

**Interdisciplinary Basic Course on Natural Resource Management in Northern  
Thailand**

**SLUSE Joint Basic Field report:**

# **Land Use Strategies in Ban Mae Raem**

**-Field study of natural resource management and the  
potentials for sustainable land use among Hmong  
minorities in northern Thailand, location 4-**

**Autumn 2000**

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## **Abstract**

This field study focus upon rural development and the factors which condition local sustainable land use strategies in a Hmong village of Ban Mae Raem, northern Thailand. The land use strategies is considered from three different, but correlated aspects where empirical studies and qualitatively interviews were conducted with local farmers from the perspectives of:

- An agricultural approach investigating land use techniques and conditions influencing farming strategies and its environmental consequences.
- A forestry approach emphasising the extent, importance and regulations of the adjacent forest areas.
- An institutional approach highlighting a number of institutions acting as facilitator for land use strategies and the potential environmental impact.

The survey seek to correlate a number of social, economic and natural preconditions which represent an immanent role for the chosen land use strategy, and the ability for farmers to pursuit a more sustainable land use strategy. This paper elaborates upon constraints as well as possibilities for taking up more sustainable land use strategies. Methodological considerations are also accounted for throughout the paper, estimating the numerous of biases as well as the problems of embracing the chosen methods and research strategies.

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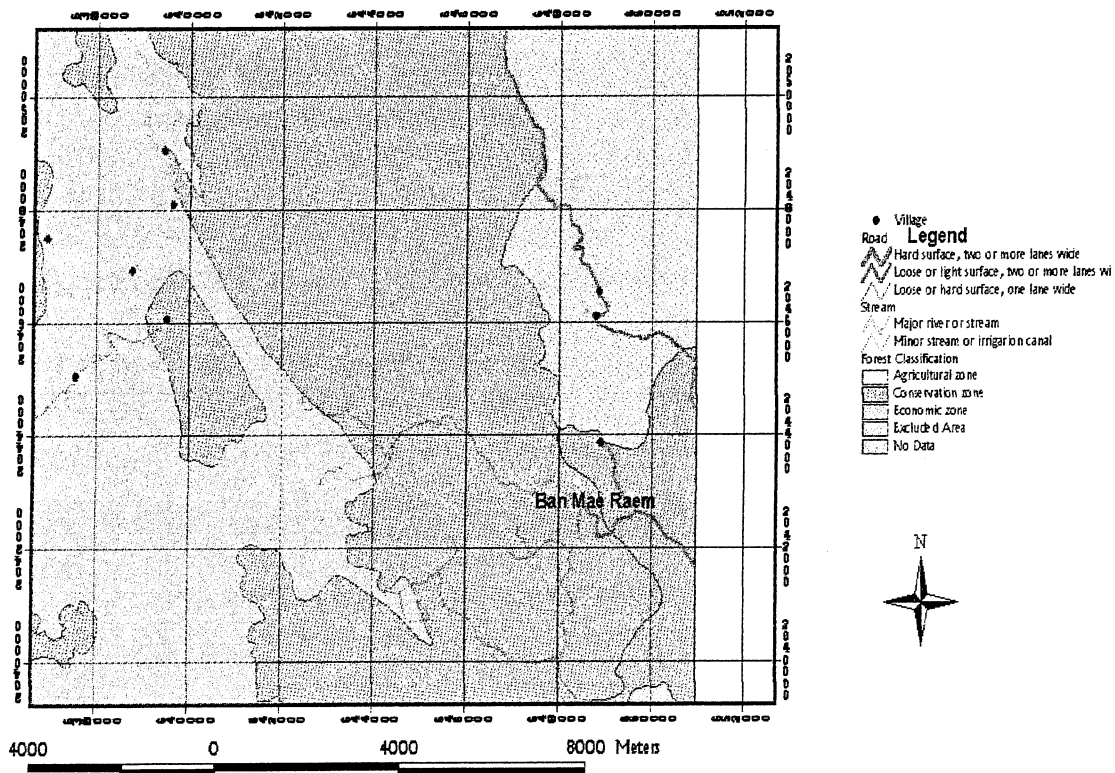
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## Introduction

### Background for the objectives

Rural development and the utilization of fragile and scarce natural resources have received increasingly attention, especially in relation to concept of sustainability. In Northern Thailand issues concerning deforestation, access to water and rights to land have been major topics for actors taking interest in natural resources. The reason for this is complex. On the one hand governmental policies of forest conservation and watershed conservation are aimed to protect the remaining part of Thailand's forest areas. On the other hand people living within the conservation zones wants to utilise the natural resources (Hirsch, 1993: 19).

## Forest Classification in Song Watershed

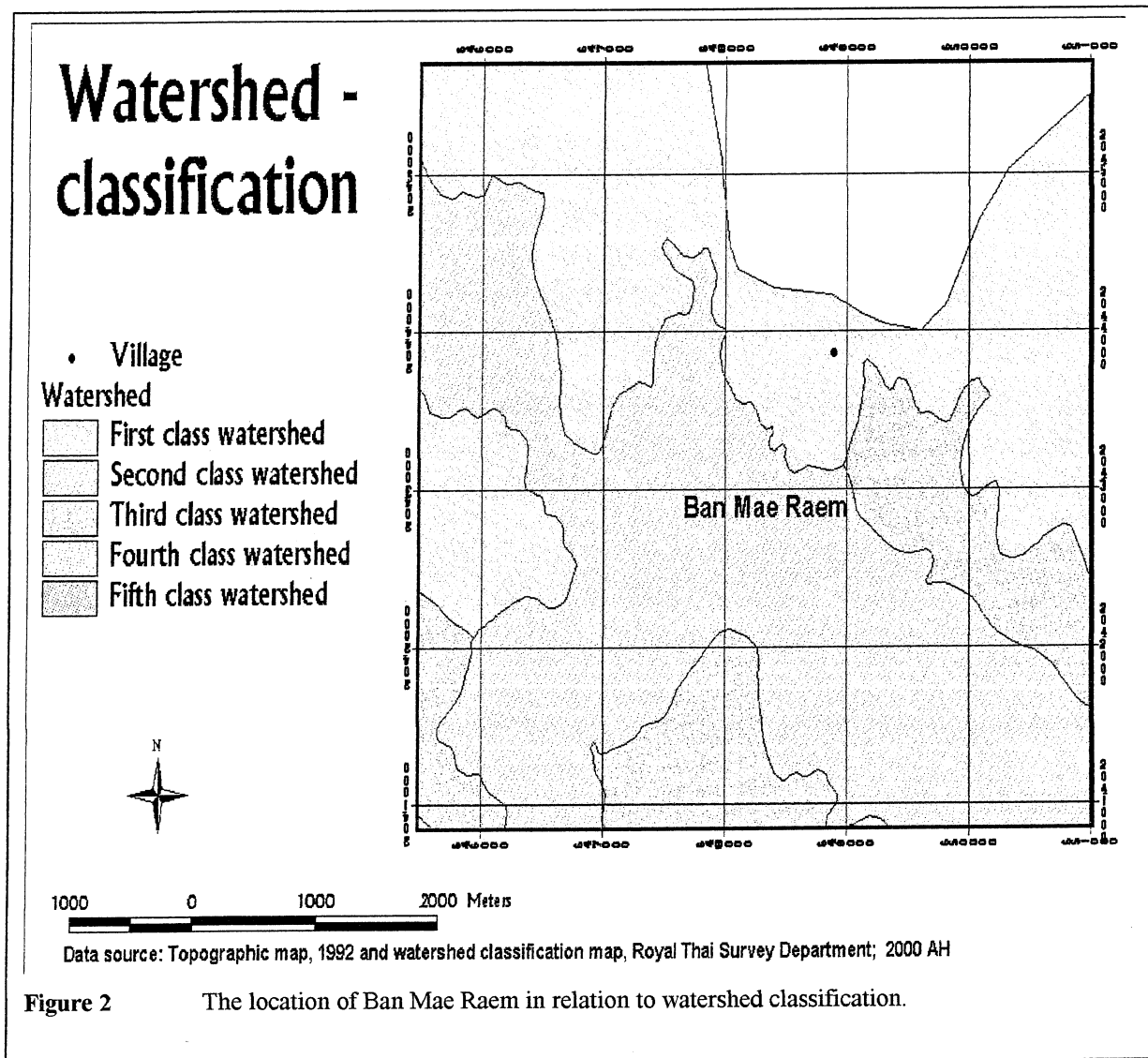


Data source: Topographic map 1992 Thai Survey Department and Forest classification map RFD; 2000 AH

Figure 1 The location of Ban Mae Raem in relation to forest classification.

Furthermore, most of the people in the hilly areas of conservation zones are ethnic minorities such as Karen, Hmong and Lisu. Northern Thailand has recently been the arena for conflicts between the governmental agencies such as Royal Forest Department (RFD) and ethnic minorities who want security for their land in terms of land certificates (Ganjanapan, 1996: 15-16). Another conflict has arisen between the lowland farmers and hill tribes within a watershed. The lowland farmers most often being of Thai origin have accused the hill tribes for causing deforestation as well as using too much water in their farming systems that it depletes the supply and quality of water in the lowland areas (Scoccimarro 1999: 2).

An ethnic minority for whom conflicts over natural resources influence their way of living, and define their space for manoeuvres, are the Hmong tribal group. The Hmong hill tribe migrated originally from southern China, to upland areas in Laos and settled down in Northern Thailand (Bello et al., 1998: 179). Some were relocated in Ban Mae Ream 30 years ago by the government due to problems of communist infiltration up north (Headman, BMR, 2000). At that time, 17 households represented the village. Today in-migration and population growth has caused an increase in the population to 1336 people living in 157 households. The population can basically relate to five major families. The majority of the villagers still practice animism as the prevailing religious institution. Their traditional occupation during the last 100 years as opium growing shifting cultivators has been halted by government strategies which encouraged locals to engage in cash crop production like cabbage (Bello et al., 1998: 181). The Hmong can generally be characterized as having bad press, because they have been associated with unsustainable shifting cultivation, drug production and pesticide-intensive vegetables production (Bello et al., 1998: 180). Today they are still being accused of taking part in drug dealing.



**Figure 2** The location of Ban Mae Raem in relation to watershed classification.

Ban Mae Raem is located within a forest conservation zone and a watershed classification WSC2 shown in figure 1 & 2. This classification can formally prohibit agricultural practices and relates to areas where reforestation programs are to be conducted (Mingtipol, 2000: 39).

Figure 3 illustrates both that the political interests, the history of the villagers and their culture determine the human resources, sets limits and opportunities, and effect choices of resource management strategies. Human resources are understood as the variety of capabilities of the people living in BMR. The natural conditions (e.g. climate and geology) are other important factors for determining the natural resource capital of Ban Mae Ream (vegetation cover, hydrology,

topography, morphology, etc.) and for the limitation and opportunities of resource management strategies. The figure should be seen as an illustration of conditions that influence the local space for manoeuvres.

