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Thailand, Moo 12 – Ban Santisuk

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The interaction of land insecurity, market access and soil quality with farming practises in a Hmong village, Northern Thailand

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Abstract

The present report is written on the basis of 10 days of fieldwork in Ban Santisuk, Phetchabun province, Thailand. The aim of our research was to explore *how local perception of soil and different social factors influence the decision making around the farming practices in Ban Santisuk.* During the fieldwork, we did semi-structured interviews, a questionnaire, observation, soil sampling and PRA methods to address the research objective. The primary social factors influencing the decision making around land use and farming practices are found to be access to land, access to market and the knowledge pool of the community. The soil quality was expected to play a primary role in the farmers decision making but it did not, as access to land is restricted due to Hmong's lack of title deeds, so Hmong still grow on soils they consider of low quality. Thus, the soil quality is less important than other social and natural factors, but still plays a role when the farmers have the opportunity to take this into account in their decision making. One of the most important factors influencing decision-making is access to markets. Ginger was found to be the most profitable crop, but also the one that requires the highest investment. Therefore, if a household can afford to invest in growing ginger it will, if it cannot it will invest in growing the next most profitable crop, being cabbage. Their farming practices are influenced by their experience. Currently, they are intensifying their farming practices in order to get higher yields to get higher income.

Acknowledgement

The Interdisciplinary field course was a collaboration between Kasetsart University, Thailand, and University of Copenhagen, Denmark. The fieldwork would not have been possible without the organisational work done by our Supervisors from Kasetsart University, Ajan Ratcha Chaichana, Ms. Sopana and Ajan Wanana (lastname?) as well as our own supervisors Dr. Thilde Bech Bruun and Ph.D fellow Søren Brofeldt. Our Thanks also goes to Dr. Kelvin Egay from University of Sarawak. They have been very resourceful, tireless guidance, constructive criticisms and assistance rendered during the fieldwork. We would also like to thank our supervisors Dr. Simon Mundus and Ph.D fellow Daniel Ortiz Gonzalo from the University of Copenhagen for the guidance and being helpful in the Laboratory during soil analysis. We stayed in the Thung Salaengluang national park and enjoyed their hospitality and excellent food. Appreciation also goes to all our informants from Ban Santisuk for welcoming us so warmly and participating in our research. We thanks the village headman and his assistance Ms. Wanna for the help and efforts made. Special thanks go to Mr Yua and his family not only for participating in our research but also for welcoming us to stay over one night in his house. The research would not have been possible without our interpreters, Cookie and Job, we highly appreciate their help and send our thanks. Reaching our informant would be difficult without our driver, we thanks Mr.(name) for driving us. The cooperation given by our fellow SLUSE students is highly appreciated.

Section	Main author(s)	Contributor(s)
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Content

Introduction

How do people make decisions regarding their farming practices and how do different factors influence their decision-making? We set out to try to understand these processes and wanted to investigate the decision-making surrounding farming practices. Small scale farmers' land use decisions play an important part in shaping the global landscape, especially in the forest-agricultural frontier zones (Mertz et al., 2008; Vliet et al., 2012). Thus making it interesting to investigate what drives local farmers in their decision making around farming practices and how this is affected by various social and natural factors. According to Mertz et al., 2008, small scale rural farmers are adapt decision makers that, often under constraining land use restriction, makes decisions about land use and farming practices based on experiences from long-term trial and error. Drawing on this we try to understand the processes affecting rural farmers, decision-making in a forest-agricultural frontier region in northern Thailand, Phetchabun Province, Ban Santisuk (Moo 12). The region is a mountainous area dominated by forest and uphill agriculture (Delang, 2002; Jarernsuk et al., 2015). Ban Santisuk is a part of the village cluster Khek Noi, which has the largest concentration of the ethnic minority, the Hmong people, in Thailand (Catalyst 2015; Jarernsuk et al., 2015). Traditionally Hmong people have been using shifting cultivation and swiddening (ibid.; Delang 2002) but this practice was banned by the Thai government in the 1960s (Hares, 2009). Together with the establishment of the Thung Salaeng Luang National park in 1963 this lead to land scarcity and insecurity, establishment of permanent fields and a more intensive farming practices with focus on cash crops (ginger, cabbage, chili and maize), combined with rice cropping for home consumption. Before the fieldwork we wanted to investigate which social factors are influencing these farming practices and how these are affecting the local environment, in terms of the soil. But because of the limited amount of time and the difficulty in obtaining information about the history of the farming practices at a field level, we chose to focus on how the perception of soil in relation with other social factors influence the decision making around farming practices in Ban Santisuk. In a simplified way the following framework is used as a way of understanding the factors influencing the farmer's decision-making around farming practices (figure 1).

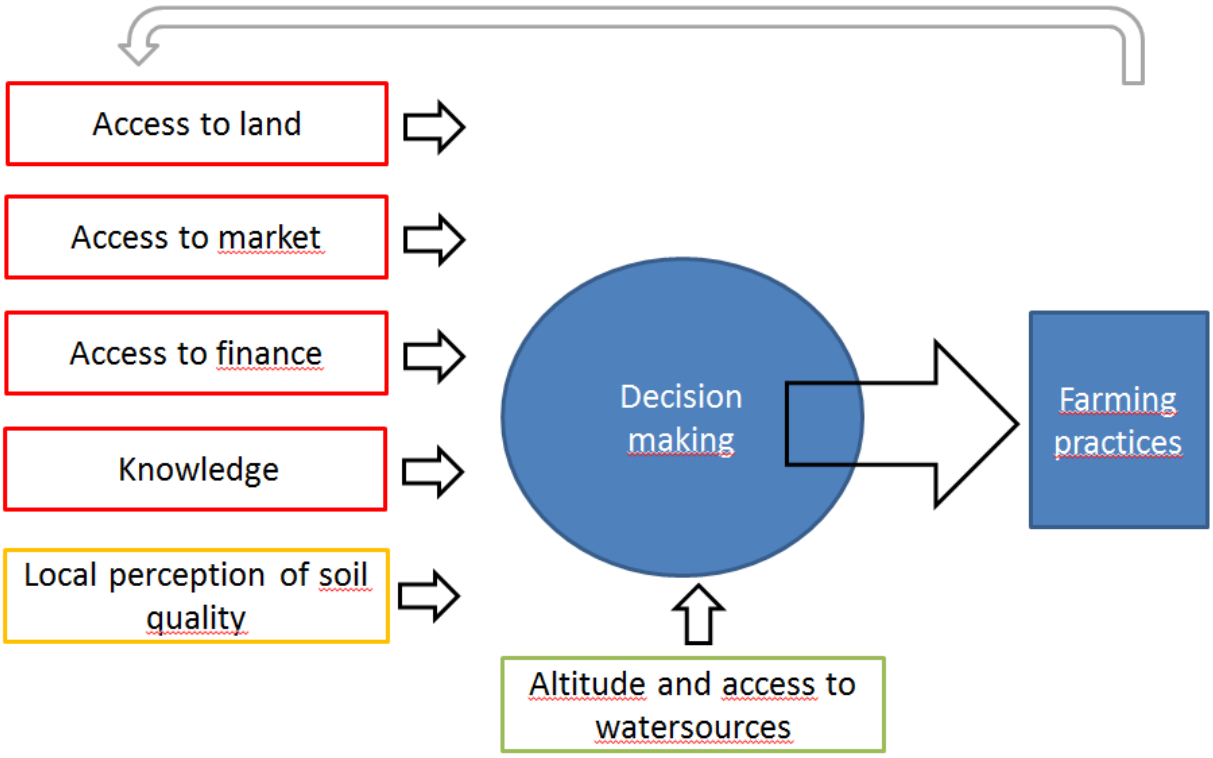

Figure 1: Analytical framework of how social and natural factors influence the farmer's decision making around farming practices in Ban Santisuk. The framework is based on the old framework that can be seen in the synopsis in the appendix.

During the fieldwork it became evident that the social factors influencing the decision making is primary issues regarding access to land, access to market and finance, and the knowledge pool in the society. Whereas the primary natural factors that was determining choice and distribution of crops were the altitude of the fields and their proximity to water sources. Contrary to what expected, the perception of soil quality showed less important as all the soils in the area were perceived as having a relatively low quality, but the land scarcity meant that people cropped them anyway.

The land scarcity and insecurity is making most of the farmers in Ban Santisuk access land primarily through renting. We want to investigate if this makes the farmers less prone to think about the long term sustainability of their farming practices.

The access to market, that is primarily established since the 1980's (Delang, 2002), have encouraged a change towards cash cropping (Shipron, 2006). Today there are a lot of ginger middlemen and warehouses in the area buying ginger for both domestic sale and export to the world

markets. We wanted to investigate how the access to market supports the choice of ginger as a cash crop and a farming practices with high inputs and outputs.

As the conditions for farming in Khek Noi have been changing, the knowledge pool of the society is evolving. The changing farming practices can lead to a loss of knowledge about earlier farming practices, but also to adoption of new knowledge (Shipron, 2006). We want to investigate how the knowledge pool of the farmers is affecting the choice of farming practices.

Ginger is prone to bacterial diseases (Sharma et al., 2010) and as a way of avoiding the spread of diseases the farmers in Ban Santisuk practice crop rotation, with a period of 7-20 years between growing ginger on the same plot. This creates a need to rent fields that have not been used for ginger cropping in many years, thus feeding back to land scarcity in the area.

Literature review

In northern Thailand the agricultural practices have been changing as a consequence of both political initiatives and increasing access to local and global markets (Shipron, 2006). Which have caused huge changes in livelihoods and farming practices (Riwtong et al., 2015; Shipron, 2006). Vliet et al. (2012) find that the change from swidden cultivation to permanent farm often have a positive effect on household income, which is in line with Riwtong et al (2015) who write that the rapid changes seen in agricultural practices in upland Thailand have resulted in "*dramatic improvements in farmer livelihoods".* On the otherhand intensification may lead to environmental degradation, lower soil quality and land conflicts (Vliet et al., 2012). Riwtong et al (2015), describe that the intensification in farming practices lead to a higher use of inputs, especially in the form of agrochemicals. And that this use both poses a health risk to the farmers, and can lead to environmental problems. Thus we expect that the intensification in farming practises in Ban Santisuk both result in higher household incomes and possible environmental problems.

The local farmers access to land, and their choice of farming practices is constrained by restrictions made far away, which is often the case for rural farmers (Mertz et al., 2008). Riwtong et al (2015) proposed that rapid changes in agricultural practices can result in knowledge gaps. Thus Shipron, 2006, describes how the Thantam Hmong have constituted a "*dynamic knowledge system"* drawing both on local and scientific knowledge as a way of securing their livelihoods.

This corresponds with conclusions in Saito et al. (2006), in which it is highlighted that local farmers use the acquired knowledge from previous generations and draw on their experience when they

have to adapt their farming practices, increase agricultural productivity and secure their livelihood. Local perception and knowledge of soil, termed ethnopedology, is the knowledge of how people view, understand and manage land at different spatial scales in local settings (Krasilnikov & Tabor, n'd). Local soil perception use manifold criterion for identifying soils mostly soil color and texture (Saito et al., 2006; Barrera-Bassols & Zinck, 2003), and weed abundance (Desbiez et al., 2003). As the local perception of good and bad soils corresponds with the results of the soil samples (chemical analysis) done in several studies (Desbiez et al., 2003; Saito et al., 2006), we also expected this correspondence in the Ban Santisuk area.

