of income to their agricultural activity. According to the results of the questionnaire, the average number of sources of income is of 2.2. The main sources of income (other than agriculture) of the 18 households interviewed are temporary or permanent wage jobs (six households mentioning it as a *very important* source of income). Two households rely also on the collecting and selling of NTFP, one household on the managing of a private business (small shop of the village), and one other on the fabrication and selling of handicrafts[17]. Besides these activities, 8 households receive remittances, and 3 receive state pensions[18].

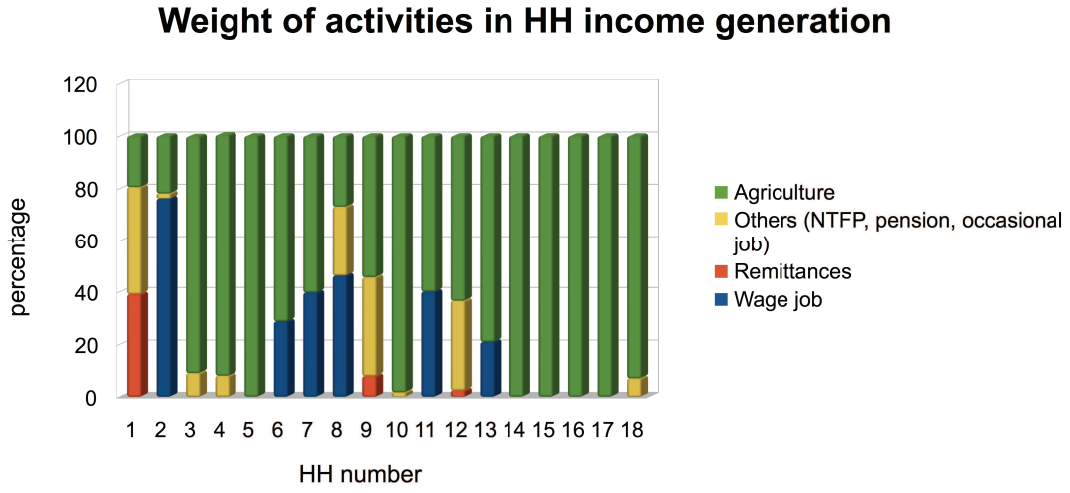


Illustration 8:Weight of activities in HH income generation
The illustration shows the weight of different activities in the HH income generation (expressed as a percentage of the total income of each household)

However, it is important to stress that in 15 of the 18 respondents stated agriculture a *very important* source of income. Diversification exists in the community but in a small extent as more than half of the households surveyed (11) rely on one or two sources of income and only two households have more than three sources of income.

4.2.2 Wage jobs: a relevant alternative with many constrains

Considering wage jobs, we can identify two possibilities available for people in the village. The

[17] All this activities, together with pensions and hired labour in others farmland have been included in Graph … under the label "Others" because the relative marginality of many of this activities. Some of them, in fact, are practised by just one or two households and others have a scarce influence on the total income.

[18] In Graph … just 3 households result to receive remittances. This is due to the fact that only for these households we had a precise indication of the amount received. In addition, in two households remittances were sent only when asked, as a kind of help, so it does not seem to be correct to include them as a stable source of income.

first one is to work as hired labourer in others farmland. From many interviews, it appears that there exists a fixed wage for this kind of job: 120,00 BHT a day for women and 150,00 BHT for men. It is not such a profitable option because, hypothesising 25 days of work per month, it can generate 3.000,00 or 3.750,00 BHT monthly. Furthermore, during our conversation with farmers, we learned that agricultural activities are mainly done by household members, while hired labour is used occasionally or for particular activities such as harvesting. Insofar, this form of income is occasional – farmers told us that there was not enough work for more than 5-10 days per month – and it is used mainly as a supplementary income. Finally, this option does not really improve income security because labour demand is strictly linked with agricultural outcomes, being high when yield and prices are high and vice versa.

Stable wage jobs, in other sectors, appear to be a better option on an economical point of view. Illustration 9[19], in fact, it shows that households with a high wage job income (8 households in total) are able to generate more savings than the others (10 households). In addition, they appear to be less indebted. In particular, households with marginal wage job income are much more likely to contract debts for agricultural purposes. It is important to note that more than half of the indebted households contracted loans for agricultural purposes. Therefore, this is a widespread practice that further characterizes agriculture as a risky activity. Just two households with high non farming income have debts for agricultural purposes; this might be due to the less importance of this activity in the total income generation, but also to the fact that they are able to pay inputs with their wage.

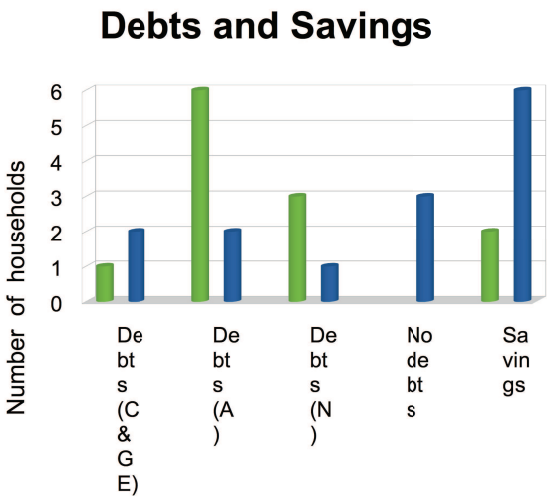


Illustration 9: Debts and savings
The illustration shows the number of HHs having debts and savings together with the reasons of indebtedness. HHs are divided between HHs with mainly agricultural income (green column) and HHs with a significant percentage of income derived from wage jobs and pensions.

Income generated by wage jobs can be really advantageous compared with agricultural activities. A farmer told us that, while he was working in a packaging factory of food products, he could gain, with extra-time work, up to 8.000,00 BHT per month. Yet, few people in the village are engaged in wage jobs. One reason could be the lack of availability of jobs. The same farmer explained that it was just a seasonal job, unable to generate a sufficient income for the whole year. Other people in the village are working as machine operators but, it is also only few

[19] The 8 households with high non-farming income include the 6 households with wage jobs plus two households whose members work as hired labourers in others field.

days per month, using this activity to complement their agricultural income. Some of the households were empty for the entire research period. Other villagers explained that they were working outside of the village, which implies a phenomenon of temporary migration for working purposes.[20] One person, has a really well paid job (12.000,00 BHT per month) in a school, which requires a high level of education. Even looking at the people permanently migrated from the village, few of them are engaged in jobs requiring a low level of education, while the most are studying or doing jobs that need at least a high school level.

Migration, indeed, appears to be a phenomenon closely linked to education, seen as a mean able to give valuable alternatives. When we asked some farmers if they would like their children to continue their activity, four of the respondents directly mentioned they would not like them to be farmers because their children have good education and therefore have access to "better lives". Two other households do not see any problem in their children becoming farmers as themselves, but directly stated also the importance to make their choice after completing school so they can choose what they want.

4.2.3 Education: the main strategy for the future

Education, therefore, can increase the chances to find a job with a better income: a girl from the village working in Bangkok as a nurse was earning 8.000,00 BHT per month. Our interpreter informed us this was a typical wage for a bachelor degree, while, with a master degree, it can increase up to 20.000,00-25.000,00 BHT. The level of some remittances in the village confirmed that statement. Accordingly, one of the richest household in the village was receiving almost half of its income through remittances by the five children living outside the village. All of them have university degrees and are now working and able to send each 20.000,00 BHT per year. We observed the importance of education through the PRA we held with the young living in the village. When asked about their "education target", out of the eight one of them wanted to reach the bachelor degree, three the master degree and one wanted to study until the doctorate.

4.2.4 Summary

Regarding agricultural activities, villagers apply different strategies, like diversified agriculture to cope with risks and to match their annual cropping calendar. However, it seems like they do not have very sustainable strategies when it comes to pest management and soil degradation.

A second strategy is to integrate income from agriculture with wage jobs that appear to be a more stable and more profitable source of income. However, the village area provides limited opportunities. Migration seems to be a necessary step in order to get a wage job able to guarantee economic security and a good level of education. If it is not a must, it is still an important

[20]The phenomenon of temporary migration that we did not discussed for lack of information. Some considerations about scarcity of permanent jobs in the village area and opportunities for people with a low education level could need to be put back to their right perspective having this further information.

prerequisite that villagers are aware of.

Chinese radish harvest

4.3 Strategies to cope with economic and environmental instabilities on a community level (Anne)

In this part we will analyze which strategies the community applies to cope with the limitations and instabilities they face. First we give an outline of the history of the community, then we analyze the solidarity of the village, followed by an analysis of self-management as a strategy. Lastly we analyze a search for independency as a strategy.

This focus on the community gives us the opportunity to grasp some of the strategies applied in cooperation between the households and in relation to institutions both inside and outside the village. With inspiration from livelihood framework we see communities as households and individuals linked by ties of social obligations that can both take form of formal networks and membership of groups, or more informal relations of trust, reciprocity and exchanges (Messer & Townsley 2003:9, DFID 1999:9).

4.3.1 A young community with a strong sense of cultural distinctiveness

Ban Huay Tao Ru (BHTR) community is defined by the geographical, historical, cultural and ethnic cohesion. The historical cohesiveness was made clear during the timeline focus group where we were told that the village was founded by 15 families, and that the 31 households the village consists of today, are their extended families. Through our questionnaire we know that the vast majority of the households have been in the village for more than 20 years. In fact only 3 of the surveyed households had settled within the last 5 years, but are also somehow related to other households in the village. This relatedness is an important part of the narrative of the community and its cohesiveness. However, this narrative can exclude people or households that do not match the narrative. Through talks and observations we found that a few households seemed detached from the community. As for example the young single-parent mother that our interpreter told us was excluded because she did not live up to the ideals of family life in the village. The narrative of the community history identified the village as an agricultural community, and events as changes in agricultural production and improvements in infrastructure, were the main historical developments mentioned in the timeline focus group.

4.3.2 Solidarity and shared work as a strategy to maintain a sustainable community

Throughout our research we repeatedly discovered a strong sense of social security and shared work. As an example we participated in the harvest of a Chinese radish field, where a group of 20 people from different households were gathered to help harvesting, so the owner did not have

to hire labour. [21]Other examples count how the community helps the oldest man in the village to grow his garden, and help the poor with blankets and other basic matters. In the focus group with the young they expressed a clear perception of the community as based on solidarity, trust, generosity and a good relationship among people (se table 8 in the chapter on deagrarianization). Solidarity and shared work can be seen as a community strategy to cope with agricultural and economical challenges and vulnerable life situations. This warmth and solidarity we also felt in the way we were welcomed in the village.

4.3.3 The strategy of self-management (Sara)

As stated earlier, settlement in the area is in principal against the law, but de facto tolerated. In interviews with the head officer of the RFD in their section of Forest Protection, and their central office in Chiang Mai, it became clear that there is a discrepancy between what the law states and the actual practice in the area. They expressed that self-management is a common occurrence, and that conservation forest in reality does not preclude human activities.

Accordingly, the people of BHTR mostly manage the natural resources themselves, though sometimes in cooperation with BMKP. The two sub-villages have entered a joint forest agreement, and one of our informants told us that villagers stand together against outsiders that do illegal logging. Most of the natural resource management and administrative tasks in the village are handled by the village committee members. The rotational irrigation system that is essential for the agricultural production in the dry season, is self-managed by the villagers. The division and the regulation of 'landownership' in the village, is based on informal rules. Though the villagers do not actually own land, they explained how they just know which land belongs to whom.

Another way the community act within the scope given, is the fund that the housewife group is managing. The members each have to contribute with 100 BHT 2-3 times a year, and the profit they get from selling their products is kept in a community fund. The fund is used to give loans to people who need a little capital to start their own business, like a woman from the housewife group, who obtained a loan to invest in a purse production.

4.3.4 One Million BHT fund

Without title deeds for their land they cannot obtain loans from formal credit institutions, but the government have created the one million bath fund for villages, a governmental development program to be used as a credit source, leaving villages to manage it with the restriction that the fund cannot be reduced[22]. BHTR and BMKP have one fund together, due to lack of data regarding this we do not know exactly what role BHTR plays in the management of

[21] As indicated in a farmer's focus group, the cost of labour for harvesting one rai of Chinese radish is 4500 BHT, indeed shared work can allow the owner of the field to save a significant amount of money.

[22] This information was provided to us by villagers members of the group in charge of administering this fund.

this. When a borrower fails to repay his loan[23], the fund administrators evaluate if the failure originates from objective causes (bad harvest for climatic shocks, pests, etc.) or subjective wrongdoings. In the first case there will be an arrangement with the interested person about modality and time of repayment, in the second case he will be interdicted of having further loans[24]. This allows borrowers to rely on a more flexible credit system than the formal one, where external shocks can easily cause the loss of collateral. It also appears to be possible only thanks to the closeness of lenders and borrowers that allow to avoid the problems of adverse selection and moral hazard and by the mechanism of social pressure (Bardhan & Udry 1999).

4.3.5 Independence as a strategy to decide the future of the village development

The cultural and ethnic cohesion were manifested several times by different villagers, always in contrast to other groups. For example the assistant headman said "*Ban Huay Tao Ru is culturally totally different from Ban Mae Ka Piang."* (field notes from interview). As mentioned BHTR and BMKP are officially one village, but in reality most administration and management is pragmatically split between the two villages, which according to the assistant headman is because it is difficult to administrate so different people as the Hmong and the Karen. The difference between BHTR and BMKP appeared to be a central theme in the self-image of BHTR. When asked about the differences, the assistant headman explained that the Hmong people differ in the traditional costume and the language. It seemed difficult for him to pinpoint the differences apart from the obvious ones. This matches Frederik Barth ideas about that group identity emerges from the relation to another group, and that the distinctiveness of each group is defined by the boundary between two groups, where the differences become clear in the comparison (Barth 1969:11). This idea of the villages as distinctively different is a generator of a strong internal community feeling, formed by kinship and the idea of cultural cohesiveness, combined with the intensive agriculture as a pivotal basis for the livelihood.

