SLUSE Interdisciplinary Joint Basic Course, 2000

Field study in Phrae Province, Northern Thailand

"The Consequences of Mae Song Reservoir on Livelihood Strategies in Ban Tao Pun"

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Content

Abbreviations

MSR: Mae Song Reservoir
BTP: Ban Tao Pun
HCV: President of the Health Care Volunteers
HWG: The Secretary of the House Wife Group
AEO: Agricultural Extension Office
RIO: Royal Irrigation Office

Abstract

The objective of this report is to investigate the effects of the Mae Song Reservoir on livelihood strategies in Ban Tao Pun. The steady water supply from the reservoir has led to an intensification of the agricultural production and changes in crops and crop rotation. A substantial increase in contract farming was detected, but the implicit management of soil nutrient input lacked development to comply with the increased output, in order to avoid soil nutrient imbalance. The increase in contract farming was related to the reservoir construction and the fertile alluvial sediments. The construction of the dam has in certain aspects influenced the sustainability of agricultural production, economy and institutional aspects.

Remarks: It must be stated that the report has its weaknesses. These are apparent in the methodology description where the purpose of the applied methods is not thorough described. The obtained results have not been discussed comprehensively in relation to the presented sustainability definition.

Acknowledgement

It has been very enlightening and valuable to affiliate the SLUSE Joint Basic Course, 2000 and we would like to thank DANCED for making this possible. We are also very thankful for the co-operation between the Thai and Danish universities in the TUCED-SLUSE programme and the engagement of the teacher staff, at the field course in Phrae Province. Special thanks must be given to the supervising teachers and our Thai colleagues at location 2. Last, but not least, our deepest thanks go to the villagers in Ban Tao Pun, Phrae Province for spending time with us and providing valuable information.

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1. Introduction to Northern Thailand

"...Although economic differences exist between South East Asian countries, they have similar environmental problems, such as: overexploitation of their natural resources, deforestation, decrease in land fertility..." (DANCED, 2000)

The above conditions of natural resource management and land use in South East Asia are reflected in rural Thailand, which has been increasingly linked to market economy, hence urban and global economy, like in many other countries in the region. (Buch-Hansen, 2000)

Since the 1950's Thailand has experienced a rapid economic growth. This was initially based on an use of the natural resources, but has become increasingly dependent on manufacturing industry in the urban areas. In 1994 about 60% of the labour force was employed in the agricultural sector, but it's share of GDP was only 12 % (Fairclough & Tasker 1994). The economic crisis in 1997 once again shifted emphasis towards the agriculture sector, creating greater pressure on the natural resource base. Presently, all land suitable for agriculture has been used (DANCED 2000). This was partly due to many temporary workers in the cities lost their job and returned to farming. The ones suffering most were the small-scale farmers being dependent on off-farm income (Buch-Hansen, 2000).

Since the 1970's Thailand has been a net importer of timber, primarily because the growing rice production in the country has been based on expansion into forest areas. From 1950 to 1980 the rice production increased by more than two thirds. This has contributed to severe environmental degradation in many areas (Hirsch 1993). But on the other hand, the growing paddy rice production created the economic surplus in the 1950's and 1960's. Today 25% of Thailand's paddy fields are located in the North (Buch-Hansen, 2000).

At a national level the environmental degradation caused concern and resulted in changes within the national environmental policy. The 7th (1992-1996) and 8th (1996-2001) National Economic and Social Plans put an emphasis on integration of economic and social development and natural resource management. This issue was furthermore

addressed by the new Constitution from 1997, which encouraged public participation in the protection and management of Thailand's environment and natural resource base. The constitution addresses the important role of community based organisations and local institutions, and decentralisation of government programmes implementation is presently promoted. One example is the formation of the Tambon Administrative Organisations (TAO) on sub-district level (DANCED 2000).
Various development projects are aiming at improving the living conditions for the poorest part of the rural population. This includes improving basic infrastructure and employment opportunities and instruction in farming practices (Phongpaichit & Baker 1999).

Different policies attempt to stop further encroachment of forests in Thailand. The aim is to leave 25% of the land as commercial forest and 15% as natural forest. This is being pursued through different policies as afforestation programmes, resettlement programs or granting of usufructuary rights, and not least supporting a change from extensification towards intensification of farming practices (Hirsch 1993). In the 1960's, the expansion of agricultural land was 45% per year and today it is 1% per year (Buch-Hansen, 2000). A reason for the big expansion of agricultural land in the 1960's and 1970's was the government focus on agricultural export, supported by subsidies, taxes and other economic and political means (Baker & Phongpaichit, 1998).

The building of dams in Northern Thailand is part of this intensification. In particular areas this has led to increased water supply, higher yields, a change from subsistence to cash crop production and integration into the market economy (Cohen & Pearson, 1998). The dependence of the cash economy has caused problems for many poor farmers, who have a low income and limited access to financial support. To obtain a loan from a bank the farmer needs a title deed, and this is a constriction to many of the poorest farmers in the rural areas. The farmers have to find ways of supplementing their low income or finding credit, and this often involves loan from the Bank of Agriculture and Co-operative (BAAC), private moneylenders, the Middleman or the State.

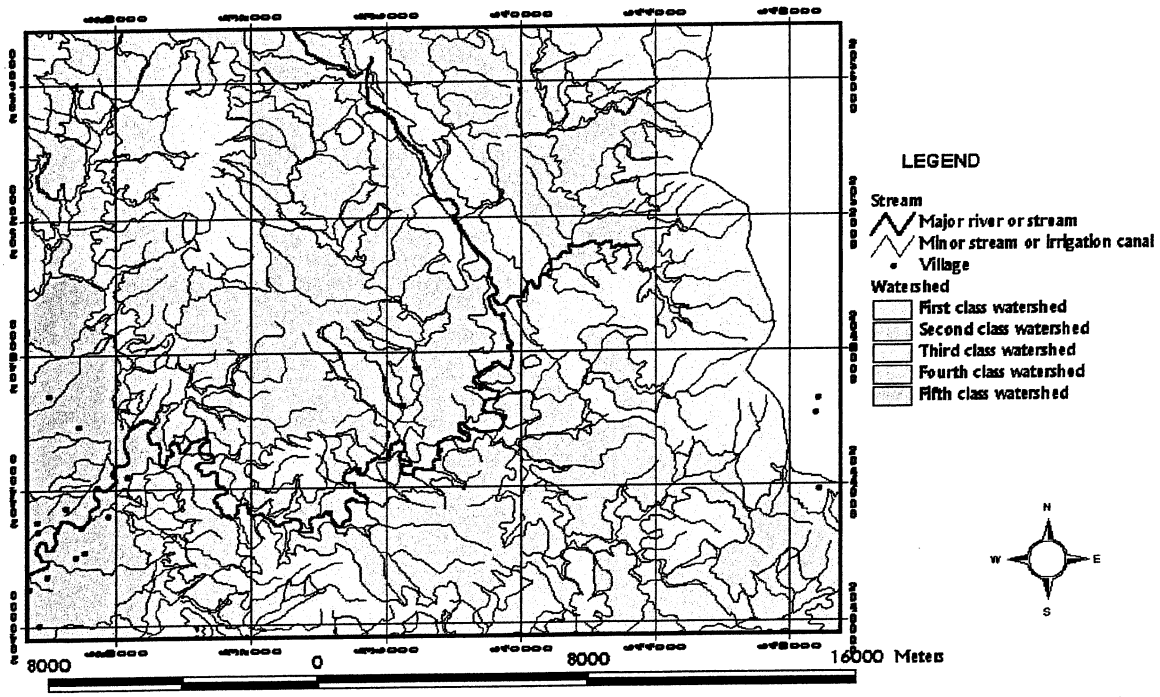
Until now, relatively low population and expanding agriculture have not forced the majority of farmers to invest in intensification of agriculture and the use of agricultural

input is still relatively modest for most of the farmers. But other commercial, export oriented farmers are closely related to agribusiness companies providing seeds and other agricultural input. (Buch-Hansen, 2000)

Thailand's position as natural resource and agricultural exporter is often related to the increasing deforestation and environmental consequences, such as irregular flooding and a total logging ban was the outcome of the flood in 1989 (Bello *et al.*, 1998). Deforestation is especially considered as an ecological problem in Northern Thailand, because the area is the main water supply to the Chao Phraya Basin and the central plain. The remaining forest in the north constitutes the main watersheds and water flow irregularities in these areas have potentially huge impact on water supply and quality, e.g. siltation from soil erosion in the lower areas (Bello *et al.*, 1998).

In order to protect the watersheds, a classification with different watershed classes was introduced. Map 1.1 illustrates the classification of Song Watershed, situated in Mae Yom Watershed, Northern Thailand. The map also indicates the villages, in which the four groups of students in the SLUSE Field Course did investigations (highlighted with yellow), which are situated in WSC2, WSC4 and WSC5. The Northern villages were studied by location 1, the South Western villages by location 2 and 3, and the Eastern most, village by location 4.

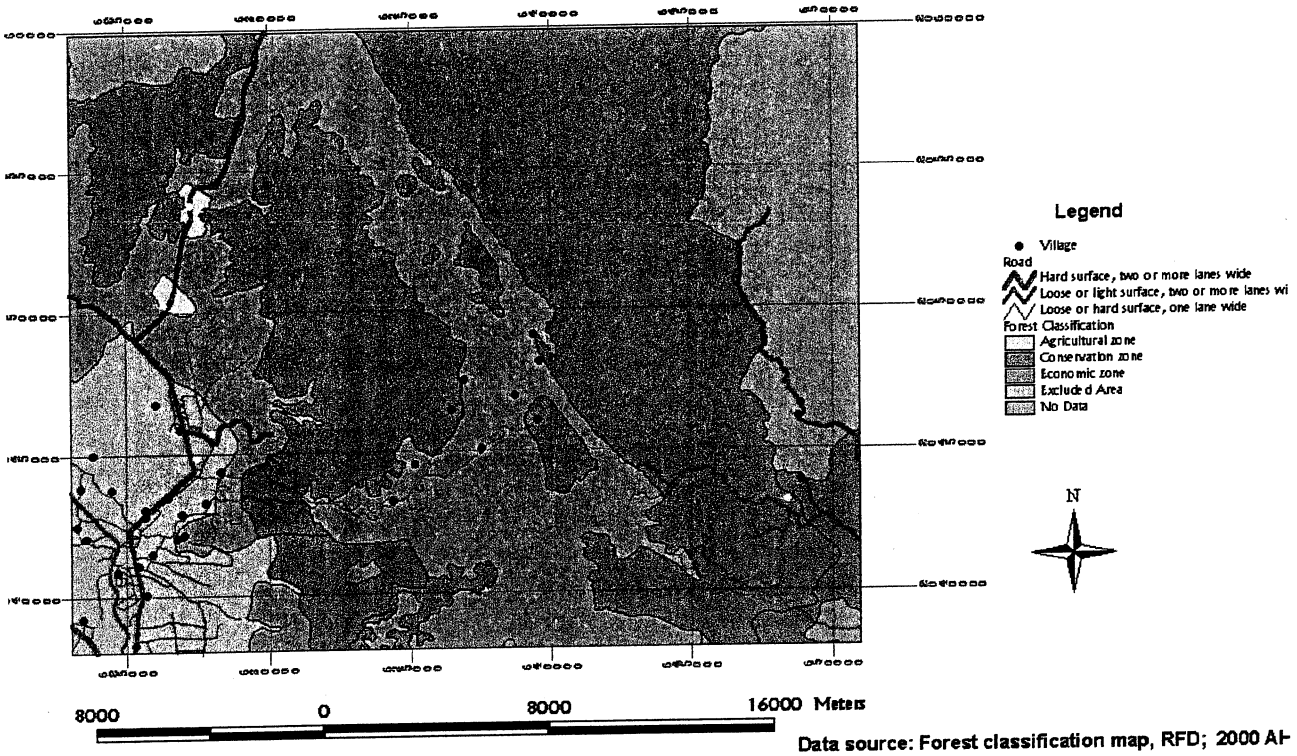
Map 1.1. : Watershed Classification



Data source:Topographic map, 1992, Thai Survey Department and watershed classification map unknown date, RFD; 2000 AH

One example of the government policy for conserving the remaining forest is the classification of land use in different zones. Map 1.2 shows The Royal Forest Department's classification in agricultural, economic and conservation zones. These zones are related to various restrictions such as prohibition of timber extraction and agricultural land use purposes.