With reference to the figure 3 our statement of the problem is as following:

*How do the villagers of Ban Mae Raem manage their resources under the given natural and political conditions?*  
*What are the consequences of these management strategies and what are the constraints and opportunities for a sustainable management of the land resources in Ban Mae Raem?*

### **Research subjects**

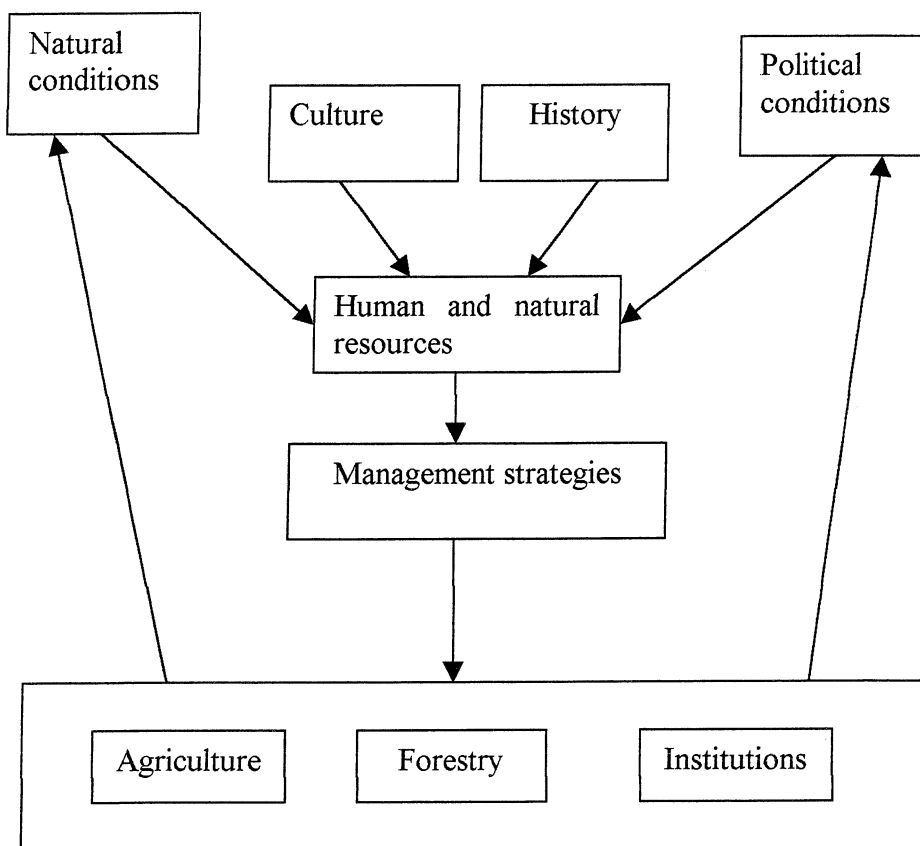
To operationalise the statement of the problem field research was carried out with specific focus on management strategies within the agricultural, forest and institutional sector.

With focus on agricultural management strategies constraints and possibilities for expansion and intensification will be investigated as well as the flexibility of the farming system.

Within the field of forestry, the focus will be on what kind of products the villagers of BMR extract from their forest areas and to what extent they depend on their community forest and the adjacent national forest. Furthermore, the administration of the forest areas and the existing regulations will be investigated.

Within the institutional field the different institutions facilitating land use strategies will be mapped. The survey focuses primarily upon the vital institutions acting within the community, which can be correlated with more or less sustainable land use strategies. Institutions promoting knowledge, training, and granting loaning services regarding land use are of particular interest.





**Figure 3** Conceptual framework for the process of designing the report.

### ***Limitations***

The purpose of the field study was to illuminate the contemporary events within the context of land use consequences and land use perspectives. The research was carried out on village level. Therefore, further investigations of political and natural conditions that are external to Ban Mae Raem will not be carried out. Neither will culture and history of the Hmong people be analysed. It should be stressed though, that there are important external determinants for the human and natural resources of Ban Mae Ream, which influence the chosen resource management strategies on village level, e.g. legislations, restrictions and development policies.

## **Definitions**

### **Intensification and expansion**

*“Intensification, more precisely defined, is the process of increasing the utilization or productivity and in contrast with expansion, that is the extension of land under cultivation” (Netting 1993: 262).*

By increased utilisation we understand increasing amount of input e.g. capital, labour, knowledge (Mortimore 1995:83).

### **Sustainability**

*“Development that meets the need of the present without compromising the ability of future generations to meet their own needs”.* (Brundtland, 1987: 43).

The above definition is very broad. Therefore it should be considered that sustainability depends very much upon the perspective from the actors involved, and therefore includes dimensions like economy, policy, social-cultural aspects and ecological aspects. In the local context, the definition refers to the ability to maintain or increase productivity on a long-term basis. Furthermore, the concept of sustainability involves the prevalence of institutions, their ability to allocate knowledge and information and to authorise regulations. An important component of sustainability is flexibility, which is understood as the ability of the community to adapt to changes in the environmental, political and economical conditions.

### **Institutions**

Institutions are collections of formalised or less formalised rules and laws, which facilitates or constrain actions. Institutions could also indicate norms, values, cultural and religious settings, but the institutions, which the survey explicates, are mostly related to village and governmental institutions influencing land use practices. ( March, 1995:34-35).

## **Methodology and Methods Used**

This chapter will present how we will undertake the task of solving the statement of the problem throughout the report. First the approach and different methods will be introduced asking *how* the research was carried out; secondly a section of methodology will go more into the scientific

assumptions. Later in the report a discussion of methods will evaluate the findings in relation to the methodological approach chosen.

### ***The research – How***

To get an image of how the villagers in Ban Mae Raem manage their resources within the Song Watershed, the research was carried out as a case study. Ban Mae Raem has some unique characteristics as the village represents a Hmong minority group and is not easily accessible from outside, which make Ban Mae Raem more problematic to compare with the other locations. Because of Ban Mae Raem's rural position and its ethnic distinctness it might possess even more interesting aspects that should be considered when investigating developmental and environmental issues in Northern Thailand in general.

Our study has been an overall combination of literature studies as *secondary* empirical material and field studies as *primary* empirical material. Before going to Thailand the secondary empirical material was used for preparations and learning about the study area, which also involved information about the political and social context of the hill tribes.

### ***Sub-groups***

From the beginning, we chose to work in subgroups related to areas of forest, agriculture and institutions. The reason for this was mainly an attempt to answer our objectives from different disciplinary dimensions, as the group of students consisted of a broad range of different disciplines. We could thus combine natural scientific methods with social scientific methods.

The different sub-groups had different research subjects and hence asked mostly different questions, but generally it can be said that the interview guides were semistructured. Some questions were structured for the purpose of statistical analyses and presentation. Others were open-ended that allow the respondent to dwell more deeply into certain topics. Open-ended questions gave us the opportunity to understand factors from the respondent's perspective and to find new causalities. (Furze, B, De Lacy, T. & Birckhead, J., 1996: p. 50).

Triangulation was taken use of within the interviews by checking topics discussed previously in the interview in the form of modified questions asked later in the session (number of fields, kind of agricultural crops, products harvested from the forest, the place of extraction from the forest etc.). To verify our information from the interviews within the field of forestry a key-informant meeting was arranged as a way of evaluating and data triangulating our findings. Furthermore, direct observation was carried out in order to provide additional information about the topics being studied. (Yin, R. K.,1994: p. 91)

### ***Methods used***

- Interviews
- Land use mapping
- Soil sampling
- Water sampling
- Direct observation

### ***Interview***

#### **The process of sampling**

We used a technique of selecting our respondents according to principals of ‘randomly sampling’. A subset of cases are selected from a larger pool of cases from where generalizations are induced (Neuman 1997: 201-02). This was done for the purpose of analysing from a wider and more random and representative pool of respondents. The selection was done among the total number of households (Table 1). Extreme cases were only used to a limited extent within the field of agriculture as the purpose of our research was to paint a general picture of prevailing conditions in the village and to obtain knowledge about the diversity of management strategies.

**Table 1** The number of people living within Ban Mae Raem distributed on households (Mingtipol, 2000: 14)

Population	1336
Household	157

58 interviews were carried out within the village including the headman, Or-Bor-Tor-officers (OBT-officers), Hill Tribe Development Center and the Health Center Doctor. Two interviews were held with persons outside the village; the chief of Song Watershed Unit and representatives of the Community Developing Department.

### **Agriculture**

By using semi-structured interviews (Appendix C) the aim was to gather information about indicators such as fallow periods, crops, input, soil and off-farm activities, which could be used for analysing farming systems in BMR.

In order to get respondent from all of the five major families in BMR, we chose to use a strategy of stratified random selection to make samples of respondents. By using the village household lists, a random selection was made of 20 households according to the relative size of the five major families. Due to practical circumstances we carried out 15 of the 20 interviews which were supplemented with three in-depths interview in order to get more precise information specifically about various kind of inputs. These three in-depths interviews were selected as extreme-cases based on households with low and high inputs and a household with orchards.

During the interview the farmer was asked to make a participatory map to indicate the geographical site of his field, so that we later on could identify the fields if soil sampling was considered relevant. Included in the interview was also a ranking session concerning output and input for a five year period, although we had to exclude this part due to the general length of the interview.

## **Forestry**

Within the area of forestry 14 households, the chief of Song Watershed Unit, the headman of the village and an OBT-officer were interviewed using structured and semi-structured interviews. (Appendix A & B). The 14 households were selected by means of stratified random sampling. It was assumed that income and spatial position in the village (proximity to the forest) were the two most important factors determining the way of using the forest. Data and information on household income was not available at first making the place of living the most obvious and accessible criteria for selection. The area of the village was subdivided into 18 squares of equal size. We planned to cover all the squares but the limited time available forced us to do the selection by lot; 14 of the squares were covered. The selection of the household within each of the chosen squares was done by flipping a coin at each intersection in the village until a household was encountered. To verify our data, we decided to have a key-informant meeting in order to check the villagers division of their forest and the mentioned regulations. A ranking of the products in the households showed up to be very difficult and time consuming therefore we decided to make a pairwise ranking of the 15 products mentioned with the 4 key-informants (6 were invited). The purpose of the key-informant meeting was to get a picture of reality; therefore we invited the most informative and well-informed farmers selected among the respondents.

## **Institutional Conditions**

A wide variety of persons were interviewed for the purpose of mapping the institutional settings. (Appendix D & E). The interviews included: 11 villagers, 3 community committee member, 2 elderly, the chief of Song Watershed Unit, one OBT administrative officer, 5 representatives of the Community Developing Department, the Headman of the village, the representative of the Hill Tribe Development Center (HTDC), and finally the Health Center Doctor.