As analyzed in the instability chapter the dissatisfaction with the relation to BMKP is based on the feeling that they are locked in a minority position, from where the autonomy scope is very limited, and the treatment is consequently unfair. This perception of being misallocated was also expressed by the women in the Housewife Group, who mentioned how they feel cut off from what used to be a collaboration of handicraft production between the two sub-villages. We tried to get the version of the story from the leader of the Housewife Group in BMKP, to learn what had led to the partition of the housewife group, but we did not obtain the information.

Because the people in BHTR feel cut off from BMKP in terms of money and information, their options of taking control over their own situation is rather limited, and thus the imagined

[23] According to the information provided by one million BHT group members the interest rate on a loan is 6% a year. In order to receive a loan a person has to become a member of the group.

[24] We were not able to understand, in case of lack of repayment, which other measures are taken, other than the exclusion from further loans, towards the borrower.

future appears more unstable than if they could take matters in to own hands and control the stream of inputs coming to the village from external sources. Therefore it can be inferred that, as a strategy to break free of that sense of minority position, the villagers identify themselves in, they navigate towards the possibility of attaining independence. Independence, indeed, is seen as a strategy to develop the village and create a better future, by obtaining funds directly from the government and not through BMKP. Both unity in the village and the independence process, are thus strategies applied to cope with the instabilities created by the relation to BMKP.

4.3.6 Summary

We found that in order to counter some limitations and instabilities, the villagers help each other and cooperate in the management of the village. The community stand united in the process of achieving independence from BMKP. This process can be a reason for the enforcement of cultural distinctiveness.

Farewell party last day

5. How the strategies are related to deagrarianization – consequences and future perspectives (Marco)

In this chapter we will analyze the consequences and outcomes of the use of the identified strategies, and how these outcomes are related to the process of deagrarianization.

> I decided to continue my studies and to accept this scholarship in Bangkok, because I was not good at farming, not because I wanted to be nurse in particular. […] The adaptation at the beginning was difficult. Everything was different. Instead of bringing my food directly from the field, I had to buy it, I had to rent a place to stay and the transport was chaotic. […] I don't like living in Bangkok. […] Even if there is more job opportunities in the city, my husband and I would prefer to come back to the village and to farming activities. […] We want our son to grow up next to nature, in the cooler climate of the mountains, where he can play outside. (Field notes from the interview with the assistant headman's daughter living in Bangkok)

As analyzed earlier and as illustrated in the quote above, migration is a rather prevailing strategy in the village. This strategy is applied to widen the scope of possibilities for generating income beyond agricultural practice, as it is perceived as a somewhat instable livelihood generator. Migration is but one of the strategies we identified as leading to the process of deagrarianization in the village.

Occupational adjustment and income-earning reorientation, spatial relocation of rural dwellers and *spatial interpenetration* - processes of deagrarianization (Bryceson, 2008, Rigg & Nattapoolwat 2001), are all taking place in the village.

Especially the young generation seem to have been given the option of choosing other livelihood strategies than the ones strictly relying on farming activities. The extended options of education is a vital factor in this, but also the spatial interpenetration, another characteristic of deagrarianization (Rigg & Nattapoolwat 2001), plays an important role with the closer interaction between city and rural life enabled by the villagers' higher degree of mobility.

One consequence of the migration could be the erosion of the social dynamic in the community. One of the elders said that: "*Now there are only old people and children in the village.* […] *The young are leaving and the village is left with a limited work force*" (Field notes). Even if this statement can be nuanced by the fact that we met several young farmers in the village and talked to many young people that found the community life really important, the community is surely in a process of rapid change.

As part of this process, we also identify the fact that the majority of the households seek to diversify their income activities. However, in most cases it is not because they do not like working in agriculture or living in the village, conversely it reflects the limitations and instabilities encountered in agricultural practice, and is thus an attempt to secure their livelihood in other ways. 11 respondents did not want their children to work in agriculture, but only two of them mentioned farming activity in itself as the reason, because it is "too hard" and the

"exposure to chemicals". The other reasons cited were directly linked to the lack of land, or to the instability of this activity. When we asked the young people in a focus group to rank different occupations, the results were quite surprising. "Farmer" and "agricultural expert" were each valued the highest (3) before trader (2,75) and government employee (2,37) (se table 8).

Gr.	Young1	Young2	Young3	Young4	Young5	Young6	Young7	Young8
5	Agricultural expert	*"Be a leader"*	Government employee	*Musician*	*Own business*	Farmer	*Star/actor Football player*	*Graduate in Msc*
4	Government employee	Farmer	Agricultural expert	#	Farmer	Trading	Agricultural expert Government employee	Farmer
3	Business woman	Trading	Farmer	Agricultural expert	Trading	#	Trading	Trading
2	Trading	Agricultural expert	Trading	Trading	Agricultural expert	Agricultural expert Government employee	Farmer	Agricultural expert
1	Farmer	Government employee	*Community leader*	Farmer Government employee	Government employee	#	#	Government employee

Table 8:Focus group young

Perhaps this picture could have been clearer for us, had we asked the participants to grade on a bigger scale and with more occupational choices. However, it told us that agriculture is still highly valued among the villagers.

If we combine these results with the opinions the young expressed about life in the city (see table 9), which is also backed by the assistant headman's daughter's negative impression of Bangkok, it allows us to imagine a possible return to the village and to farming activity. Two young farmers we interviewed in the village could be seen as representatives of a so called *re*-agrarianization process (Rigg 2009), as one had been living and studying agriculture in Chiang Mai for 12 years, while the other had been working in Bangkok in 4 years, but both returned to the village to work in agriculture. However, it is important to state that to investigate this further, we should have included opinions of more people living outside the village, which was not possible due to the short duration of our stay in the village.

City		Village/ Countryside	
Advantages	Disadvantages	Advantages	Disadvantages
Convenience, dynamism and variety of activities **9** - Markets - Shopping center - 3 - Life is convenient - 1 - Transportation - 1 - Many places to visit - 2 - Many places to eat - Food market - 2 *High opportunities for professional life* **8** - High opportunity - 2 - Better education - 2 - Knowledge-technology & activities - 2 - Development - 2 Higher quality in every aspects **2**	*Bad quality of environment - Pollution* **13**: - Global warming- air pollution - from cars 5 - Water pollution and consequences 4 - Trash 2 - Hot-bad weather 2 *Bad quality of relationship among human community:* **3** - "Bad guys"/ violence - Civilization → spoil people - Competition → less love High density of people - **1**	*Good quality of relationship among human community* **12**: - Trust/ respect - 3 - Generosity - 2 - Solidarity (help- share-exchange) - 4 - People are friendly - create a warm environment - 3 *Good quality of environment/ nature* (and related activities) **9**: - good-cooler weather - 5 - Landscape/mountains/trees/wild animals – 3 - Hunting – 1 *Own production/generation of food:* vegetable cultivation/agricultural activity **2** Not too much people **1** Easy to go everywhere **1**	*Attempt at nature and consequences* **5**: - Forest fire/deforestation - 3 - People hunting animals - 1 - Pollution from agriculture - 1 *Inequalities between rural and urban population and consequences* **6**: - People from the city have more skills than people in the village - 2 - Rural people are left behind - 1 - Rural people are easy to be disadvantaged and cheated - 3 *Low opportunities for educational/professional life* **4** - Low education - 2 - Lack of technology - 2 Drug addiction **1**

Table 9:The youngs perception of the city/village

The numbers indicate the number of times each argument was mentioned by the participants.
The categorization in italic was made afterwards based on the analysis of the data

Thus, a process of deagrarianization is present in the livelihood strategies of the village, but there are simultaneously signs of *re*-agrarianization. The village life still represents a positive ideal, but the insecurity of agriculture compel a diversification of income strategies, that makes the spatial interconnectedness between the village and the city stronger through permanent or temporary migration.

6. Conclusion

As analyzed throughout this report, the community of BHTR is challenged by a series of limitations and instabilities. Agriculture constitutes the main activity and source of income. Being BHTR located in a conserved area, farmers can expand cultivated land only by renting plots in lowland areas. The environmental and geographic conditions, market requirements and fluctuations as well as water and labour constrains are other given factors that further narrow farmers' possibilities. Individual inclinations and community access to knowledge through tradition, networks or government agencies are the last elements that contribute to determine an agricultural system characterized by a prevalence of cash crops, diversification and intensive use of land and inputs.

In this context of strong determinants, some of the elements of the adopted agricultural system appear to be rational strategies to cope with instabilities and limitations; diversification of crops, indeed, allows to balance the aim of profit maximization with the one of risk reduction and to maintain production through the whole year. Other elements – as soil nutrients and pests management - instead, evidence a lack of long term sustainable strategies inside the agricultural framework.

Diversification of income sources is another way to answer to challenges, but still presenting constraints. Wage jobs appear to be a considerable supplement to the income, but rarely a full time occupation for people living in BHTR. Migration is another constant of the village, both on a temporary basis, for study purposes or temporary wage jobs, where people maintain a strong link with the village, and on a permanent basis, mainly for skilled wage jobs.

An important aspect is the positive role played by the community in helping households to face instabilities. BHTR appears to be a very cohesive community implementing different forms of mutual cooperation, counting shared work and a strong sense of solidarity. Economic inequalities, the only false note in this cohesiveness, do not seem to have provoked any breaks in the social unit, at least for now. The relation with BMKP, instead, is perceived as a limitation. Many in the community of BHTR feel they are misallocated and treated unfairly with regards to the economic distribution and political priorities. Independence from BMKP is seen as a strategy to develop the village by obtaining own funds and autonomy.

It seems that the most crucial challenges the community will face in the near future are related to the intensive use of agrochemicals on the one hand and migration on the other hand. Though we are not able to make any precise previsions, the fact that farmers need more and more inputs (agrochemicals and manure) to maintain the same level of productivity and that they are not investing in other alternatives, indicates a future challenge regarding the economic and

environmental sustainability. Modest attempts to escape this trap have been undertaken by some farmers, willing to introduce more sustainable techniques. If these techniques prove their efficiency, we can suppose that the dynamism and cohesion of the community will help to spread and accelerate the changes. The independency from BMKP could possibly strengthen the search for alternatives, partly due to new resources and collaborations with governmental institutions, partly because of a possible renewed understanding of the community that would then not necessarily be in contrast to BMKP. With or without independency, a closer and less strained cooperation with the farmers in BMKP, more involved in organic farming, could be an inspiration.

The other challenge is linked to the possible consequences of migration that could cause a disequilibrium in the structure and cohesion of the community, or even have a negative impact on the quality of life, if people who prefer the life in the village are forced to live in the city.

At the same time, deagrarianization could also play a positive role in the village. A clear indicator of this is the parent's focus on sending their children to school, because education appears to be a strategy to cope with possible instabilities in the future and maybe jump the social ladder. Furthermore, deagrarianization could reduce pressure on land and consequently help to solve the problem of soil fertility.

7. References

Ahn, P. M. 1993. Tropical soils and Fertilizer use, Longman Scientific and Technical, Harlow, Chapters 9-14. pp. 114-167.

Aumtong, S., Buzt –Hansen, M., Mingtipol O., Prabudhanitisarn S. Sangawongse, S. and Metzger, C. 2009. Basic Information for the SLUSE Field Course, 2009. Mae Ram Watershed, Chiang Mai Province.

Bardhan, P. and Udry, C. 1999. Development Microeconomics, Oxford: Oxford University Press.

Barth, Frederik (red.) (1969): Ethnic Groups and Boundaries: The Social Organization of Culture Difference, Universitetsforlaget, OsloDFID. 1999. *SUSTAINABLE LIVELIHOODS GUIDANCE SHEETS*, Department for International Development.

Bourguignon, C. and Bourguignon, L.2008. Le sol, la terre et les champs: Pour retrouver une agriculture saine. Paris: Sang de La Terre. 217p.

Bryceson, D. 2000: Rural Africa at the crossroads: livelihood practices and policies, Natural Resource Perspectives. No. 25. http://www.odi.org.uk/resources/download/2095.pdf 13022011

Bryceson, D. F. 2008. RURAL LABOUR DISPLACEMENT & WORLD BANK AGRICULTURAL POLICY, African Studies Centre, Oxford University, WDR 2008 Conference, Oslo, Norway, 29 February, 2008. Available on: http://www.nai.uu.se/events/archives/conferences/african_agriculture/bryceson.pdf, 11022011

Carpenter, S. R., Caraco, N. F., Corell, D. L., Howarth, R. W., Sharpley, A. N. and Smith, V. H., 1998. Nonpoint pollution of surface waters with phosphorus and nitrogen. *Ecological Applications*: Vol. 8. No. 3. pp. 559-568.

Chaboussou, F. 1987. Plantas doentes pelo uso de agrotóxico (A teoria da Trofobiose). Porto Alegre: L&PM. 256p.

Crepin, J. And Johnson, R.L. (1993) Soil Sampling for Environmental Assessment. In. Carter, M.R. (ed.) *Soil Sampling and Methods of Analysis*. USA: Lewis.

De Almeida, F. F. 2006. Coping with rural transition in northern Thailand: an analysis of rural economic diversification and social movements' response, University of Jyväskylä.

Delang, C. O. 2002. Deforestation in NorthernThailand: The Result of Hmong Farming Practices or Thai Development Strategies? Society and Natural Resources, 15:483-501.