Map 1.2: Forest Classification in Song Watershed



The field study was carried out between 13th October and 3rd November 2000 in Phrae Province, located in Mae Yom Watershed on latitude 18°25′ - 18°39′ N longitude 100°10′- 100°25′ E, covering an area of approximately 406 km^2. Song Watershed is situated in the sub-humid tropical climate zone. The annual rainfall is 1200 mm and almost 90% fall in the rainy season in August and September. The cold and dry season is from November to March, when it starts getting warmer again (Rungrojwanich, 1998).

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2. Introduction to Study Area.

The case study village of Ban Tao Pun (Mu 3) (E0627626, N2044598) consists of 153 households and has a population of approximately 650. 80% of the households are engaged in farming activities. The village is situated below the Mae Song Reservoir (MSR) a medium scale dam constructed in 1995 by the Royal Irrigation Department. This was done by request from the sub-district headman and the president of the Ban Klang District Council, who, in a letter to the Thailand King, advocated for the need of water control in the watershed. The effort to promote sustainable water management is based on the agricultural sectors consumption of fresh water. The unstable water supply was a result of intensive illegal logging in the upland area, surrounding the Mae Yom River, leading to drought in the dry season and flash floods during the rainy season. The MSR covers an area of 30.000 Rai (app. 48 Km^2) with a capacity of 65.8 million m^3 irrigating 51.000 Rai of agricultural land controlled by the Tao Pun, Ban Nun and Ban Klang sub districts. (RIO)

The villagers of Ban Tao Pun was organized themselves in a number of groups, representing their interests and needs. Organizations like Welfare Group, Local Water Management Group, Agricultural Co-operative, Agricultural Development Group, Health Care Volunteers and the House Wife Group gave villagers a forum to discuss their situation and helped with agricultural challenges. The interesting feature about BTP was the recent improvement of the water supply for irrigation and its impact on the village, i.e. on agriculture and society at large.

2.1 Sustainability

The sustainability discussion is implemented in this project in order to evaluate if the present livelihood strategies in Ban Tao Pun can be seen as sustainable.

"Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability of future generations to meet their needs" (WCED, 1987).

Investigation on whether a livelihood strategy is sustainable or not calls for a clarification to which degree sustainability is measured, which indicators are to be investigated, whether intra- or intergenerational equity is to be fulfilled and on which scale these are to be applied (Buch-Hansen, 2000). In this project the focus will be on institutional, economic and agricultural sustainability on a local scale, in relation to

contract farmers in Ban Tao Pun within an intra generational timeframe. The sustainability discussion will take place in the final discussion.

"Sustainable livelihood securities is an integrating concept.. livelihood is defined as adequate stocks and flows of food and cash to meet basic needs. Security refers to secure ownership of, and access to, resources and income-earning activities, including reserves and assets to offset risk, ease shocks and meet contingencies. Sustainable refers to the maintenance or enhancement of resource productivity on a long-term basis"(Chambers, 1988).

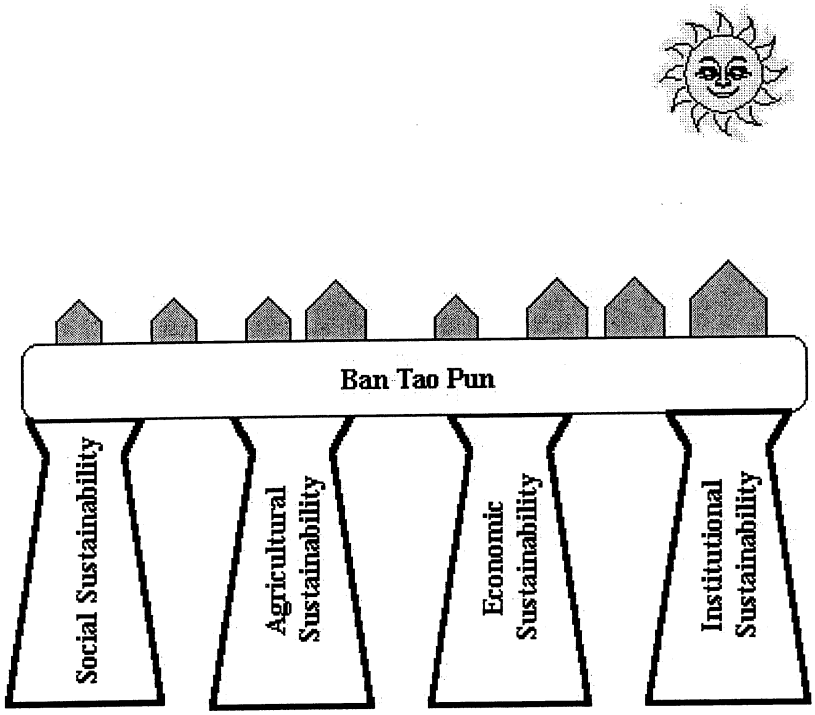


Figure 2.1: Sustainability framework of Ban Tao Pun. The four columns are interdependent factors and contribute to the general sustainability framework. (Own production. 2000)

2.2 Livelihood Strategies

The concept of livelihood is defined as means of living or of supporting life and meeting individual and community needs (Korten, 1995). This report approaches livelihood strategies as the way of living in a community, i.e. how villagers either in general or as a group allocate their resources, such as time and money. A sustainable livelihood provides meaningful work that fulfils the social, economic and environmental needs of all the members of a community (Korten, 1995). Since contract farming has an impact on farmers' economy and on the environment, it will be studied as a livelihood strategy in BTP.

2.3 Contract Farming in Ban Tao Pun

According to professor Hamilton, contract farming, also known as an agricultural production contract, is an agreement of a fixed term, entered before production begins, under which a producer agrees to sell a designated crop to the contractor and is paid according to a determined payment method (Redhage, 1998). The contract agreement offers producers lower market risk and greater access to inputs and ensure contractors a guaranteed supply of farm produce (FAO, 1998).

In the field study the producers were represented by contract farmers in BTP, duration of the contract was fixed to six months, the designated crop was maize and the contractor was the agribusiness company Monsanto. The agreement is arranged so that the company provided seeds and other agricultural input, including credits (Buch-Hansen, 2000). As the supervisor of Monsanto's seed production in Song District, Mr. W. Praman claimed, Monsanto has the market and the know-how and farmers sell produce to them in return. Monsanto' field supervisors advised farmers on farming practises.

Monsanto sold a part of the production to other countries while another part was kept to breeding programmes and selection to varieties aiming at crops' quality and production (Monsanto).

Monsanto's criteria required towards the farmers engaged in contract farming were:

- Honesty and attitude towards Monsanto
- Good soil fertility
- Secured irrigation system.

Monsanto kept the contract, containing the rules; e.g. payment, seed quality and fixed price for the product. Farmers were chosen either by Monsanto or by AEO. Once a year, with the presence of AEO, a meeting was held between Monsanto and the contract farmers to discuss any problem related to the contracts (AEO).

Monsanto had been engaged in contract farming in Song district the last seven years and took over the agribusiness company Cargill two years ago, in order to strengthen its seed business. These two companies are in the future expected to jointly develop seed business in Thailand (Arunmas & Keeratipipatpong, 1998).

The above mentioned leads to the problemformulation and sub-questions on which this investigative report is based.

2.4 Problem Formulation

In which way has the construction of Mae Song reservoir influenced the socio-economic and agricultural livelihood strategies in Ban Tao Pun?

In order to provide a fulfilling answer to the problem formulation sub-questions have been implemented.

2.5 Sub-questions

- How has the construction of MSR influenced the livelihood strategies in relation to income, health and recreation?
- How has the construction of MSR changed agricultural practices?
- How has the construction of MSR affected pests, weeds and diseases in agricultural production?
- Has there been an increase in contract farming and is this related to MSR?
- How has contract farming influenced social, economic and agricultural practices of villagers in Ban Tao Pun?
- What are the effects of contract farming on plant available mineral N, P and K?
- How has the MSR influenced the sustainability of the livelihood strategies in Ban Tao Pun with focus on contract farming?

3. Methodology description

The fieldwork aimed to resolve the problem formulation, which was to investigate the influences of the construction of MSR on the livelihood strategies of villagers in BTP.
To reach this goal it was decided to collect data, on villagers' socio-economic conditions, agricultural practises and soil quality through Participatory Rural Appraisal (PRA) methods. As Chambers claims, PRA are social research methods, which maximise the development of key social knowledge, minimise the gain of superfluous

information, optimise the cost-effectiveness of rural social research and ensure the participation of local people in problem identification and solutions (Furze *et al.*, 1996).