Thus, rural farmers are influenced by land use decisions made by others far away, and are themselves making important land use decision drawing on both local knowledge and adapting to the changing social and natural environment. To better understand the decision making concerning farming practices undertaken by rural farmers, social and natural factors must be explored, as it is believed both have an influence on the decision making. Therefore, this study aims to explore:

How local perception of soil and different social factors influence the decision making around the farming practices in Ban Santisuk?

From this general question, we came up with the following sub questions:

1: What are the social factors influencing decision-making on farming practices?
- How does different forms of access to land influence the decision making?
- How does the assets owned by individuals affect their decisions concerning land-use?
- How does social relations (Kinship) between household influence farming practices?

2: Which farming practices and crops are used and on which soils?
- Which crops are grown?
- Which farming practices are used on which crops?
- How does input and output influence the farmers crop choice?
- How do farmers get information about farming practices?
- How do farmers get fund/credits for their farming activities

3: How does soil quality affect decision making process?
- What is the local perception of soil quality?
- What do the soil samples show about soil quality?

To investigate these questions and gain knowledge about the village-life we have used semi-structured interviews, informal talks, observation, questionnaire, soil sampling and PRA methods being community map, soil ranking, village walk.

Context

The history of the area

Hmongs came to the Khek Noi area around the beginning of the 1920s (Hares, 2009). In 1967 the war between the communists and the Thai Royal Army peaked in the area and both sides promised the Hmong people that they would get land rights if they joined their side. According to our informants 90% of the Hmongs in the area at that time joined the communists and the remaining 10% joined the Royal Army. The communists and their Hmong supporters retreated to the forest and Hmong siding with the Royal Army were sent after them because they would know their way around the forest better than the Thai soldiers. In 1972 the prime minister suffered a military coup and the government promised to cancel the national park and give 20,000 rai of land to all Hmong if they left the forest. This meant that the Hmong loyal to the Royal Army convinced the Hmong people in the forest to come out of the forest again and by 1983 most people had left the forest. The 20,000 rai were not given to the Hmongs but came under the National Treasury and was turned into rental land. To this day Hmongs in Khek Noi still do not have any title deeds for the land but rather a customary right being a sort of invisible right to use the land.

Kinship

Hmong have 12 different clans which they know the difference of by the last name of the people in the clan. As we see it Hmong's kinship structure might under the broader terms be described as a classificatory kinship system and further subdivided into a patrilineal lineage classification. In this kinship system one's family consists of one's siblings (only unmarried sisters are included), one's parents, father's siblings, father's father and his siblings (Eriksen, 2013). It was explained to us that to the Hmong one's father's brothers will also be one's fathers and the same generation within one's clan would be one's brothers and sisters. Thus the Hmong people have a different way of classifying family and relatives than we do in the West. This created quite some confusion in the beginning of the fieldwork because it seemed that one person would have a lot of siblings spread throughout not only the village but the province and in some cases all over Thailand. Kinship is influencing how farmers access land and how they access credit.

In Thailand they use the term rai to describe land area, why we also use it in the report. 1 rai is equal to 0.16 ha.

Figure 2: Pictures of the landscape in Khek Noi

Methodology

Before going to Ban Santisuk, we spent three weeks in Denmark making a plan of the methods that would be applied in the field. We decided of the PRA methods that would be carried out and designed interview-guides and a questionnaire. Therefore, we already had a focus before even getting to the field. We realized that this approach was a top-down approach as we had our ideas about what the problems were and therefore narrowed the information we got from informants. Therefore, after two days we decided to go to the field with a more explorative approach, carrying out informal talks in order to find out from the villagers what was going on in the village. Once this was done for a few days we decided to gather the information we had got, discuss and to select a focus. Thereafter, we redesigned the research questions and the questionnaire and we decided on the PRA methods we would carry out.

Semi-structured interviews and informal talks

The semi-structured interview is a type of interview in which the conversation has a specific direction (Hastrup et. Al, 2013). An interview-guide is created with divided thematics and open-ended questions and the interviewer has the freedom to follow up on relevant information obtained during the interview (ibid.; Mikkelsen, 2005; Casley & Kumar, 1988; Bernard, 2011). Whereas in informal talks *"...the interviewer enjoys complete freedom and flexibility to explore a broad subject..."* (Casley & Kumar, 1988). We used the Semi structured interviews and informal talks to obtain information about farming practices and livelihoods in the village both as an overview from the headman and more specific information from the individual farmers.

Before going to the field we had prepared interview-guides for 4 different categories of informants: farmers, the village headman, a local government officer and an extension officer. As it turned out upon arrival to Ban Santisuk there was no claimed extension officer and no government officer in the form we had imagined back in Denmark. We did a total of five semi-structured interviews. Being one with the headman, one with a farmer and one with a knowledgeable farmer regarding land-rights; gaining background and overall information of the village. We also made an interview with the mayor of the local TAO office and the recently hired agricultural officer. The last two interviews were as the only ones of our interviews recorded and with a more direct line of questions meaning the interview-guide was followed more strictly. In line with Bernard's (2011) point regarding the semi-structured interview being well suited for bureaucrats and high-level members of a community due to the more formal but also curious character of the conversation it seemed to work well in the formal setting with these two people.

We had imagined to conduct a lot of semi-structured interviews with the farmers we would meet in the field but after two days in the field it became clear to us that the informal talks as a means of creating empirical data felt more suitable in this context. When we met farmers we would small talk with them and start conversations of informal character to make it more pleasant for all involved parties and introduced our reason for being in Ban Santisuk. If the conversation evolved to topics regarding our research objective we would ask for permission to take notes and with some people we would arrange to meet again to gain more in depth information. These farmers were chosen based on availability and their crops.

We see some of the informal talks we had as unstructured interviews because we kept our research objective in mind and the farmer was aware that we were mostly interested in their farming practices. If the fieldwork had been longer it might have become more suitable to conduct more semi-structured interviews with targeted questions, because we would have a better relation to the villagers than what we had time to build in 10 days.

Observation

Our aim was to carry out participant observation, however this did not happen. We expect that if we had stayed in the village instead of in the national park then we would have had better circumstances to apply participant observation while hanging out, preparing food etc. Nevertheless, when in the village and during informal talks, interviews etc. we tried to take notice of what was

going on around us which helped getting nonverbal information and an understanding of the village life. We were able to get relevant information on farming practices from our observations.

Small scale Questionnaires

A questionnaire is a structured research instrument with written questions aimed for gathering standardized information from many respondents using few well-defined variables (Rea & Parker, 2005). The questionnaire covered issues on livelihood strategies, soil considerations and inputs and outputs in farming practices of crops being grown by farmers surveyed (figure 3). The survey was designed to gather quantitative data on the issues. To make the data comparable and easy to analyze, we decided that the majority of the questions in the survey would be closed. Furthermore the data was gathered on a plot basis, with the aim to increase the accuracy of our information concerning inputs and outputs (Reardon & Glewwe, 2000).

On arrival, we made some modifications to the questionnaire and piloted it. Accordingly to Rea & Parker's (2005) point regarding privacy, we adjusted it to make it less time consuming for the farmers and adjusted the questions that seemed to invade the respondent's privacy. Although, the questions were directed to one respondent, other family members participated in giving answers.

Considering the sampling strategy, we decided not to disseminate the questionnaire through network brokers to avoid snowballing which could lead to biased data. We had previously planned to use random sampling by asking every 10th household. However, after a bad experience, where it felt imposing to go to the 10th household and require of them to do the questionnaire we decided to change our strategy to convenience sampling, which may have forfeited the representativeness of our results from the sample. Therefore, we would walk around the village, at a time where farmers would be back from the fields and start conversations with people who came to us and then ask them if they would be willing do the questionnaire.

We surveyed 18 households instead of the 30 households planned previously. Figure 3 shows the geographical distribution of participants. We can see that the questionnaires were mostly carried out in the north-west part of the village, this is because most of the villagers live there.

The section concerning the inputs and outputs of each crop grown was not filled in consistently by each group member. Therefore, we chose a well filled in questionnaire to make a field sketch of a cabbage and ginger crop, instead of averaging values of all questionnaires. The rest of the data was

analyzed in excel. However, we did not quantify the soil perception answers as it was an open ended question.

PRA methods

Community soil mapping.

Community mapping is a method whereby the surrounding of a village are drawn up on paper by the farmers in collaboration with a facilitator (Mikkelsen, 2005). The objective of the exercise is to understand information about land use, the distribution of fields and natural resources (Strang, 2010). We chose this method because we wanted to address the question of farmers' local soil perceptions of their farm lands which was our main focus area. The activity was conducted at a key informant house. Three farming families were present. The farmers were asked to map the community and the farmlands in the area. Giving farmers control over the exercise resulted in them mapping based on their way of conceptualize their surroundings. The different soil types were unveiled based on their farming experience. The major disadvantage of this approach was that we had no control and could not intervene in any way because respondents talked Hmong to each other, and it was difficult to tell how respondents came to conclusions. One older respondent concluded on the discussion before anything was put on paper this might be because she was perceived to have more knowledge than other farmers or it was out of respect since she had been farming for many years. Our introduction towards the activity turned out to be biased because the farmers excluded the soil types in the village itself hence the focus was directed to farmland outside the village.

Soil Ranking

Identification of key indicators may also be realized through engaging in a participatory exercise of ranking and scoring. The exercise reveal information through comparison of different indicators that maybe be used for intervention purposes by interested institutions (Mikkelsen 2005). We chose this method to find out if specific crops are better suited to certain types of soil. The disadvantages we encountered for the community mapping were the same we encountered for the soil ranking activity. We asked the farmers to rank soils according to their suitability to grow different crop types. We had to intervene when drawing the soil ranking matrix to help farmers with the exercise. However, we gave the farmers the liberty to discuss on their own and reach an agreement concerning the pairing soil types and crops based on their past farming experience.

Village walk

Walking through the village or fields with informants often gives the researcher the scope of the village innovations and key indicators of the village status (Kirssopp-Reed 1994). We chose to carry out a village walk in order to get a different perspective of Ban Santisuk and the farming practices taking place. This activity was carried out with the aid of the village head man and TAO member. We took a route that enabled us to have informal talks with some of the villagers found in homes. The key informants explained different issues taking place in the village regarding agriculture which is the major livelihood. The downside was that the informants took us on the path they deemed important to us because they were aware of our research objectives. Due to limited time on the side of the key informants we only managed to walk through less than a third of the village.

Soil Sampling

The aim of the soil investigation was to compare the differences between the soil types in the area and to compare the soil quality of the different soils with the local perception of the soils suitability for cropping, this was agreed on in the field. Thus we will be drawing on the ideas of Etnopedology, where the point of departure for accessing the soil quality and its influence on farming practices is the local perception of soil (Barrera-Bassols & Zinck, 2003).

Before going to the field, the idea was to obtain soil samples from fields with different farming practices in order to compare their effects on soil quality. However, it was not discussed how to distinguish between inherited differences in the soils and differences that could be attributed to the management practice. During the fieldwork it furthermore proved difficult to investigate the cropping and management history of the different fields as most of them were rented for short term. Therefore, we chose to sample according to the local perception of soil types and their placement in the area. We tried to sample from fields with similar farming practices but with different local descriptions of the soils and different perceptions of the quality.

Soil samples were taken from three different fields, covering four different soil types based on the farmers perception. The different soils were described by colour and texture. In each soil three profiles of 50 cm depth were digged,out and samples were collected from 2.5 cm, 20 cm and 40 cm depths.