In order to get a better understanding of the context of the Ban Mae Raem villagers a few key-informant interviews were initially conducted with the Headman, OBT-officer and the leader from the Hill Tribe Development Center. This provided useful data for completing interview guides.

For learning about the institutional setting as the villagers perceived them, we selected three households from three different stratifications (low, moderate and high income) plus two women to consider information from another gender perspective. A woman, who knew the village and family

names well helped us to organise the different groups from which random sampling was made. The selection also considered the five different family names which were representatively included in the sampling pool. The questions asked functioned as a way of learning what community activities were taking place, to what extent villagers participated, the different land use restrictions, training projects and loaning institutions. These factors resemble the indicators and potential implications for sustainable land use management.

### ***Direct observation***

Direct observations is an important and always appearing method to get an overview of the surroundings, to verify or falsify data, to be incited to address additional and relevant questions and to make an superficial investigation of topics which are beyond the limit of our professional skills and beyond the limit of time. Observations of crop variety, land preparation, use of fertiliser and pesticides and areas cultivated or laid idle were also carried out.

### ***Land Use Mapping***

To get an idea about the extent of the forest areas surrounding Ban Mae Raem we were assisted by one of the two OBT-officers in the village. The measurements were done by means of using a GPS to estimate the co-ordinates of the boundary. Measurements were taken every 20-40 meters in places where the view of the sky was more or less clear. The purpose was to establish the area of the community forests which the village perceived as their property and thereby to get some indications of the potential production, the impact of the regulations and evidences for the place of extraction of the products.

### ***Soil sampling***

The aim was to collect soil samples from fields where different crops were cultivated and from fields laid fallow. This was done mainly to get an idea of pH and N,P,K values and EC which could be correlated to the farming practices and related to the cultivation of the various crops. Soil samples were taken from fields where highland rice (one field that was cultivated using chemical

inputs and fertilizer, and one cultivated without such inputs), cotton, cabbage, maize, tamarind and mango were cultivated and also from fields laid fallow. Therefore, fields cultivated by farmers who we interviewed in-depth were sampled, as well as fields, cultivated by informants, located at a reasonable distance from the village were chosen. As a reference, soil was sampled from different forest areas to get an idea about the texture and the values of soil that had not been disturbed by agricultural activities. The soil samples were taken using a 0-15 cm drill on fields where annual crops were cultivated and on fields laid fallow. A 0-30/30-60 cm drill was used for sampling on orchard fields and in forested areas.

On the fields where crops were grown the area was sampled according to a zig-zag pattern. 25 samples from each field (to get a kg of composite soil sample) were collected randomly in plastic bags. Samples from the orchard fields were taken from underneath the three canopy as well as from the bare soil areas. The randomisation was done by throwing a stone. Here 1 kg soil from 0- 30 cm dept and from 30-60 cm was collected in separate bags.

The soils were analysed for mineral N, exchangeable K and plant available P using simple field techniques. pH and EC were measured in a soil:water (1: 2,5) suspension using podet pH and EC meters. pH values, EC and N,P,K values were found using a soil test kid (Kasetsart university soil test kit) after the soil had dried in the shadow for a couple of days and sieved with a 2mm sieve. Soil texture was classified using the USDA classification method; finger test and soil colour was classified using the Munsell colour chart.

### ***Water sampling***

Samples were taken from the Ban Mae Ream stream, which supply the main agricultural areas with water. Four points were chosen on the main stream at points where water from the tributary streams flowed into Ban Mae Ream stream. For each point 1000mL of water was collected. Another sample was taken a few meters downstream from the headwater. The samples were analysed according to turbidity, EC and pH. By using a Water-Meter the amount of water that a sprinkler use per minute was measured.



## ***Presentation of Results***

### ***Results within the area of Forestry***

Interviews during the first days revealed that Ban Mae Raem does not possess the legal right to their forest but due to accept of their settlement for 1 year ago and their presence in the area for almost 30 years the village perceive the area surrounding the village as belonging to Ban Mae Raem. Ban Mae Raem is situated within a conservation zone where no harvest of timber is allowed and within a Watershed Class 2 where agricultural activities are strictly prohibited (Mingtipol et al, 2000), GPS measurements and interviews showed that they possess three different kinds of forest with different kind of management and regulations. The three different forests surrounding the village are bordered by The National Forest.

#### **Spiritual Forest**

Constitutes an area of 12 rai (Figure 4) and no use at all is accepted not even cutting down trees the size of a pen!

#### **Graveyard Forest**

This forest constitutes an area of 21 rai. (Figure 4). The villagers are not allowed to cut down big trees. Trees up to one arm size (circumference) can be used if the purpose is building of enclosures for pigs. NTFP's can be collected for the purpose of household.

If the regulations concerning the spirit forest and the graveyard forest are broken the villagers will be fined in the range of 500-1000 baht. The fine depends on the judgement of the community. Furthermore, the culprit has to sacrifice one pig.

#### **Community forest**

This forest constitute an area of 393 rai (Figure 4) and surrounds most of the village. The villagers are allowed to use all the NTFP's needed for household, but not for sale. They are allowed to cut down trees smaller than 5 hands measure (circumference) for household use. If a villager cuts down a tree bigger than 5 hands measure he will be fined 500-1000 baht.

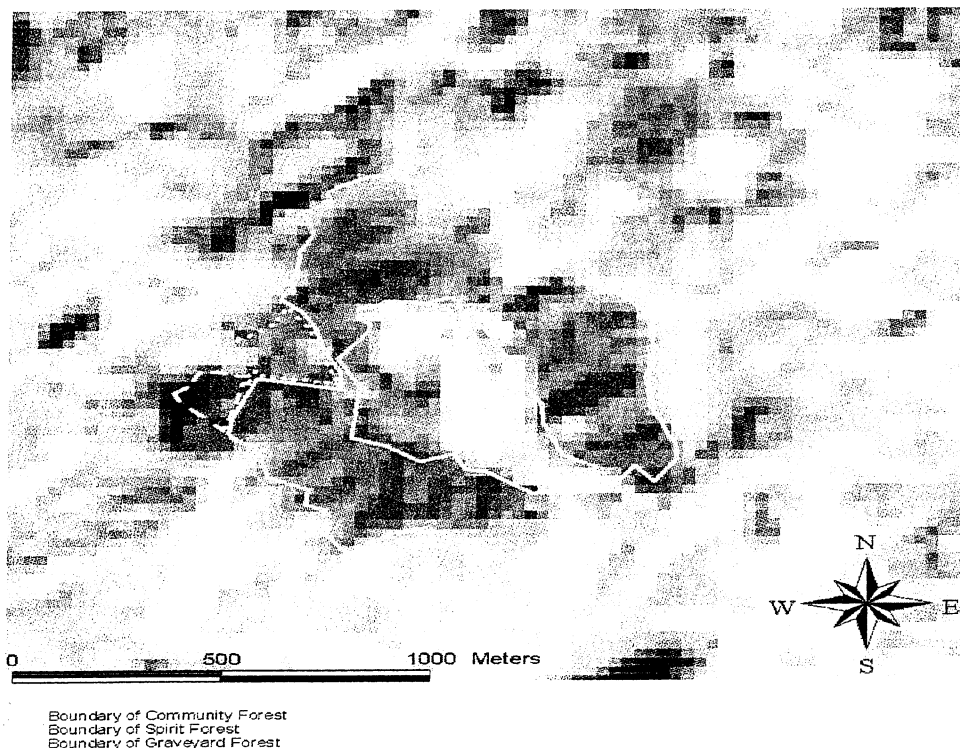
### The National Forest

Concerning the amount and purpose of use of NTFP's there are no rules and regarding the size of trees used there are no rules as well. But the purpose should be for household use and not for sale.

We were told that the farmer has the right to use the all the forest products next to his field in the range of 100 to 200 m but only for the purpose of household use.

### Ranking of the Forest Products

A pairwise ranking with four key informants indicated the relative importance of the products extracted from the forests. The villagers were asked which one of the two products mentioned was the most important concerning their use. The ranking revealed that timber (several species) followed by fuelwood (several species) were most important and used by all farmers. These TFP's were followed by several NTFP's illustrated in Table 2.



**Figure 4** The area of the three different kind of forest regarded by the villagers as being the property of Ban Mae Raem even though the location is within the Conservation Zone. (Landsat TM Jan. 1989 (5,2,4)).

**Table 2** The relative importance of 15 products mentioned by 4 key informants compared with the frequency with which the products were mentioned by the 14 farmers interviewed. If product A was preferred to product B; product A was given 1 point. If equally preferred both were given ½ point.

<b>The order of the products</b> The number in the square bracket indicate the points achieved in the pairwise ranking.	<b>The frequency with which the product was mentioned by the 14 farmers interviewed.</b>
Timber (several species) [14]	100%
Fuelwood (several species) [12]	100%
Nor Taw (palm shoot) [11½]	no farmer mentioned it
Rattan ( <i>Calamus latifolius</i> ) [11]	79%
Mushrooms (several species) [9½]	64%
Bambooshoots ( <i>Bambusa sp.</i> ) [9½]	100%
Phak Waan ( <i>Melientha suavis</i> ) [9½]	43%
Makiur Pong ( <i>Solanum torvum</i> ) [7]	22%
Flower of Banana ( <i>Musa sp.</i> ) [6]	50%
Phak Kuut ( <i>Diplazium esculentum</i> ) [5]	43%
Olive Tips ( <i>Olea sp.</i> ) [2½]	no farmer mentioned it
Mango ( <i>Mangifera indica</i> ) [2]	14%
Por Sa Leaf (Mulberry tree) [1½]	no farmer mentioned it
Wild Longan ( <i>Dimocarpus longan</i> ) [0]	7%

Other products were mentioned by the farmers interviewed but not mentioned by the 4 key-informants and therefore not included in the pairwise ranking. These encompass the following NTFP's:

**Table 3** Forest products mentioned by the 14 farmers interviewed but not included in the pairwise ranking. The dominance is illustrated by the frequency.

<b>Name of the product</b>	<b>The frequency with which the product was mentioned by the 14 farmers interviewed</b>
The stem of bamboo ( <i>Bambusa sp.</i> )	71%
Wild chicken	7%
Wild pig	29%
Phak Bung ( <i>Ipomea aquatica</i> )	7%
Fish (no species mentioned)	7%
Crab (no species mentioned)	7%
Turtle (no species mentioned)	7%
Squirrel (no species mentioned)	14%
Pausa ( <i>Sterculia sp.</i> )	7%
Mafei (no scientific name founded)	14%

### **Subsistencial Importance**

The interviews revealed, that the well-off villagers only use the products for household use but that some of the poor villagers get some off-farm income by selling some of the forest products. 5 of the farmers received a minor off- farm income by selling NTFP's at the market in Nan. 3 of them mentioned only 1 product and the last two used to sell 3 and 5 forest commodities, respectively.

The majority of the products were harvested far away from the village in the range of 5- 20 km from the village.