Ellis, F. 2000. Livelihoods, diversification and agrarian change, in *Rural Livelihoods and Diversity in Developing Countries,* Oxford University Press, New York, pp. 3-27.

Euler, D., Martin, K., Sauerborn, J. and Vichian, H. 2006. Challenges for Sustainable Lychee

Production Systems in Northern Thailand: an Ecological Perspective. In: Booklet for the Second International Conference on Sustainable Sloping Land and Watershed Management: Linking Research to Strenghten upland policies and practices. Luang Prabang: NAFRI. 159p.

FAO. 2002. Lychee Production in the Asia Pacific Region. Bangkok. 128p.

Forsyth, T. and Walker, A. 2008. Forest Guardians, forest Destroyers: The politics of Environmental Knowledge in Northern Thailand, University of Washington Press.

Heath, A. G. 1995. Water pollution and fish physiology. Edition: 2, illustrated. Publié par CRC Press. 359p.

Heckman, J. 2006. Soil Fertility Test Interpretation, Phosphorus, Potassium, Calcium and Magnesium, fact sheet 719, Rutgers Cooperative Extension, New Jersey Agriculture Experiment Station.

Ismail, M. H. and Junusi, R. M. 2009. Determining and Mapping Soil Nutrient Content Using Geostatistical Technique in a Durian Orchard in Malaysia, Journal of Agricultural Science, Vol. 1, No. 1.

Kakwani, N. C. 1977. Applications of Lorenz Curves in Economic Analysis. Econometrica,Vol. 45, No.3

Messer, N. and Townsley, P. 2003. Local institutions and livelihoods: guidelines for analysis, Rome: Rural Development Division, Food and Agriculture Organization of the United Nations.

Michaud, J. P. 1991. A citizen's guide to understanding and monitoring lakes and streams. Publ. #94-149. Washington State Dept. of Ecology, Publications Office, Olympia, WA, USA (360) 407-7472. Moore, M. L. 1989.

Mikkelsen, B. 2005: Methods for development work and research. A new guide for practitioners, New Delhi: SAGE Publications Pvt. Ltd

Mingtipol,O., Buch–Hansen, M., Sangawong, S., Prabudhanitisarn, S., Sripun, K. and Aumtong, S. 2011: Mae Lor Watershed, Mae Rim District, Chiang Mai Province, Thailand, SLUSE field course 2011, Basic information.

Prasad, R. and Power, J. 1997. Soil Fertility Management for Sustainable Agriculture, Lewis publishers, New York.

Rief, Y. M. and Cocharane S. H. 2011. The Off-Farm Labor Supply of Farmers: The Case of the Chiang Mai Valley of Thailand, in Economic Development and Cultural Change, Vol. 59, The University of Chicago Press.

Rigg, J. 1993. Forests and farmers, land and livelihoods, changing resource realities in Thailand. Global Ecology and Biogeography Letters, 3. pp. 277–289.

Rigg, J. 2009. Grand narrative or modest comparison? Reflecting on the ‘lessons’ of East Asian

development and growth, Singapore journal of tropical geography. Vol. 30 (1). pp. 29-34.

Rigg, J. and Nattapoolwat, S. 2001. *Embracing the global in Thailand: Activism and pragmatism in an era of deagrarianization,* World Development. Elsevier Science Ltd. Vol. 29, issue 6, pp. 945-960.

Suraswadi, P., Thomas, D. E., Pragtong, K., Preechapanya, P. and Weyerhauser, H. 2000. *Changing Land Use Mosaics of (Former) Shifting Cultivators in Watersheds of North Thailand*, Chapter submitted for a book on the Alternatives to Slash and Burn (ASB) Initiative being edited by Dr. Pedro Sanchez for publication by the American Society of Agronomy.

Tindall, H. D., Rice, R. P. and Rice, L. W. 1990. Fruit and vegetable production in warm climates. Macmillian Education Ltd. London. 181p.

UNDP. 2009. *Thailand Human Development Report 2009: Human Security*, United Nation Development Programme, Bangkok.

USDA, United States Department of Agriculture. 1998. Soil Quality Information Sheet. [online] Available from: http://soils.usda.gov/sqi/publications/files/indicate.pdf [Accessed 22 March 2011].

Vanwambeke, S. O., Somboon, P. and Lambin, E. F. 2007. *Rural transformation and land use change in northern Thailand*, Journal of Land Use Science, Vol. 2, No. 1. pp. 1-29Walker, A. 2002. Forests and Water in Northern Thailand, Chiangmai University Journal Vol. 1, issue 3.

Wannamolee, W. 2008. Development of good agricultural practices (GAP) for fruit and vegetables in Thailand, paper presented for Training of trainers in good agricultural practices (GAP) and benchmarking: GLOBALGAP for fruits and vegetables, 14-23 July 2008, at Sheraton Subang Hotel & Towers, Kuala Lumpur, Malaysia.

APPENDICES

Appendix I: Questionnaire

Dear respondent, many thanks for answering to this questionnaire. We are a mixed group of students from University of Copenhagen and Chang Mai University doing a research about life conditions in Ban Huai Tao Ru. Please answer the following questions honestly and sincerely and feel free to skip any question that you consider inappropriate or invasive. However, remember that there are no wrong answers and that the information that you are giving to us will be treated with upmost confidentiality.

(Remember to mention that there will be questions relating to 'before', and what we mean with 'before')

Household number: GPS point:

General information

1)Name: Position in the household:
Age: Gender: □M □F

(Your name and surname are only used to identify which household the questionnaire is coming from, and will not be published in a report or revealed to others. However, the interview can be anonymous if you prefer that)

2)Where were you born? □ Ban Huai Tao Ru
□Another village/town in Chiang Mai province
□ Another province of Thailand
□ Outside Thailand

3)For how many years have you been living in the village? …… years

4)What is your education level: □ primary school
□ secondary school □ professional
□ college □ university
□ no formal schooling

5)*How is your household composed* (people who contribute to or benefit from the same income in your house)?

Parental position	Age	Level of education	Contribution to cash income	Contribution to work/activities

6)Do you have a Thai citizenship?
□ Yes □No

If yes, since when?

7)Are you member of a social group or association in or outside the village?
□ Yes □No

If yes, specify:

8)Do some members of your household/family live outside Ban Huai Tao Ru ?
□No □ Yes:

Parental relations	Age	Location	Permanency & duration	Occupation	Remittances
			P□ T□ …… year(s)		Yes □ No □ If yes: VI□ I□ R□
			P□ T□ …… year(s)		Yes □ No □ If yes: VI□ I□ R□
			P□ T□ …… year(s)		Yes □ No □ If yes: VI□ I□ R□

VI: Very Important I: Important R: Residual

P: Permanently T: Temporary

9)What are your main sources of income (please, indicate all the activities that you practice and that contributes to sustain your household putting at the first the main one)?

Occupation	Income generated	Importance of income generated in overall income	Stability of income	Development over time
□ Agriculture	_____BHT	VI□ I□ R□	VS□ S□ US□	Increased□ Decreased□ Same□
□ Wage job	_____BHT	VI□ I□ R□	VS□ S□ US□	Increased□ Decreased□ Same□
□ Private business	_____BHT	VI□ I□ R□	VS□ S□ US□	Increased□ Decreased□ Same□
□ Remittances	_____BHT	VI□ I□ R□	VS□ S□ US□	Increased□ Decreased□ Same□
□ Pension	_____BHT	VI□ I□ R□	VS□ S□ US□	Increased□

				Decreased□ Same□
Others				
	_____BHT	VI□ I□ R□	VS□ S□ US□	Increased□ Decreased□ Same□

VI: Very Important I: Important R: Residual

VS: Very Stable S: Stable US: Unstable

10)Does your household have debts?

□ Yes □ No

If yes, specify purpose, amount and creditor:

11)Do you have savings?

□ Yes □ No

If yes, specify importance, purpose, amount

12)Do you have/own

□ Land

□ Livestock (number)

□ Refrigerator

□ Freezer

□ Television

□ Mobile phone

□ Computer

□ Motorbike

□ Car/truck (number)

13)Are you relying on products from the forest (timber, mushrooms, fruits...) in your daily life for your household consumption or for market purposes?

□ Yes □ No If yes, which ones:

Product	Own Consumption	Market purpose
	VI□ I□ R□ Not consumed □	VI□ I□ R□ Not market purpose □
	VI□ I□ R□ Not consumed □	VI□ I□ R□ Not market purpose □

	VI□ I□ R□ Not consumed □	VI□ I□ R□ Not market purpose □
	VI□ I□ R□ Not consumed □	VI□ I□ R□ Not market purpose □

VI: Very Important I: Important R: Residual

14)Have you faced main problems (economic or social) within the past 20 years? How have you tried to tackle them? With what results? (disease, death, market-related, production-related, resources-related, etc.)

Problem 1:

Strategy:

Results:

Problem 2:

Strategy:

Results:

Problem 3:

Strategy:

Results:

Perceptions of Well-being

15)How often you and the other members of the household are sick?

Nowadays	In the past
□ Often □ Not often □ Rarely Specify:	□ Often □ Not often □ Rarely Specify:

16)Do you think you eat better now than **before**?

□ Yes □ No □ It did not change □ I do not know

17)Do you think your local environment is better now than **before**?

□ Yes □ No □ It did not change □ I do not know

18)Do you feel worried about your economic situation?

□ Yes □ No □ I do not know

19)Would you like your children to continue your activity?

□ Yes □ No

Why?

20)If you had the opportunity, would you move to city?

□ Yes □ No

Why?

Agricultural information

21)How did you get your land?

□ I inherited □ I bought it □ The state gave it to me □ Other

22)Which crop (s) have you been cultivating for the past 12 months (on your own or rented lands)?

Crop	Area (rai)	When did you started to grow	Yield per rai (kg)	Price per kg	Evolution of productivity overtime	Purpose	
						Own consumption	Sale
					Increased□ Decreased□ Same□		
					Increased□ Decreased□ Same□		
					Increased□ Decreased□ Same□		
					Increased□ Decreased□ Same□		
					Increased□		

					Decreased□ Same□		

23)Has there been any change to your cultivated land since you established in the village?

□ Yes, it has increased □ Yes, it has declined

□ No, there have been no change

If it has changed, please explain why? When?

24)Which input(s) do you apply in your farming?

Inputs	**Yes/No**	**Use today compared to before intensification?**
Chemical Fertilizers	□Yes□ No	□ More □ Less □ Same
Manures (Organic)	□Yes□ No	□ More □ Less □ Same
Pesticides	□Yes□ No	□ More □ Less □ Same
Irrigation	□Yes□ No	□ More □ Less □ Same
Improved seed	□Yes□ No	□ More □ Less □ Same
Tractor	□Yes□ No	□ More □ Less □ Same
Family labour	□Yes□ No	□ More □ Less □ Same
Hired labour	□Yes□ No	□ More □ Less □ Same
Hand tools	□Yes□ No	□ More □ Less □ Same
Others		
	□ More □ Less □ Same	

25)Do you use any soil conservation techniques (such as mulching, legume crop, cover crop and grass, terrace farming etc.)?

□ Mulching □ Legume crop □ Cover crop and grass □ Terrace farming

Others:

If you have observed significant effect(s), please specify:

26)Have you ever experienced problems related to water (quality or quantity)?

Categories	Yes/No	If yes, please specify possible reasons
Household consumption	□ Yes □ No	
Livestock consumption	□ Yes □ No	
Agricultural purposes	□ Yes □ No	

27)Are there any crop (s) that you do not grow anymore?

□ Yes □ No If yes, specify:

Crop	Subsistence crop	Cash crop	Why you stopped growing it

Appendix II: Summary of Methods Applied

Methods	Description	Techniques	Objective/Reflections
Questionnaire interviews	Questionnaire survey with 18 of the 31 households in the village.	31 questions combined with semi-structured interview and informal conversation.	To get quantitative, factual overview of the livelihood situation and to generated a basis to investigate further. To get to know the villagers and see there houses.
Semi-structured Interviews	Ass. Headman	Conducted with all group members present, but with one interview-leader guided by an interview guide.	Focussed on his role, basic data of the village and the relation to BMKP.
	Chanachai (gatekeeper and committee member)	Was conducted by all group members.	Covering the basic knowledge about the village, the agricultural practices and knowledge about the Hmong people.
	Ass. headman's daughter	Interview by 3 group members+interpreter	On migration and city life.
	Committee secretary	Interview by 3 group members+interpreter	On committee and use of his education as farmer.
	Committee member (education)	Interview by 3 group members+interpreter	On committee and relation to neighbour village
	Members of the Church	Interview by 1 group member+interpreter	On church structure & function.
	Official from the tambon	Interview with representatives from all group.	On the tambon.
	Official - land department	Interview with representatives from all group.	On land titling.
	Official at the Royal Forest Department in Mae Lor	Interview with representatives from all group.	On forest policy and land use.
	Official at the Royal Forest Department in Chiang Mai	Interview with representatives from all group.	On forest policy and land use.
Focus Group (PRA)	Young people - nine participants	A drawing and writing workshop facilitated by members of our group. With the following three stations: 1. Occupation ranking, outline of their daily activities and aim of education. 2. Their biggest dream for the future and where they saw themselves in 10 years time. 3. Their opinion on advantages and disadvantages of city and village life. At the end we asked them to draw wished for the village together.	We wanted to grasp the individual ideas, dreams and aspirations. As dreams and expectations also can be a sensitive matter, we found that perhaps the participants would be more comfortable expressing them individually and on paper, without necessarily having to share. This focus group was carried out with a lively and focussed atmosphere, and provided us with highly useful data.
	Community history with old people – drawing of timeline	4 people participated. The information was put down on a big piece of paper in front of the participants – creating an actual timeline. The focus group shifted between having the form of an interview and more of storytelling, where the participants narrated their memories.	The topic was essential events and development from the establishment of Ban Huay Tao Ru to the present, to understand the development in the agriculture, the living conditions and livelihood strategies.
	Housewives	First a discussing of topics raised by us. After we asked the participants to draw what are the activities that are women's responsibilities, what are the shared activities between men and women, and what are the men's activities. The focus group was	To receive information about the group and to get a more general talk about being woman in the village. The women were firstly not jumping at the task, but when a few took up the challenge, all eventually followed, and an light atmosphere spread of laughter and