The following parameters: color according to the Munsell color chart, texture according to FAO (2006) bulk density, pH, POX-C, total C and total N were measured at Copenhagen University in accordance with the soil analysis method description 2016 (Mundus, 2016).

The data was statistically analyzed in SPSS; ANOVAs were used to determine if the fields were significantly different for each of the measured parameters, at each depth. Fisher's Least Significant Difference post hoc was used to locate where the significant differences lay between each field.

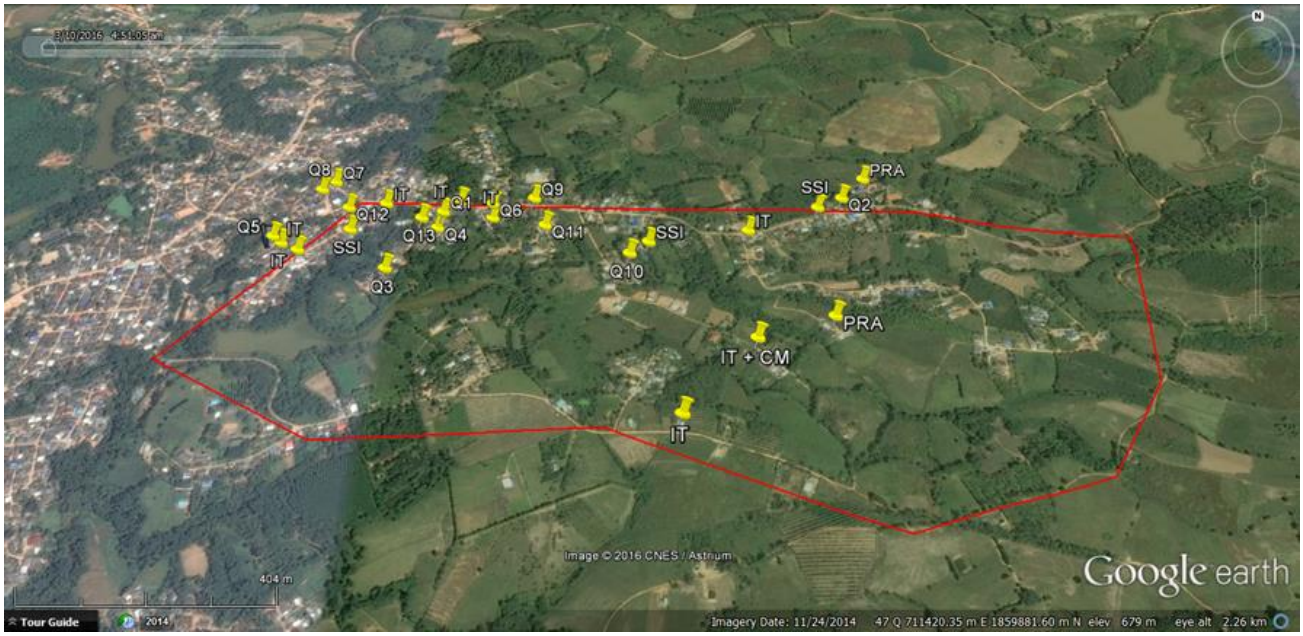

Figure 3: Satellite picture showing the distribution of questionnaires (Q1-13), Semi Structured interviews (SSI), informal talks (IT) and participant rural appraisals (PRA). The red polygon is denoting the area of Ban Santisuk. It was not possible to establish where all the data was collected, eg. the place of 5 questionnaires is missing due to the lack of GPS points.

Discussion

Farming practices

In Ban Santisuk, Hmong's main livelihood is agriculture. In this study we found that the main crops grown in the village are ginger, cabbage, rice, chillies and maize. Farming activities include farmland management, crop establishment and crop management. Thailand has been undergoing agricultural development these recent decades resulting in land use intensification (Riwthong, 2015). We found that, in Khek Noi, Hmong started using agrochemicals 10 years ago, due to a decline in soil fertility and pest problems causing crop productivity to decline.

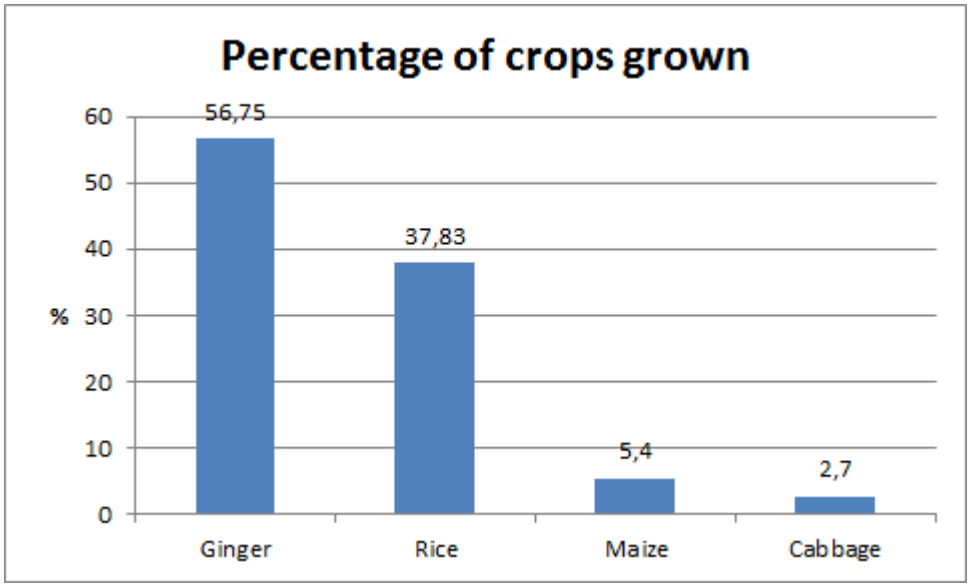

Figure 4: graph showing the % of crops being grown from 38 fields of the 8 questionnaire (data made with questionnaire data).Results from the questionnaire survey shows that 56.75 %, 37.83%, 5.40%, 2.7% of the land was allocated to ginger, rice, maize and cabbage cultivation, respectively.

According to the questionnaire data, ginger is the main cash crop grown in the village (figure 4), followed by rice, maize and cabbage. Ginger production started expanding in the area about 20 years ago. This is due, according to the agricultural officer, to it's high yield returns and profitability. There are two types of ginger grown in the area. One is the seasonal ginger which is rainfed and planted just before the rain season in April-May. This type is grown once a year. The second one is irrigated ginger, which we were told is grown twice a year. The input-output farm flowchart for ginger (Figure 5) shows that, ginger production requires high inputs but consequently brings high yield returns to the farmer.

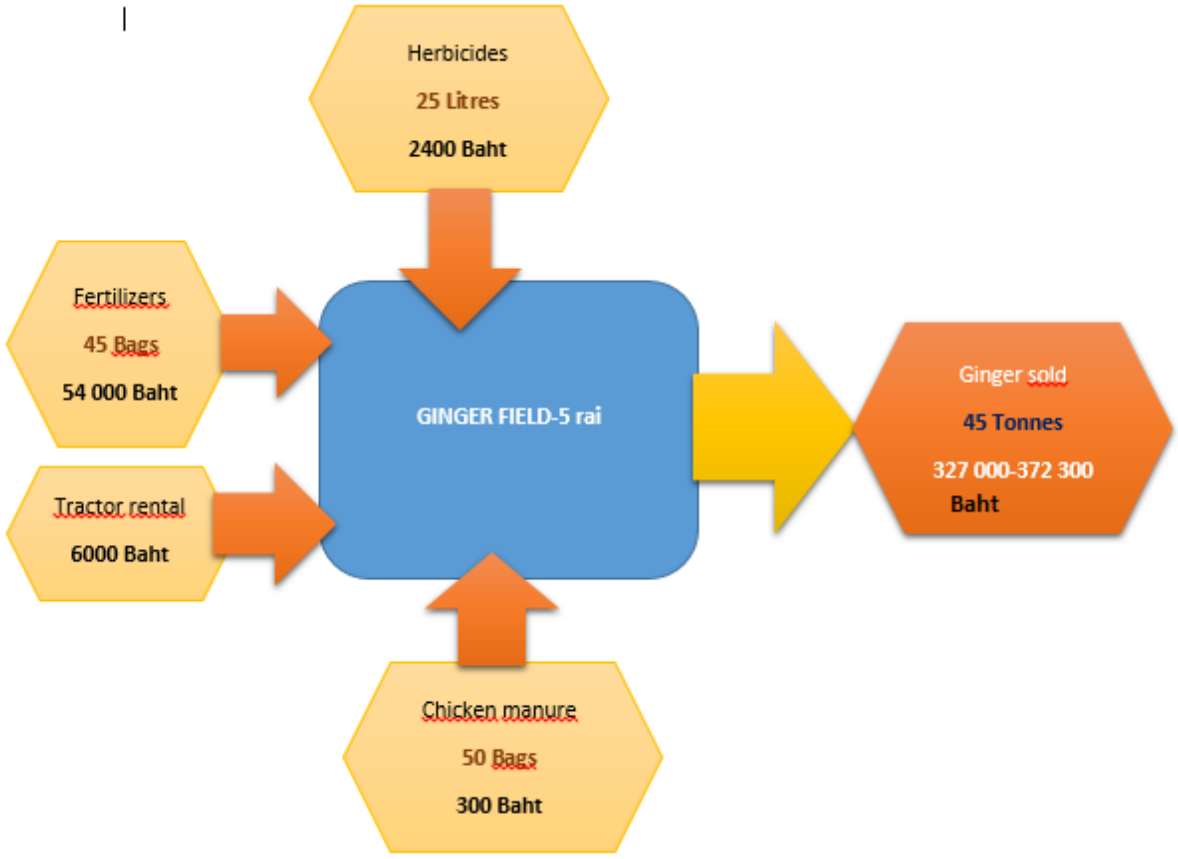

Figure 5: Field/farm flow diagram of 5 rai seasonal ginger crops (data gathered from on case questionnaire). GINGER SOLD FOR 405 000-450 000 Baht - Inputs (15 000+2400+54000+6000+300)=PROFIT (327 000-372 300).

The land needs to be tilled before ginger is sown and chicken manure is used in the primary stage as basal dressing to improve the soil fertility. Tilling of the land used to be done manually. However, it is now done mechanically with four wheel tractors in gentle slopes and two wheel power tillers in highland steep slopes. We found that, the farmers use 600 kgs of ginger seeds/rai, mostly their own.. Ginger is threatened by bacterial wilt (Xizhen, 2016), in order to prevent this, channels are made on the ground to reduce the spread of diseases, these help to transport the water and separate the different parts of the field in an attempt to stop the spread of diseases to the entire field (figure 6). Furthermore, once ginger has been grown in a field, because the primary source of bacterial wilt comes from contaminated seed rhizomes, the land needs to be left to fallow for 5-6 years before ginger can be grown again on that same land.

Figure 6: Pictures of channels made in ginger fields

We learnt that, bundle of rice and grass straws are used in ginger cultivation to provide shade for the ginger seeds whilst they are being sown prior to rain season. In addition, it also acts as mulch and hold water. When walking in the village we observed piles of straws (figure 7) and deducted that the households with them were the ones growing ginger.

The second most grown crop is rice, the headman pointed out that, 80% of the people in Khek Noi grow rice. From our questionnaire we found that 56 % were growing rice. This crop is mainly used for home-consumption and sold when in surplus. We did not make a field sketch of a rice crop as this one is not a cash crop

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Figure 7: Picture of straw used as cover in ginger fields.