9 of the 14 informants stated that they would have difficulties surviving without having access to the forest because the income from the agriculture is not sufficient to buy the products harvested from the forest. The last 5 persons did not experience such a symbiotic relation to the forest even though they harvested a minor amount of NTFP's. They explained their less pronounced dependency with their ability to grow their own vegetables and replace fuelwood with gas.

### **Regulations and Demarcation**

Regarding the regulations, most farmers seemed to be aware of the prevailing rules and agreed with the limitations to the use. 8 of the informants had a comprehensive and almost complete knowledge about the rules and fines, 4 possessed a partial knowledge and 2 farmers showed an insufficient and ignorant insight in the restrictions and sanctions. This and the below mentioned division was made by a subjective categorising.

Despite this awareness we observed illegal logging within the community forest.

The majority of the farmers interviewed had a good and precise idea of the boundary of the community forest (57% of the 14 farmers) and the rest (43%) gave an overestimated idea of the extent of the community forest or possessed an indistinct knowledge of the place of the boundary.

The regulations regarding the permission to use the forest is characterised by an equal accessibility and is without any social differences.

### Interviewing the chief of Song Watershed Unit (Royal Forestry Department)

The interview revealed that:

- RFD accept Ban Mae Raems present settlement and extent of agricultural fields but will not tolerate any expansion of agriculture and any extensive logging.
- Mr Pramoun stated, that besides being allowed to harvest NTFP's, the villagers should have the permission to cut down timber for household use.
- Mr Pramoun emphasised the necessity for the communities within the conservation zone to possess and implement sound management rules and regulations to control the use of the forest so that the forest will maintain its ability to continue regeneration and growth.

### Results within the area of agriculture

#### Fields

Figure 5 shows the number of fields, which are cultivated or laid fallow by each household. In average the respondents had 5 fields, with extremes of 1 and 10 fields among which 0-5 were laid fallow. Farmers who had less than 7 fields had no more than 2 fields fallow, whereas farmers having more than 7 fields had 3-5 fields laid fallow. This indicates a trend of positive correlation between number of fields and length of fallow.

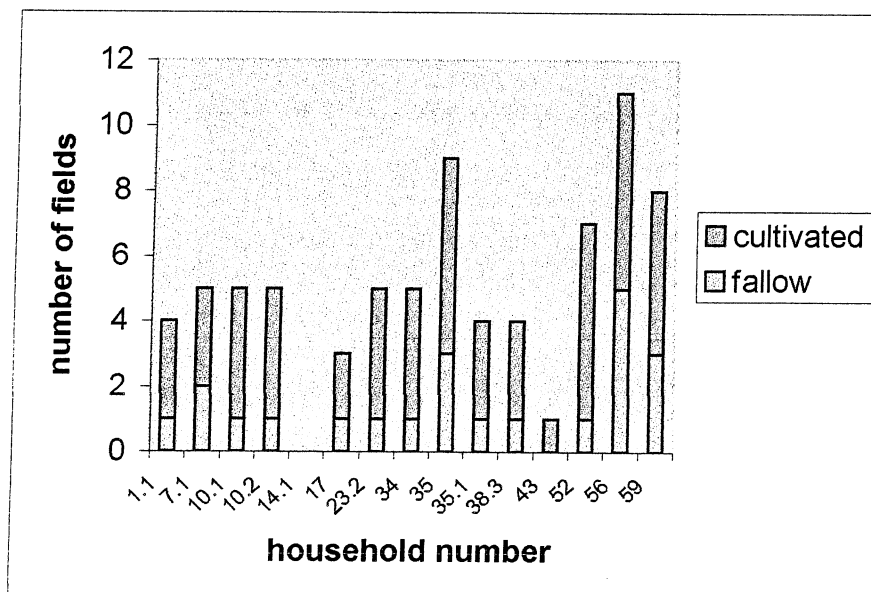
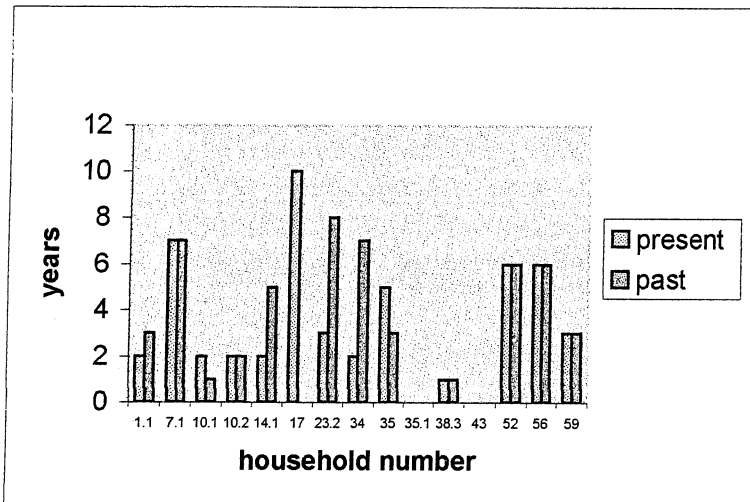


Figure 5 The number of fields cultivated or laid fallow by the informants.

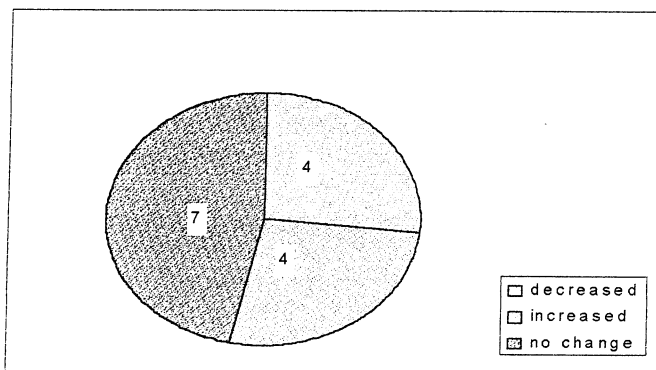
**Fallow**

As figure 6 shows, some farmers have changed the length of fallow. The fallow period is at present 0 – 10 years and this is also the case for the past (5-10 years ago). Some farmers have not changed their fallow period whereas others have increased it or decreased it. The extreme decrease is 5 years and the extreme increase 3 years.



**Figure 6** The change of the length of fallow from the past (5-10 years ago) to the present.

Figure 7 illustrates that 7 people have not changed their fallow period, 4 have increased it and 4 have decreased their fallow period. Increase in fallow periods is caused by lack of labour, decreasing soil fertility and transport difficulties to fields. Decreasing fallow periods is caused by land limitations and the need to show ownership of the land.



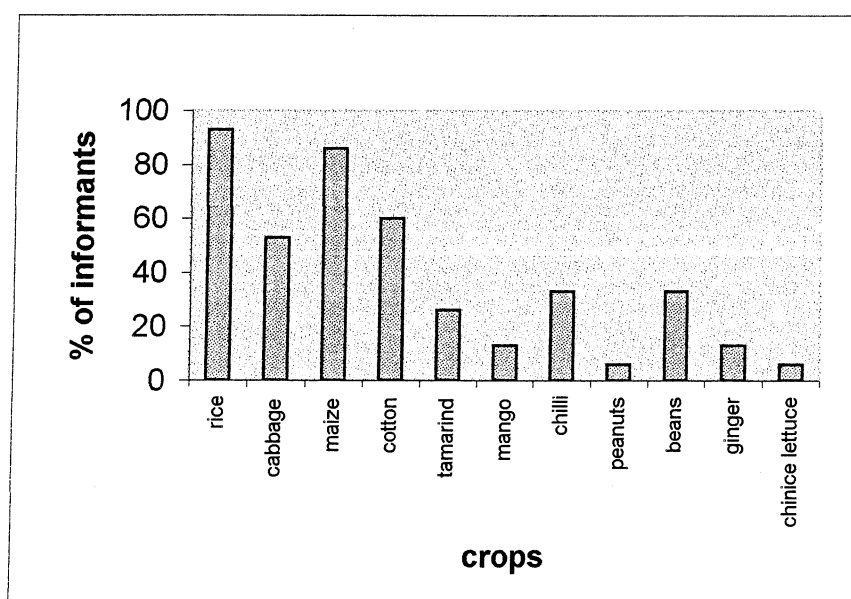
**Figure 7** Number of informants who have decreased, increased or not changed the length of the fallow period.

## Crops

Figure 8 shows the frequency of household growing the different crops. Rice and maize, which are grown by most households, are subsistence crops, whereas cabbage and cotton are the most frequently grown cash crops.

## Land tenure

None of the informants had land certificates but one who bought land certificate for one of his fields from a lowlander. All are interested in getting land certificates, but do not know how to get it.



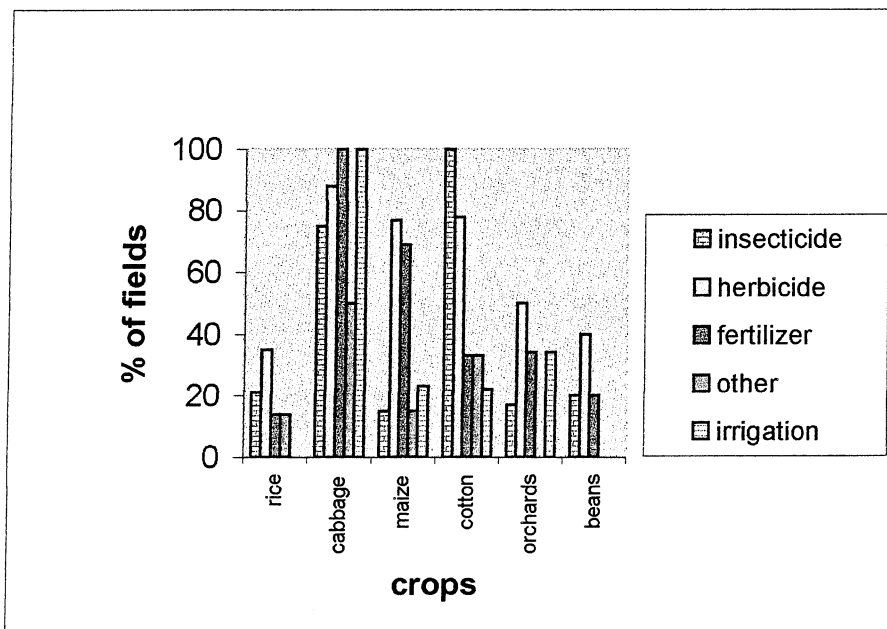
**Figure 8** Percentage of informants growing the different crops (n=15).

## Inputs

Inputs are used in form of fertilizer, pesticides, other chemical inputs, irrigation and labour. Figure 9 shows the frequency of inputs (labour and seeds not included) for different crops, and the figure shows that most inputs are used on the cash crops, whereas limited inputs are used for growing rice. Insecticides, herbicides and fertilizer were used for all crops. Other chemical inputs were used for cultivating cabbage, cotton, maize, corn and rice. Irrigation was mainly used for cultivating cabbage, corn and cotton. Three informants did not use inputs for cultivation.