		conducted only by the girls in the group to ensure trust and esoteric conversation.	participation, and some very good drawings gave us an insight to the gender roles in the village.
	Farmers	2 men and 4 women started, while many others participated discontinuously. The workshop where composed of the following exercises: 1. Completion of a table about agricultural production. 2. Ranking of 6 problems in relation to the effect on the income, on the household and how difficult the solution was. 3. Problem tree: with identification of causes, consequences and possible remedies of the most important of the problem. 4. Seasonal calendar.	To get a thorough and detailed overview of the agricultural system in the village.To get information about yield, price per kg, agricultural inputs, etc. To get an overview of how activities, income, expenditure, different weather-seasons and limitations are distributed throughout the year. To get information on the most important problems in the agricultural production. In general, the discussion was dynamic and people were very committed in trying to provide exact information, which was sometimes a challenge for them, as they did not seem to be used to reflect on this.
Informal interviews	Women with long hair	Field talk	About crops+decline in litchi.
	Old man while harvesting	Field talk	About cutting litchi trees.
	Committee secretary + wife	Field talk	About litchi trees and land use.
	Hired worker cutting trees	Field talk	About cutting litchi trees.
	Old woman on the mountain	Field talk	About litchi trees and land use.
	Singer and brother	Village talk	Regarding blood test
	'Rich woman'	Village talk	Regarding blood test
	Old man of 100 years	Village talk	
	Old people	Village talk	History of the village and their life.
Participatory observation	Harvesting Chinese Radish	We participated in harvesting a Chinese radish field, which enabled us to enrol with informal conversation about farming, work division and village life.	To understand the agricultural practises, and get insight in the relations between the villagers in the field. Despite not being in the same role as the farmers, it provided us with a perspective of actual personal experience as oppose to observe or being told about the practice (Rubow 2003, Wolcott, Cohen).
	Participation in church ceremony	Two from the group participated in the church ceremony.	To get insights in the churchs role in the community.
Natural sciences	Soil Samples	Stratified random sampling was used to choose seven sampling plots on land with different crop types.Observation an GPS marking of the plots were made.	To assess the environmental instability associated with intensified agriculture on soil.
	Water and sediment samples	Conducted on five locations along the Ban Huay Tao Ru stream. The sites were marked using GPS.	To assess the environmental instability associated with intensified agriculture on water.
Mapping the village	Mapping the village	Three farmers drew the borders of the village, the fields, the forest and pointed out the streams from which they receive water on a big map.	To get information of the borders of the village, and to identify where to take water and soil samples.
	Transect walk	Our key informant Chanachai went with us on a transect walk in the field.	To get familiar with the village and its surroundings, and to get an understanding of the agricultural practice and the work load and division.
	Mapping the	Mapping households with GPS and	

	households	photos.	
literature review			Data collected through literature review to supplement the findings from primary data.

Information on the questionnaire interviews

We conducted a questionnaire survey with 18 of the 31 households to get quantitative, factual overview of the situation in the village, an insight to the limitations and possibilities in farming and the villager's strategies to generate income. This generated a basis from where we learnt what to investigate further. The advantages of this method was that besides getting to know the people of the village and getting insight in their situation, we saw how people lived. This method became a rather time consuming activity because of the extensiveness of the questionnaire. After carrying out two pilot questionnaires, we discussed the process, and decided to open up for including more informal conversation and interviews in the questionnaire sessions allowing us to follow up on interesting stories. Thus we received a lot of useful more qualitative data.

We choose our sampling methods after a visual assessment off an economical and a spacious differentiation in the village. Having covered the different types of households, we then chose households from availability, trying to cover as many as possible. Many households where out during the daytime so, we tried to adjust by carrying out questionnaires in the evenings and in the field. Other households were living outside the village during our stay and others again only spoke Hmong which we couldn't get translated. As the aim was to investigate how household as a unit generate income, share work and what strategies they would apply to secure themselves, we focused on the household rather than individuals. When choosing people to interview, our criteria were that it should be a participating representative of the household of the age 18 or above. To facilitate the interviews, we had two people from the group – one leading the interview, and one taking notes about the extra data we could receive. Each team had an interpreter with them (Hansen & Andersen 2000).

Income data generation explanation

In order to calculate households' incomes and the relative weight of activities in income generation we used data collected during questionnaire survey, interviews and focus group with farmers. In particular, data relative to non-farm income were generated through questionnaire survey. We divided them in three categories: wage jobs, remittances and other, which include pension, occasional jobs and collection and sale of NTFP. The calculation of in-farm income is more complicated, because the information provided by interviewed people were less accurate and sometimes contradictory.

Households (HH) income							
HH number	*Non-agricultural income (BHT per year)*	*Weight on total income (%)*	*Agricultural income (BHT per year)*	*Weight on total income (%)*	*Total income (BHT per year)*	*Income per person (BHT per year)*	*Number of HH members*
1	206240.0	80.6	49750.0	19.4	255990.0	127995.0	2.0
2	123000.0	78.1	34465.0	21.9	157465.0	52488.3	3.0
3	7200.0	9.2	70950.0	90.8	78150.0	15630.0	5.0
4	5400.0	7.6	66000.0	92.4	71400.0	14280.0	5.0
5	0.0	0.0	24850.0	100.0	24850.0	/	/
6	60000.0	28.7	148955.0	71.3	208955.0	23217.2	9.0
7	96000.0	39.7	145955.0	60.3	241955.0	26883.9	9.0
8	95000.0	73.1	35000.0	26.9	130000.0	43333.3	3.0
9	87000.0	45.5	104000.0	54.5	191000.0	11937.5	16.0
10	2000.0	1.7	117150.0	98.3	119150.0	17021.4	7.0
11	18000.0	40.0	26955.0	60.0	44955.0	6422.1	7.0
12	77000.0	36.6	133500.0	63.4	210500.0	70166.7	3.0
13	24000.0	20.9	90905.0	79.1	114905.0	22981.0	5.0
14	0.0	0.0	47390.0	100.0	47390.0	6770.0	7.0
15	0.0	0.0	70890.0	100.0	70890.0	23630.0	3.0
16	0.0	0.0	23250.0	100.0	23250.0	7750.0	3.0
17	0.0	0.0	38610.0	100.0	38610.0	6435.0	6.0
18	7200.0	7.0	95205.0	93.0	102405.0	25601.3	4.0
Village average	44891.1	37.9	73543.3	62.1	118434.4	29561.3	5.5
Standard deviation	58292.3		42530.1		76224.9	30777.2	3.4

This was due mainly to the complexity of the agricultural system present in the village, characterized by a mix of many different crops for each household and by a lack of time to discuss and understand deeply this system. For the crops grouped under the label “others” we used data collected during questionnaire survey where farmers estimated by themselves the approximate revenues that they get from a crop. In other occasion, they told us the number of rai dedicated to a crop, the yearly yield and the price of sale, and after we used this information to calculate income.

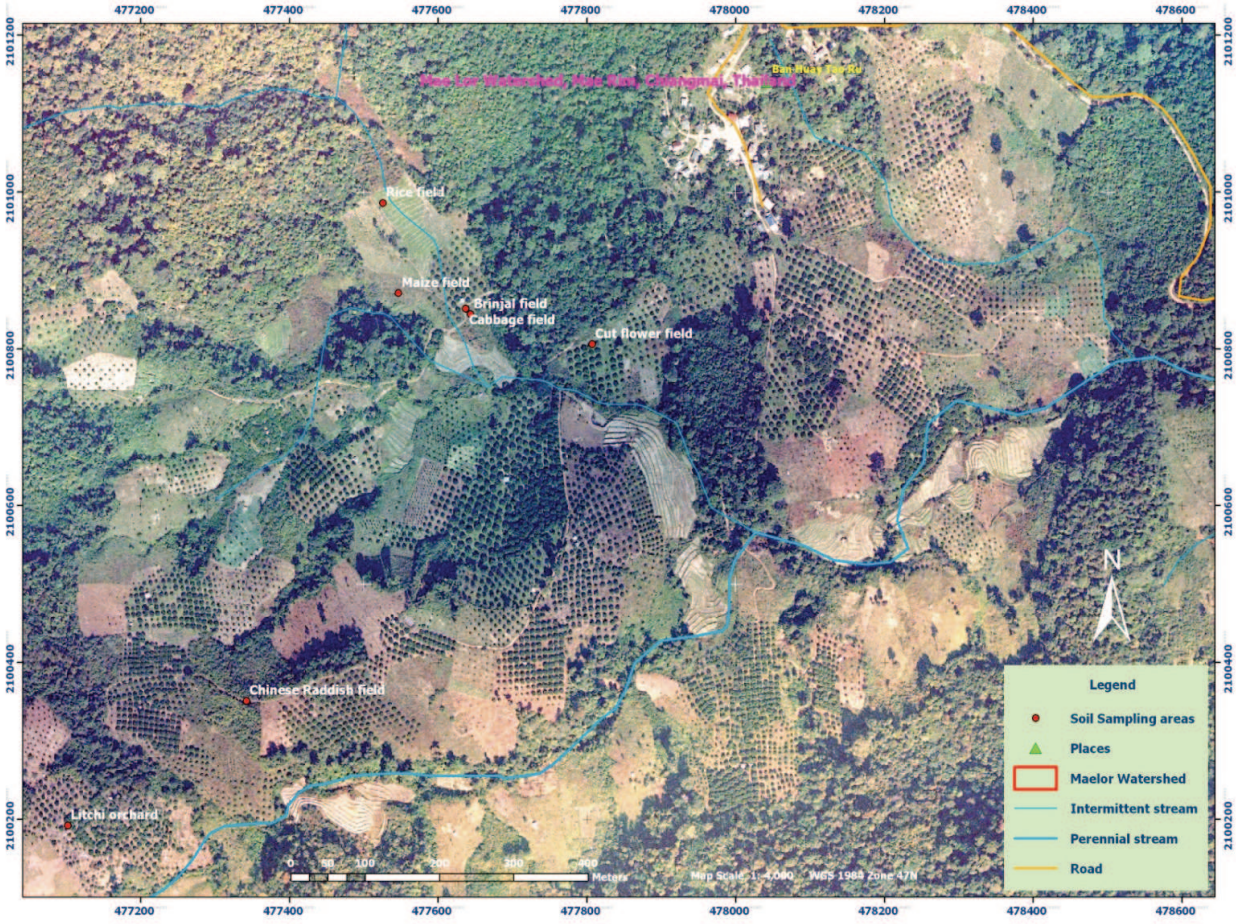
For the 5 main crops discussed in the focus group (lychee, cabbage, Chinese radish, paddy and upland rice), we got more precise information regarding maximum and minimum prices, yields under favourable and unfavourable conditions, cost and use of natural and chemical fertilizers and pesticides and cost of needed labour, all related to a single rai of land.

Therefore, we preferred to use this information that appear more precise and allow calculating the net revenue for each crop. For the calculation of the final income relative to these 5 crops, when it was indicated a variation in price and yield, we simply used the revenue obtained averaging the worst and the best scenario, not having any information about probabilities related to different scenarios. Indeed, for lychee we calculated yearly revenue of 2450 BHT per rai, for cabbage 11000 and for Chinese radish 10955. Finally we simply multiplied these values for the number of rai dedicated to each crop, told us during questionnaire survey. In the case of upland rice, we did not used the values collected in the focus group because this crop is used mainly for household consumption and our interpreter explained us that upland rice, being much more expensive than paddy rice, is a very niche market, that can be sold only in limited amount. Therefore, in calculating its value we used the data relative to paddy rice, its closed substitute. Finally, we used paddy rice to calculate the final income even it was indicated as a cultivation for own consumption, because we thought consumption is a better indicator of well-being than simple income. On the contrary, we did not do the same for other crops such as pumpkins, lacking information about prices and yield.