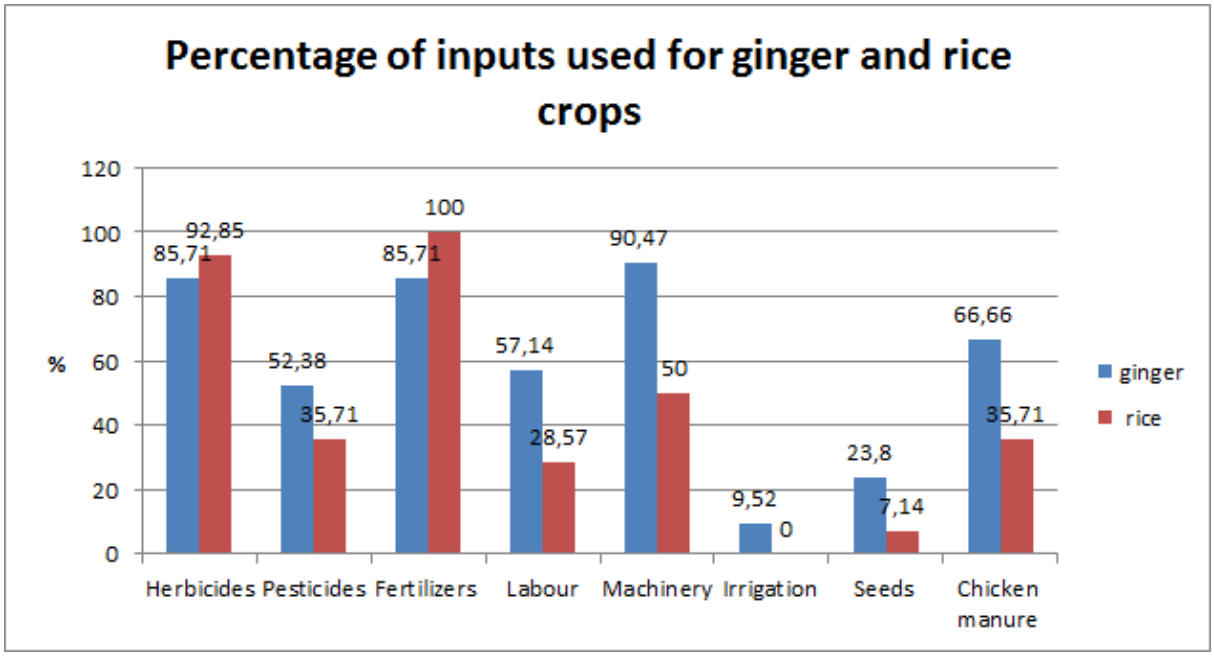

Figure 8: % of inputs used for ginger and rice crops (data obtained with questionnaires) 85.71%,52.38%,85.71%,57.14%,90.47%,9.52%,23.80% and 66.66% of the ginger farmers use herbicides, pesticides, fertilizers, labour, machinery, irrigation, seeds and chicken manure, respectively. For the farmers growing rice 92.85 %, 35.71%, 100%, 28.57%,50%,0%, 7.14% and 35.71% use herbicides, pesticides, fertilizers, labour, machinery, irrigation, seeds and chicken manure, respectively.

The graph shows high herbicide use for rice as the farmers often practices zero and minimum tillage for upland rice production. Therefore, herbicides are applied to kill the weeds prior to planting. We can see from figure 8, that irrigation is not used for rice crops and that mostly farmers use their own seeds. Labour was mostly used for ginger and 9,52 % of the crops were irrigated. As a whole, results show that ginger requires more inputs. It is interesting to see that 100% of the farmers questionnaires use fertilizers on their crops, this is maybe because land of lower quality is used for rice as it is not a cash crop.

Figure 9: Picture of a cabbage field

The headman told us that it was one of the main crops cultivated. However, on the 18 questionnaires we only found one non-irrigated cabbage cultivator. There are two types of cabbages which are grown, irrigated and seasonal cabbage. Manure is used in the primary stage. It takes 2 months to grow. Non-irrigated cabbage can be cultivated 1-2 times a year. There is one main pest which is the butterfly worm that attacks during the rainy season. According to the agricultural officer, pesticide application is the only way used to control it.

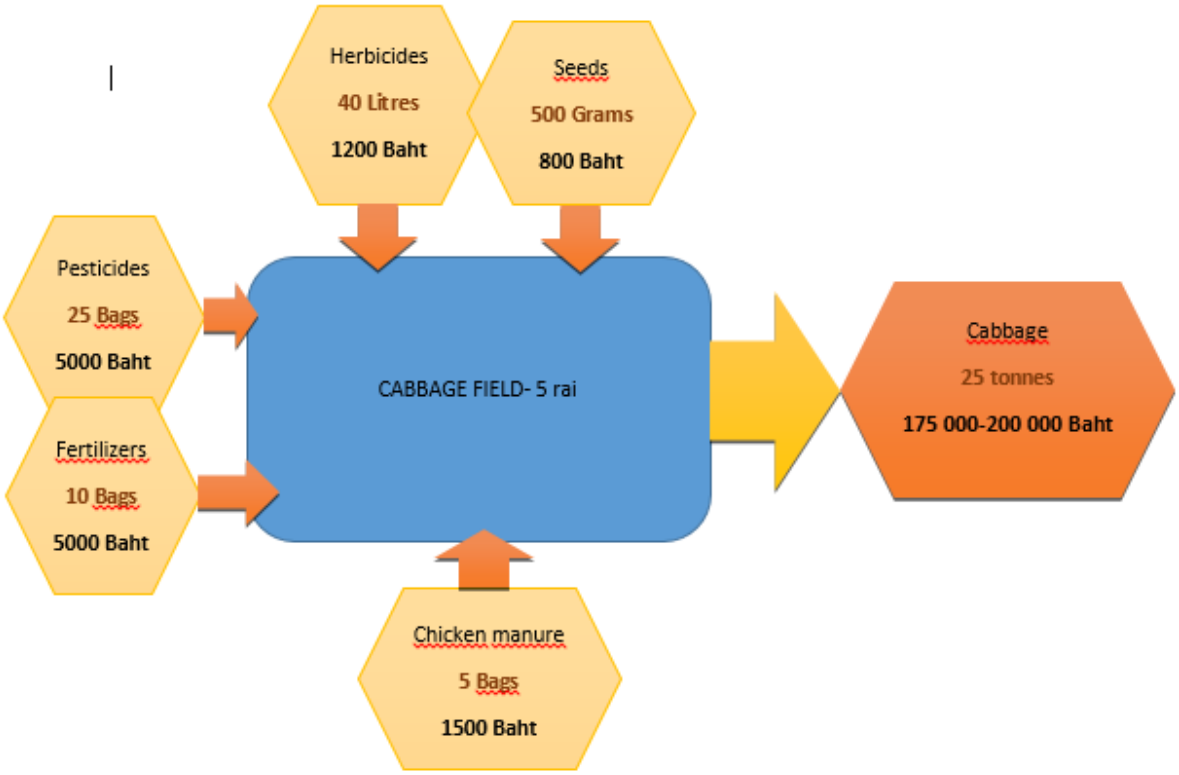

Figure 10. Field/farm flow diagram (data gathered from one questionnaire) CABBAGE SOLD (175 000-200 000 bath) - Inputs (5000+5000+1500+800+1200)= PROFIT (134 000 -159 000)

When looking at the input-output field flow diagrams of cabbage (see figure 10) and ginger (see figure 5), it can be seen that ginger has higher yield returns and hence more profitable. From the data of the one farmer we found growing cabbage we can see that it is also a profitable crop, not as much as ginger and therefore does not require as many inputs. However, it is hard to really conclude on the data as we saw one cabbage field. It could maybe be suggested that cabbage fields are not grown in the area.

The results of this study show that, when the soil fertility declines, farmers leave the land to fallow for 1-2 years. Organic and inorganic fertilizers are applied before sowing of a crop. Concerning livestock we learnt from the headman and the PRA that cows and buffaloes are reared on infertile lands around the village. Farmers in the village practices crop rotation between rice, maize and ginger.

To conclude, it can be seen that, the farmers in Ban Santisuk's farming practices have intensified in the last years with the uptake of agrochemicals, mechanization of tilling and the use of irrigation when household can afford it.

Land access

The farmers' access to land in Khek Noi area is still affected by the establishment of the Thung Salaeng Luang National park in 1963 and the war in 1967-1982 (Jarernsuk et al., 2015; Delang, 2002). Through interviews with, Suvit; the mayor of the Khek Noi tambon administration office (TAO) and two other informants as well as some informal talks we have tried to understand how this history influence the land access and the farmer's decision making around farming practices.

After the war the 20,000 rai were distributed between Hmong. According to our informants the Hmong people went out with sticks to put in the ground around their fields to secure the plot for their use when dividing the 20,000 rai. Some of the farmers described it as a first come first served process, where the people who settled in the area first secured land for themselves. Therefore people arriving later either have to rent from the people who have land in the area, or rent land in other areas.

According to Suvit, in 2009 the villagers were informed that the 20,000 rai were never given to the Hmong, but was transferred to the National Treasury, and that the farmers therefore have to pay rent. The Hmong farmers refuses to pay rent for the land as they argue that the land belongs to them.

The farmers refer to the Hmong lacking Thai citizenship and land rights as part of the government's and Thai society generally bad view and treatment of the Hmong. The so called *Hill Tribe Problem* is described by Delang (2002), Siriphon (2006) and Hares (2002) as being that the Thai society both historically and presently blaming the Hmong for deforestation, drug production (opium) and communist activity. According to Hares (2009) there are several reasons behind the lack of citizenship; unwillingness from the Hmong to become Thai citizens; difficulties with proving residence of the paternal grandfather, which is a requirement from the government; and the government's reluctance to grant citizenship, among other things because of the continuous illegal immigration from the neighboring countries. One farmer described the rights of Hmong as: "we have the right to stay, pay taxes, and have voting rights, but no citizenship and no land rights".

Consequently the legal status of the Hmong is today complex and probably differ, but it applies for the majority that they are registered and pay taxes, but still lack formal citizenship and title deeds.

According to both the headman, Suvit and the farmers the struggle for title deeds continues, but they are worried about the future. Suvit expressed worries that the Hmong people would give up the hope of getting rights to their land. This worry was actualised because Hmongs started to sell their land, primarily to Thai people from the south. The Thai people either establish rubber plantages or build tourist resorts on the land. According to Suvit some Hmong saw this as a good opportunity. Because of the lack of land rights some Hmongs are afraid of losing their land and therefore rather want to sell their land, thus securing at least getting paid for the land. The new owners of the land pay rent to the National Treasury, and therefore secure the formal recognition of their right to the land. According to Suvit in the article *Khek Noi - The land without the concept of a title deed* (Catalyst, 2015) is it not a problem for the new Thai owners to get title deeds to land. The process of selling is probably also supported by the fact that a lot of the farmers in the village perceive the soils in the area as being of low quality.