Among the several methods contained in PRA (Furze *et al.*, 1996), the following were chosen:

- Structured interviews
- Semi-structured interviews with key informants
- Group discussion
- Pair wise ranking
- Secondary data review
- Direct observation

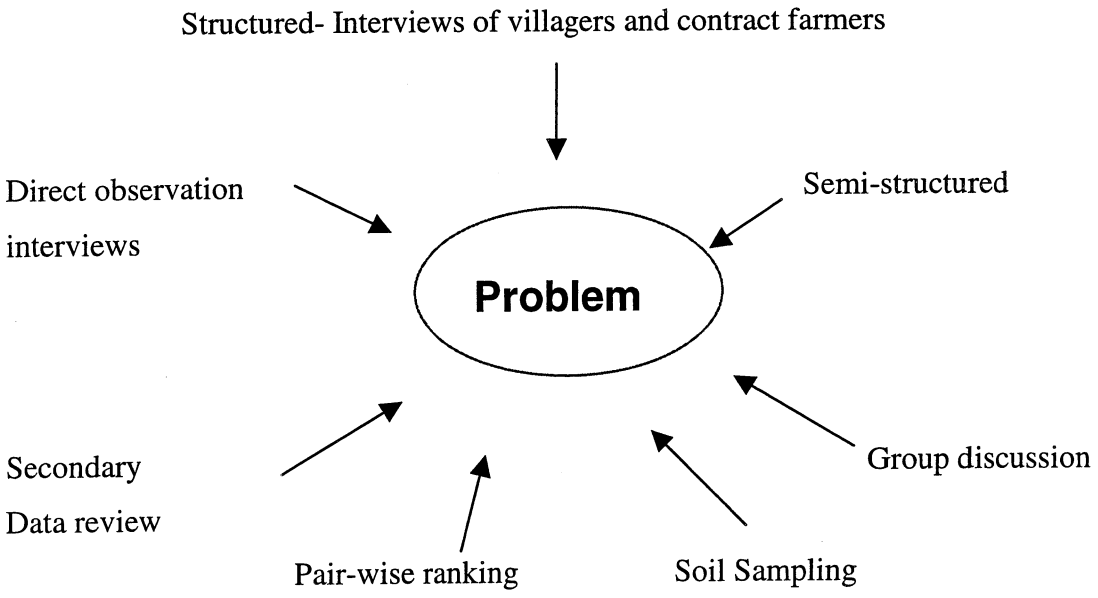


Figure 3.1: Inspired by "convergence of multiple sources of evidence, single study"(Yin, 1994).

As it can be seen in figure 3.1, the data collected by various methods came from multiple sources, referring to a specific method, and aimed at explaining the same problem.

The use of different methods presented great advantages. As White argues this provides new information and permits to crosscheck or triangulate information from different sources (Furze *et al.*, 1996).

As the data collection proceeded, it was found that there had been a noticeable increase in the number of contract farmers, since the construction of the MSR. This was found

interesting and it was decided to focus on contract farming - seen as a consequence of the reservoir construction - and how MSR further influenced farmers´ livelihood strategies.

This change of interest hindered the study especially concerning the structured interviews and the soil sampling methods, resulting in selection of new samples.

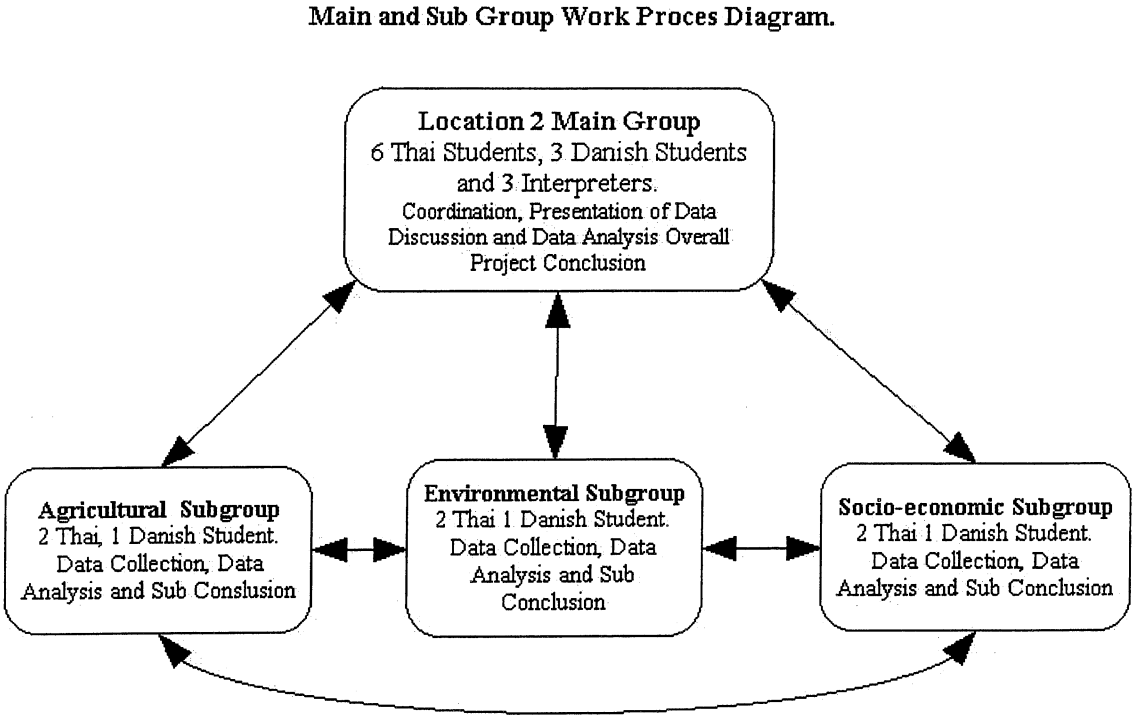


Figure 3.2: Group work division (Own production, 2000).

During the fieldwork the main group divided into three sub-groups, in the area of socio-economic, agriculture and environment, as it can be seen in the figure 3.2.

Among the several ways of conducting an interview, it was chosen to apply the structured and semi-structured interviews. As Minichiello claims, *"quantitative information is collected through measuring things (using survey instrument, structured interviews) and is analysed through numerical comparisons and statistical inferences' and is reported in the same way, using statistics, whereas qualitative information is collected through methods such as unstructured and semi-structured interviews and participant observation, and is analysed by themes from descriptions by informants"* (Furze *et al.*, 1996).

3.1 Structured Interviews

The purpose of doing structured interviews was mainly to collect quantitative data. During the framework process two structured interviews were designed; one with villagers and one with contract farmers. These interview guides were the same apart from specific questions on contract farming that were added to the contract farmer interviews. Interviews included both closed and open-ended questions on themes, such as economy, daily life and agricultural practices, related to changes in livelihood strategies (see Appendix 1).

3.1.1 Villagers' Structured Interviews

Two stratified random samples were completed:

- The first was of every 7th household selected from the household list, obtained from the headman. We did a pre-test on 3 of the selected households and then revised the interview guide. The process of pre-testing helps to refine the set of questions. A field pre-test is desirable to identify problems, which may occur under 'real' conditions (Furze *et al.*, 1996).

  The first stratified sample proved to be too small to be representative to conduct statistics and the household list lacked addresses. To find people by this sample was too time consuming and sometimes impossible.

- Therefore, a second stratified random sample of every 5th household was made from the village map that contained addresses and names of the households, obtained from the headman.

  At this point, when analysing our data collection, contract farming was found interesting and therefore it was decided to finish interviewing only 23 out of the 30 selected villagers.

3.1.2 Contract Farmers' Structured Interviews

The number of contract farmers in BTP varied depending on the informants. Decision was made to work with the list of contract farmers obtained from the headman of Mu 10 and from this list we made, by lottery, a random sample of 22 contract farmers from a total of 33 listed. But we found later that the real number of contract farmers in BTP was 43, as seen on the official list of Monsanto.

3.2 Semi-Structured Interviews

The interviews with key informants were semi-structured topic-focussed interviews, depending on the subject each informant represented. By using this method mainly qualitative information were obtained.

Key informants were selected from the first semi-structured interview with the headman and the "SLUSE Basic Information Paper 2000". Key informants were used to provide information about specific situations or conditions in the area. They are essentially knowledgeable individuals, who are in a position to provide relevant information, ideas and insights on a particular subject. They understand local customs, traditions, social and economic conditions and are capable of clearly articulating their point of view (Casley & Kumar, 1988).

To collect data to answer the problem formulation the following representatives of institutions and organisations were interviewed:

- Headman: To get a general understanding of the structure of the village, of the function of the different organisations and the relations among these. The headman also acted as the President of the Agriculture Co-operative and by interviewing him information on the collaboration between the Co-operative and the farmers was obtained.
- President of the Health Care Volunteers (HCV): To investigate if the construction of MSR had any impact on the villagers´ health conditions.
- Secretary of the House Wife Group (HWG), also a representative of the Welfare Group (WG): To study if farmers had adopted new agricultural practises and if household activities have changed after the MSR.
- Royal Irrigation Office (RIO): To get information on the history of the MSR construction and on eventual problems related to the water distribution and collaboration with the farmers.
- Agricultural Extension Office (AEO): To investigate AEOs´ engagement with farmers and Monsanto and if new advises and agricultural practises had been recommended after MSR.
- Monsanto: To understand why Monsanto was involved in contract farming in Song district and to collect general information on contract farming in BTP.

3.3 Pair Wise Ranking

In this study, pair wise ranking was used as a supplement to semi-structured interviews and through the ranking process to give village informants the opportunity to define problems caused by MSR and how these problems could be solved. In this way, the qualitative data was created with a great involvement of the participating informants, opening for development of solutions corresponding to the villagers´ needs. With this method a quick overview of the problems the informants knew of was obtained. The pair wise ranking was performed with 5 villagers, all of which were key informants on livelihood conditions in the village (See appendix 3 on the pair wise ranking description).

3.4 Group Discussion

A group discussion with four contract farmers was arranged in order to study the advantages and disadvantages of contract farming. The 4 farmers were selected randomly from the contract farmers' structured interviews. Our Thai colleagues conducted the group discussion in the local language, to make an easier and fluent discussion, while we participated with questions, and maintained a 'low profile'. The group discussion was used to crosscheck information obtained from the interviews of contract farmers and Monsanto, and to get further information on contract farming in BTP.