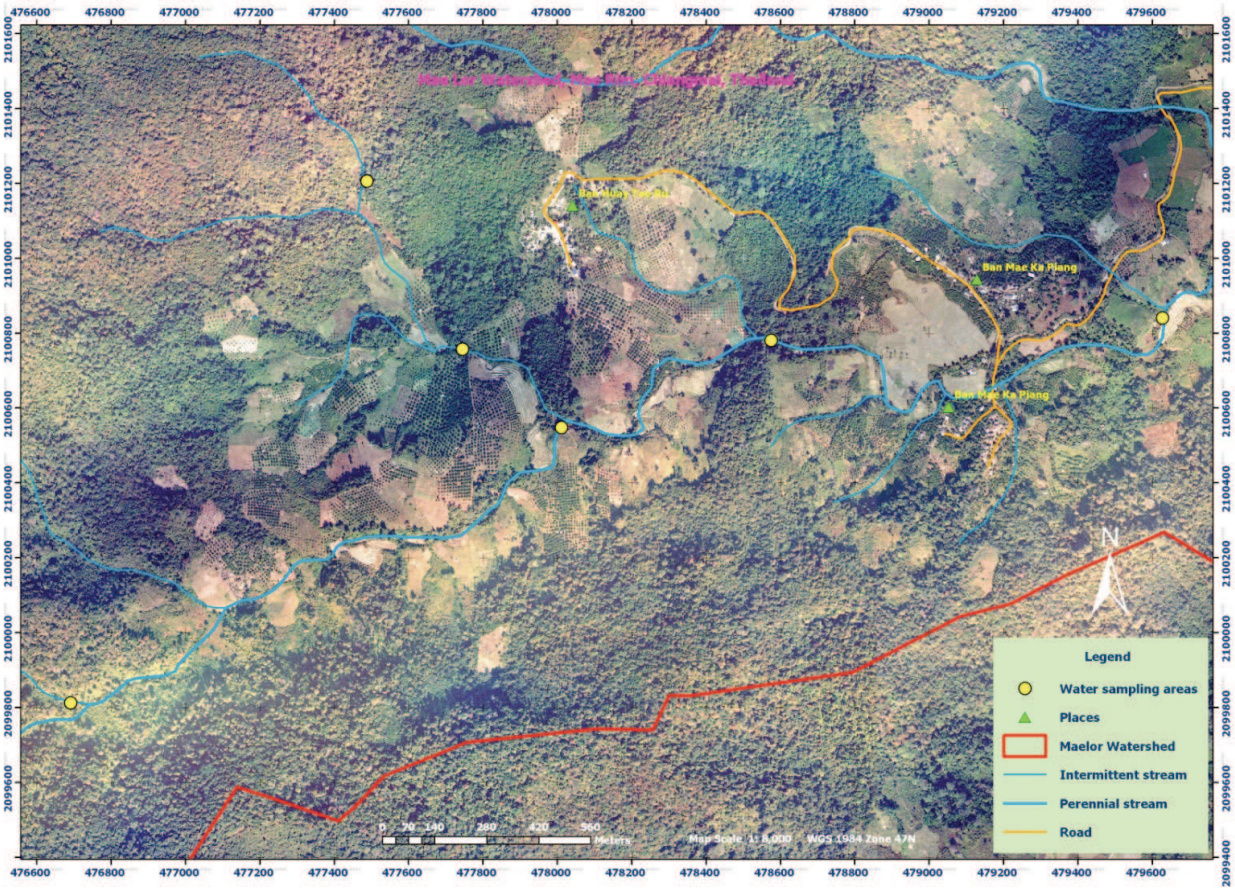
The built table suffers of many lacks and imprecision's. First of all crops under the label of "others" often indicate the gross revenue while for the others 5 we have net revenues. Of course, this could have produced bias in the calculation of weight of different activities with an overestimation of "others" crops. The average estimation for the 5 main crops is another assumption not really consistent with statistical principles, but it was an attempt to calculate the long period income instead of relying on data referred to this year that, from many interviews, appeared to be very problematic for different crops (especially lychee and cabbage).

Some sources of income could have escaped to our analyses. The case of household number 6 is emblematic of this. It has 30 rai, one of the highest farmland in the village, some of them left uncultivated, probably used as grazing land, but the final calculation of income per person results among the lowest in the village. This seems to be contradictory. A first explanation is that we did not include the possible income generated by the 6 cows owned by this household, the only one in the village to use cattle with commercial purposes. Bias like this might be present for other households. Unfortunately, the short time we had and the broad perspective of our study, made impossible to collect more precise information about income.

Appendix III: Soil sampling map in Ban Huay Tao Ru, Mae Lor Watershed



Appendix IV: Water sampling sites in Ban Huay Tao Ru, Mae Lor watershed, Northern Thailand



Appendix V: Soil test results - Laboratory of Maejo University

NO	NAME	pH	EC (Us/cm)	Total N %	Avairable P (mg/kg)	Available K (mg/kg)	%OM
1	s-0 litchi	6.79	81.1	0.114	63.78	353	2.28
2	s-1 cabbage	5.85	85.5	0.052	24.81	120	1.03
3	s-2 egg plant	5.87	40.7	0.036	5.05	184	0.72
4	s-3 corn	5.31	43	0.036	2.87	113	0.72
5	s-4 Raddish	4.85	104.3	0.041	3.61	90	0.83
6	s-5 rice	5.47	20.7	0.134	1.74	63	2.69
7	s-6 flower	4.64	154.1	0.057	9.89	165	1.14
8	A-1 ป่าลุ่มน้ำ ชั้น 1A	5.57	39.9	0.057	1.08	185	1.14
9	A-2 ป่าชุมชน	5.01	39.4	0.114	1.03	99	2.28
10	A-1 ดินนา บ้านแม่ก๊ะเปียง	5.34	43.4	0.052	1.97	149	1.03
11	A-2 ดินนา	5.51	20.4	0.021	0.59	92	0.41
12	A-3 ดินนา (นาหัว)	4.99	85.2	0.036	0.86	150	0.72
13	A-1 ลิ้นจี่บ้านแม่ก๊ะเปียง	5.81	52.1	0.109	3.26	258	2.17
14	A-2 ลิ้นจี่บ้านแม่ก๊ะเปียง	5.97	43.2	0.083	0.51	169	1.66
15	A-3 ลิ้นจี่บ้านแม่ก๊ะเปียง	5.66	19.1	0.067	0.40	148	1.34
16	A-4 ลิ้นจี่บ้านแม่ก๊ะเปียง	5.58	39.5	0.062	0.31	257	1.24
17	C1C ป่าอนุรักษ์	5.5	35.9	0.093	0.28	159	1.86
18	U1C ป่าใช้สอย	5.29	32.6	0.129	0.54	108	2.59
19	OM1C ไม้ผล	4.99	38.7	0.098	0.46	162	1.97
20	แปลงลิ้นจี่พื้นที่ล่าง	7.35	25.2	0.026	0.50	183	0.52
21	1 แปลงกะหล่ำพื้นที่สูง	6.75	38.8	0.041	0.41	210	0.83
22	2 แปลงหัวไชเท้า	6.25	63.3	0.067	1.06	150	1.34
23	subsistene 1 upland rice ห้วยส้มสุก	6.07	66.9	0.093	0.31	209	1.86
24	subsistene 2 upland rice ห้วยส้มสุก	6.36	48.6	0.072	0.20	298	1.45
25	homogenius forest ห้วยส้มสุก	6.41	41.1	0.140	0.21	235	2.79
26	cash crop 2 orange tree outside p.3 shade	6.19	101.8	0.031	0.64	452	0.62
27	plot # 3 under shed cash crop2	4.66	321	0.078	5.40	302	1.55
28	plot# 1 Lemon (under shed)	5.6	59.8	0.088	2.63	269	1.76
29	plot # 4 outside shed	5.81	141	0.119	1.84	460	2.38

Appendix VI: pH Category

pH category	Range in pH
Ultra acid	1.8-3.4
Extremely acid	3.5-4.4
Very strongly acid	4.5-5.0
Strongly acid	5.1-5.5
Moderately acid	5.6-6.0
Slightly acid	6.1-6.5
Neutral	6.6-7.3
Slightly alkaline	7.4-7.8
Moderately alkaline	7.9-8.4
Strongly alkaline	8.5-9.0
Very strongly alkaline	9.1-11.0

(Adopted from: USDA 1998)

Appendix VII: Salinity level based on range of electrical conductivity

Salinity Class	Electrical Conductivity (dS/cm)
Non saline	0 to <2
Very slightly saline	2 to <4
Slightly saline	4 to <8
Moderately saline	8 to <16
Strongly saline	≥16

(Adopted from: USDA 1998)

Appendix VIII: Classification based on Soil Organic Matter (SOM), Total N, Available P and Exchangeable K levels

Level	Organic matter	Total N (%)	Available P (ppm)	Exchangeable K (ppm)
Very high	>3.5	>1	>50	>300
High	2.5-3.5	0.6 – 1.0	40-50	200-300
Moderate	1.5-2.5	0.3-0.6	20-40	100-200
Low	0.5-1.5	0.1-0.3	10-20	40-100
Very low	<0.5	<0.1	<10	<40

(Adopted and modified from: Mingthipol; and NMSU 2000; Ismail et al, 2009)

Appendix IX: Water quality of Huai Tao Ru (11 March 2011)

ตัวชี้วัด	Position						Standard quality for surface water (Agricultural propose)	Analysis method
	Upstream	B1	B2	B3	B4-M4	B5		
1.Nitrate (water)	2.34	2.72	1.45	1.80	3.04	3.95	≤ 5.0 mg/l	AOAC (2000)
Sediment	4.25	-	-	-	19.28	22.00		
2.Phosphate (water)	1.46	1.21	1.29	3.34	2.46	3.45	≤ 0.03 mg/l	
In Sediment	3.78	-	-	-	19.58	23.64		
3.Sediment residue	ND	-	-	-	ND	ND		GT Pesticide Test Kits

Appendix X: Quantity of fertilizers and pesticides

Crops	Quantity of natural fertilizer and agrochemicals per rai					
	Natural fertilizer (Kg)		*Chemical fertilizer (Kg)*		*Pesticide (cc)*	
	Per year	*Per yield*	*Per year*	*Per yield*	*Per year*	*Per yield*
Litchi	130	130	26	26	2000	2000
Chinese radish	450	150	300	100	1500	500
Cabbage	400	200	400	200	10000	5000
Upland rice	0	0	10	10	0	0
Paddy rice	0	0	15	15	1000	1000

Appendix XI: Expenses of fertilizers and pesticides

	Expenses for natural fertilizer and agrochemicals per rai (BHT)					Expenses for hired labour (BHT)	
Crops	*Natural fertilizer*	*Chemical fertilizer*	*Pesticide*	*Tot. per year*	*Tot. per yield*	*Per year*	*Per yield*
Lychee	520	468	1000	1988	1988	/	/
Chinese radish	6750	4200	600	11550	3850	13500	4500
Cabbage	6000	8000	5000	19000	9500	/	/
Upland rice	0	140	0	140	140	/	/
Paddy rice	0	210	500	710	710	3000	3000

Appendix XII: Synopsis

Interdisciplinary Land Use and Natural Resources Management

Thailand 2011

Synopsis - Group 3 – Village of Ban Huai Tao Ru, Province of Chiang Mai

INTENSIFICATION OF AGRICULTURE AND DEAGRARIANIZATION

Authors:
Anne Rehder
Camille Brigitte Marthe Déhu
Marco Rogna
Mohammad Kamrul Hasan
Sara Klinke Wæver
Teweldebrehan Tesfay Gebremedhin

(2.809 words) February 2011

Since 1981, the area has come under many projects to replace opium cultivation with new crops. The army, the UN, the Thai- Norway project, and the government have all been involved. They told us that our shifting cultivation was destroying the forest, and that opium was creating problems for the society and nation. The projects gave us fertilizers and pesticides to grow new crops such as coffee, lychees, cabbages, and Chinese pears.
We got many benefits. We could send children to school. We got access to health care. But not everything was good. People became more selfish. We depended more on the outside for new goods. Some people got Thai citizenship but others didn't. After the opium eradication projects ended, some of the supporting agencies departed. […]
Planting the crops which these projects supported was not a good solution for the villagers, because after a time it created new problems, and we were criticized for using too much chemicals and creating all sorts of problems for the lowlanders down below. We began to think that the problems did not come from what we Hmong did ourselves, but from what outsiders encouraged us to do. But as the problem came down on our heads, we'd have to find the solution.

– Hmong villager (UNDP 2003)

1. Introduction

1.1. Context

Influenced by the widespread ideas of the Green Revolution, the Thai government has launched a series of development plans since 1961, with the objectives of "modernization" of the agricultural sector. "Modernization" was initially introduced to intensify agriculture, and thus to increase the productivity of small farms, farmers have been encouraged to invest - often through obtaining bank loans - in inputs for the crops (chemical fertilizers and pesticides) and physical capital (high-efficiency machinery or irrigation equipment) (de Almeida F. F. 2006). However, after a period of increased profit, the small farmers soon faced several severe challenges. First, Thai farmers now have to deal with a decline of fertility and quality of their land, affected both by the excessive use of chemicals and by intense deforestation. Indeed, intensive agriculture and deforestation can cause leaching, salinity and erosion of the soils and affect the quantity and quality of water in the watersheds. To maintain their land productivity, farmers are thus often forced to increase the quantity of inputs (chemicals, water, etc.) worsening the environmental situation. Between 2003 and 2006, the imports of pesticides increased from 73 to 102 thousand tons as land remained constants (UNDP 2009).

The food security of many farmers has also been affected by these transformations. From subsistence to a monocropping system, families do no longer grow what they consume themselves and are now more dependent on market prices. Besides, Thailand has lost half of its forest area during the past four decades and new delimitations of conservation areas make the access to harvesting and the role of forests as safety net more limited (Suraswadi et al. 2000, UNDP 2003).

Thai farming has also faced structural challenges. First, a better access to education and increasing aspirations related to a modern lifestyle make the young people reluctant to continue the hard and demanding farming activities of their parents. Consequently, the average age of agricultural workers in Thailand is alarmingly increasing from 30 to 40 years old between 1985 and 2003 and the reproduction of work force is in danger.

The lake of land tenure represents a discouraging factor for many landless and illegal farmers. In 2002, more than 460.000 families were still living in one seventh of the conservation areas. The process of regularization may be difficult as a great majority of these populations do not dispose of land documentation or proof of the date and conditions of their settlement (UNDP 2009).

As a consequence of the embrittlement of agriculture, many farm households have been seeking to diversify their sources of income. In 2004, only one third of farming households' income was generated by agriculture - a significance change from more than half of the income in 1976 - and

in 2007, around 9% of total income of rural populations in Thailand came from remittances (UNDP 2009).