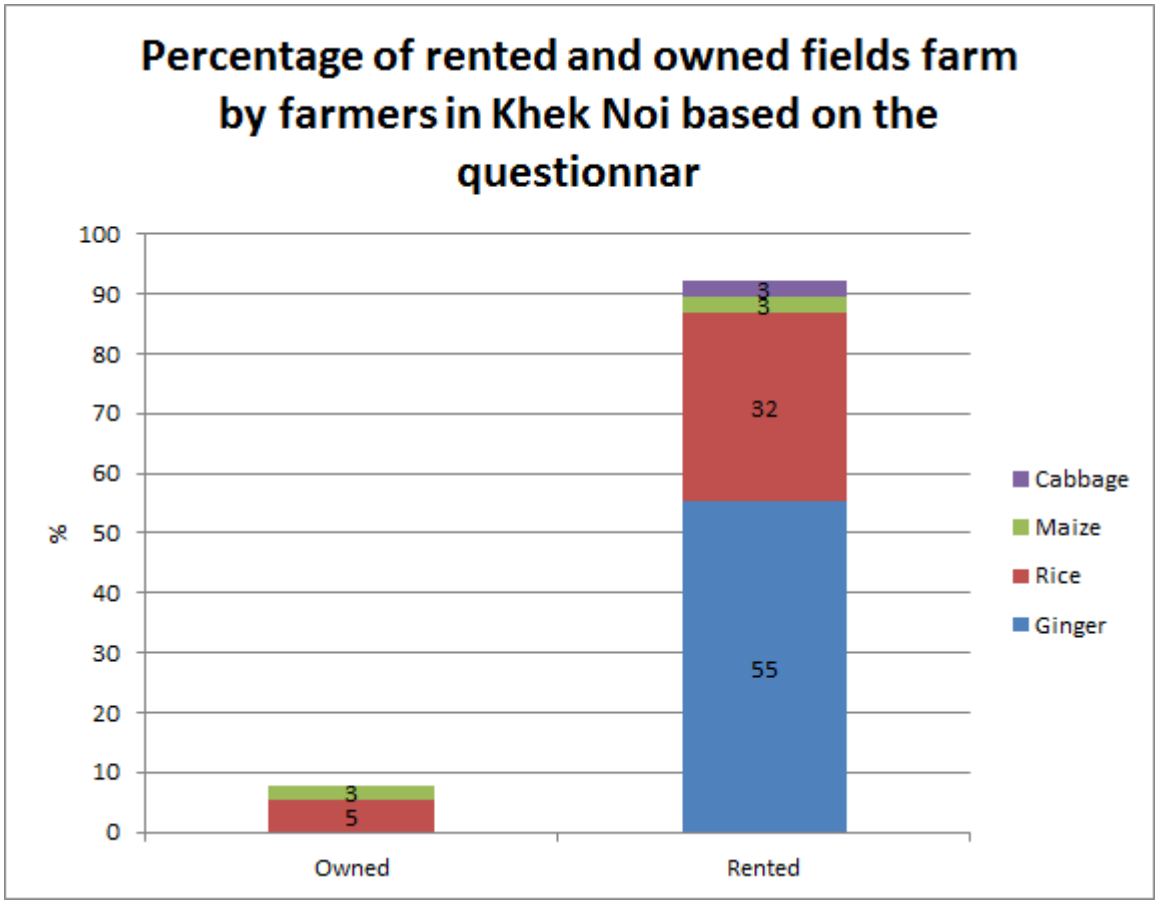

Figure 11: Rented and owned field shown as percentage of total cabbage, maize, rice and ginger fields (38) investigated in the questionnaire. Significant more field are rented than owned (x^2 = 19, degree of freedoms 1, significant=p>0.05).

The two primary ways of getting access to land is either by customary rights or by renting (figure 11). A relatively small percentage of the respondents in the questionnaires own land, but when we were talking to farmers in the village some of them explained that they own land. Asked how the land came in their possession the common answer was inheritance, and that none of them have title deeds to the land. Therefore it seems that customary rights to land areas are present in the village and that these rights are respected amongst the villagers.

According to our questionnaires the primary way of accessing land, especially for ginger, is by renting. Because of the ginger diseases the farmers need to find “new” land each year. This can explain why none of the respondents are growing ginger on owned land. On the other hand one of the fields used for soil sampling was under customary ownership and a part of it was used for ginger production this year. The contradictory data might be a result of the relatively small questionnaire sample.

Renting land covers land rented from relatives, sometimes without payment, land rented in more formal ways from Thai owners, and land rented from other villagers. The farmers explained that the renting agreements were done verbally and from year to year. When renting from relatives the earlier described kinship structure and thereby the relation between the two parties becomes important to make it possible to rent the land and be preferred as tenant. One farmer described that the Thai landowners, on the other hand, put up signs on the land for rent with phone numbers to call. Another farmer showed us a ginger farm in the middle of an old lerche plantation and described how a lot of the land in this area was owned by a big Thai company.

Searching for "new" land to grow ginger on a lot of the informants explained that they go to the north. The farmers went to the fields just before the rainy season to prepare the soil and sow, thus some of the farmers had left or were leaving the village during our fieldwork. Some farmers stayed in the north during most of the growing season, and some of the farmers went back and forth. The major reasons given for this practice was, shortage of land in Khek Noi and the better quality of soils in the north. Thus the farmers is moving seasonally in search of land.

The farmers often only had a vague idea about the cropping history of the fields and used expression such as "This land is good to grow rice - so probably rice". When asked about how the farmers choose the land they wanted to rent, and how to be sure it was not used for ginger for the last couple of years the farmers explained that they looked at the weeds and left overs, e.g. ginger roots, in the soil. The verbal agreements on land renting and the uncertainties about the cropping history of the fields, show the relatively big insecurity which is connected to land renting in the area.

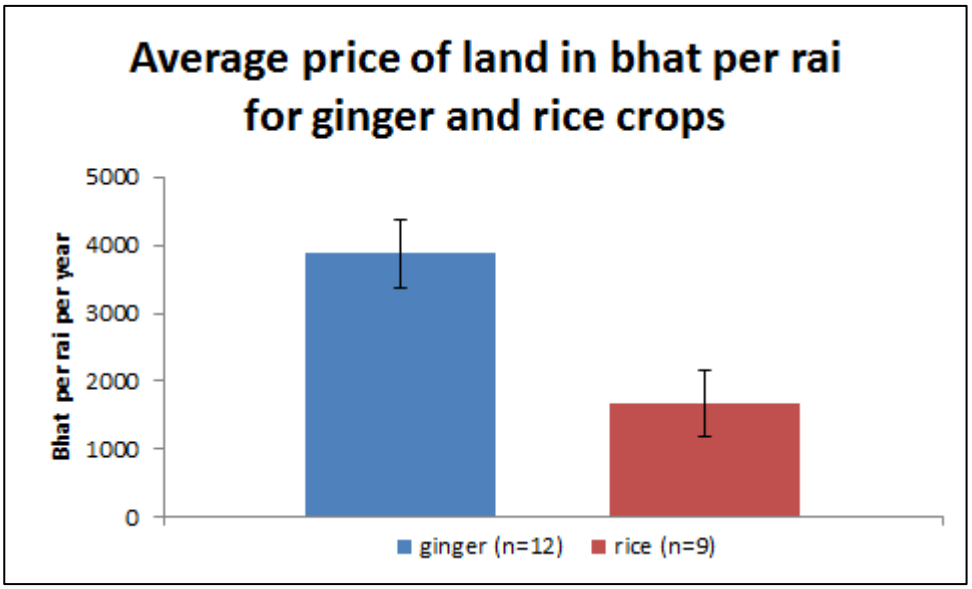

Figure 12: The average price and the standard deviation of land in bhat per rai rented for ginger and rice cropping, based on the answers in the questionnaires.

The rent for land vary a lot from around 400 baht/rai up to 7000 baht/rai. According to the farmers the price is determined accordingly to the crop grown, thus is it much more expensive to rent land for ginger (figure 12). The farmers explained the higher price for land rented for ginger with the soil damage that the ginger causes. Another factor that was highlighted as determining land prices was the slope of the land. Likewise is new land that have not been used for agriculture before more expensive than used land.

The combination of lacking land rights, low soil quality and the need for new fields to grow ginger causes the farmers to rent land throughout northern Thailand.

Access to markets

Cash crops are directed towards international market and ginger is an important cash crop in Thailand (Lohmann, 1993). Thailand is in the 6 top countries contributing to the ginger global market, for example, from 1997-2001 Thailand had the second highest proportion (10%) after China of ginger exports contributing to global ginger market (FAO, 2004).

However, farmers in the study area expressed they are limited on the markets where they can penetrate and sell their ginger in high volumes. Middlemen were said to be the ones who have monopoly in this market hence farmers only produce and cannot market most of their produce. One respondent said “the middlemen dictate the price”, and as a result farmers have an option to sell or withheld their produce. An organized cartel as alluded by respondents makes it difficult for them to avoid the middlemen when marketing their ginger. The middlemen were said to have access to

exporters and based on the existing networks, exporters only buy from middlemen as a result farmers are excluded. To combat this issue a respondent said “I will only dig out the rest of his ginger when the price on the market was favorable”. The other reason given was that because of limited access to markets, this practice will enable him to return good profits.

The respondents stated even though they are limited on market access, the presence of middlemen are a motivating factor to grow ginger yearly. Furthermore it was also found that if the ginger was to gain a high price at market the middleman would come to the field to collect the ginger, saving farmers transportation costs. As the unseasonal ginger shown to be more likely to gain a higher price by the results of the questionnaire, at 45 baht/kg on average compared to rainfed ginger which gained 13.5 baht/kg.

Therefore the access to the international market mostly through middlemen may influence the farmer’s decision to grow cash crops such as ginger, as many of the farmers grew ginger as a main income (figure 4). Furthermore involvement of the middle man and their collection of high price ginger, may result in farmers utilizing irrigation systems in order to grow the higher priced unseasonal ginger.

Source of Finance to support farming

During the informal talks with key informants, we established 12 sources of financing farming that farmers turn to. The respondents depend on combined various forms of financing which is savings, family, bank and pawning being the dominants. While other respondents depend on a single form of financing.

The graph below shows where the money used for financing agriculture come from. The source of money accessible to the farmer guide him towards choosing the crop to grow and the study showed that farmer with high endowment of income grow ginger and those with low income grow rice.

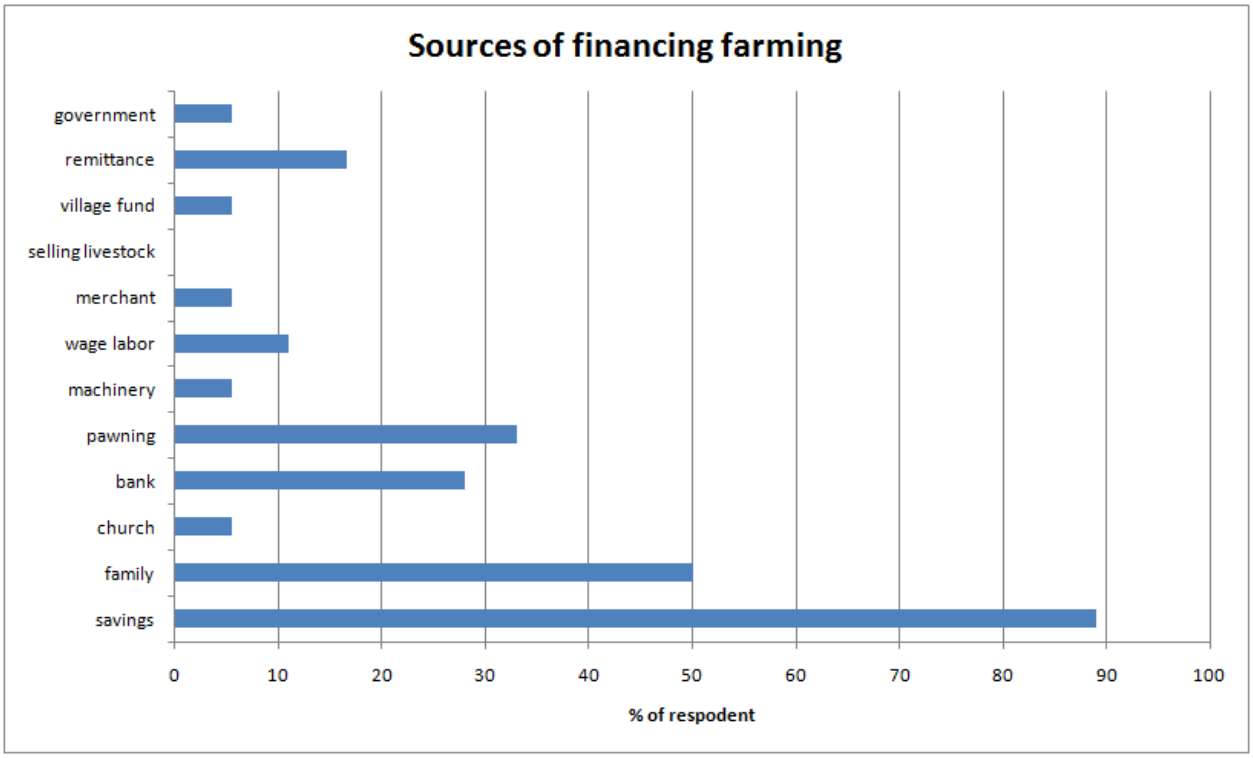

Figure 13:Percentage of sources of financing farming in Ban Santisuk based on the questionnaires