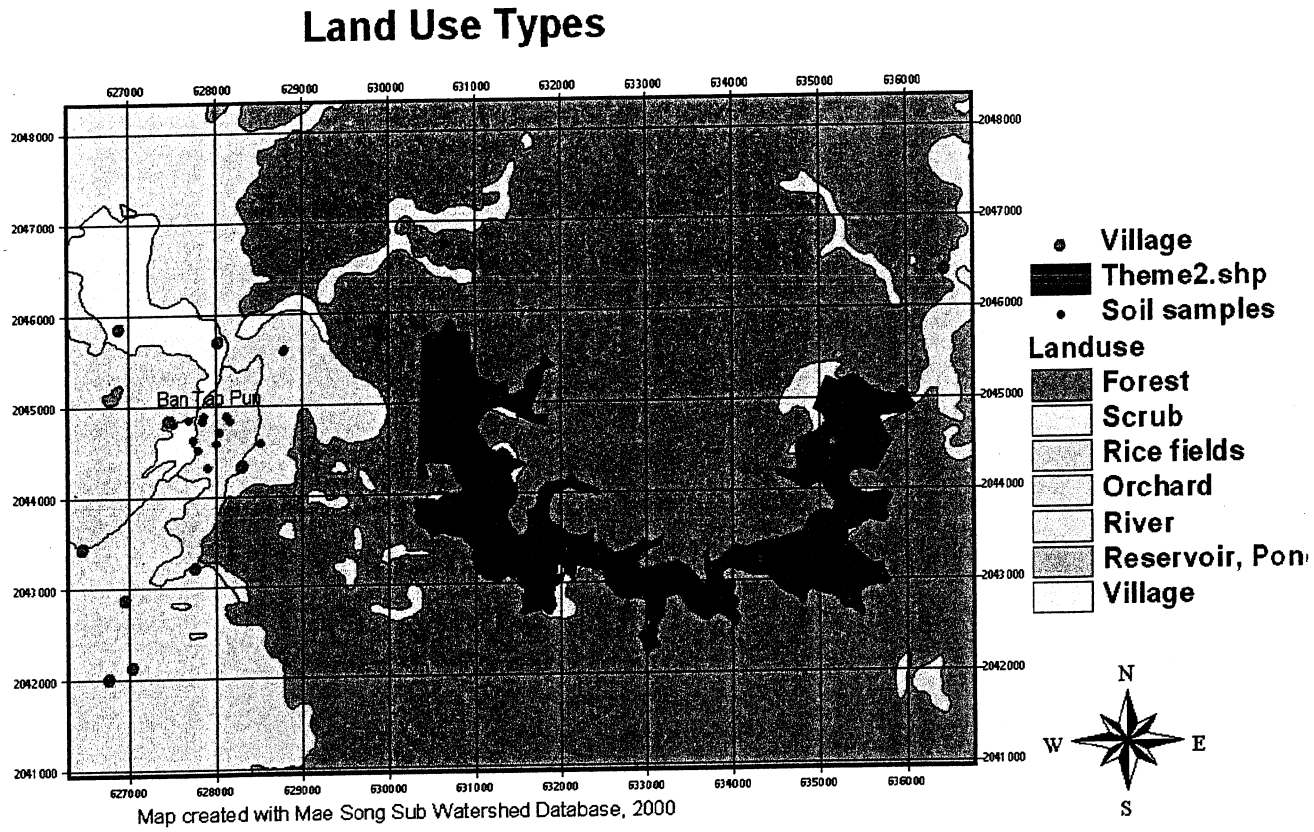
A discussion of a specific topic is promoted by focus groups composed of representatives of targeted groups in the community (Furze *et al.*, 1996). In this field study both the pair wise ranking and the group discussion methods used focus groups to ensure a good discussion.

3.5 Soil Sampling

At first, the environmental subgroup decided to collect soil samples from farmers selected randomly from the village map. Collection and analysis began, but as our overall investigation focused on contract farming we decided to investigate only soil samples from contract farming fields and through analysis to conclude whether or not there were signs of nutrient depletion as a result of this particular farming practice. These soil samplings were conducted on 12 contract farming fields chosen among the 22 interviewed contract farmers (see map 3.1). During the interviews the farmers were

asked if soil samples could be collected from their fields, no farmers rejected our inquiry and therefore the fields of the initial 12 interview respondents constitute the sampling fields.

From each sampling field, soil samples were obtained by using a big orker to collect 10-15 samples, approximately 1-2 kg depending on the H_2O content, from the top 15 cm of the soil profile. The soil samples were then dried in the shade, mortered, mixed and sieved to 2mm to create a homogeneous sample, from which an allignot was taken. The allignot was then analysed using the Kasetsart University N.P.K. Soil Test Kit©, in order to assess plant available mineral nitrogen and phosphorous and exchangeable potassium levels. The pH level and electric conductivity (EC) were estimated in a 1:2.5 solution of soil and demineralised water by using hand pH-meters and an EC-meters. The 1:2.5 solution was obtained by mixing 1 part of soil with 2 ,5 parts of water in a small beaker and shaking this thoroughly. For precise EC measurement the result must be multiplied by 3.6 to get the saturation level (Landon, 1996). The soil texture was estimated by using the USDA (United States Department of Agriculture) soil texture triangle (Petersen,1994).



Map 3.1: Ban Tao Pun village, the Mae Song Reservoir, soil sample sites and land use themes.

3.6 GIS

In order to illustrate how relations between soil samples and local characteristics of the Ban Tao Pun area are, Geographical Information Systems have been implemented through the use of the Mae Song Sub Watershed Database. Unfortunately the use of GIS has not been a priority on the reasons of lack of time and lack of GIS skills.

3.7 Secondary Data and Observations

Secondary data was acquired, where it was possible, in order to gather information about the area and as a supplement to the primary data collection. The secondary data acquired came among others from governmental institutions, local survey projects and the 2000 Mae Song Watershed Database. Observations can be seen as an additional angle in describing the chosen object. In this way observation contributes to the holistic project approach and works as a good in field method to rapid evaluate and possibly validate information.

4. Results

4.1 Socio-Economic Results

The MSR has caused several changes in social and economic conditions of villagers in BTP. Through a study of these, the most interesting changes were selected and described below.

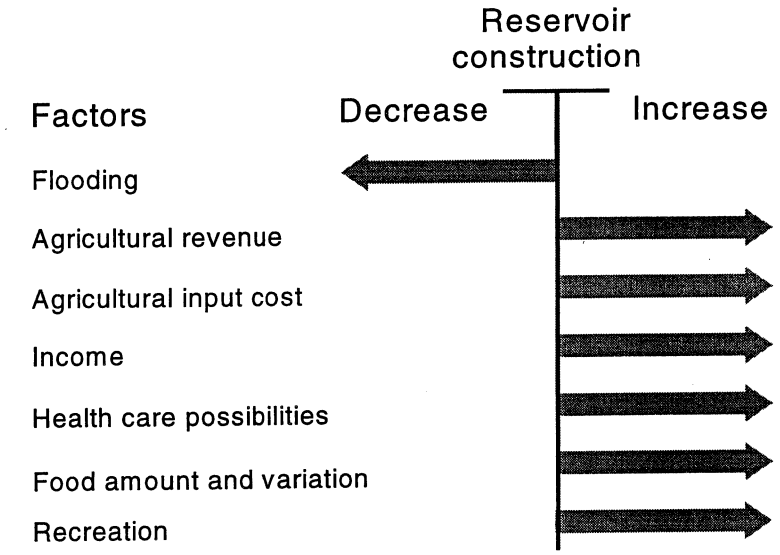


Figure 4.1: Changes in social and economic factors caused by the reservoir. The results are based on key informant interviews, villagers' and contract farmers' interviews. The arrows illustrate the tendency of increase or decrease of the factors compared to their status before the MSR.

4.1.1 Agricultural Production

As illustrated in the diagram above, the MSR construction decreased flooding, meaning that no flooding of lowland fields occurred after the reservoir construction (RIO). This had a positive effect on the agricultural production and income.

The diagram shows the increase in agricultural production, which affected an increase in agricultural revenue and input cost. Thereby, the village general income level has increased, as the main income source and main occupation were farming. (Headman, HCV, AEO, HWG, Pair wise ranking & villagers' interviews).

The agricultural input cost did not only increase as a result of larger amounts of input, but also because of the economic devaluation, caused by the economic crisis in 1997 (Headman & AEO). Even though, the input costs increased, the increase in agricultural revenue was bigger (Structured interviews, Headman & AEO).

4.1.2 Health

The general increase in income allowed villagers to use more money on social livelihood aspects, such as health, food and recreation (HCV & HWG). As a result, the health care possibilities increased. For example, only 1/3 of the villagers purchased the health insurance card before MSR, where as 50% of the villagers possessed the card after the reservoir. The house quality also rose, because villagers - who could afford it - changed to zinc roofs instead of rice straw roofs, as they used before (HCV).

Because of the increased agricultural production and thus increased income, villagers had greater possibilities to achieve larger amounts and variation of food, since the reservoir made it possible to catch or buy more fish (Villagers' interviews, HCV & HWG).

4.1.3 Recreation

Expenditures on recreation increased after MSR and approx. 75% of the contract farmers used more money on recreation than before. The area around the reservoir was used to recreate and the reservoir to boating activities. The latter also gave the opportunity to do business in floating boats, which tourists enjoyed for sailing (Villagers' interviews and contract farmers' interviews).

4.1.4 Upland Farming

The reservoir construction also had negative impact on the agricultural production practises. Farmers who had upland fields, which became flooded by the reservoir, consequently had to rent fields lowland or to change occupation. Some land was situated across the reservoir and the headman claimed that 10 farmers could not afford the transportation required to reach their fields after MSR (Headman, pair wise ranking, HWF, villagers' interviews & contract farmers interviews).

Farmers who had their land occupied by the reservoir received compensations according to their title deed. The amount was 5,000 Bath/Rai for Sor-Por-Gor and 10,000 Bath/Rai for Nor Sor Sam (Headman interview & Mingtipol *et al*, 2000). This money was either invested in rented lowland fields or to start another occupation. One of the villagers interviewed still had fields close to the reservoir, which gave him compensation as the

authorities had the official right to do investigations on his fields (villagers' interview of headman assistant).

Although this report focuses on the changes caused by the MSR, the level of education was also studied as an aspect of livelihood that could change as an effect of the income increase. The data showed that the level of education had not changed. This might be because the time of the study was too close to the reservoir construction to detect any change in this aspect.

4.1.5 Contract Farming in Ban Tao Pun

As MSR provided a steady water supply and hence a good irrigation system, the contract farming company Monsanto got an interest in the area of Song District. This led to an increase of contract farmers in the district (Monsanto).

Table 4.1: General information from the structured interviews of 22 contract farmers. Percentages given are based on the 22 contract farmers.

	Number of interview persons	Percentage
Female	5	22,7
Male	17	77,3
Years working in farming:		
1-10	10	45,5
11-20	3	13,6
21-30	6	27,3
30 ->	3	13,6
Years working in contract farming:		
1	5	22,7
2	6	27,3
3	4	18,1
4	4	18,1
5	1	4,5

The table illustrates that most of the informants were men. Out of the 22 informants 16 were the head of the household (see appendix 2), but no correlation has been made between gender and family status, to show the number of women and men being head of the household.

It is also illustrated that nearly 50% of the contract farmers had not farmed for a very long time –less than 10 years - before they began contract farming. For the very young

farmers, this might cause little knowledge on other agricultural practices than contract farming and thereby less critical approach to contract farming, which is described further later in the report. Some of the young farmers might have agricultural knowledge from their parents' farming.

Out of 22 informants, only 20 are represented in "Years working in contract farming" in the diagram, because of missing answers. Never the less, it shows that contract farming has increased rapidly after the construction of MSR in 1995, since 20 farmers have done contract farming for five years or less.

Table 4.2: Income of the interviewed contract farmers before and after MSR

	Before	After
Minimum (Baht/year)	5.000	5.000
Maximum (Baht/year)	60.000	53.000
Average (Baht/year)	21.786	24.194
Total interview persons	14	18

The above table illustrates that average income increased and maximum income decreased after the MSR. Together with the constant income minimum, these factors show that the reservoir has increased economic of contract farming. Most of these farmers had an income increase from 10.001–15.000 B/year to 15.001–20.000 B/year after the MSR (Appendix 2). One has to mention that the source of these results is a small and variable number of contract farmers, i.e. only 14 answers given on income before the MSR and 18 on income after the MSR. This problem is further described in the methodology discussion.

Another way to describe the income change is the frequency of loans, since villagers needed to have savings in the bank to obtain a loan.