This deagrarianization process – the movement away from strictly agricultural-based modes of livelihood in terms of: occupational adjustment, income-earning reorientation, social re-identification and spatial relocation of rural dwellers (Bryceson 2008) – has been observed not only in Northern Thailand, but in the whole country. Indeed, the impact of deagrarianization process on livelihood can be a factor of impoverishing if it takes place haphazardly, in an untimely fashion and in the absence of rural food security. It can be at the roots of a decreased human security and humanitarian crisis - famines and political instability (Bryceson 2000).

1.2. Study case - Ban Huai Tao Ru, Northern Thailand

Ban Huai Tao Ru is a sub-village of the village of Ban Mae Ka Piang, located at 800m ASL in the midland of Mae Lor Watershed, in the province of Chiang Mai. Two kilometres north of the other sub-village established 60 years ago by the Karen tribe, Ban Huai Tao Ru is a recent settlement, created by the Hmong – an ethnic minority that have emigrated from China and Laos to the highlands of Northern Thailand, for the two past centuries (Ember et al. 2005). In total, Ban Mae Ka Piang and Ban Huai Tao Ru counts 440 people divided in 82 households.

As a hill tribe, the Hmong people are subjected to negative connotations. These entail prevailing notions of hill tribes as being uncivilized, disloyal and unstable. Partly because of these notions, most Hmong people do not hold a Thai citizenship, and are strongly restricted by conventions and actions from the national governmental, sub-district government and The Royal Forest Department (RFD) that limit their traditional land use. Thus a complex mix of institutional influences is impacting the situation and room for navigation for the people of Ban Huai Tao Ru (Isager & Broge 2007, Suraswadi et al 2000).

The two sub-villages are currently sharing a forest area – divided into conserved and utility zones- in an agreement of resources co-management. But, according to the classification of Thai water legislation, the village is settled in zone 2 - important ecological area where agricultural activities must be avoided and programmes of reforestation should be adopted – confirming a possible problem of land tenure and use, added to the fact that there are not title deeds for land in the area (Mingtipol et al. 2011).

The economy of Ban Huai Tao Ru is essentially based on intensive cultivation of vegetables, fruit orchards, field crop and ginger (Mingtipol et al. 2011). Intensive agriculture is a common practice of Hmong minority. They often started to invest in this system after the governmental actions against opium cultivation – main cash crop cultivated by the ethnic group until the 1990s (Michaud 1997). Hmong since have been blamed by lowland populations for the contamination

of water and depletion of natural resources in the watershed (de Almeida 2006).

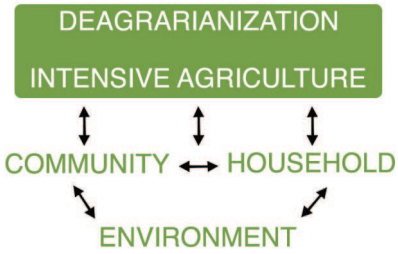
2. Objective, Problem formulation, Research questions and definitions

This study is part of a bigger project with the overall objective of investigating causes and consequences of deagrarianization in Mae Lor Watershed. Our study will focus on the relations between intensification of agriculture and deagrarianization, and the consequences for the livelihood in the village of Ban Huai Tao Ru.

On the basis on the above information, we have the following problem formulation:

What are the implications of the intensification of agriculture on livelihood in the village of Ban Huai Tao Ru in Northern Thailand?

To operationalize the problem formulation, we will focus on the implications of intensification of agriculture on the environment, and on household and community level (se figure 1). We have the following research questions and sub-questions



1.What are the characteristics of the households in the village, and how have they changed according to the intensification of agriculture?

- How is income generated in the households?
- How is work organized between the members of the household?
- How have family structures changed in relation to intensification of agriculture?
- Which members of the households are migrating? And what is their continued influence on the household economy?
- How have the households coped with earlier economic shocks?
- What do the members of the household think about their current living situation?
-

1.What are the environmental consequences of the intensification of agriculture in the village?

- What are the characteristics of the previous and current agricultural system?
- What is the impact of intensive agriculture on soil nutrient and water quality?
- How are changes in the agricultural system perceived by the villagers?
- How is water for consumption in the households and in agriculture impacted by intensification of agriculture?

1.How is the community affected by and affecting the intensification of agriculture?

- Why do members of the community migrate? And what are the aspirations for future possibilities related to the migration?
- How has the power relations in the village changed in accordance with intensification of agriculture?
- What are the influences on the community related to intensification of agriculture from external factors such as the national government, the neighbour village and regional and global institutions?

We define *livelihood* as the elements that contribute to and affect people's ability to secure their basic needs both themselves and their household. This include: capabilities; assets, both human, natural, social, financial and physical; activities required for a means of living; as well as external factors related to environment, climate, policies and institutions (Messer & Townsley 2003:8)

We define *household* with inspiration from FAOs definition of a *household economy* as "[...] *the total pattern of productive, household maintenance and reproductive activities of a group of people who eat from a common pot, and share a common stake in perpetuating and improving their socio-economic position from one generation to the next* (FAO 1992:9). Household is an economic and social unit. There can be no single definition of household, because different social groups and cultures think of the household in different terms. Some households are based on family relations others are not (Messer & Townsley 2003:7). In our definition, people from the village who have migrated can still be part of the household if they for example send remittances. Households pool some of the resources, but access may differ between different members of the household (ibid.). It is therefore important to note cooperative conflicts in the household, as Amartya Sen names different gendered preferences and access to resources (Sen 1987).

We define *community* as the interaction between the different households living in the village. The interaction can both be institutional, through political and social organisation and cooperation, or informal through shared norms, values or ideas.

We define *environment* as the natural environment that surrounds the village. It includes air conditions, water, land, atmosphere etc. Environmental impact in our study is mainly used to refer to the impact of intensification of agriculture on soil and water.

3. Methods and data

To answer our research questions, we will use different methods from both the social and natural sciences. Our methodological approach is characterized by triangulation, participation, depth and

alignment with the contextual premises. To ensure validity and substantiate our knowledge, we will use triangulation by combining different methods (Mikkelsen 2005:349). Triangulation can also help us cope with difficulties related to translation and communication in the field. We use a participatory approach to secure the involvement of the villagers and get better insights in the community. Because of the limited size of the village, we have the opportunity to talk with a great deal of the villagers and participate in their daily activities, which can give us an in-depth knowledge and an invaluable insight in to their reality.

Because of our scarce knowledge of the village, we will choose and adapt our methods once we are in the field, in order to be able to align our methods with the context, and chose the most appropriate approach. However, the following text will introduce the methods we are planning to use in the field as they seem suitable for the situation, as we know it. In addition we have a toolbox inspired by Participatory Rural Appraisal with tools we can use in the field (appendix II). As we will be living side by side with the villagers, it is of upmost importance to reflect on the roles we take on while we are there.

3.1 Questionnaire

By using an extensive questionnaire in the village, we can get an overview of the village and obtain quantitative information about the characteristics of the households. We will carry out questionnaires in as many households as possible to acquire knowledge of demographic character, and about socio-economic differences. The questionnaire will hopefully give us an insight to how intensification of agriculture is impacting the households and how they navigate in the premises given trough changes in their livelihood strategies. We will be filling in the questionnaires while having a more informal conversation in the households, to avoid misunderstandings and difficulties caused by possible illiteracy. We have a questionnaire for households and if they are dependent of incomes from agriculture we have an extended questionnaire (appendix IV).

3.2. Interview (semi-structured and informal conversations)

To get more in-depth information, we will use semi-structured interviews. This way we can get an insight to the details and actual dynamics of the village organization and its different components. At the same time it gives us the opportunity to ask the villagers about the intensification of agriculture and its implications. This kind of interview has the potential advantage of creating closeness, through the combination of the anonymity of the informant and the fact that his story is the actual *raison d'être* for the conversation (Rubow 2003:235). We have designed different draft interviewguides for different villagers (Appendix V). We will develop

the guides further in the field. The guides will help us direct the conversations to concern the topics that will generate relevant information and knowledge for our project. At the same time, this loose form will allow the informants to talk about the topics they find significant, whereby we can discover articulated and unsaid knowledge about the village, the villagers and the dynamic of the community. We will make interviews with a broad sample of informants (Cohen 1987:223), and thereby take into account that the authorities of a society do not represent the diversity of the society.

3.3. Participatory Rural Appraisal (PRA)

By using different kinds of participatory methods we can access the local knowledge and people's perceptions about development in the village. This gives us an opportunity to capture agreed upon and conflicted narratives, and it gives the villagers access to the project. PRA is an applied, action-oriented and capacity building framework, encompassing a variety of techniques and tools (Mikkelsen 2005). Because we only have limited knowledge about the village, we will bring a 'toolbox' (appendix I) containing techniques to apply in the field, as mapping, ranking, workshops, diagramming and reporting on the spot. Owing to the time-restrictions of the project, we will have to take into account that we cannot offer the village anything in the long run. However, what we can offer is an interest in their lives and a room for reflection.

3.4. Focus group discussion (FGD)

With the focus group discussions, we hope to experience how the villagers speak internally about the way they cultivate their land, how they understand the intensification that has taken place and how they perceive their options for navigating in the community, and create an income. Besides, the FGD may give us the possibility to discover their livelihood strategies. We will find out what the possibilities are for conducting FGD when we arrive.

3.5. Observation

Observation is crucial in gaining knowledge about the social rules and norms of the village, their land use and different livelihood strategies, and can help us to learn how to act tactful in the field. We will be doing observation from the first day, which will help us to plan the use of other methods, what themes to follow and what questions to ask (Mikkelsen 2005:88). To share the information in the group and generate knowledge from our daily observations, we will discuss our observations and write notes at the end of each day.

3.6. Participant Observation

Participant observation is a qualitative method that will enable us to experience the perspectives held by the villagers. By both observing and participating, to varying degrees, in the daily activities, we hope to get an understanding of how the villagers perceive their own situation and the options they have. While carrying out participant observation we will primarily write short, so called jot notes (DeWalt & DeWalt 2002:144-148), and then later develop them into actual fieldnotes, when possible.

3.7. Soil analysis

To know the impacts of intensive agriculture on environment it is necessary first to study the current condition of the soil. The samples will be located by GPS. We will do around 10 samplings on places located via information about the relevant areas of our study from different methods, as the mapping, transect walk and headman interview. The soil sampling will be divided into two main categories due to the expected different characteristics: agriculture and natural soil. The data will be collated in a table (Appendix II).

3.8. Water analysis

The study of the water - upstream and downstream - will be used to evaluate the quality of water before and after irrigation of agriculture land. The samples should be taken in areas where the water can be used to irrigate fields. Information from the headman interview, mapping, transect walk among other methods will help us decide how to select the areas of the samplings. We will conduct the water sampling from the chosen locations. The data will be collated in a table (Appendix III). The GPS will be used to situate the samples and pictures will be taken.

3.9. Mapping with GPS/GIS

Mapping the village and tracking the extent of agricultural area can give us an impression of the developments in the area, through comparison with older maps on Google Earth. In that way we can see if there are significant changes.

4. Reference list (Synopsis)

Ayers, R. S. & Westcot, D.W. 1994: Water quality for agriculture, FAO IRRIGATION AND DRAINAGE PAPER, Food and Agriculture Organization of the United Nations Rome http://www.fao.org/DOCREP/003/T0234E/T0234E00.HTM 13112011

Bernard, H. Russel 1995: Research Methods in Anthropology - Qualitative and Quantitative Approaches, Walnut Creek: Alta Mira Press.

Bryceson, Deborah 2000: Rural Africa at the crossroads: livelihood practices and policies, Natural Resource Perspectives. No. 25. http://www.odi.org.uk/resources/download/2095.pdf 13022011

Bryceson, Deborah Fahy 2008: RURAL LABOUR DISPLACEMENT & WORLD BANK AGRICULTURAL POLICY, African Studies Centre, Oxford University, WDR 2008 Conference, Oslo, Norway, 29 February, 2008, http://www.nai.uu.se/events/archives/conferences/african_agriculture/bryceson.pdf, 11022011

Cohen, P. 1987:Participant Observation, in Ethnographic Research. A Guide to General Conduct, R. F. Ellen (red.). London: Academic Press.

de Almeida Frederico Fonseca 2006: Coping with rural transition in northern Thailand: an analysis of rural economic diversification and social movements' response, A Pro Gradu Thesis of Sociology and Master's Programme in Development and International Co-operation, University of Jyväskylä

DeWalt, K. M. & DeWalt, B. R. 2002: Participant Observation. A Guide for Fieldworkers, Lanham: AltaMira Press.

Ember Melvin, Ember Carol R., Skoggard Ian 2005:Encyclopedia of Diasporas, Immigrant and Refugee Cultures Around the World, New York: Springer Science+Business Media Inc.

Encyclopædia Britannica 2011: Intensive Agriculture, in Encyclopædia Britannica, http://www.britannica.com/EBchecked/topic/289876/intensive-agriculture, 11022011

1.FAO 1992: *Sociological analysis in agricultural investment project design*. FAO Investment Centre Technical Paper No. 9. FAO, Rome.

Hach Company 2006: Important Water Quality Factors, http://www.h2ou.com/h2wtrqual.htm, 14022011

Mayoux, Linda 2005: TREES, PALS, http://www.lindaswebs.org.uk/Page3_Orglearning/PALS/PALSIntro.htm, 14022011

Messer, Norman & Townsley, Philip 2003: Local institutions and livelihoods : guidelines for analysis, Rome : Rural Development Division, Food and Agriculture Organization of the

United Nations

Michaud, Jean 1997: Economic transformation in a Hmong village of Thailand, Human Organization, Vol. 56, No. 2, 1997

Mikkelsen, Britha 2005: Methods for development work and research. A new guide for practitioners, New Delhi: SAGE Publications Pvt. Ltd

Mingtipol O., Buch–Hansen M., Sangawong S., Prabudhanitisarn S., Sripun K., Aumtong S. 2011: Mae Lor Watershed, Mae Rim District, Chiang Mai Province, Thailand, SLUSE field course 2011, Basic information,

Mayoux, Linda 2011: Road Journeys, Participatory action learning system, http://www.palsnetwork.info/index_content.html, 14022011

NexSens 2011: Water Temperature Measurement, NexSens Technology, Inc. © 2000-2011, http://www.nexsens.com/knowledgebase/water_temperature.htm, 13022011

Rubow, Cecilie 2003: Samtalen. Interviewet som deltagerobservation, in Ind i verden, Copenhagen: Hans Rietzels forlag.