Access to Credit

Better access to credit is often regarded as a contributing factor towards growth in agriculture production (Machethe 2004). When we conducted informal talks, semi-structured interviews and questionnaires many respondents pointed out the need and the importance of credit when involved in farming. The bank, village fund, middleman, merchants, family and friends are the institutions that respondents turn to when in need of credit.

A majority of respondents during the informal talks, said that the middlemen and merchants provide credit to farmers based on trust and this was also suggested by Lyon (2000) credit is offered on the basis of relationship that goes years back. Agriculture officer alluded the presence of the village fund and 1 respondent had access to the fund and other respondents did not have access to the fund due to the limited amount of money that has to serve the whole village. 28 percent of respondents on questionnaires access credit from the bank and during informal talks respondents did not have access because of no collateral and/ or Thai citizenship this is similar to a study conducted by FAO (2013) access to financial resources is often made complex by interest rates and collateral guarantee. The Agricultural bank also has a complex guarantor system for farmers to be eligible for the loan based on the interview with agricultural officer and if farmers fail to form a group of 5

members as per bank loan requirement procedure, it is difficult to access loans when farmers are a group of less members.

During informal talks, respondents talked of pawning as a means to access credit because of difficulties when accessing bank loans and one respondent had this to say " I turned to pawning our family car as a way to secure cash for farming". 33 percent of questionnaire respondents are presently involved in pawning to finance farming.

During informal talks, respondents talked of friends as a source to acquire credit because a relationship is present. Family was established as a source of credit by respondents during informal talks, 50 percent of questionnaire respondents get credit from family to finance farming and one respondent said "when in need for money to finance my crop, I turn to the family members and they will help out". This scenario is similar to Lyon (2000) description: *"Obligations towards co-operation and trustfulness can also come through moral and social pressure and are based around common norms most notably that of reciprocity"* (Lyon, 2000). Henceforth family members have an obligation to fulfil since it is a continuous circle.

Knowledge

Moreover, not only access to markets, land ownership and soil quality affect farmers' decision making around farming practices. Education also plays a role. It was found in the questionnaires that 94% got their knowledge from their parents (figure 14).

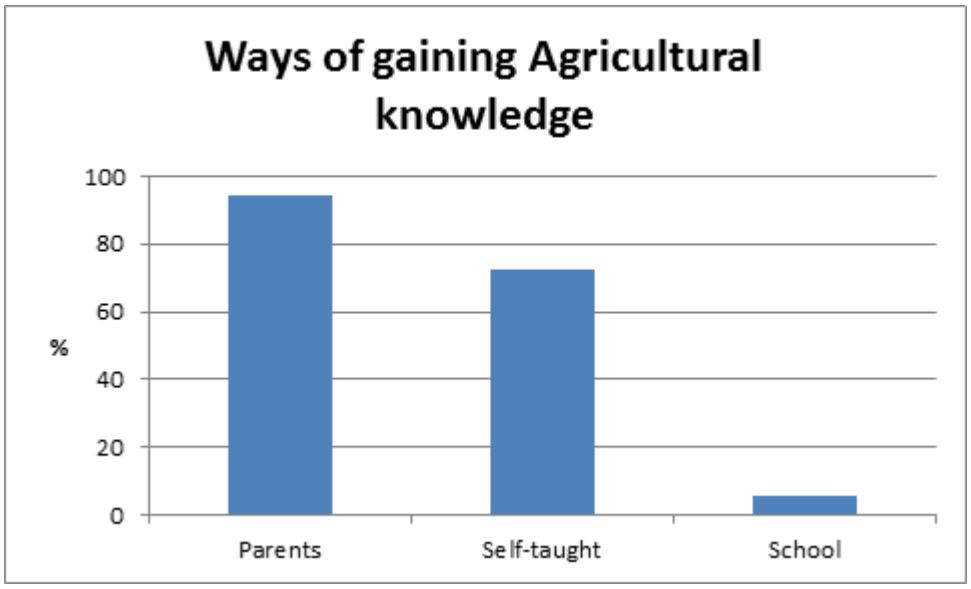

Figure 14: How farmers in the questionnaire gain agricultural knowledge, most farmers has gained knowledge through several channels.

The Hmong people we spoke to mentioned there lack of education. Agricultural knowledge is gained by personal experience and/or from knowledge passed on by previous generations. Indeed, there lack of Thai citizenship inhibit there access to higher education, so as the distance to high level education facilities. When it comes to how much pesticides need to be applied, farmers follow the instruction that are on the package, do the same thing as a successful neighbor or what an elder told them. This is in line with Riwtong et al (2015) that found that smallholder farmers in Thailand generally lack information about how to use pesticides in a safe way. Two of the respondents used chemicals and manure on their fields because it "produces more" and "makes crop bigger". This shows, that their farming practices are influenced by their own farming experience, confirming the findings from Mertz et al (2007) that states that rural farmers makes land use decision based on experience and long term trial and error. Furthermore, respondents showed that they were not aware of the effect of chemicals on the environment. One respondent argued that he did not follow advice given by agricultural programs on the radio because he knew better. Therefore, Hmong farming practices depend on their own personal experience which is influenced by their lack of education. Basing the knowledge on both own and previous generations experience, but at the same time adopting and evolving the local knowledge pool according to new farming practices is comparable to what Shipron (2006) termed a "*dynamic knowledge system"*

Soil

Soil quality can be defined in many ways (Brady and Weil, 2014), in this study we focus on the soils ability to sustain plant production. Barrios (2006) denotes the different ways of assessing soil quality, related to plant production, as Local Indicators of Soil Quality (LISQ) and Technical indicators of Soil Quality (TISQ).

During the fieldwork it became evident that the farmers in Ban Santisuk have and use local knowledge to describe the types and the quality of the soils in the area.

The information obtained from the questionnaires, PRA (soil ranking and community soil mapping), and informal talks taught us that the LISQ primary used by the farmers is color, texture and vegetation/weed abundance. Weeds is used by farmers to assess the fertility of the fields and when deciding on which land to rent. On the otherhand soil color and texture is dominating when describing soils and when assessing the quality.

The TISQ will be related to the soils function as a plant production medium. Thus pH around 5-7 would be seen as an indicator of good quality, as it secures the highest availability of nutrients

(Brady & Weil, 2014). Similar are high content of total carbon an indicator of good soil quality as C is a major component of soil organic matter (SOM). SOM is influencing many factors determining the soil quality, both physical; as the stability and water holding capacity of the soil and chemical; as the cation exchange capacity, and constitution a material wherefrom the nutrients slowly can be released by mineralization (Brady & Weil, 2014). The total carbon can be divided in an active and a passive pool, where the active part is the one where changes in the soils carbon pool first can be detected (Brady and Weil, 2014; Aumtong, 2009). A way to measure the type and possible change in the carbon pool is by POX-C, as POX-C measures the active carbon pool (Weil et al., 2003, Aumtong, 2009). Nitrogen is an important macronutrient for plant growth (Brady & Weil, 2014). Total nitrogen and especially the C:N ratio determines whether the plants will suffer from N deficiency, thus also determining whether the soil quality is suitable for plant growth (Brady and Weil, 2014).

Table 1: The four soils sampled, information about the fields, descriptions of the soils and the local perception of the soil quality. *The farmers answer when asked whether their soil was good or bad. **Based on their placement on the community soil map and soil ranking where 1 is the best and 4 is the worst.

Ranking of soils	Field Number	ID	Local describtion of soil by the farmer of the field	Local perception by the farmer of the field*	Local perception of the soils**	Colour in field (determined by us)	Vegetation/ crop	Irrigation	Elevation GPS	Ownership	Notes
1	Field 3	CSD	crumble sandy dark	good	1	dark brown/black	maize	yes	871	owned - inheritage from parents	prepared it for cabbage
2	Field 1	RS	Red sticky	70-80% good	2	red	rice	no	732	rents (1 year)	he prepares
3	Field 1	CSA	Crumble sandy	70-80% good	4	yellow greyish	rice	no	718	rents (1 year)	he prepares for ginger
4	Field 2	CRS	crumble red soil	Not good - not bad	4	red	rice	no	725	owned	Exchusted, not going to grow there

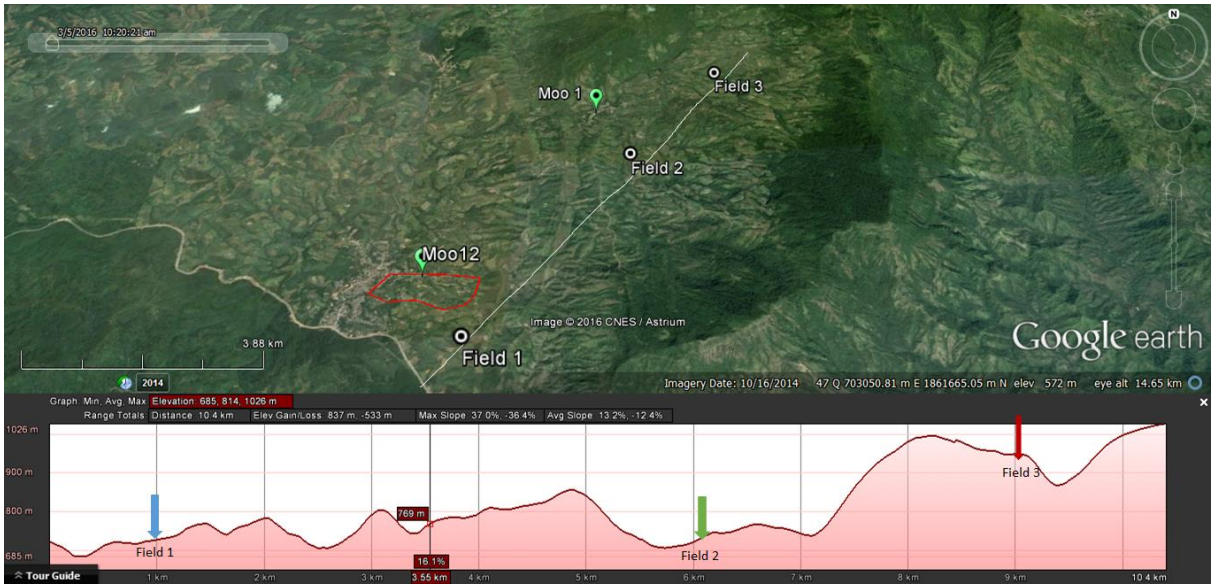

Figure 15: The Placement of the 3 sampled fields and the elevation. RS and CSA are sample at field 1, CRS is sampled at field to and CSD is sampled at field 3. The red polygon encapsulate the area of Ban Santisuk.