### Pesticides

80% of the informants used herbicides and/or insecticides, while fungicides were only used by one household on a cabbage nursery. 20% of all the informants did not use any kind of pesticides for economic reasons.



**Figure 9** Percentage of fields where informants use various inputs for cultivation of different crops.

### Fertiliser

Fertiliser (organic and inorganic) was used by 80% of the informants. The most common was chicken dung and various formulas of NPK. The 20% of the informants who did not use fertiliser were identical with the household who did not use pesticides.

### Irrigation

35% used irrigation (sprinkler, pipelines and pumps) in cultivating their fields from BMR stream and Huang Mang Peng stream. Irrigation is mainly used on cabbage. Irrigation is used everyday in the dry season (oct.-mai/june) during the daytime. The amounts of water used are 12l./minute/sprinkler. There are no restrictions for irrigation, but in periods of water shortage



arrangements are made among the farmers. There are apparently no conflicts between highland and lowland farmers concerning water availability or water quality.

### **Labour**

There are two kind of labour used in agriculture: paid labour and labour exchange. It is common to work on other household's fields (90% of the informants) as well as having other people working on the fields (66% of the informants).

Workers are daily paid 100B. All farmers cultivating cabbage used labour from outside their own household, 63% of these used paid labour. Contradictory only 43% of farmers not cultivating cabbage used external labour, and none of these had paid labour.

### **Knowledge**

Knowledge about using chemical inputs comes from official channels (Agricultural Promotion Agency, Agricultural College, Soil Doctor), chemical industry, shop owner and from imitating other farmers and reading the labels. Traditional knowledge are used to improve the soil fertility, to increase productivity by protecting the crops against pests; ancestors feeding ceremony, new rice eating ceremony, burning joystick for good luck ceremony.

### **Income from agricultural production**

All farmers except from one (very poor household) gain income from commercial agricultural production. Agricultural products were sold in Rong Kwang District, in Nan, rural areas of Phrae and cotton is sold to cotton factories. It is not common to sell the product to the middleman (13% does). Farmers not having own means of transportation rent vans.

### **Off-farm income**

Among the informants, migration to Taiwan and temporary work in Bangkok was mentioned as ways of gaining off-farm income. It was stated, that 30 villagers had been working in Taiwan. Two of the informants were local shop owners and two others, had members in the household, who were officials paid by the government. 50 % have earnings from off-farm activities. No significant income was gained from tourism.

### **Loaning possibilities**

It is common to take loan (60% of the informants) mainly for buying seeds, plants, chemical inputs and fertilizer. In times of crises loans are also taken to buy food for consumption.

Loans could be obtained through the Bank of Agriculture, Community Committee Fund and through relatives.

### **Livestock**

73 % of the informants had a few domestic livestock. Pig, chicken and duck were the common species.

### **Soil analyses**

The results of the soil samples are shown in appendix F. Reference of soil sampling from mixed deciduous and dry evergreen forest shows that mineral exchangeable N and plant available P values are low and very low whereas value of K is moderate to high. The reason for the high value of K could be that the parent materials contain high amounts of this mineral. The parent material is mainly limestone ( $\text{CaCO}_3$ ) in the mixed deciduous forest where high values of pH were measured. The soil samples from the evergreen forest have the lowest value of pH, which is probably due to shale parent material.

The soil sampled from the cabbage fields where fertilizer recently had been applied, showed high amounts of  $\text{NH}_3$ , and P. On these fields ionised salt had also been applied which causes a high value of EC. From HH 52 soil samples from upland rice field where no fertilizer was applied, showed high amount of P and low amount of N. This could be due to burning as a part of land preparation.

Soil samples from fields with tamarind and mango (HH 35/1) left for 2-3 years without adding any kind of fertilizer show low values of N and P. Soil samples from a maize field of household 35/1 where chicken dung was applied could be the reason for a high level of P.

For all the fields from which we took the soil samples, we found moderate to high values of K, which we assumed are due to the parent material. In general, the fields have pH values between 6.1-7.3, and this pH value is not a limiting factor for plant growth in tropical areas. An exception is the orchard field with tamarind and mango, where the pH values are 4.7-5.3 and this is a limiting factor

for plants growth. The reason for the low pH value of these fields can be due to shale as parent material. The texture of all the soil samples can be characterized as loam. The soil could be characterized as ultisols.

### **Soil problems**

80% of the informants had observed soil erosion on their fields. They mentioned soil erosion as a problem because it causes a decrease in soil fertility and destroy the soil.

Farmers also mentioned hard soils as a problem. This was the case when 1) only N was applied as fertilizer 2) where the amount of lime in the water used for irrigation was high so it created a lime-layer on the topsoil.

### **Soil conservation**

To prevent soil erosion 47% of the farmers planted vetiver grass, which had been promoted by the government. To conserve soil fertility a common strategy was to grow beans and peanuts in rotation.

### **Hydrological analyses**

The turbidity measured for Ban Mae Ream River is between 2,04 –2,7 (Appendix G). The level increased moving down stream through the agricultural areas from the point of the headwater.

Therefore it seems like there are only small amounts of particles in the water, this indicate that soil erosion is not a significant problem at the time when we did the measuring (after the rainy season). EC values are between 0,41-0,47 and pH value between 7,8-8,4. The relatively high value of pH is due to a high content of lime in the water. Low values of EC show a low content of salt indicating that salinity should not be a problem in the area.

### ***Institutional Results***

In this section a selection of a few indicators have been chosen for the purpose of describing the prevalent institutions that we consider as imperative when analysing the institutions influencing the land management.

Inside the village the following institutions were found:

**Table 4** Illustration of the selected institutions surveyed within Ban Mae Raem

<b>Institutions functioning in the village</b>
<ul style="list-style-type: none"> <li>➤ Hill Tribe Development Center (HTDC).</li> <li>➤ Community Committee institution, self imposed restrictions.</li> <li>➤ Numerous of volunteer village activities.</li> <li>➤ Several projects, e.g. including planting Vertiver grass, Fruit trees usually facilitated by institutions within the village (HTDC), thus mostly financed by governmental funds.</li> <li>➤ Training activities and the spread of know-how were taking place both by intern and extern institutions, HTDC appeared to be the main training facilitator within the village.</li> <li>➤ Loaning institutions were prevalent within the village institutions especially the ‘Circular fund’.</li> </ul>

Exact distinctions from outside and inside institutions are difficult to do especially because government institutions usually fund the various initiatives inside the village, but the links we were told about is as follows:

**Table 5** Illustration of the external institutions.

<b>Institutions outside the village</b>
<ul style="list-style-type: none"> <li>➤ Agricultural Department District,</li> <li>➤ Extension Office,</li> <li>➤ The Hill Tribe Development Center</li> <li>➤ RFD</li> <li>➤ Funding for loaning institutions</li> </ul>

We had only few opportunities to talk to governmental officials why it is difficult to distinguish which governmental department organizes the various village activities, but the data we have shows that activities originates by the regional or local sub-department under the Ministry of interior and of Agriculture (Community Development Office, Sub-district Administration Office, Extension office etc.) which recently have institutionalized the different activities in Ban Mae Raem especially following the official ‘village’ status of Ban Mae Raem as a legitimate village in 1999.

## ***Analysis and Discussion of Results***

### ***Introduction***

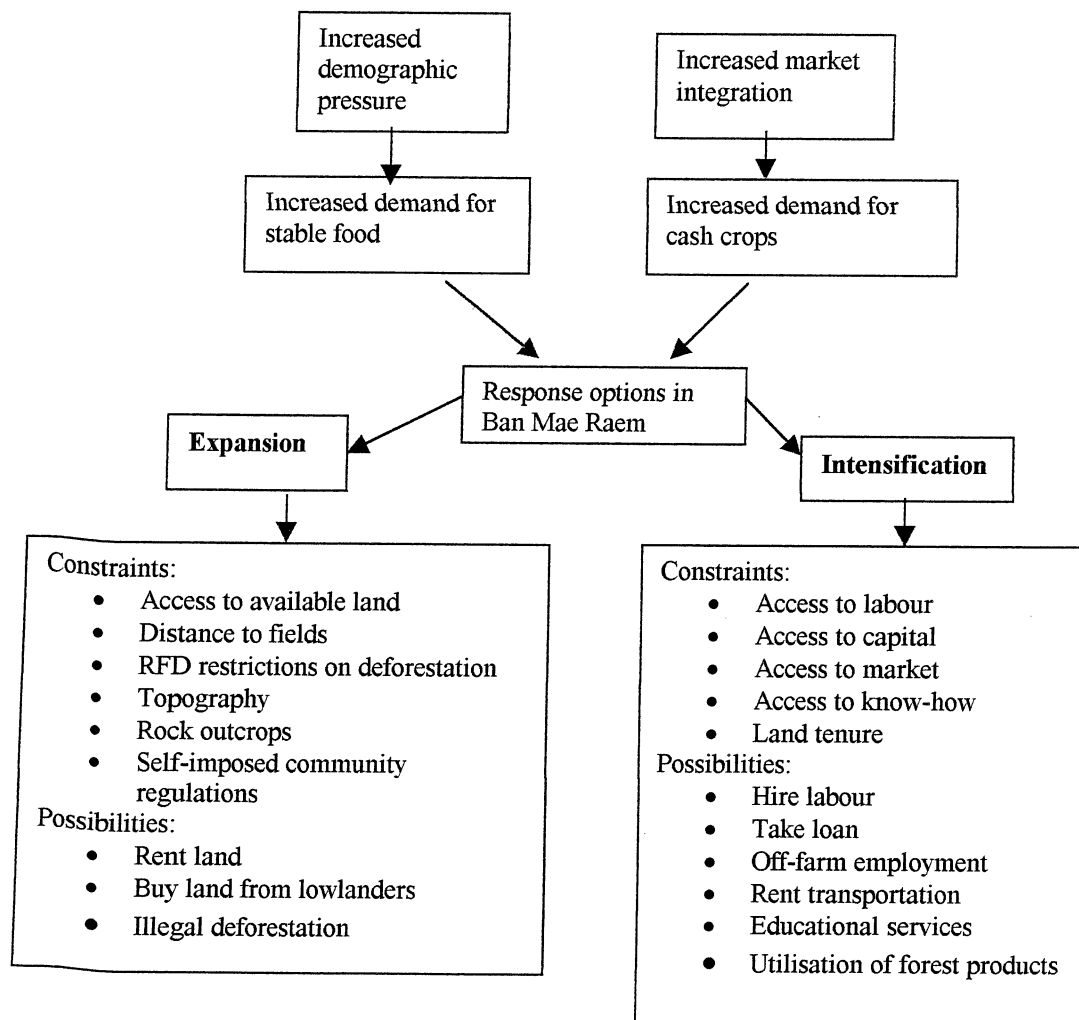
The analysis will attempt to assess the complexity of natural and social conditions influencing the land use. The analysis will illuminate various management strategies and consequences of these strategies and elaborate on the opportunities and constraints for a sustainable management of the resources in BMR.