Selener, D. et. al. 1999: Participatory rural appraisal and planning, International Institute of Rural Reconstruction, Quito

2.Sen, Amartya 1987: *Gender and Cooperative Conflicts*, Working Papers, 1987/18, UNU-WIDER

Spradley, James P. 1979: The Ethnographic Interview, New York: Holt Rinehart and Winston

Suraswadi, P., Thomas, D.E., Pragtong, K., Preechapanya, P., Weyerhauser, H. 2000: *Changing Land Use Mosaics of (Former) Shifting Cultivators in Watersheds of North Thailand*, Chapter submitted for a book on the Alternatives to Slash and Burn (ASB) Initiative being edited by Dr. Pedro Sanchez for publication by the American Society of Agronomy

UNDP 2003: *Thailand Human Development Report 2003*, United Nation Development Programme, Bangkok.

UNDP 2007: *Thailand Human Development Report 2007: Sufficiency economy and Human Development*, United Nation Development Programme, Bangkok.

UNDP 2009: *Thailand Human Development Report 2009: Human Security*, United Nation Development Programme, Bangkok.

Appendix A: Toolbox of Participatory Methods[25] (Synopsis)

Ranking

Ranking means placing something in order, e.g. different kinds of jobs, crops, problems or resources. This technique can help us access knowledge about differences in the beliefs and

[25] The toolbox is prepared with inspiration from *Methods for Development Work and Research* by Britha Mikkelsen (2005).

preferences for members of the village (Mikkelsen 2005:90ff). It is performed by asking the participant to sort cards with keywords in a hierarchy, or to put stones or alike on a sheet of paper with the keywords or the thing we want to rank (ibid.). Could be used both when interviewing individuals, households and in workshops.

Transect Walk

The data desired from a transect walk is mainly, knowledge about location of households; fields; wells, ponds or any other source of water; type of crops, livestock and infrastructure. The purpose is to identify land use and infrastructure in the village, as well as getting an immediate impression of problems related to land use in the village (Mikkelsen 2005:90). The walk is drawn by the villagers as a cross-sectional map or diagram, with the different features observed by them and the notes taken by the facilitator of their own comments during the walk. The first column may include items such as soil, land use, water crops, problems, opportunities, potential solutions, on the following columns each items is analysed based on the section of the transect (Selener et. Al. 1999, Mikkelsen 2005:90).

Walks and visits

The use of walks and visits has the objective, on the one hand to get an idea about the use of land and forest in the village, and on the other hand to create space for more informal conversation. It can be relevant for us to have the locals in the village show us their fields and the forest. Further it could be an valuable to visit the neighbouring village together with people from our village.

Mapping

We can use participatory mapping to gather information about demographics, resources and infrastructure, as well as the participant's impression of the spaciousness of the village. Participants draw maps on paper; on the ground using chalk or in the sand. The stories told or the discussions had while drawing the map will show different perceptions about the village.

Diagramming

Participatory diagramming can be used for summarizing empirical data, and obtain an insight to how the participants measure and perceive developments and structures in the village. The idea is to ask people to make their own diagram.

Venn diagrams

For us the use of Venn diagrams can be relevant to obtain knowledge about how the villagers or the leaders in the village see the social structures in either the village, or the village related to institutions outside of the village. In a Venn diagram the participants

place circles of different sizes in relation to each other depending on how they see the symbolic relationship (Mikkelsen 2005:92-3).

A seasonal diagram

A seasonal diagram can help us get a better idea of variation in the agricultural production during the year. Diagrams of daily routines can give us an insight in the differences related to social differentiation as gender or age.

Action tree

An action tree is a technique to identify challenges, causes and solutions. An action tree is done by drawing a tree, where the trunk is the challenge, the roots the cause, and the treetop the possible solution (Mayoux 2005).

Road Journey Diagram

Chart a journey from A to B over time, either vision journeys: looking forward, or achievement journeys: looking back. Between A and B there are different steps on the road of the journey, obstacles, opportunities, risks (PALS 2011).

Time Lines - Community History

The application of this tool can generate knowledge about the history of the village, with focus on changes related to agriculture. This can help us understand how the villagers have overcome difficulties, explored opportunities and give us an insight in the narratives of the village. We can use participatory drawings of time lines regarding the history of the village as a turning point for talks about the development of intensive agriculture.

Workshops

Because of our limited time in the village and the fact that we cannot offer the villagers anything in the long run, we can only use workshop methods quite limited. Besides, it will only be feasible if some of the villagers will spend the time necessary. A lot of workshop methods focuses on identification of and solutions to problems. Because we will not be there to implement a possible solution, we should be quite considered of what we anticipate. It can be relevant for us to use tools as Appreciative Inquiry (AI) or Strengths, Weaknesses, Opportunities and Threats Workshops (SWOT). AI focuses on identifying 'what works well' and based on that talking about 'what could be done' (Mikkelsen 2005:95,245-). This would be useful for identifying how the participants perceive the village, and what their dreams and visions are. SWOT can be used for discussing retrospectively strengths and weaknesses of an intervention or development (Mikkelsen 2005:95). This could be useful for us to get insights into how the

participants see the historical development in agriculture.

Informal meeting with the young villagers

We would like to talk to the young villagers about their wishes and dreams for the future, to get an idea about the drivers for change in the village. We think that this could best be done in an informal way, without the family of young ones. One way could be to invite them over in the weekend for a party or tee.

Reporting on the Spot

If possible we would like to report on our preliminary findings to some of the villagers, so as to get their reaction and inputs on the continuation of our project. In that way the community can participate in the analysis and can correct us if we have got something wrong.

Seasonal Ranking

	Village activities		**city activities**		
	Farm	**Non farm**			
	Type of job / type of cultivation	Type of job	Type of job	Type of job	Type of job
Profit/income					
Healthfulness					
Social status/consideration					
Comfortability					
Safety (ability to generate a safe and stable income)					
Requirements:					
capital (money)					
land					
assets					
skills/period of training					
education					
social relations					
bureaucratic needs					
others					
Total					

Economic opportunity ranking

Participants: For this exercise there is a need of a group of people of different ages. The group could be mixed if we notice that there is not a strong gender division in economic activities, otherwise it could be better to do a separate exercise for women and men because opportunities

for them could be very different and members of one group could find difficult to evaluate opportunities of the other group or tend to under/over evaluate them.
If the number of participants is bigger than ten people it could be too hard and too time consuming to run the exercise, and if it is lower than 5, it could lose its significance. It is important to try to include people that have lived in a city or that have a member of the household living outside the village, possibly doing a non-rural job, as they might have a basic knowledge of available opportunities outside the village. In addition, it should be better to include people with different level of welfare, in order to see the difference in their opinions. There are no other specific criteria of selection of participants if not their willingness to participate.
Procedure: the group of participants should agree on a list of economic activities plausibly available to them (cultivation of different crops will be considered as different activities in order to understand their different value for the villagers). These activities should be both rural and not, including activities in the city. Once this step has been accomplished, a list of parameters aimed at evaluating the value attributed to the activities will be suggested by facilitators, but it could be extended in accordance with the opinion of villagers. Finally, each participant should give a score to each activity for each parameter. The average of the participants' single scores will be taken as the final score for the considered parameter. Activities will be ranked in accordance of the total score obtained. Facilitators should record each participant scores in order to compare differences between young and elderly.
Aim: understanding the perceived importance that villagers accord to different activities. The presence of rural and non-rural activities allows an immediate comparison between them and provides a possible reason of deagrarianization in case non-rural activities reach a sharp higher score. The same holds for activities in the city: if they are more evaluated, this can explain migration.
List of parameters and example of score matrix:
Seasonal and daily calendar:
Participants: owing the fact that in the village most part of the household are committed in agricultural activities (Mingtipol O. et al, 2011), the group of participants should be composed by 4-6 farmers. However, if during the survey other diffused occupations will become evident, at least one representative of each of these occupations should be included. Farmers should be chosen in accordance with data collected in the survey, in a way that makes possible to represent the main farming systems individuated. Wealth should be taken into consideration as well, in order to have information about daily and annual activity of both wealthy and less wealthy farmers. Hired agricultural workers and farmers with multiple occupations should be included in

the group if they are present in the village in a significant proportion. Women should be part of a different group if, like in many societies, there is a strong division in the daily activities.
Procedure: A paper with twelve column representing the months of the year will be distributed to each participant. Each of them, in turn, will have to graphically show his/her level of commitment during each month giving a short explanation of the main activities done. Level of commitment could be indicated through colouring a square where a fully coloured square means a maximum effort level. When this is done by all the participants, paper will be attached on a wall and differences will be explained and discussed by participants. Facilitators might address the debate asking questions that they find interesting. After this first exercise, each participant will be asked to show his/her daily occupation in some typical day during different periods of the years.
Aim: understanding how villagers conduct their lives and the level of commitment required by different farming systems and by different occupations. It could be also interesting to individuate unwanted period of under or over-occupation. Combining these results with descriptions of past way of living, collected through interviews and informal conversations, could give an idea of changes driven by intensification of agriculture. In addition, if it will be possible to collect information about working hours of non-rural activities and common occupations in the city, a further comparison, useful to explain deagrarianization, could be done.

Farm sketch/flow diagram of the production system
Participants: ideally all the members of a farm. The farm will be chosen in accordance with its representativeness of farms in the community.

Procedure: one participant should walk with the facilitators along the farm explaining all its features. During the walk facilitators should record with the GPS the boundaries of the farmland. After, all the members of the farms should draw a sketch of the farm indicating boundaries, crops, infrastructures, water sources and external factors as market and inputs. Through arrows and other graphical tools participants should indicate the relations of these elements. It should be useful to include quantitative information about costs of inputs and possible revenues and also problems.

Aim: getting a precise overview of a farm functioning and its relation with external factors. Income sources as well as strategies to cope with risk are elements that could be obviously shown by this exercise.

Appendix B: Soil analysis and data table (Synopsis)

The soil analysis method is used to study the main factors that influence the nutrient quality of the soil. In any type of soil, the availability of the nutrients for the plants depends on the soil pH, nutrient status and there are different key factors, as aluminium and salinity that limit the growth of some crops. The samples will be taken from the upper layer (approximately 20cm) this part is the main that influences the crop development.

The analyses to be used are:

- pH: electronic measurement method in the field that indicate the soil pH
- EC: electrical conductivity that study the salinity of the soil.
- Nutrients analysis: Total N, Phosphorus, Potassium, Aluminium that study the fertility status of soil.
- Soil organic matter (SOM), Bulk density (BD)
- Pesticides

Justification: The samples on the agriculture land and natural lands are used to study the current nutrient condition of the soils and compare the fertility status of intensive crop production area and natural soil area.

Soil data table

Sample	**pH**	**EC** (dS/m)	**SOM** (%)	**BD** (g/cm^3)	**N** (ppm)	**P** (ppm)	**K** (ppm)	**Al** (ppm)	**Pesticides**
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									

Appendix C: Water analysis and data table (Synopsis)

Water analysis: pH, EC, temperature, dissolved oxygen, nitrate, phosphate, pesticides.

The water quality study is to compare the quality of upstream and downstream water.

The salinity of the water can decrease the water availability of the crops and induce some infiltration problems (Ayers and Westcot, 1994).

Water temperature affects the solubility of dissolved gases, including dissolved oxygen. Colder water holds more dissolved oxygen than warmer water. Unnatural increases in water temperature then can cause thermal pollution (also known as heat pollution), endangering aquatic life (NexSens, 2011).

Other parameters as nitrates and phosphates can contaminate the water and affect the aquatic organisms and the crops yield (Hach Company, 2006).

Different parameters are needed:

- pH: electronic measurement in the field.
- EC: electro conductivity that study the salinity of the water.
- Nutrients analysis: nitrate, phosphate.
- Temperature, Dissolved Oxygen
- Pesticides

Water data table

Sample		**pH**	**EC (µs/cm)**	**Temperature** (^{0}C)	**Dissolved Oxygen** (ppm)	**Nitrate** (mg/l)	**Phosphate** (mg/kg)	**Pesticides**
Downstream water	**1**							
	2							
	3							
	4							
	5							
Upstream water	**1**							
	2							
	3							
	4							
	5							

Appendix D: Questionnaire draft (Synopsis)

Dear respondent, many thanks for answering to this questionnaire. We are a mixed group of student from University of Copenhagen and Chang Mai University doing a research about life conditions in Ban Huai Tao Ru. Please answer the following questions honestly and sincerely and feel free to skip any question that you consider inappropriate or invasive. However, remember that there are no wrong answers and that the information that you are giving to us will be treated with upmost confidentiality.

Household number: GPS point:

General information

1)Name:

Age: Gender: □M □F

(Your name and surname are only used to identify which household the questionnaire is coming from, and will not be published in report or revealed to others. However, feel free not to write them if you do not want)

2)Where were you born?□ Ban Huai Tao Ru

□ Another village/town in Chiang Mai province

□ Another province of Thailand

□ Outside Thailand

3)How many brothers and sisters do you have? Are some of them living in the village?