Table 4.3: Frequency of loans before and after the MSR of the 22 interviewed contract farmers, illustrated by the number and percentage of these.

	Before the MSR		After the MSR	
	Number of informants	% of informants	Number of informants	% of informants
Obtained loan	7	31,8	13	59,1
Did not obtain loan	15	68,2	9	40,9
Total interview persons	22	100	22	100

The table above shows more representative results than the results on income, because all informants answered the questions about loan. The table illustrates that nearly twice as many contract farmers were able to obtain loans after the MSR than before. This demonstrates that many of these had savings in the bank, which shows that many farmers had an increase of income. More than 50% of the contract farmers having loans after the MSR, obtained the loans because of farming. The known sources of loans are Bank of Agriculture and Co-operatives, Monsanto and the Agricultural Co-operative, but no data is collected on the number of loans from each source.

According to the contract farmers attending the group discussion, the main reason for farmers in Ban Tao Pun to engage in contract farming was the guarantee sale of the produce, at a fixed price. Monsanto provided a certain amount of agricultural inputs, which costs were subtracted from the farmers' payment after harvest. If the farmers needed additional agricultural inputs, they had to buy it themselves. The zero starting investment was quite attractive for farmers.

A disadvantage of contract farming, mentioned in the group discussion, was the bad organisation of harvest time. The time when Monsanto collected product was often not co-ordinated, meaning that farmers had to wait in queue to harvest, inevitably leading to decrease of produce quantity and thereby a reduced income.

The contract farmers suggested that a different crop schedule for each farmer, spreading the harvest time through out the year could be a solution.

Most of the contract farmers were middle to maximal satisfied with their co-operation with Monsanto, which is illustrated in the diagram below. The farmers gained approx. 8 Baht/kg maize, while Monsanto sold the maize at 50-70 Baht/kg, depending on the market price (AEO). If a farmer did not fulfil the contract, he /she would be punished, e.g. if the farmer sold some of the maize to another than Monsanto or did not conduct the cultivation practices imposed by Monsanto. The punishment was a fine of 3000 Baht/kg and termination of all contracts within the village (Monsanto & contract farmers group discussion).

The farmers stressed that if the price predicted by Monsanto failed or if another company proposed a higher price, they would leave Monsanto after their half-year contracts.

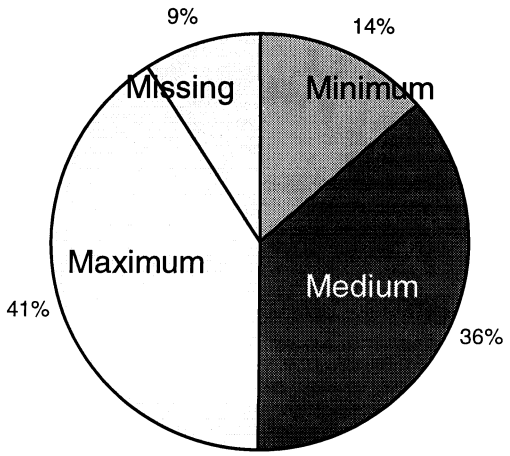


Figure 4.2: The percentages of the 22 interviewed contract farmers who were minimum, medium or maximum satisfied with contract farming, or which answers were missing. Data from structured interviews of contract farmers, see appendix 1 and 2.

4.2 Soil Analysis Results

The results of the analysis are presented in the appendix 4. From this appendix it can be seen that the samples are dominated by sandy loam soils with the overall texture being loam. The pH values range between 6.3 and 7.0 with an average of 6.64. The electric conductivity (EC) ranges between 0.1 and 0.27ms/cm with an average of 0.19 (non corrected value). In table 4.4 the average values of N, P and K are shown. By exchanging lexigram values with numerical values from VL=1 to VH=5 in N and P values and L=1 and H=3 in K values a numerical average can be calculated, to give a more precise value.

Table 4.4: Calculated average macronutrient, pH and EC values of 12 soil samples collected around Ban Tao Pun.

	Plant available N and P, VL-L-M-H-VH values			Exchangeable K, L-M-H values	pH value 1:2.5 solution	EC value 1:2.5 solution
Macro Nutrients	NH_4^+	NO_3^-	P	K		
Numerical average value	1.38	1.25	3.42	1.17	6.64	0.58 [0.19*3.6]
Lexigram average value	VL-L	VL-L	M-H	L-M		

4.2.1 Discussion of Soil Results

The texture analysis showed that ¾ of the soil consisted of sandy loam, which is in accordance with the general soil texture of the alluvial lowland area (Mingtipol *et al*, 2000). Due to high precipitation many humid tropical soils are known to have problems with acidification, leading to a decrease in cation exchange capacity and increasing aluminium, iron and manganese levels (Stern, 1997). An average pH value of 6.64 does not imply any acidification and is well within the optimal pH level of plant production, which for rice is between 6 and 7 and for maize 5.5 and 8. This pH level could be due to the wide distribution of lime-containing rocks in the watershed (Mingtipol *et al*, 2000).

In irrigated agricultural areas soil salinity can be a problem, but as the electric conductivity analysis showed, with an average of 0.58 ms/cm, the salinity is low in the test soils and therefore impose no threat to plant production.

The NPK analysis reveals the contemporary content of the plant available macronutrients mineral N and P and exchangeable K. The low (2) to very low (1) levels of ammonium (NH_4^+) and nitrate (NO_3^-), characteristic of the sampled soils, indicates an imbalance. Since most of the fields were recently harvested the low content could be a result of the last crops´ nutrient uptake or application of an incorrect fertilizer combination, but it is most likely that the low mineral N levels are a result of nitrification, mineralising or leaching. As a reason of the recent N mineralisation it is difficult to conclude in detail.

Normally the natural low level of P is one of the major problems in the management of tropical soils, but as it can be seen from the table 4.4 the content of P is medium (3) to high (4). This could be a result of the application of fertilizer with a high content of P and of the soil pH.

The K content is low to medium and in the long term it would be advisable to apply fertilizer with K to avoid nutrient imbalance. In addition to these results it was stated by the AEO that the area did not lack P and K.

As it can be seen from the contract farming interviews there is a distinct application of the chemical fertilizers 16-20-0. The low levels of N and K are most likely a result of the intensification seen in the agricultural production.

As micronutrients are just as important in agricultural production as macronutrients, thus to fully investigate the sustainability of the soils production capacity, micronutrients should have been investigated.

In addition, it would have been significant to compare traditional farming systems with those of contract farming, to see if there were any differences in nutrient balance.

4.3 Agricultural Results

The agricultural results obtained through interviews addressed to contract farmers, villagers and key informants are presented in the following table:

Table 4.5: Changes in agricultural practises related to the construction of Song reservoir.

Agricultural production factors	Before the Reservoir	After the Reservoir
Crop rotation	Cultivation of one crop/year	Cultivation of 2 to 3 crops/year
Main crops	Tobacco, cotton, maize and rice	Production of tobacco has decreased due to flooding of highland fields An increase in maize due to contract farming
Land location	Fields upland and lowland	Less fields upland
Water supply	Rainfall Small dams and Mae Song stream	Rainfall Song Reservoir irrigation
Agricultural inputs	Use of few chemical fertilisers Use of green and animal manure Low or none use of pesticides	Increase in chemical fertilisers use Increase in green and animal manure use Increase in pesticides use
Equipment	Spades, hoe and buffaloes	Machines and tractors, spades and hoe
Labour	Family members and friends	Hired labour, family members and friends
Disposition of produce	Own consumption and sell to middleman	Own consumption, sell to middleman and contract farming company (Monsanto)
Disease/pests/weeds	Few pests Pests not considered as a problem	Increase in pests population such as Golden Snail, Plant hopper Increase of weeds

As it can be seen in the table 4.5, by providing a stable water supply, the construction of MSR, offers both positive and negative agricultural aspects.

4.3.1 Positive Aspects

Increase of agricultural output:

The constant water supply assures crop production all the year around leading to a better household economy. The introduction of agribusiness companies in Song District permitted farmers to engage in contract farming and through this secured a fixed price on their products.

4.3.2 Negative Aspects

Appearance of pests and weed:

The main harmful pests, mentioned in the Ban Tao Pun area, were Golden snail (*Pomacea canadicula*) and Planthopper (*Nephotettix* spp.) (farmers, AEO, Headman). They caused serious problems especially on rice crops by inducing chlorosis and consequently reducing the yield. Several weeds spread rapidly in irrigated areas, and an increase of the amount of weeds was observed after the construction of MSR (farmers, AEO, headman). Contamination of both pests and weeds can be controlled and reduced by the application of Integrated Pest Management methods (AEO). They mostly consist of manual eradication and introduction of natural enemies of the pests. It has to be stressed that this method is efficient only at the beginning of the contamination, in order to control the spreading of the infestation. The method also requires labour to observe evolution of pests and degradation of plants in the field and is a time consuming process. The easiest way to get rid of pests and weeds is the use of chemical products, such as pesticides (AEO).

4.3.3 Discussion of Agricultural Practises and Crop Production

The increase in contract farming led to a change of crop production and agricultural practises (Monsanto). Farmers mainly grew rice, tobacco and cotton. As Monsanto was interested in growing maize, this crop was introduced at the expense of the earlier crops. This change was easily adopted, since as mentioned no production investment was required (farmers and Monsanto). Farmers had to obey to the inputs and field practises imposed by the company. The production of maize was mainly used in research aimed at improving varieties through breeding programs. The new selected varieties were

more productive and more resistant to diseases, such as Downy Mildew, which seriously infests maize (Monsanto).

Maize is not drought tolerant and water stress during the flower formation could lead to a total loss of the harvest. It can grow on many different types of soil, but is best on sandy loam, with a pH of 5.5-8. These characteristics are actually within the properties collected in our soil samples (refer to soil analysis results). Maize is one of the more demanding crops, particularly during early growth (Rehm & Espig, 1991). As Monsanto and AEO recommended, crop rotation and soil condition must be combined and considered in order to get the best production output. Monsanto said that the last three years the maize production decreased by 20%, with the same input. Within ten years, the carrying capacity of the soil will considerably be reduced and the agricultural production will face output decline (Monsanto). To avoid this situation, improved agricultural practises must be applied (AEO and Monsanto). Since the soil in this area has a low to medium content of N and K, a recommended crop rotation could be the production of wet rice during rainy season followed by maize and in prolongation legumes, such as mung beans or pigeon pea, aiming to increase soil nitrogen content. As mentioned in the soil analysis discussion, a supply of more appropriate fertilisers could improve the soil condition.

4.4 Overview of the Changes Caused by the MSR

The diagram below provides an overview of the causal relations between the MSR and its consequences. It is also a summary of the socio-economic and agricultural results.

Cause and Consequences of Mae Song Reservoir Construction on Livelihood Strategies in Ban Tao Pun.