These land use strategies can be seen as being influenced by demographic changes and the restrictions related to the official area classification. Furthermore, these strategies have to cope with changes and challenges of the environmental and socio-economical conditions. Several management strategies can be found functioning in BMR according to expansion possibilities, intensification possibilities, commodity production, consumption production and management of forest resources. These will be discussed with reference to Figure 10.

There are several theoretical traditions that yield different expectations of the relationship between population growth and agricultural growth. These can roughly be distinguished between those who expect a negative outcome (neo-Malthusian) and those who expect a positive outcome (Boserupian) (Turner et al; 1993). We do not have any attention of pursuing either of the theoretical positions, but will keep in mind that a variety of theoretical frameworks exist.

### ***Expansion possibilities and constraints***

By relating direct observation and various responses from the interviews, we find that there are limited land expansion possibilities. Quite a few of the fields were placed on slopes with a gradient measured as up to 53 %, which are limiting the agricultural use. Another factor is that the distance to the fields from the village gets longer as suitable agricultural land has to be found further away from the village.



**Figure 10** The figure shows the different options in response to increased demographic pressure and market integration in Ban Mae Raem. The constraints and options of expansion and intensification are listed.

Figure 7 shows that four informants had decreased their fallow period and intensified the use of inputs to increase outputs. Four informants had increased fallow period. One informant in this category had increased fallow period because the distance to the fields were too long, instead he would intensify the use of his other fields. This is a clear indicator of distance as a constraint to expansion. On the other hand some villagers had increased the fallow period because labour input was a limiting factor.

None of the respondents expanded the number and size of their fields by any other ways than renting, borrowing or purchasing surplus land. This indicates that the only way of expanding land is through access to capital.

Each farmer possesses the non-formal right to take use of the resources in the forest next to his field. It seems unclear if this informal right to use the forest goes as far as clearing the area

completely for expansion purposes. According to regulations set by RFD, expansion into the conservation forest is not allowed. Regardless of the official protection status, the community committee allows some sort of logging and forest extraction for the purpose of household use within the conservation forest. According to Mr Pramoun (RFD) the villagers should have the possibility to gain more benefits from the forests. RFD states that forest and populations adjacent to forest have to coexist. It implies that there is a governmental 'blind eye' largely accepting the gap between formal policy regulations and practical policy realisation.

Village representatives informed that village activities have rocketed with the recent establishment and assistance of the Hill Tribe Development Center that acts as the generator of numerous activities such as information about and distribution of Vertiver Grass and new farming technologies. The role of the community committee should not be neglected, as the institution to a large extent organise, implement and authorise the general regulations imposed by government institutions as RFD. Most of the villagers are aware of restrictions upon encroachment and forest exploitation which the community committee themselves impose villagers to respect with the instruments of rules and fines.

The importance of a thorough knowledge of the regulations should not be underestimated. It has ecological, political and institutional implications; it could imply potential mismanagement, bringing Ban Mae Raem into disrepute by RFD and indicate a lack of internal distribution of information within the village.

The village committee is also the institution handling cases about controversy over land ownership within the villagers of BMR. Even though we do not have data on the frequency of this kind of dispute most of the informants had knowledge about such cases and one respondent had decreased the fallow period because of fear that someone else would grow his land.

Controversy over land ownership could also be seen as a consequence of lack of land tenure. But most of the respondent highlighted that holding an official land certificate specifically was important in relation to uncertainties such as protection against reforestation programs in the future. The headman mentioned that the villagers showed greater respect towards the resources since the acknowledgement of their settlement a year ago. Lack of land tenure can also be seen as a constraint

in access to capital as the land cannot be used as loaning deposit, this can limit the initiatives to major land investment such as terracing.

The ability to organize and institutionalise regulations seems like an essential prerequisite for sustainable resource management and possibility to avoid conflicts.

### ***Intensification possibilities and constraints***

When there is limited possibilities for expansion of cropping land, then growing the same plot longer by shortening the fallow period, and/or cultivating the field using more inputs to avoid decreasing yields is another option. Intensification might be applied under conditions where the pressure on resources are increasing. Intensification in BMR can be seen as a response option to both increasing market and subsistence demands as well as access to new technologies. The different options for intensification in BMR are listed in Figure 11.

<b>Land investment</b>	<ul style="list-style-type: none"> <li>• Soil mangement (Vertiver-grass)</li> <li>• Irrigation system</li> </ul>
<b>Technology</b>	<ul style="list-style-type: none"> <li>• Sprinkler, pipeline, pump</li> <li>• Ploughing</li> </ul>
<b>Capital inputs</b>	<ul style="list-style-type: none"> <li>• Fertilizer</li> <li>• Manure</li> <li>• Chemical inputs</li> <li>• Pesticides</li> <li>• Hybrid seeds</li> </ul>
<b>Labour inputs</b>	<ul style="list-style-type: none"> <li>• Paid labour</li> <li>• Labour exchange</li> </ul>
<b>Change in land use pattern</b>	<ul style="list-style-type: none"> <li>• Cash crops (Cabbage, Cotton)</li> <li>• High yield varieties (Hybrids of maize)</li> <li>• Utilisation of forest products</li> </ul>
<b>Knowledge</b>	<ul style="list-style-type: none"> <li>• Training programmes and institutions</li> </ul>

**Figure 11** Various indicators of intensification in Ban Mae Raem

In BMR we found a correlation between the use of new technologies such as irrigation, chemical fertiliser and pesticides as well as ploughing and farmers growing cash crops. Especially crops for commodity production (cabbage and cotton), are grown very intensive with high input requirements (Figure 9). Furthermore, use of Vertiver grass and various kinds of beans and manure were used to minimise erosion and improve soil fertility, respectively.



In the process of intensification labour availability is necessary, as the same plot of land has to be worked more intensely in order to give the same or higher amount of output. In BMR both men and women are working on the fields. All the respondents growing cabbage use a surplus amount of labour (other than people from the household), whereas those household not growing cabbage only use surplus labour to a limited extend and only as labour exchange. Labour showed out to be a limiting factor for further intensification, one household mentioned that it was only due to the fact that people had come back after the economic crisis in 1997 that they had shortened the fallow period. Another household mentioned that he had given up cultivating some plots because of the overwhelming amounts of weeding that had to be done. Other household's strategy was to use quite large amounts of herbicides to fight the weed.

When considering the sustainability of agriculture in BMR, it is relevant to correlate herbicides and labour as input for fighting weeds on the fields. Firstly, since nearly all the respondents use herbicide and secondly since we have revealed an insufficient knowledge about handling chemicals. It seems like labour availability is limited because all the households that we knew of have to work their own fields before working on other peoples fields. Furthermore, herbicides are relatively cheap and the loaning institutions in BMR makes it possible to take minor loans on a short-term basis and thereby obtain capital for purchasing such chemical input. The above-mentioned conditions seem to cause that herbicides are preferred to labour and thus indicate potential environmental and human consequences.

In the long term knowledge and access to knowledge about the appropriate technologies seems to be crucial. In the field work, we encountered several evidence such as problems with the topsoil hardening, low yields from orchards, dangerous handling with chemicals and difficulties in estimating amounts of chemical input, which indicate that insufficient knowledge is a problem and could be a limiting factor for further sustainable intensification.

The local Agricultural Extension Office performs training activities to promote more sustainable farming practises and the Department of Community Development officers informed that they try to alter perceptions and make villagers think about the natural resources. Most of the villagers knew of training and various projects aiming more sustainable farming pattern in the village. Despite the training activities the effects are limited due to the villagers scarce resources and limited time to

participate. Training in sustainable land use could be one of the institutional factors influencing and perhaps alleviate the negative environmental impact of farming.

In return, the training institutions could be analysed and discussed for the purpose of drawing into question the institutions methods, their knowledge about the local farm land condition, the socio-economic status of the villagers being able to participate. In short, what would make the training successful, and is it actually durable in the highlands?

When we are discussing intensification in land use practices, we also have to consider the villagers use of the forest. The access to use the forest among the villagers is without any social restrictions but despite this social equality people who owns a truck has the possibility to get hold of products from forests further away. Another aspect that we have to remember is that access to and use of the forest is crucial for subsistence use, specifically for poor households. In the following we will therefore discuss the possibilities for sustainable intensification of forest resources. The interviews and the direct observation indicated that Ban Mae Raem try to protect the forests by means of regulations and fines aimed at the size of the trees extracted and the purpose of the harvest. But protection of the forest by means of a maximum size of the trees logged seems like an inefficient and insufficient conservation strategy.

A more sustained protection could be a situation where the saplings and smaller trees are preserved in combination with a very low harvest rate of the bigger trees. Investigations of volume growth for species or groups of species would reveal the maximum volume to be harvested annually and indicate the diameter for optimal volume production (ITTO-Guidelines, July 1992). Some medium sized trees could be selected and labelled to make sure that populations of big trees are maintained. A selective logging management should pay attention to that the population of the single species will survive and that the extraction of timber is equally distributed in the forest (Nebel, 1999). A more sophisticated management scheme with felling restrictions, minimum diameter cutting, labelling of trees for cutting and preserving and mapping the logging actions would improve the possibilities for increasing the extraction level in a sustainable way. Furthermore, a more regulated and controlled management approach could also serve as a way of justifying Ban Mae Raems existence in the conservation forest towards RFD. RFD perceives proper management as a prerequisite for the communities to stay within the conservation zone (Mr. Pramoun, RFD,

pers.com.). Even though, RFD is accused of being opponent of implementation of community managed forest systems because their administrative authority will be weakened and because they do not trust the local's ability to manage the forest resources (Ettrup, B. et al., 1998).

The construction of a road is a high priority for the headman as the very prosperity of the village depends much upon the road conditions, which make the transport of products a difficult, and sometimes a hazardous task. The village is close to an agreement with the government about funding the road construction that is highly regarded because a road would make market accessible as well as off farm activities in the adjacent communities easier. Henceforth, this could even suggest that off farming activities and income could substitute farming and make alternative income possibilities in the long term. As such the bad road conditions represent a constraining factor for the economic activities of the village.

## ***Discussion of Methodology and Methods used***

It will pay first, in this chapter, to briefly consider some of the general "lessons learned" that have arisen during our methodological approaches

### ***Discussion of Methods in General***

This chapter will include some of the initial considerations, precautions and assumptions according to how the research at the field trip was done and if this has happened in accordance with the general methodological concepts of doing research.