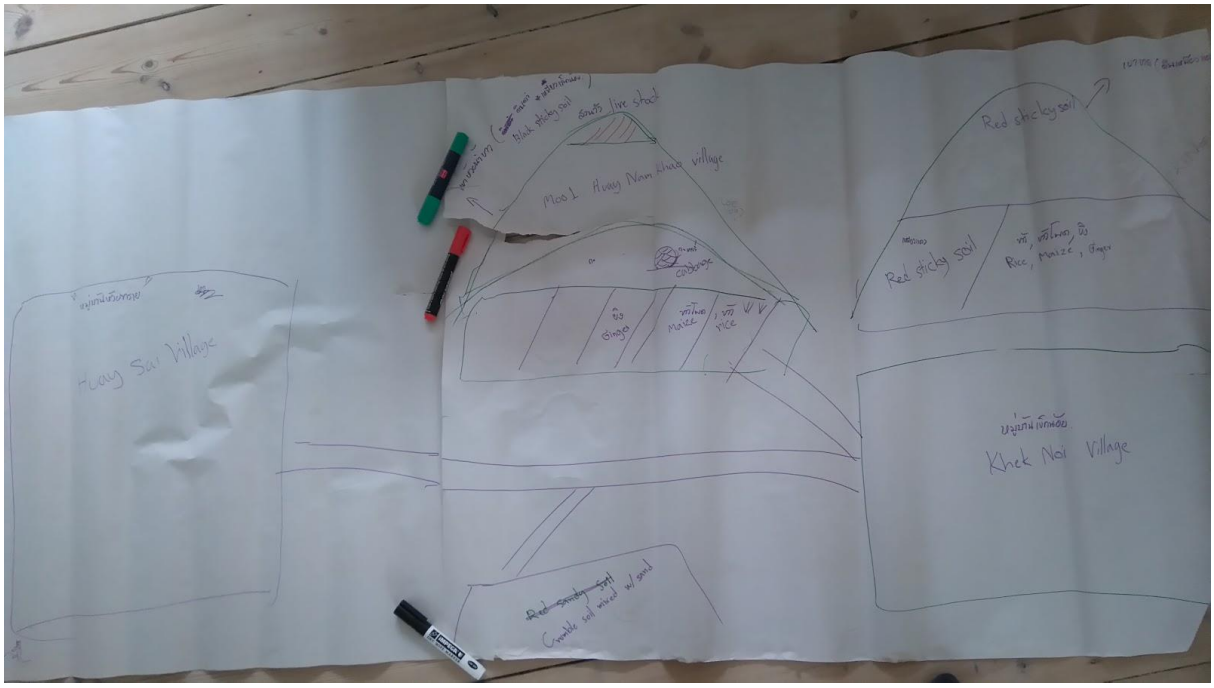

Figure 16: Community soil map produced using PRA

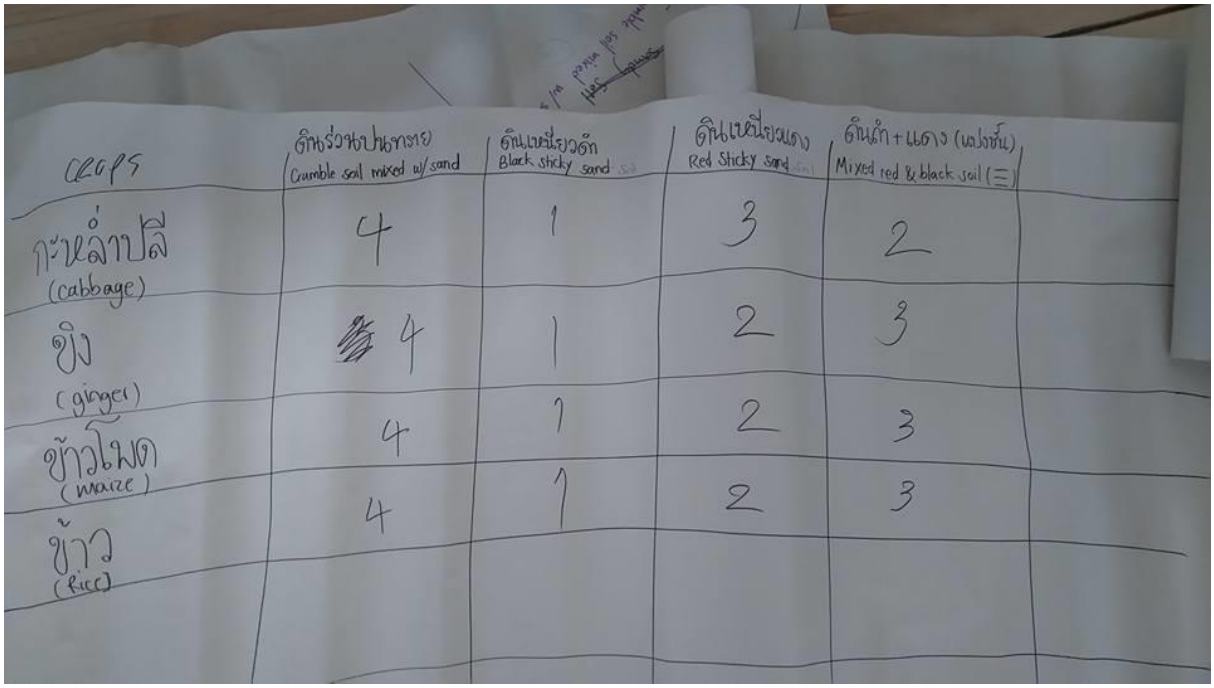

Figure 17: Soil ranking produced using PRA

When comparing the PRA soil map, figure 16, and the satellite picture, it can be argued that field 3 represented the mountains behind Moo1 described as black sticky soils, field 2 represent the flat plateau with crumble soil and the upper slope at field 1 represents the mountain close to Khek Noi with red sticky soil, while the lower slope also represent crumble soil, see figure 18. Based on the PRA and the perception of the farmers farming on each field the 4 sampled soils are ranked by us accordingly to their perceived soil quality, table 1. The descriptions good and bad is used, both during the fieldwork and in the report, to denote productive and unproductive soils respectively.

Figure 18: Picture sampled fields. To the left: Feld 1. Were RS is sampled on the up slope in the red area and CSA is sampled at the lower slope in the grey area. To the right: Field 3 where CSD is sampled.

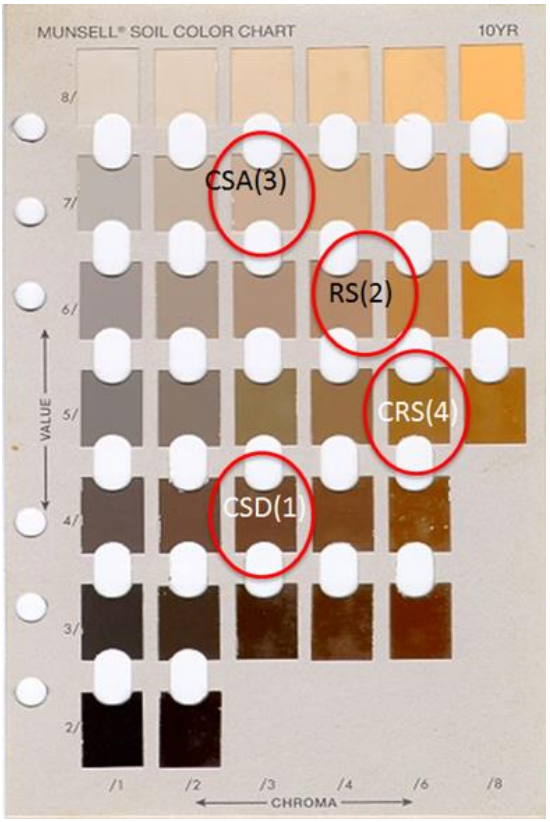

Figure 19: A page modified from Munsell's color diagram to show the value of the soil and the soil color of each sampled field, CSA, RS, CRS and CSD and their rank in brackets.

The color of the soil described by the farmers corresponds to the results in Munsell's color chart.

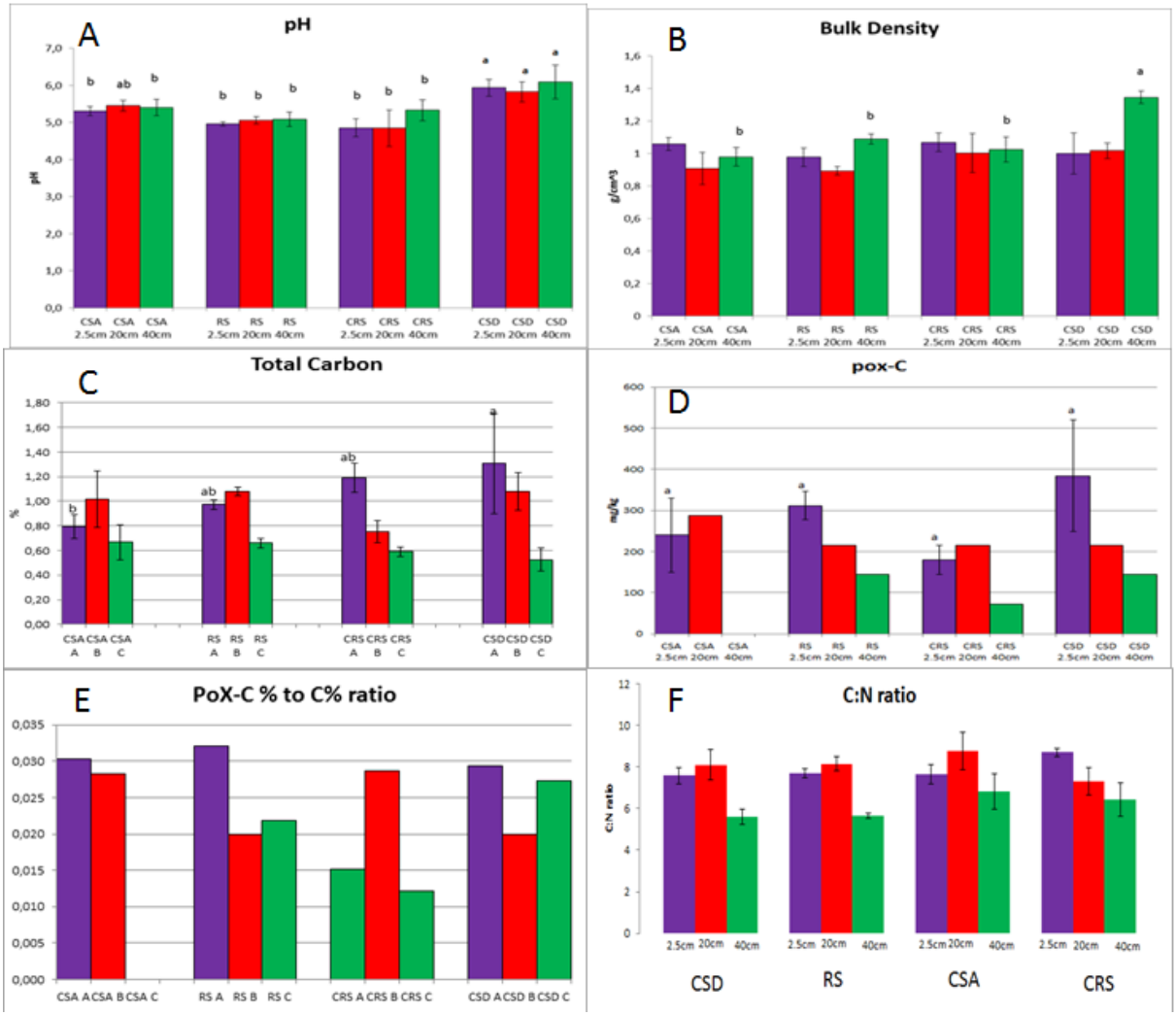

Figure 20: A series of graphs displaying the average results of the technical analysis of each soil type (the TISQ). A shows the ph; B the bulk density; C the total carbon, D the POX-C; E the POX-C; E the POX-C:C ratio and E the C:N ratio. The error bars included show the standard error. If there is a significant difference detected by the ANOVA and located by the LSD post hoc test, the letters will be included above the colums. The letter *a* indicates the highest mean, then it will decrease as the lettering continues. If there are no common letter the samples are significantly different, if there is a common letter there is no significant difference. For the POX-C:C ratio we did not calculate the standard error and the significants.