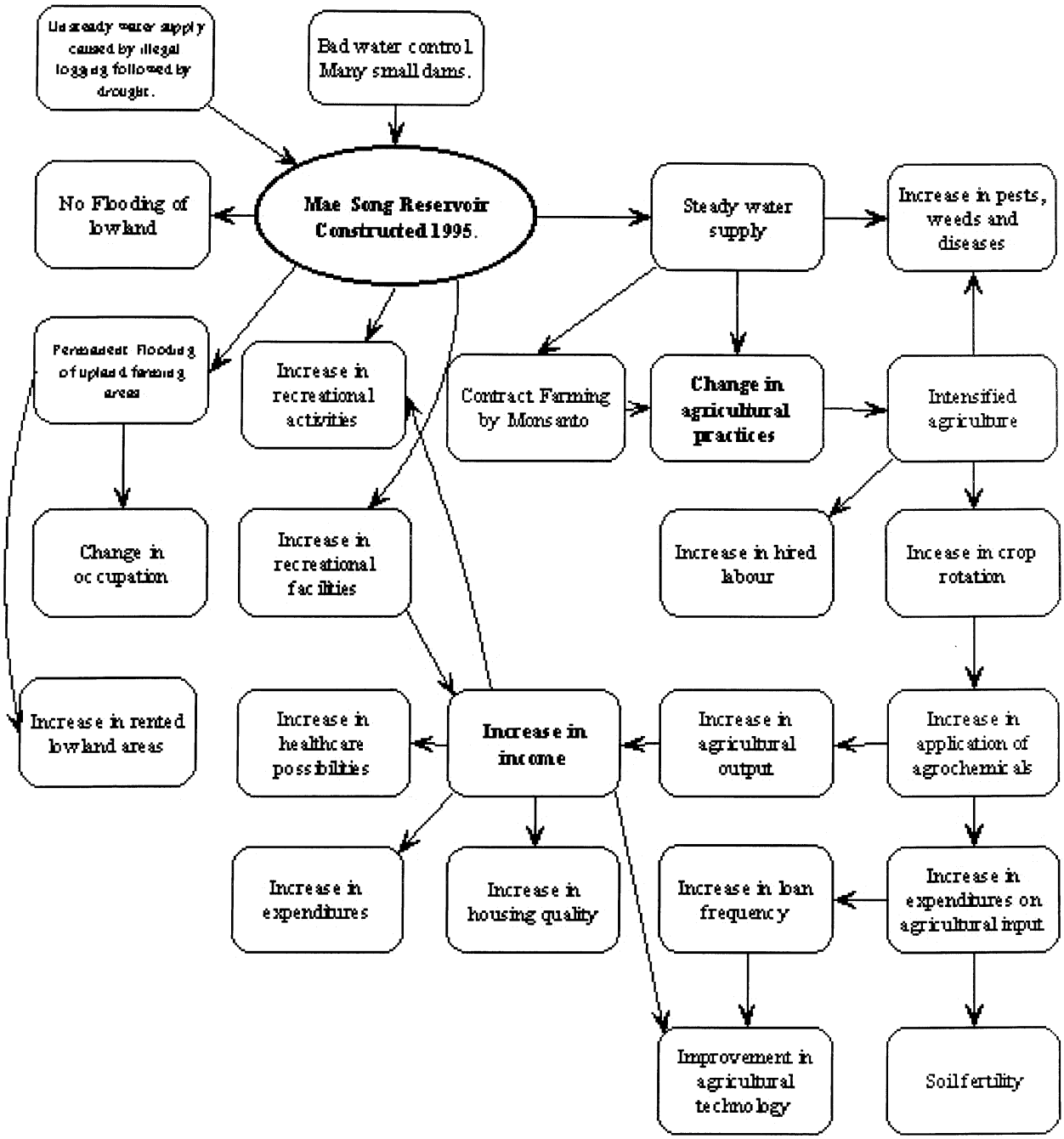


Figure 4.3 : Inspirated by the Logical Framework Approach, showing the Cause-Effect Relationship (Mikkelsen, 1995)

5. Methodology Discussion

The core of the methodology discussion is the results achieved from the applied methods. This deals with the quality of the results, related to the applied methods, and depends on reliability and validity of the results.

In this report the perception of these scientific measurement tools is based on Kirk & Miller's statement, *"reliability is the degree to which the finding is independent of accidental circumstances of the research"* (Mikkelsen, 1995). By this we also understand reliability as *"demonstrating that the operations of a study –such as the data collection procedures can be repeated, with the same results. Therefore the applied method has to be as explicit as possible"* (Yin, 1994).
This report understands validity, as in which degree each method is able to provide the "correct" results, in relation to reality. Consequently, validity must be considered in a space and time frame that deals with the representativity of the results. Validity is restrained to the time frame of the moment of data collection. The spatial constrain of validity depends on each method: The villagers' interviews, pair wise ranking, observation and secondary data are related to validity on village level. Validity of the contract farmers' interviews, group discussion and soil sample analysis is related to the number of contract farmers in BTP.

Table 5.1: Overview of reliability and validity of the results, achieved from the applied methods.

Ranking values: Low-Medium-High	Reliability	Validity
Structured interview of villagers	Medium	High
Structured interview of contract farmers	Medium	Low
Semi-structured interview	High	High
Pair wise ranking	High	High
Group discussion	Medium	Medium
Observation	Medium	High
Secondary data	High	High
Soil sampling	Medium	Medium

The above table presents an overview of the degree of validity and reliability and is the quality report of the results. The basis of claiming these valuation degrees of each method is explained below.

5.1 Structured-Interviews

Reliability is medium because of the following biases:

- ➔ The interview guide was in English - both for semi-structured and structured interviews, causing that some interviewers misunderstood the questions as they were meant to be understood.
- ➔ The English interview guide caused that questions had to be translated into Thai and then into local language and the opposite way at answers.
- ➔ We did not discuss all the questions together, before we started interviewing.
- ➔ Different interviewers caused divergent formulations of the same question, since the questions were not all written as a whole sentence. These divergent ways of asking and other methodological biases, such as leading questions, made informants understand the questions differently and thereby causing divergent answers.
- ➔ Inconsistent notation of interviewers.
- ➔ Some questions were not precise enough. For example "farm income in Baht per year before the reservoir?" raises the question, as income of which year. Further more it can be discussed whether income is a good indicator of wealth or sustainable livelihood, since villagers also achieve food and services by non-income sources.

Validity of the contract farmers' interview is low because:

- ➔ The sample was obtained from an erroneous number of farmers. This was discovered, when the sample was already done, by a cross-check of the data. This led to a more reliable source – Monsantos´ list of contract farmers - containing the real number of 43 contract farmers in BTP, showing that the total number of contract farmers was not the basis of the sample, thus giving a less valid sample.
- ➔ A few results were based on a small and variable number of contract farmers, leading to low representativity of the results.

Validity of the villagers' interview is high, because it was a stratified random sample on the basis of all households.

5.2 Semi-Structured Interviews

Reliability is high because no major biases occurred:

- ➔ The semi-structured interviews were cross-checked by data-triangulation and other methods. For instance, in the interview of AEO we tried to prove or disprove information obtained from Monsanto. As well, the information of the headman was cross-checked by interviewing Monsanto and other informants.
- ➔ The informants seemed to be willing and not shy in response, making the data collection more reliable than if the interviewers had asked many times through many approaches to achieve a comprehensive respond.
- ➔ Some of our Thai colleagues could understand and speak the locale language. Thereby, some of the semi-structured interviews were not conducted as expected, because unprepared questions rose. These interviews were difficult to analyse and repeat, reducing reliability of the results. On the other hand unprepared questions have other advantages to validity, elaborated below.

Validity is high because:

- ➔ The key informants covered a wide spectre of institutions and organisations with relevance to the village. In general, they had great knowledge and engagement in the issues of relevance towards the investigation.
- ➔ The validity of the House Wife Group is high, partly because the women were open and contributed with a lot of relevant information and partly, as bystanders they had another perception of the farming activities than men. Furthermore women delivered gender related information, which were not obtained from men, e.g. the lack of sideline jobs for women as a village problem.
- ➔ Open-ended questions were used to give the informant the opportunity to express personal point of view. As Casley & Kumar state: *"questions posed in an open-ended way encourage free conversation."* and informants can suggest new categories or ideas that might not have occurred to the designer of the interview (Casley & Kumar, 1988). For example, information on the increase of contract farmers focused the investigation and thereby the development of new categories. Hence, open-ended questions made it possible to achieve more relevant data.

The validity and reliability of information obtained from the headman was negatively influenced, since he was ill and different assistants influenced his response during the interviews. Some of this information proved incorrect as it was cross-checked. For example, the headman claimed that the number of contract farmers in BTP was 80, which was cross-checked with information from the headman of Mu 10 and Monsanto. This showed that he and the headman of Mu 10 provided incorrect data on this matter. This kind of incorrect information delayed the project framework, and investigated key aspects were reviewed to improve reliability and validity.

5.3 Pair Wise Ranking

Reliability is high because:

- ➔ The informants presented information not directly asked for, creating a greater extent of reliable information, since many methodological biases, such as leading questions, did not influence the responses.
- ➔ Since all informants had the possibility to respond on the more specific questions, there was only a little risk that an informant, who could not answer, would make up an answer and thereby decrease the reliability.
- ➔ The impression was that the informants did not seem to be insecure or in another way affected by eventual hierarchy structures among the informants or between the interviewers and them. Our Thai colleagues and interpreters, whom we asked about the appearance of these biases, further affirmed this. Though, the women talked a lot and they were deciding many of the opinions stated, it did not seem like the men were insecure or without power to make decisions.

Validity is high because:

- ➔ The informants covered a wide spectrum of villagers. Both difference in age, gender, educational level and occupation were met.
- ➔ The informants were asked a very broad question, which they had an opinion on, as they were selected from different organisations and institutions related to this question.

5.4 Group Discussion

Reliability is medium because either all of them agreed on a common opinion, or only one of them stated his opinion, which made the group discussion more like a group agreement. This might be caused by hierarchy structures among the farmers, or that some of the farmers were tired and drunk.

Validity is medium since the random sample of farmers only covered the farmers who were medium or maximum satisfied with contract farming. This caused a lack of representativity, because different points of view and information on contract farming could have been obtained, if the minimum satisfied contract farmers had been present.

5.5 Observation

Reliability is medium because:

- ➔ By observing a lot of the conditions affecting the village and fields, data obtained by other methods could be crosschecked, e.g. the trustworthiness of farmers statement on the use of fertiliser.
- ➔ Difference in cultural behaviour and expression caused biased interpretation and misunderstanding between Danish and Thai cultures.

Validity is high because:

- ➔ By doing many observations of the conditions affecting the village and fields, a broad impression was achieved on factors affecting livelihood.

5.6 Secondary Data

Reliability is high since data was obtained from official sources.

Validity is high because most data focussed on the local area: Song District or BTP.

5.7 Soil Sampling

Reliability is medium because:

- ➔ The Kasetsart University N.P.K. Soil Test Kit© in it self is a good field analysis tool. It is easy to manage and the results are given in a clear and understandable manor. Results are though not precise enough to properly conclude.
- ➔ Results depend on type, quality and amount of fertilizer applied, time of year of soil sampling, type of crop and the stage of the crops' growth cycle.