#### **Reliability**

Usually research need to meet standards that will reveal if the research questions (the variables/indicators) produced consistent answers which was not subjects for various deviations (Neuman 1997: 138) If the indicator was ambiguous it would yield varied answers which indicates low reliability. Reliability is not excluded to the process of making consistent retest of methods. Reliability concerns also if however our respondents from the three income groups could answer

correspondingly to the same indicators. The questions we asked basically yielded the same category of answers. Some of the questions asked yielded dissimilar answers. This happened because of different knowledge, experience and livelihood etc. but also because that the character of some questions were ambiguous. The ambiguity was in some cases enlarged by the use of interpreters. To some extent the interpretation also suffered from inaccuracy, which influences the reliability.

Did the respondents trust us and felt confident about us? Did they try to please us giving the 'right' answers? Were they in a situation where they wanted to paint a positive picture of the land use? These questions are related to reliability. The fact that the villagers of BMR are an ethnic minority located in a conservation area and are accused of drug trafficking emphasise the actuality of the above mentioned questions as important biases. This caused the respondents to be cautious and suspicious answering the questions.

### **Validity**

Validity concerns if however we succeeded measuring the problem that we want to investigate (Andersen (red.)1994:77). We could discuss for example if we succeed to investigate social links to various reasons for finding soil-erosion, land degradation. A problem of validity could be if we did not ask the right questions, meaning that we failed to address the physical problems with the correct social correlation, leading to a misinterpretation of the casual relation.

A better point of certainty for the indicators chosen could be achieved by comparing answers with records, documents, papers etc. that would give a parallel indicator of, lets say, training activities. This would have been too much use, but it was not possible to get such information on location. A reasonable approach would have been to corroborate interview data with information from other sources. Our main problem was the use of limited sources of evidence. The study could have been strengthened if it was based on a use of multiple sources of evidence.

### **Gender Bias**

Often the men were most familiar with Thai language and at first sight knew most about farming practices, forest regulations and prevailing institutions. The women were very shy and afraid to talk to us. The majority of the interviews were carried out with males. The females might have

contributed with comprehensive knowledge about medical and ceremonial plants used, organisation of labour within the household etc.

### ***Time Limitation***

The field trip was carried out within the strict limitations of what one might call 'time and space' as we had limited time (only 10 working days at the location) and we had limited possibility to visit e.g. crucial government offices and representatives. This means that formal data about regulations, public policies and programs etc. could have served as a tool and foundation for analyzing specific themes at the location. Our research includes therefore some exploring with the intention of learning as well as searching for specific research questions.

Because of the length of the interviews, ranking sessions of annual output and input could not be accomplished. Such data could have helped us to correlate increased input with output over a period of say 5-10 years.

### ***Locating Respondents and Fields***

Locating the household in the village according to the household numbers and names from the household list turned out to be very difficult as quite a few of the villagers did not know people by household numbers and the similarity of family names made it very confusing to find out who was who. The same problem was encountered at the fields; even though we had the participatory map from the interview it was difficult to be absolutely sure about the owner of the fields. The most successful way was to go out with the owner to the field and conduct the interview on his field, followed up by taking relevant soil samples. But, because all the farmers left early in the morning this strategy could only be used to a limited extent, and most of the interviews were held at night in the village. The amount of interviews were therefore reduced to 15 instead of 20, and we chose to interview some of the farmers twice, these second interviews were conducted in order to get supplement information about yields and amounts of fertiliser and pesticide used on specific fields from where we had taken soil samples.

## ***Agricultural research***

Answers about the size of the field are very difficult to rely on. Firstly many people did not know the size in rai of their fields and could thus not answer questions concerning size of fields. Secondly others might have over- or underestimated the size of their fields when answering the questions. The reason for this insecurity is properly the fact that the fields are not officially measured as hardly any had land certificates and the farmers themselves do not know the metric size of the fields. In some cases we measured the area by GPS, but encountered problem with limited knowledge concerning metric values for input. This turned out to be problem, in trying to do the calculations for the amounts of fertiliser and pesticides applied to the various kinds of crops/rai, and we had to abandon those kinds of calculations.

Another methodological problem that we encountered is related to the research subjects for the agricultural subgroup. In the beginning the objective was to collect data about the impact on soil and water of the present farming practices. But, it turned out to be very difficult to measure direct impact on soil and water firstly because of limitation in the equipment, secondly because of time limitation, we could not analyse a sufficient number of samplings because of the drying time, thirdly is it difficult to conclude upon the result from the soil and water analysis, as the results are highly dependent on different factors which are influencing upon the results. Instead of concentrating upon the impacts we therefore changed the objective for agriculture to focus on intensification of land use in BMR, by analysing expansion possibilities, new technologies, labour, capital and flexibility and compare this with the results from the soil and water analysis.

## ***The institutional research***

The institutional sub-group found it necessary to ensure that the sample chosen included respondents from the different social categories, for the purpose of learning about different experiences with the village institutions. But this turned out to generate some immediately methodological considerations as depicted in the following section.

The way of organising the different groups from where the stratified sampling was done is of course highly questionable. In this case it is Mrs. Wilailuk perception of the social groups and not a

completely randomly selection. However, by using a villager's perception of low, middle and high income we attempted to ensure that the respondents belonged to different social groupings. Alternatively we could have chosen to do an unconditioned random sampling but the variables concerning family heritage and social status could then maybe prove not to have received a prominent position in our research.

The importance of training and loaning institutions is difficult to measure. We did not have access to data informing about percentage of villagers participating in such activities, neither within the village nor compared with more general figures of the district. We only had the assumptions based upon the prevalence of Extension office services, rural development plans and our own pre-assumptions.

### ***Forestry research***

Concerning the sampling method within the field of forestry the selection of households within the chosen squares should have been done in accordance with the number of households within each square and not considered as being of equal importance.

The pairwise ranking at the key-informant meeting showed up to be a convenient and well informing method to get a picture of the importance of the different crops harvested from the forests, but more people should have participated and the ranking should have been based on the products mentioned by the farmers interviewed and not by the four participants.

### ***Final Comment***

The approach applied at the field trip was not exclusively a matter of investigating determined fixed variables, theoretical assumptions and so forth which would have made the research more open and sensitive to methodological critique. For this particular group it is also a matter of simply learning about the internal and external farming conditions, land use techniques and individual perception of using the surrounding environmental resources, that have guided our approach.

Furthermore, it should be stressed that a major purpose of the project was to get to know how to cope with the challenges of interdisciplinary and intercultural co-operation. It turned out to be a

difficult task, where issues like definition of important concepts, sharing of information and being open minded and listening were experienced as being necessities for completing the field research in a 'sustainable' way.

## ***Conclusion***

Our statement of the problem was to investigate resource management strategies in BMR and their consequences. Followed up by discussing opportunities and constraints for sustainability. What did we find out?

Local strategies have to be seen as an interaction with the surroundings. We therefore attempted to correlate resource strategies of forest and agriculture to institutional strategies.

We found that there seems to be an increased pressure on the resources due to population growth. Expansion strategies are limited due to both internal and external regulations. Most farmers are growing both subsistence and cash crops. The subsistence crops are grown with a minimum of input compared to the cash crop, which require a high input in terms of labour, capital and knowledge. Compared with a tendency by some farmers to shorten the fallow periods this points to an intensification of agriculture.

We found that some of the direct consequences of intensification are a dependency of labour availability and market access. Also access to capital seems like an important issue both in purchasing different input and to resist crisis situation.

9 of the 14 farmers interviewed within the field of forestry stated, that they would have difficulties surviving without having access to the forests because the income from agriculture is not sufficient to buy the products harvested from the forest. The commercial value of the forest is at present of minor importance compared to the subsistence value.

The villagers have managed to take care of their 'own' forest resources indicated by the fact that the forests surrounding the village (Community Forest, Graveyard Forest and Spiritual Forest) have not



decreased during the last 11 years. This is mainly due to the fact, that most of the products are harvested between 5-20 km from the village in the National Forest (Conservation Forest). The extent of deforestation, which has taken place in the National Forest adjacent to the village, was not investigated.

When considering the sustainability of the strategies we take point of departure in our definition. When attempting to assess the villagers ability to maintain or enhance the productivity it should be stressed that the water and soil analysis did not yield evidence that allow us to conclude that the present land use strategies are unsustainable.

We identified a need for a more comprehensive and sophisticated protection and management of the forest if the forest should be able to meet the future needs. Interviews indicate that the community-based restrictions appear to function partially. Though, it appeared that the village possess the institutional framework, the experience with collective management and the awareness of the importance of the forest to carry out a sustainable forest use.

When considering the sustainability of agriculture on a long-term basis training and loaning services resemble valuable opportunities for sustainable land use strategies. Training services is widely known but a majority of the informants do not participate. Training and extension services do not succeeds targeting all groups in the village and sometimes it fails to deploy the relevant knowledge for interested parties.

Similarly, the loaning services are crucial as a management tool for many villagers, which expands the opportunities for adapting different farming strategies. But it is important to stress that the loaning institutions do not specifically favour the concepts of sustainability. However, the potential for promoting sustainable land use exists and the perspectives for accomodating more sustainable land use strategies exist within the well-integrated institutional framework.

The villagers of BMR possess a variety of strategies, which improve the flexibility of the village. These strategies encompass the cultivation of diverse crops, extraction of forest products, livestock and access to loaning possibilities. These strategies improve their ability to cope with environmental

and economical fluctuations. But, there is a need to handle the political instability such as lack of tenure rights and RFD reforestation policies.

This conclusion has to be seen in the light of the methodological problems we encountered and should not be seen as an absolute picture of the 'reality' in BMR. We have not investigated all aspects and areas in the conceptual space of sustainability. The study can inspire to further research such as the formal and informal relations between the state and the village, participatory approaches to action oriented research, prevalence and potential use of agroforestry and monitoring the land use by GPS/GIS. Comparative analysis between other Hmong settlements could also be interesting.

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- 12) How do you take care of the regeneration of different species?  
Do you plant some timber or fruit trees in the community forest?  
What kind?
- 13) How do you cut down the trees?
- 14) Is there any plantation projects in the area?  
What organisations are responsible for the plantations?
- 15) Do you know what kind of species which are used in the plantations?  
What do you think about the plantations?  
Do you think the species used in the plantations are suitable for the area?