4)For how many years have you been living in the village? …… years

5)What is your education level: □ primary school

□ secondary school

□ professional

□ college

□ university

□ no formal schooling

6)How is your household composed (how many people live in your household)? (people who contribute to or benefit from the same income in your house)

Parental position	Age	Level of education	Contribution to cash income	Contribution to work/activities

7)Do you have a Thai citizenship?

□ Yes □No

8)Are you member of social groups in the village/outside?

□ Yes □No

If yes, specify:

9)Do some members of your household/family live outside Ban Huai Tao Ru ?

□No □ Yes:

Parental relations	Age	Location	Permanency & duration	Occupation	Importance of remittances
			P□ T□ …… year(s)		VI□ I□ R□ S□
			P□ T□ …… year(s)		VI□ I□ R□ S□
			P□ T□ …… year(s)		VI□ I□ R□ S□

VI: Very Important I: Important R: Residual S: Support

P: Permanently T: Temporary

10)What are your main sources of income (please, indicate all the activities that you practice and that contributes to sustain your household putting at the first the main one)?

Occupation	Income generated	Importance of income generated in overall income	Stability of income
□ Agriculture	_____BHT	VI□ I□ R□	VS□ S□ US□
□ Wage job	_____BHT	VI□ I□ R□	VS□ S□ US□
□ Private business	_____BHT	VI□ I□ R□	VS□ S□ US□
□ Remittances	_____BHT	VI□ I□ R□	VS□ S□ US□
□ Pension	_____BHT	VI□ I□ R□	VS□ S□ US□
Others			
	_____BHT	VI□ I□ R□	VS□ S□ US□
	_____BHT	VI□ I□ R□	VS□ S□ US□
	_____BHT	VI□ I□ R□	VS□ S□ US□

VI: Very Important I: Important R: Residual

VS: Very Stable S: Stable US: Unstable

11)Does your household have debts?

□ Yes □ No

If yes, specify purpose, amount and creditor:

12)Do you have savings?

□ Yes □ No

If yes, specify purpose, amount

13)Can you give us an indication of the proportion of your yield that is directly consumed in your household and the proportion that is sold or bartered?

Yield consumed by the household_____%

Yield sold in the market or bartered _____%

14)Do you have:

□ Land

□ Livestock

□ Freezer

□ Television

□ Mobile phone

□ Computer

□ Internet connection

□ Agricultural machinery:_____

□ Motorbike

□ Car/truck

15)Do you use products from the forest (timber, mushrooms, fruits...) for your household consumption or for market purposes?

□ Yes □ No If yes, which ones:

Product	Own Consumption	Market purpose
	VI□ I□ R□	VI□ I□ R□
	VI□ I□ R□	VI□ I□ R□
	VI□ I□ R□	VI□ I□ R□
	VI□ I□ R□	VI□ I□ R□
	VI□ I□ R□	VI□ I□ R□

VI: Very Important I: Important R: Residual

16)What main problems have you faced for the past 20 years? How have you tried to tackle them? With what results? (disease, death, market-related, production-related, resources-related, etc.)

Problem 1:

Strategy:

Results:

Problem 2:

Strategy:

Results:

Problem 3:

Strategy:

Results:

Perceptions of Well-being

17)How often are you sick?

Nowadays		In the past (to specify after 1st interviews)	
□ Often □ Not often	□ Rarely	□ Often □ Not often	□ Rarely
Specify:		Specify:	

18)And other members of the households?

Nowadays		In the past	
□ Often □ Not often	□ Rarely	□ Often □ Not often	□ Rarely
Specify:		Specify:	

19)How many meals a day do you eat per day?

Nowadays	In the past

20)Do you think you eat better now than before?

□ Yes □ No □ It did not change □ I do not know

21)Have you ever experienced problems related to the water you drink?

□ Yes □ No

If yes, specify (when, what, etc.)

22)Do you think your local environment is better now than before?

□ Yes □ No □ It did not change □ I do not know

23)Do you feel more stressed / worried now than before (talk with interpreter- Thai to specify)?

□ Yes □ No □ It did not change □ I do not know

Aspirations

24)Would you like your children to continue your activity?

□ Yes □ No

Why?

25)If you had the opportunity, would you move to city?

□ Yes □ No

Why?

Agricultural information

26) How large is your agricultural land (Rai)?

27)Has there been any change to your cultivated land for the past+++++++ years?

□ Yes, it has increased

□ Yes, it has declined

□ No, there have been no change

If it has changed, please explain why:

28)How did you get your land?

□ I inherited □ I bought it □ The state gave it to me

□ Other

29)Which crop (s) do you cultivate?

Crop	Area cultivated (rai)	When did you started to grow	Yield per rai (kg)	Purpose	
				Own consumption	Sale or barter

30)Are there other crop (s) you used to grow but not now?

Crop	Subsistence crop	Cash crop	Why you stopped growing it

31)Has there been any change in your agricultural yield overtime?

□ Yes, it has increased

□ Yes, it has declined

□ No, there have been no change

If it has changed, please explain why:

32)Which input(s) do you usually apply?

Inputs	**Yes/No**	**Use today compared to before intensification?**

Fertilizers	□ Yes □ No	□ More □ Less □ Same
Manures	□ Yes □ No	□ More □ Less □ Same
Pesticides	□ Yes □ No	□ More □ Less □ Same
Irrigation	□ Yes □ No	□ More □ Less □ Same
Improved seed	□ Yes □ No	□ More □ Less □ Same
Draft power	□ Yes □ No	□ More □ Less □ Same
Tractor	□ Yes □ No	□ More □ Less □ Same
Family labor	□ Yes □ No	□ More □ Less □ Same
Hired labor	□ Yes □ No	□ More □ Less □ Same
Others		
	□ More □ Less □ Same	
	□ More □ Less □ Same	

33)What do you think the effect of using fertilizers and pesticides is on soil and water?

□ More negative effect than positive

□ More positive effect than negative

□ No significative effect

If you have observed significative effect(s), please specify:

34)Do you face any shortage of water for household consumption, livestock and agriculture

Categories	Yes/No	If yes, please specify possible reasons
Household consumption	□ Yes □ No	

Livestock consumption	□ Yes □ No	
Agricultural purposes	□ Yes □ No	

Appendix E: Interview guide for institutional informant (Chiang Mai) (Synopsis)

Key informant: a member of the Royal Forest Department (RDP) or another department (Ministry of Agriculture and Co-operatives, National Parks Department, etc.) with competences related to environmental policies.

This guideline is created on the supposition that we will be able to interview a member of the RFD. However, information provided by this interview and the choice of questions are depending on the contact that the University of Chiang Mai will give to us.

Topics that we want to investigate:

•Brief explanation of environmental problems in Chiang Mai province and the policies adopted to face them.
•Relation between environmental and social concerns during the policy creation phase.
•Procedures of policy implementation with particular focus on the problem of people living and farming in protected areas.
•Environmental legislation related to Mae Lor Wathershed. (All the previous topics will now be related to the specific situation of Mae Lor Wathershed)
•Opinion about environmental behaviours of people, in particular ethnic minorities, living in protected areas

Questions:

•We know that in the last decade Thailand has adopted a wide range of policies on environmental protection through the creation of many protected areas (wildlife sanctuaries, National parks, Watershed areas). Please could you give us a short description of the environmental problems in this province and what has been and is being done to face them.
•We have read in many articles that sometimes a protected area is established in a zone where people are living and that this fact can cause conflict. Is this problem taken into account during the preparation of a policy and what is done to go about it? What are the priorities when an environmental policy is discussed and prepared?
•How do you react if there is already a community of people living and farming in an area that is declared protected?

In accordance with the answer given by the RFD member, we could ask if alternatives (new lands/re-location) are offered to community members and which criteria are followed in this process. Further we could ask if they are asked to limit their activities in the area, but they are allowed to stay there. In this case it is interesting to know what the usual reaction of community members is and the reaction of the authorities.

•If we are not wrong, Mae Lor Wathershed is a case as the one just described. Can you tell us something about it? (Specific questions will be decided in accordance to the answer of the RDP member to this general questions taking into account our general aims).
•Do you think that Mae Lor Wathershed presents environmental challenges? In accordance with the answer we can ask to the interviewee his opinion about the behaviour of people living there.

Interview guides

Interview guide for Village Administration

Key informant: Village head man (woman)

Questions

1.How has the agriculture system of the village been evolving?

i. Cultivated land area

ii.Types of crops (cash crop versus subsistence)

iii.Yield conditions

iv.use of inputs (chemicals, implements, labor)

1.Has there been major external change that impacted agriculture in the village?

i.Policy

ii.infrastructure

iii.market (demand)

1.Is there any impact of intensification of agriculture on availability of water for household and livestock consumption and agricultural purposes?

Interview Guide for Agricultural Extension Officer of the Village

Key Informant: Agricultural extension officer

Questions

1.How has the agriculture system of the village been evolving?

i. Cultivated land area

ii.Types of crops (cash crop versus subsistence)

iii.Yield conditions

iv.use of inputs (chemicals, implements, labor)

1.Is there any impact of intensification of agriculture on availability of water for household and livestock consumption and agricultural purposes?

2.Which types of agrochemicals do the villagers use?

i.Types of fertilizer

ii. Types of pesticides

iii. What effect do they have on the soil, water and health?

1.Can you describe the impact of agricultural intensification (use of fertilizer and pesticides) on soil in the village?

Interview guide for Water Health Bureau (Chiang Mai)

Key informant: Health officer

Questions

1.Are there problems of water quality due to consumption for households and livestock which could have been polluted by fertilizer and pesticides? Incidence or report?

2.What are the impacts of application of fertilizer and pesticide on water in the village?

Interview Guide for Agricultural Bureau (Chiang Mai)

Key Informant: Member of the agricultural bureau

1.How has the agriculture system of the village been evolving?

i. Cultivated land area

ii.Types of crops (cash crop versus subsistence)

iii.Yield conditions

iv.use of inputs (chemicals, implements, labor)

1.Has there been major external change that impacted agriculture in the village?

i.Policy

ii.infrastructure

iii.market (demand)

1.Can you describe the impact of agricultural intensification (use of fertilizer and pesticides) on soil in the village?

2.Is there any impact of intensification of agriculture on availability of water for household and livestock consumption and agricultural purposes?

Appendix F: Time Line (Synopsis)

Activities	*Chiang Mai*			*Ban Huai Tao Ru*											
	25/02/11	26/02/11	27/02/11	28/02/11	01/03/11	02/03/11	03/03/11	04/03/11	05/03/11	06/03/11	07/03/11	08/03/11	09/03/11	10/03/11	11/03/11
	F	St	Sa	M	Tu	W	Th	F	St	Sa	M	Tu	W	Th	F
Study preparation	x	x	x												
Informal talks with people in Chiang Mai	x	x	x												
Literature search and review	x	x	x												
Interviews with institutional informants		x	x												
Transect walk				x	x										
Community mapping					x										
GPS mapping				x	x	x	x	x	x	x					
Interview with the head-man				x	x										
Questionnaire survey					x	x	x	x	x	x					
Interviews with:															
farmers						x	x	x	x	x	x	x			
young people living outside the village										x					
elderly							x		x		x				
young people living in the village						x		x		x		x			
PRA exercise:															
Economic opportunity ranking											x				
Farm sketch/flow diagram of the production system									x						
Seasonal and daily calendar								x							
Community history										x					
Soil sampling															
Water sampling															
Presentation & discussion of our work with villagers															x
Data discussion and first analysis														x	x

Appendix XIII: Distribution of income

Households' incomes and goods											
HH number	HH income	Income per person	HH's cultivated land (rai)	Number of HH members	HH goods						
					Refrigerator	Freezer	Television	Mobile Phone	Computer	Motorbike	Car/truck
1	333400	166700	20	2	Y	N	Y	Y	N	Y	Y
9	162000	10125	13	16	N	N	Y	Y	N	Y	N
2	147000	49000	15	3	N	N	Y	Y	N	Y	Y
7	144000	16000	6	9	Y	N	Y	Y	N	Y	Y
6	132000	14667	6	9	Y	N	Y	Y	N	Y	Y
10	120000	17143	30	7	Y	N	Y	Y	N	Y	Y
8	110000	36667	15	3	Y	N	Y	Y	N	Y	N
13	96000	19200	6	5	Y	N	Y	Y	N	Y	Y
12	66000	22000	28	3	N	N	N	Y	N	N	N
5	66000	16500	18	4	Y	N	Y	N	N	Y	N
14	54000	7714	4	7	N	N	Y	Y	N	Y	Y
4	35400	7080	36	5	Y	N	Y	Y	N	N	N
16	35000	11667	21	3	N	N	Y	N	N	Y	N
11	25000	3571	17,5	7	N	N	Y	Y	N	Y	N
18	7200	1800	3,5	4	Y	N	Y	Y	N	Y	Y
3	7200	1440	26	5	N	N	Y	Y	N	Y	N
Average	90263	15698	16,56	5,75							
Standard deviation	81427	39772	9,98	3,49							
Legend:	colour red = lowest income quartile (0 – 25%)										
	colour orange = 26 – 50% income quartile										
	colour yellow = 51 – 75% income quartile										
	colour green = upper income quartile (76 – 100%)										
	colour pink = household with income from pension (additional to income from agriculture)										
	colour blue = household with income from wage jobs (additional to income from agriculture)										
	Y = possessed good										
	N = non possessed good										

The table shows the distribution of income in the surveyed households. HH are sorted according to their income and divided in 4 quartiles. Income per person is simply calculated dividing the HH income for the number of people in the HH. Also this column is divided in quartiles, but it is not sorted. The table shows the land cultivated (owned, rented and borrowed) by each HH and some goods elected as indicative of the HH's wealth[26].

[26]HHs number 15 and 17 are not present because the data about their incomes were incomplete.