Validity is medium because:

- ➔ Number of samples on each field was too low to be representative.

The above methodology discussion is used to appraise the general quality of the results. By the degrees of the two quality parameters and the arguments, we claim that the results in general are of medium to high quality. Soil sample analysis, structured and semi-structured interviews are the most applied methods, when speaking of results. These are mainly of medium quality, expressing that compared to an ideal investigation, biases and problems related to application of methods have not been avoided. Thereby the results of the investigation are difficult to replicate by other researchers at another time.

5.8 Evaluation on Working Intercultural and Interdisciplinary

When working in an alien culture with representatives from both rural and urban environments, cultural dependent differences become obvious. During the SLUSE field course we learned a lot of valuable lessons in working intercultural in a Thai context. It was a firsthand introduction to rural and urban culture and Thai university students and traditions, but also an insight in our own cultural behaviour and reactions towards the exposure of Thai culture. The differences in cultural dependent behaviour and academic approaches were visible in the group work and led to a number of compromises in order to maintain a positive plenary discussion.

In our field study we applied a holistic interdisciplinary group work and participatory approach in order to give a comprehensive description of the livelihood strategies of Ban Tao Pun. In the question of differences in scientific approaches it became obvious that the Thai Students had prime academic skills and were descriptive in their project approach, opposed to the more independent critical problem and method oriented approach, applied by the Danish students. But what was the most efficient and direct approach remains to be determined, since they both contributed to the results.

The benefits of working intercultural are numerous and with regards to our Thai colleagues it would have been difficult to implement data collection without their presence. Their knowledge of the local culture, traditions and language was of invaluable importance to the fieldwork, without them we would still be standing in the patty fields looking for answers.

In conclusion we found that it is important to let each participant perform, contribute and implement their results in the conclusion and that it is important to be open towards the ingenuity and contributions of others. As Mikkelsen (1995) wrote it is essential not to turn the participants of an interdisciplinary project into generalist.

5.8.1 Working with Interpreters

Working with interpreters proved to be very challenging and had great effect on our overall group work. Neither Thai nor Danish students had any prior experience in working with interpreters, which sometimes caused a mismanagement of the interpreters' function. There were several misunderstandings due to incomplete translation, causing unnecessary frustrations and tensions. If we had been better in listening to our Thai colleagues when they spoke English and if we had coached our interpreters in specific academic terms, then some of the frustrations might have gone unnoticed.

Working with an interpreter calls for consideration as meaning, understanding or reliability of information can be affected through interpretation. Attention must be turned towards the interpreters understanding of the research question, specific terms and ability to act neutral when posing questions, as well as the researchers attitude towards the interpreter (SLUSE Internship 2000).

6. Final Discussion

This discussion will focus on sustainability of contract farming, seen as a livelihood strategy, by looking at agricultural, economic and institutional indicators.

Sustainable agriculture is understood as a combination between development and conservation. The emphasis is on utilising rather than exploiting the natural resources, avoiding pest, weed or disease related problems. The three factors water, soil and pest and disease management can be considered as the most important factors determining the level at which agricultural productivity can be sustained (Rowland, 1993).

The sustainability of contract farming depends on whether or not the contract encourages the farmers' choices, innovation, decisions and on the resulting changes in the structure of agriculture (Redhage, 1998).

Stable water supply and agricultural intensification requires an increase in chemical inputs in order to comply with the nutrient depletion and the eradication of weeds and pest. The low levels of N and K ascertained in the soil analysis could be a result of the agricultural intensification, among other things. Without a correct input of fertilisers and an improved soil management, soil fertility and agricultural yield will most likely decrease. Monsanto and AEO were aware of these implications and proposed programmes in order to avoid soil degradation. These initiatives were among others, the application of green and animal manure, the cultivation of legumes and the application of lime facilitating e.g. the uptake of fertilisers in the soil. AEO only demonstrates these practises to the farmers, but are not able to support the implementation economically.
Monsanto claimed that field supervisors gave advises to farmers, whereas some of the contract farmers disapproved. Monsanto's supervisor, Mr. Pramon admitted that contract farming was business only and that the contract imposed rules that were not always possible to comply, resulting in misunderstandings and unpleasant relations between Monsanto and contract farmers.
To strengthen their own position in negotiations contract farmers should organise into groups or co-operatives. A higher involvement and engagement of farmers will provide motivation and mobilisation, which complies with the institutional sustainability criteria of Redhage as seen above.

If agricultural sustainability is to be reached then contract farmers must adapt to the criteria of intensified agricultural production, i.e. a balanced nutrient input and output and correct crop rotations.

For contract farming to be economic sustainable, cost and benefit must be balanced so that an economic surplus can be established. The advantage of contract farming is the fixed price of products and the secure disposal of produce and this makes contract farming attractive. Further, the structured interviews of contract farmers illustrated an increased income equity among contract farmers after the MSR (see table 4.2). This could be appraised as if contract farming has increased economic sustainability.

Referring to the sustainability figure in chapter 2, sustainability consists of a number of inter dependable factors that have to be, in theory, equal in order to attain sustainability. If one of the four columns fail the whole sustainability framework will be influenced, but will not collapse.
Social sustainability was not included in the discussion, since the results of the structured interviews only vaguely incorporated the social factors in contract farming.

Having the monopoly in BTP Monsanto imposed contract farmers to follow the rules concerning agricultural practises. Farmers thus are under control, but they are still free to engage in a contract.
Because of the increase of market-oriented agriculture, the local production of the farmers in BTP has been globalised through Monsanto. As AGSD (Agricultural Support System Division) claimed, this shift from traditional to contract farming is one of the most critical development challenges facing Asia in the coming century. Strategies and priorities for supporting development of market-oriented agriculture have to be identified, with emphasis on improved production-market co-ordination, from the local to the global level (FAO, 1998).

7. Conclusion

The purpose of this field study was to investigate in which way Mae Song Reservoir influenced the socio-economic and agricultural livelihood strategies in Ban Tao Pun.

By creating a steady water supply the agricultural production was intensified which led to an increase in agro-chemical input and output of produce. A change in agricultural practice was detected as intensification and a rapid increase of contract farming, based on the combination of the stable irrigation and production potential of the area. This intensified agriculture in combination with the extensive irrigation led to an increase in pests, weeds and diseases.
The agricultural intensification led to an income increase giving the villagers an economic surplus which was mainly invested in agricultural production, housing improvements, Health Insurance Card, food and recreational activities. All are factors of improved life quality.

The MSR related increase in contract farming influenced agricultural practices by changing the crop rotation, choice of crop, management and agrochemical input. The economic practices were influenced as Monsanto offered agricultural input on credit terms and the farmers were guaranteed sale at a fixed price on the produce.

It is difficult to conclude whether or not contract farming has any effect on the plant available mineral N and P and exchangeable K, but there is a possibility that the low values of N and K are a result of intensified agricultural practices, of which contract farming is part.

The sustainability of contract farmers livelihood strategies in BTP was influenced by MSR on an intra generational level. This influence was a result of the many changes in the different livelihood strategies. The economic livelihood strategies can be perceived as sustainable, but the economic sustainability depends on an agricultural practice that hardly can be seen as sustainable and the institutional sustainability could be improved. These factors must be adjusted if the present livelihood strategies are to be perceived as sustainable in the future.

The complexity of the MSR affected changes in livelihood strategies demanded a multifaceted approach in order to cover as many aspects as necessary. We think that the quality of the results is medium, implying that validity and reliability are not optimal.

8. Perspective

The significant increase in contract farming connected farmers in Ban Tao Pun to the global market economy and consumers all around the World. The relation between construction of reservoirs, spreading of contract farming and increasing globalisation could be an interesting study to follow up on the results of this report.

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Appendices

Appendix 1

Name of interviewer: ..... Date .....Time.....No.....

Contract farm interview
General information of villager in Ban Tao Pun
Song district Phrae Province

Part 1 Background

1. Name :
2. Gender ( ) male ( ) female
3. Ages
4. Family Status
   ( ) Head ( ) Spouse
   ( ) Son/Daughter ( ) Parents
5. Occupation.....
   the second occupation (off farm).....
6. Number of years working on this field.....years
7. When did you begin Contract Farming?
8. Are you satisfied with it? ( ) min ( ) medium ( ) max

9.Situation of the fields

Plot position	Up land & low land	Upland	Low land	Rent
Before				
After				

10. If land situated in the reservoir area before R, how big a compensation did you get? price/plot/rai

.....

For what did you use this money?

12. Plot owner

Location		Size (rai)	Before							
Up	Low		Type of land use				Type of land certificate			
			Rice	Maize	Cotton	other	None	STK	NS-3	Other

Location		Size (rai)	After							
Up	Low		Type of land use				Type of land certificate			
			Rice	Maize	Cotton	Other	None	STK	NS-3	Other

13. Why did you change crops type

.....

...

14. Which crop do you produce in Contract Farming?

15. Crop calendar

	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Maize												
Cotton												
Rice												
Tobacco												
Other												

16. farming practices

	Before	After
Crop rotation		
Fallow		
Others		

17. livestock

Kind of livestock	Before	After

18. workers and members of family are working in the farm

before.....

After.....

Kind of equipment	Before		After	
	up	Down	Up	Down
A hoe / a spade				
Tractor				
Others				

19. Where do you get pesticide and fertilizer from?

	Before				After			
	Name	Time/year/rai Amount	Against which pests?	Price/kg	Name	Time/year/rai Amount	Against which pests?	Price/kg
Maize Pesticides Fertilizer Herbicides								
Rice Pesticides Fertilizer Herbicides								
Others Pesticides Fertilizer Herbicides								

20. Did you get some new varieties after R construction?
    If yes, which one?
21. Problems

	Before	After	Reasons
Soil erosion			
Soil degradation			
Diseases/pests			
Others			

Socio economy

22. Do you have a loan?
(if yes) because of farming?
(if yes) Have you made the loan before or after the R?

23. Where did you get the loan?

24. Why did you get loan?

25.Income bath/year

	Before	After
In farm		
Off farm		

Income/crop/year	Before	after
Maize		
Rice		
Cotton		
Others		

Farming expenditure	Before	after
Pesticides		
Fertilizers		
Herbicides		
Seeds		
Other		

Family expenditure	Before	after
Foods		
Labour		
Recreation		
Other		

26. If you have more income, what would you use it for (1&2 priority)
    ( ) Investment in farming
    ( ) Food
    ( ) Education
    ( ) Health
    Others.....

27. Impacts of irrigation construction

Positive	Negative

Appendix 2

The statistic below is an extract of a larger statistics of 22 contract farmers. The most interesting issues are presented below.