## Appendix B

### **Forestry interview guide - Questions for OBT-officer and the headman concerning the regulation of the forest areas**

Name:

Age:

Sex:

“Position” in the village:

- 1) What kind of community forests do you have and how do you differ between them?
- 2) Do you know the size of the community forests?
- 3) What is the history of the area?  
Have the size of the community forestry been declining or increasing? (What was the size of the forest for 20 and 10 years ago?  
20 years ago:  
10 years ago:
- 4) Is there any organisation to take action in community forest management?  
What organisation?  
If yes, Any meetings, how often?  
Who is in charge of the use and management of the forest?  
How do you make the decisions? How do you solve disagreements?  
What is the purpose of the “management” of the forest? (subsistence and/or commercial products?)
- 5) What kind of regulations exist?  
How do you take care of the regeneration of tree species? (protection, weeding, nursery-plants etc)?  
How much timber and for what purpose are you allowed to cut down the tree species?  
Do you have any regulations about the harvest of herbs and fruits?  
How much and during what time of the year?
- 6) Have the village changed the regulations?  
What kind of regulations did the village have for 10 years ago?
- 7) Do the village have any sanctions if the regulations are broken?  
What kind?
- 8) Are all the people allowed to use the community forest?  
How do the villagers get permission to use the community forest?  
(Is it the rich or the poor part of the village that use the forest or depend on it?)
- 9) Do the village experience any problems with non-members or people from other villages harvesting from the community forest?
- 10) Do you have any conflicts about the management of the community forestry?  
Do you find any conflicts within the village?
- 11) Do the villagers have other experiences with collective management? (like irrigation systems, purchasing of chemicals and fertiliser?)
- 12) Do the people from the village sell any products from the forest on the market?  
If yes, how is the money from the market distributed?
- 13) Do the village receive any support about the management of the forest?  
If yes, where do you get this support?
- 14) If no, would you like to get some advice/support?
- 15) Do the village have the legal right (possess title deed) to use the forest? Is the forest considered as state or communal property?

16) If there is a legal right, how is it authorised? Do the village have any contractual arrangement with the state/RFD?

17) If there is no legal right, how do the village work on getting the permission to manage the forest?

How?

18) How is the communication with the local forest authority/RFD?

Have the village had any conflicts with RFD?

When and what kind?

19) What do you think the forest will look like in 10 and 20 years?

20) Do you have enough forest areas?

Do you need to increase the area?

21) Have you had any forest fires?

How often?

Where did it happen?

What is the causes of the forest fires?

Do you have the equipment and knowledge to prevent forest fires?

22) Is there any plantation projects in the area?

What organisations are responsible for the plantations?

23) Do you know what kind of species which are used in the plantations?

What do you think about the plantations?

Do you think the species used in the plantations are suitable for the area?



## Appendix C

### **Agricultural interview guide – Question to farmers**

Semi-structured interview and participatory ranking with head of the household/farmers

#### **Household**

Household number/name?

How many men, women and children live in the house (age/gender)?

Ethnic group:

Citizenship:

Age:

#### **Fields, crops and fallow period**

1. How many fields and rai do you cultivate ?

2. Does this include those that are laid fallow?

*If yes - How many fields and rai?*

*Where are your fields situated, fallow and crops grown (participatory mapping)*

*(Works well by turning this paper and letting the farmer draw on it)*

3. Please mention all the crops you grow and how many fields and rai of each crop?

4. How long are your present fallow periods?

*Have the fallow periods increased or decreased during the past years?*

#### **Labour and tenure**

5. Do other people (than the household) work on your fields?

*If yes - Do they get paid?*

6. Do you, or people from your household work on fields owned by other people?

*If yes - Do they get paid?*

7. Do you have land certificate for all/any of the fields you grow?

*If yes - what kind of land certificate is it?*

*When was it issued?*

*If no - Are you trying to get a land certificate?*

8. What does it mean to you to have a land certificate?

9. What if anyone starts cultivating your land?

*Do you have any way of claiming your land?*

10. If you had a land certificate would you cultivate your fields different?

*If yes - In what way would it be different if you had land certificates?*

11. Do you have more fields/rai now than for five years ago?

*If yes - how did you get them?*

*If no - do you want to expand your field?*

12. Have you observed any soil erosion?

*Is soil erosion a problem?*

*If yes - how/why?*

13. Do you have any way of preventing soil erosion (how)?

14. Do you have any way of conserving the soils (quality) in the fields (how)?

### Chemical inputs

15. Do you use pesticides?

Type of pesticides	Used on which crops.	How much is used	Others
Insecticides			
Herbicides			
Fungicides			

16. Do you use fertilizer (organic/ inorganic)?

Type of fertilizer	To grow which crops.	How much is used	Other

17. Do you use other chemical inputs? (such as hormones, lime)

Type of chemical input	On which crops	How much do you use	Other

18. What else do you do to increase productivity?
19. When did you start using inputs?
20. Do you receive any information or advice about how to use the chemical inputs (soil doctor, extensive service, where you buy it, private etc.)?  
*If yes - from where?*  
 Do you think that the chemicals you use on your field can effect the water quality (How)?
21. Which soils are the most productive?  
 How do you know which soils are the most productive?
22. Do you have some traditional knowledge/some special Hmong knowledge to increase soil quality/fertility/productivity ?
23. Do you have any problems with soils?  
*If yes - What are the problems (which fields)?*

### **Irrigation**

24. Do you use irrigation, on which crops?  
 How do you irrigate ?  
 What kind of different irrigation systems do you have?  
 When do you irrigate (day/night, time of the year)?  
 When using irrigation, for how long a period do you use the irrigation (hours, days, weeks, months)?
25. Where do you get the water from?
26. Are there any restrictions or limitations on the use of water?  
*If yes - have you been restricted from using the amount of water that you wanted?*  
 Have you ever experienced that there was not enough water?
27. Have you ever experienced any conflicts about the use of water among villagers from Ban Mae Ream and villagers from the lowlands?

### **Off-farm income**

28. Where do you sell your products?  
 Do you sell the crops yourself or do you use middleman?
29. Does anyone else but you earn money for the house?  
 Is there any people living away from the village who send money to you?
30. In case of crisis (bad harvest) do you have any loan possibilities (interest)?  
 Do you take loans from cooperative communities or can your neighbours help you in bad times?
31. Do you have some special Hmong ceremony that you practice, please tell us why and how you do this?
32. Do you have any livestock (what is it used for food/cash)?
33. Ranking session ask the farmer to compare – if the number of rai was the same
1. time spent on the different crop
  2. amount of pesticide
  3. amount of fertilizer
  4. food value
  5. cash value (if possible try to ask for amount (number of sacks, kg/sacks, price for sacks)

*Ranking session according to the most important crops in term of money income, food value, time investment etc..*

*Lowest number: most important/highest amount  
 Highest number: least important/smallest number*

Crop	time spend	Pesticide	fertilizer	Harvest per year	Irrigation	Food value	cash

**34.** How do you feel about the tourist coming to Ban Mae Raem?

**35.** Have you ever had any income from tourism?

What do you think of more tourism coming to Ban Mae Raem (good things/bad things)?

What do you think is of interest here in Ban Mae Raem and the surrounding area to show to tourist?

*General observations during the interview:*

## Appendix D

### *Institutional interview guide - Question to villagers*

Names :

Age :

Household member :

Position :

1. Do you participate in any community committee arrangements? If yes, what kind?
2. Do you have any topics that the community committee have handled?
3. Do you think that the community restriction are acceptable?
4. Can you think of any community cooperative? for example funeral fund, healthcare volunteer and housewife group?
5. Can you think of any projects in Ban Mae Ream arranged by the community?
6. Do you know about land development Department (LDD) projects? for example about planning fruit tree etc.
7. Do you know about restriction of RFD's policy?
8. What do you think that after RFD's restrictions has effected you farming practices?
9. Have you had or Do you receive any advice or formal/informal training or advice of any sort about how to practice farming? for example neighbour to neighbour advice, family advice, advice from LDD, Agriculture Extension Office and OBT etc.
10. Have you also been advised in the usage of any agronomic substances/non-chemicals etc.?
11. Where do you get the pesticide of fertilizer from and do you cooperate with others when buying it?
12. Do you know about money loaning institution in the village?
13. If you need money, what do you do?
14. Do you know about soil erosion in you fields?
15. Have you ever been encouraged to prevent soil erosion?
16. Do you know of any disagreement about water resource etc.?
17. Do you believe in any spirits? if yes, Can you describe if possible how this might influence you action/practices at his fields/forest?
18. Do the spiritual doctor help you?
19. Are there any spiritual rules that are more strict than the community committee rule?

## Appendix E

### *Institutional interview guide - Question to community committee members*

1. Do you think that the community restriction are acceptable?
2. Can you try to mention the different community cooperative in Ban Mae Ream?
3. Can you think of any project going on Ban Mae Ream?
4. Do you know about land development department (LDD) project?
5. What do you think that after RFD's restriction/regulation has effected the farming practice in Ban Mae Ream?
6. Have the farmers receive any advice or informal/formal training or advice of any sort about how to practice their farm?
7. Have you also been advised/trained in the usage of any agronomic substances/non-chemicals etc.?
8. How many land management project and training activities?
9. Who are the teachers conducting the training?
10. How many villagers receive this sort of training? How about in the practical way?
11. What kind and how many loaning institution take place in Ban Mae Ream and who organise them?
12. For what purposes to do villagers borrow money?
13. Are these restriction about how money should be utilised?
14. Who and what institutions arrange projects and activities?
15. Does the different government institutions perform training? What sort and How many resources are used upon village training projects?
16. Is the Ban Mae Ream somehow neglected compared to other villages, in terms of getting resources?

## Appendix F

### Soil Analysis in Ban Mae Raem

Source	crop	texture	color	P	K	pH	EC	remark
Forest	Mix deciduous	loam	reddish brown	low	high	6,7	0,18	depth 15 cm
		loam	reddish brown	low	high	6,2	0,108	depth 30 cm
	Dry evergreen	loam	reddish brown	low	high	5,1	0,18	depht 15 cm
		loam	yellowish red	very low	moderate	4,6	0,108	depht 30 cm
		loam	yellowish red	very low	moderate	4,6	0,072	depht 45 cm
HH No. 52	upland rice	loam	yellowish brown	very low	high	6,7	0,288	
HH No. 10/1	cotton	loam	dark yellowish brown	moderate	high	6,1	0,324	
HH No. 1/1	fallow	loam	strong brown	high	moderate	6,1	0,18	
	cabbage	loam	strong brown	high	moderate	7,3	0,9	
	cabbage(old maize)	loam	strong brown	high	moderate	6,1	0,144	
HH No. 7/1	upland rice	loam	dark reddish brown	moderate	high	6,1	0,144	
HH No. 35/1	tamarind	loam	strong brown	moderate	high	5,3	0,144	depht 15 cm
		loam	yellowish red	low	moderate	4,7	0,036	depht 30 cm
	mango	loam	strong brown	low	high	5,3	0,0114	depht 15 cm
		loam	red	low	moderate	4,9	0,39	depht 30 cm
	maize	loam	reddish brown	high	high	6,6	0,216	
	fallow	loam	reddish brown	very high	high	6,5	0,396	

## Appendix G

### *Water analysis*

Point	turbidity	EC	pH	East-value	North-value
1	2,04	0,41	8,4	647606	2043084
2	2,24	0,45	8,3	646588	2043482
3	2,03	0,47	8	646199	2043780
4	2,42	0,41	7,8	645469	2044230
5	2,7	0,44	8,1	643574	2043457