General information of 22 contract farmers in Ban Tao Pun

Table 1 General Information on Informants:

Variable	Frequency	Valid percent
Sex		
Male	17	77.3
Female	5	22.7
Total	22	100.0
Ages (min=31 : max=63)		
30-40	6	27.3
41-50	10	45.5
51-60	4	18.2
60 up	2	9.1
Total	22	100.0
Family status		
Head	16	72.7
Spouse	4	18.2
Parents	2	9.1
Total	22	100.0
Number of year that work in farm (min=1 : max=43)		
1-10	10	45.5
11-20	3	13.6
21-30	6	27.3
30 up	3	13.6
Total	22	100.0
Number of year that work with contract farming		
1	5	23.8
2	6	28.5
3	4	19.0
4	4	19.0
5	1	4.7
Total	21	100.0
Satisfied with contract farming		

Minimum	3	15.0
Medium	8	40.0
Maximum	9	45.0
Total	20	100.0

Comparison of General Information Before and After Reservoir Construction (Table 2 – 13)

Table 3 Details of Farmland (Up land)

Plot size Up land	**Before**		**After**	
	Frequency	Valid percent	Frequency	Valid percent
Plot 1(min=1rai : max=25rai)				
1-5	7	77.8	2	66.6
6-10	1	11.1	1	33.3
11 up	1	11.1	-	-
Total	9	100.0	3	100.0

Plot certificate Up land	**Before**		**After**	
	Frequency	Valid percent	Frequency	Valid percent
Plot 1				
None	1	11.1	-	-
STK	3	33.3	2	100.0
NS3	2	22.2	-	-
Title deed	1	11.1	-	-
SK1	2	22.2	-	-
Total	9	100.0	2	100.0

Table 4 Details of Farmland (Lowland)

Plot size Low land	Before		After	
	Frequency	Valid percent	Frequency	Valid percent
Plot 1(min=1.5rai : max=8rai)				
1-5	15	83.3	17	80.9
6-10	3	16.7	4	19.1
11 up	-	-	-	-
Total	18	100.0	21	100.0
	Before		**After**	
Plot land use Low land	Frequency	Valid percent	Frequency	Valid percent
Plot 1				
Rice & maize	10	58.8	10	47.6
Maize	5	29.4	9	42.9
Cotton	1	5.9	-	-
Tobacco	-	-	1	4.5
Rice	1	5.9	1	4.5
Total	17	100.0	21	100.0
Plot certificate Low land	**before**		**After**	
	Frequency	Valid percent	Frequency	Valid percent
Plot 1				
None	2	12.5	3	14.3
STK	1	6.3	2	9.5
NS3	6	37.5	6	28.5
Title deed	7	43.8	10	47.6
SK1	-	-	-	-
Total	16	100.0	22	100.0

Table 5 Kind of Live stocks

Kind of livestock	Before		after	
	Frequency	Valid percent	Frequency	Valid percent
Buffalo	1	16.7	1	16.7
Chicken	3	50.0	3	50.0
Pig	2	33.3	2	33.3
Total	6	100.0	6	100.0

Table 6 Number of Members working on the farm

Number	Before		after	
	Frequency	Valid percent	Frequency	Valid percent
1-5	20	100.0	20	95.2
6-10	-	-	1	4.8
Total	6	100.0	6	100.0

Table 7 Farming Equipment

Up land	Before		after	
	Frequency	Valid percent	Frequency	Valid percent
Hole	5	55.6	4	50.0
Tractor	1	11.1	2	25.0
Buffalo	1	11.1	2	25.0
Hole & tractor	1	11.1	-	-
All of equipment	1	11.1	-	-
Total	9	100.0	8	100.0

Table 8 Farming Problems

Erosion	Before		after	
	Frequency	Valid percent	Frequency	Valid percent
No	2	66.7	1	33.3
Yes	1	33.3	2	66.7
Total	14	100.0	3	100.0
Soil degradation	**Before**		**after**	
	Frequency	Valid percent	Frequency	Valid percent
No	2	66.7	9	100.0
Yes	1	33.3	-	-
Total	3	100.0	9	100.0
Diseases/pests				
No	2	40.0	15	100.0
Yes	3	60.0	-	-
Total	5	100.0	15	100.0

Table 9 In Debt Status

Loan	Before		After	
	Frequency	Valid percent	Frequency	Valid percent
No	15	68.2	9	40.9
Yes	7	31.8	13	59.1
Total	22	100.0	22	100.0

Because farming	Frequency	Valid percent
No	9	47.4
Yes	10	52.6
Total	19	100.0

Table 10 Farmers' Incomes

In farm income/year (bath/year)	Before		after	
	Min=5,000 ; max=60,000 Mean=21785.7		Min=5,000 : max=53,000 Mean=24194.4	
	Frequency	Valid percent	Frequency	Valid percent
5,000-10,000	1	7.1	3	16.8
10,001-15,000	5	35.6	2	11.2
15,001-20,000	2	7.1	5	27.8
20,001-25,000	-	-	-	-
25,001-30,000	4	28.6	4	22.2
30,001 up	2	14.2	4	22.4
Total	14	100.0	18	100.0
0ff farm income/year (bath/year)	**Before**		**after**	
	Min=2,400 : max=20,000 Mean=7983.3		Min=4,200 : max=42,000 Mean=12466.6	
	Frequency	Valid percent	Frequency	Valid percent
Under 5,000	1	16.7	1	11.1
5,000-10,000	3	50.0	6	66.6
10,001-15,000	1	16.7	-	-
15,001-20,000	1	16.7	-	-
20,001-25,000	-	-	-	-
25,001-30,000	-	-	-	-
30,001 up	-	-	2	22.2
Total	6	100.0	9	100.0
Income from maize/year (bath/year)	**Before**		**After**	
	Min=3,000 : max=30,000 Mean=8916.6		Min=1,000 : max=42,000 Mean=11900	

	Frequency	Valid percent	Frequency	Valid percent
Under 5,000	1	8.3	1	10.6
5,000-10,000	10	83.4	5	26.4
10,001-15,000	-	-	6	31.6
15,001-20,000	-	-	3	15.8
20,001-25,000	-	-	-	-
25,001-30,000	1	8.3	1	5.3
30,001 up	-	-	2	5.3
Total	12	100.0	19	100.0

Table 11 Chemical Use

Expenditures	**Before**		**after**	
	Frequency	Valid percent	Frequency	Valid percent
Pesticides				
No	13	59.1	5	22.7
Yes	9	40,9	14	63.6
More	-	-	3	13.6
Total	22	100.0	22	100.0
Fertilizers				
No	16	72.7	3	13.6
Yes	6	27.3	12	54.5
More	-	-	7	31.8
Total	22	100.0	22	100.0
Herbicides				
No	17	77.3	8	36.4
Yes	5	22.7	11	50.0
More	-	-	3	13.6
Total	22	100.0	22	100.0
Seeds				
No	19	86.4	8	36.4
Yes	3	13.6	11	50.0
More	-	-	3	13.6
Total	22	100.0	22	100.0

Table 12 Expenses

Expenses	Before		after	
	Frequency	Valid percent	Frequency	Valid percent
Food				
No	-	-	-	-
Yes	2	100.0	6	27.3
More	-	-	16	72.7
Total	22	100.0	22	100.0
Labor				
No	1	4.5	1	4.5
Yes	21	95.5	7	31.8
More	-	-	14	63.6
Total	22	100.0	22	100.0
Recreation				
No	1	4.5	1	4.5
Yes	21	95.5	5	22.7
More	-	-	16	72.7
Total	22	100.0	22	100.0

Appendix 3.

Pair wise ranking description.

The 5 key informants and the ranking process:

Headman (overall knowledge about the village and farming), Secretary of Housewife Group (knowledge about the women), President of Health Care Volunteers – approx. 70 years old (general knowledge about villages' health and elderly people), Man from Health Care Center (relatively professional knowledge about villagers' health), farmer – woman having husband doing carpentry.

1. Problem identification: We asked the informants, which problems were the biggest problems of the villagers. The students helped the informants to write the problems on papers. These were translated into English and placed on a pair wise ranking chart. Some of the papers mentioned the same problems, these were grouped within same theme.

2. Problem ranking: A student asked the informants to rank the problems pair wise, which they did by discussion and voting. Some of the problems were not discussed because of time limitation.

3. Identifying the biggest problems: The students counted the score of each problem, i.e. how many informants ranked this as the biggest problem.

Appendix 4. GPS coordinates, GIS attributes and soil analysis results.

Soil analysis results, attributes and GPS coordinates Ban Tao Pun, 2000.

GPS Coordinates		
Easting	Northing	Attributes
628575	2045168	Contract farmer, Maize Mr. Pratin 3 Rai.
628792	2045609	Contract farmer, Maize Mr. Charunn 3 Rai.
628785	2045583	Contract farmer, Maize Mr. Sangha 3 Rai.
627744	2044616	Contract farmer, Maize Mrs. Daungchaun 3 Rai.
628181	2044826	Contract farmer, Maize Mr. Ardunn 3 Rai.
628011	2044579	Contract farmer, Maize Mr. Samritt 4 Rai.
637103	2044620	Contract farmer, Maize Mr. Prakrob 3 Rai.
628523	2044570	
627918	2044313	
627873	2044875	
627802	2044501	
627511	2044795	
628140	2044871	
627860	2044819	
627701	2044841	
624802	2044504	
628052	2044692	
627918	2044313	Contract farmer, N.N. Moist soil, new crop 5 cm crops, maize. Located directly at the Irrigation channel.
628053	2044692	Contract farmer, Maize Mr. Nicom 3 Rai.No crops in field. But farmer in the process of maize seeding. Farmer did not know the nameof the pesticide applied. Field was adjacent to headman´s rice fields. App. 300 m from Irrigation channel.

Soil	Color	Texture						
Maize upland	5YR3/4 dark reddish brown	sandy loam	pH	EC	N	-	P	K
Maize plot 1	5YR4/6 yellowish red	loamy sand	01:10	ms/cm	NH4+	NO3-		
Maize plot 2	5YR3/3dark reddish brown	silt loam	7,10	0.13	VL- L	L	H	L
Maize plot 3	5YR3/4 dark reddish brown	sandy loam	6,50	0.11	VL- L	VL	H	L
Maize plot 4	5YR3/4 dark reddish brown	sandy loam	7,05	0.27	VL	VL	H	L
Nikom Suksard	5YR3/4 dark reddish brown	sandy loam	6,50	0.26	VL	VL	VH	L
Sutham Vanmahachai	7.5YR3/4 dark brown	sandy loam	6,25	0.26	L	L	VH	L
Sumrith Plungkam	5YR3/4 dark reddish brown	sandy loam	6,40	0.1	L	L	L	M
Prapin Khrawsong	5YR4/4 reddish brown	Loam	6,50	0.26	L	VL	M	L
Dungchern Kwangle	5YR3/4 dark reddish brown	clay loam	6,65	0.24	L	VL	VH	M
Adun Chaichalard	5YR4/4 reddish brown	sandy loam	6,85	0.1	VL	L	L- M	L
Chalard Seethi	5YR4/4 reddish brown	Loam	6,85	0.24	VL	VL	L- M	L
Sa-nga Charnplute	5YR4/4 reddish brown	sandy loam	7,00	0.25	VL	VL	M	L