The average total carbon in the soils are between 0.5 to 1.3 per cent, which is relatively low. The low carbon content of the soils correspond with the expression by the farmers that the soils in the area generally are perceived as bad.

If the C:N ratio is above 20 a shortage of nitrogen is expected (Brady and Weil, 2014). All the soils have similar C:N ratios with no significant differences and no nitrogen shortage, which can be due to the high use of chicken manure and NPK fertilizers in the area.

Table 2: Presenting the weighted averages of the TISQ measures for each soil type.

		Weighted Averages for TISQ						
Rank	Soil Type	pH	Bulk Density (g/cm^3)	Total Carbon (%)	POX-C (mg/kg)	POX-C:Carbon Ratio	Carbon:Nitrogen Ratio	Description of soil texture (FAO table)
1	CDS	5,95	1,15	0,90	220,80	0,02	7,30	Clay loam
2	RS	5,05	0,99	0,89	206,40	0,02	7,49	Clay loam
3	CSA	5,40	0,97	0,83	163,20	0,02	7,78	Sandy loam-Sandy clay loam
4	CRS	5,04	1,03	0,78	151,20	0,02	7,73	Clay loam

Results show that the TISQ for the four soil types do not contain a huge variance between the different soil types, and only few significant differences were found (figure 20 and table 2). This lack of variance between soil types and indicators of soil quality corresponds with the finding that farmers don't consider the soil type of the fields as a major factor influencing their decision making. But there appears to be correspondence between the LSIQ and TISQ, this idea fits the hypothesis in that the parameters the farmers use for identifying soil quality are relevant.

The PRA, and information from the questionnaire highlighted that black sticky and dark soil is considered more fertile as compared to light crumble soil. This corresponds to a study concerning local soil classification systems which highlighted that color and texture were the most relevant indicators of soil quality, as color and texture were included in 100% and 98% of the local classification systems studies respectively (Barrera-Bassolls & Zinck, 2003).

The CSD soil is the highest ranked soil and it has the darkest colour, both according to the local perception and when determined using the Munsell colour chart. Thus the hypothesis that the darkest soil also possesses the best soil quality based on selected TSIQ, is supported by this study. Thus CSD shows a significantly higher pH (5.8-6.1), compared to the other soils. Vogel et al (2001) performed a study in Northern Thailand which showed the optimum pH for availability of nutrients for plant uptake is between 5.5 to 7.5. Thus it is only the CSD soil that has a pH securing optimal availability of nutrients, which is in agreement with the fact that it perceived as the best soil. The other soils have pH that are low (below 5.5), below the optimum rage for nutrient availability, supporting the general perception of farmers that the soils in the area were of bad quality. As Soil

Organic Carbon (SOC) is dark it was expected that CSD had a higher carbon content than the other soils, but the results are not significant. On the other hand the slightly higher carbon content, and the fact that the top CSD sample had the highest POX-C reading support the notion that different in SOC content in this soil compared to the others can explain some of the reasons for perceiving this soil as good.

The red sticky soil has TIQS values which match its place as second best quality soil. Neither the POX-C or total C was significantly lower than CSD. Furthermore, it has a significantly lower bulk density than CSD soil at 2.5cm, which may accommodate better root growth than CSD (Brady & Weil, 2014). But the pH of the soil is 5.05 implying lower availability of nutrients than CSD.

The light color result supports the hypothesis that the CSA soil was low ranked. Furthermore, it had significantly lower total C, supporting the low ranking of the soil's quality. On the other hand it has a little higher pH, 5.40 compared to CSA and RS, only significant at 20 cm depth, indicating a higher availability of nutrients.

Continuous cultivation is the reason given, by the farmers, as causing the soils to lose its fertility and become bad. Similarly when the soil is cultivated, the farmers explained that it loses its stickiness and oiliness and becomes loose and sandy which is perceived as bad. Due to this the farmers alerted us that there was no black sticky soil in the Khek Noi area, and therefore we were unable to sample any. The farmers described intense color as an indicator of higher fertility compared to faded color. Which is in line with other studies that shows that soil color is used as a way of monitoring the fertility of the soil (Barrera-Bassols & Zinck, 2003; Barrios, 2006). However, CRS has a sandy loam texture and the second darkest, and most intensive color according to the Munsell colour chart (figure 19) and the farmer planned to leave the land to fallow the coming year as the land was exhausted. Thus other factors might contribute to the fallowing-plans. Furthermore, the carbon content of CSA is not significant lower than CSD, but the POX-C:C ratio at 2.5 cm depth is lower than CSD, supporting the interpretation of this as a soil that is exhausted. Likewise is the pH significantly lower than the CDS indicating a lower soil quality than CDS.

Altitude and access to water

When determining where to rent land or which crops to grow where, other natural factors showed to be more important than soil quality. This was not taken into account as part of the research question, but became clear during the fieldwork as it was highlighted by farmers during informal

talks and the PRA. For the farmers that had the opportunity to grow irrigated crops proximity to a source of water was important. Our findings showed that ginger requires a cool environment to grow well and therefore needs to be grown in high altitude. This was also mentioned by the headman who said that ginger grows best above 500 ft. Thus, the choice of land is affected by factors such as altitude and the proximity to a water source. A farmer told us that uphill fields are more suitable for the cultivation of carrots, cabbage and strawberry because they grow better in cooler environments and rice is perceived to be grown in a warmer environment. However, in the field we saw rice and ginger grown together and the farmers often explained that rice and ginger succeed each other. This is probably, because other factors also influence the distribution of fields and crops, eg. access to land and closeness to water, the village and roads. The placement of fields can thus be seen as a priority and interplay between different social and natural factors.

Part conclusion: social and natural factors influencing farming practices

We have seen that, Hmong's farming practices in Ban Santisuk are intensifying with the uptake of agrochemicals, mechanization of tilling and the use of irrigation. The easy access to markets and the high returns makes ginger the most profitable cash crop. Farmers are motivated to grow ginger yearly because there is a high demand on both the domestic and international market. Middlemen are interested in this crop and come to farmers to buy their ginger and put in on the market. However, it requires higher investments compared to other crops. Therefore, growing ginger is only possible if the household has enough money to invest in it or if they can access credit. Especially if they want to grow irrigated ginger it requires high monetary investment. However, irrigated ginger is even more profitable as this will be sold off season at a higher price. Cabbage crops also have a high return, but they are not as profitable as ginger. Similarly irrigated cabbage is more profitable but also requires a higher money investment. Therefore we can say that households with lower funds will invest in cabbage as a cash crop as it requires lower inputs. Concerning rice, most households grow it for self-consumption and sell if surplus and therefore do not contribute largely to the household's monetary income. Farming practices have been influenced by development and recent access to markets. Access to markets, bringing new sources of income has allowed households to invest in inputs to gain a higher production of their crops. To sum up, farming practices are governed by the household's savings and endowment, if the household has enough it will grow the most profitable crop being irrigated ginger. If it hasn't it will grow the next profitable crop. Furthermore, lack of education, makes agriculture Hmong's main source of income and therefore it is in their interest to be as productive as possible. This also means that they lack

knowledge on the impacts of intensified farming practices on the soil. On the other hand they use LISQ as color, texture and weed to assecc the fertility of the soil, and when these are compared with the TISQ, it is seen that the LISQ used are reprehensive of the soil quality, as expected according to (Barrera-Bassols & Zinck, 2003). Generally there are few significant differences between the soils in the TISQ which correspond with the fact that the farmers don't consider soil quality as a major factor when considering which crops to grow where. Land scarcity in the area and the choice of ginger as a cash crop gives the farmer an need to search for new land every year, which makes it impossible to monitor the soil fertility of each field.

Ethical considerations and general reflections

Before going to Ban Santisuk, we had discussed how we as researchers might be an intervening factor in the villagers' lives which might not be in the best interest of the people studied. This would for instance be by taking up time that would otherwise have been used in the fields. We had imagined to be able to compensate for the lost working hours by helping out in the fields during participant observation. However, we did not do much participant observation in fact we did not go to a single field to do participant observation and help out with the work.

Lost in translation

Regarding the translation issue, it is obvious that when something is interpreted, that, part of its originality can be gone astray and this risk can be more accentuated when the translators are not experts. Being aware of it, we occasionally had to re-explain the questions and request/ask the translators to elaborate on their interpretation if the responses given by the respondents were not comprehensible. In addition, to being "lost in translation" from English to Thai and vice versa, many of the group members are not native English speakers and Hmong people are not native Thai speakers. Therefore, information was sometimes being lost in translation through four mediums (see figure 21).

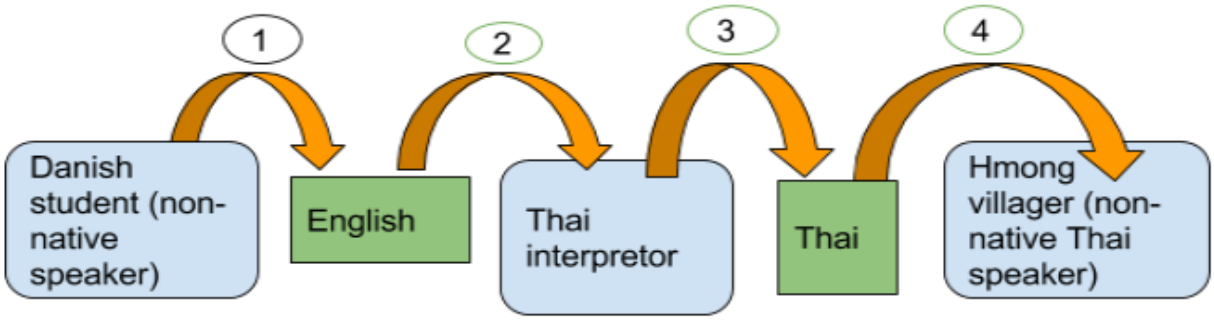

Figure 21: The four stage translation loss

Having interpreters

Firstly, not being able to speak the villagers language, having interpreters as a medium of communication with others created distance and made it challenging to connect with the villagers. Secondly, it might also have been a problem that the interpreters were Thai as we know from the literature that Hmong are seen in a bad light by the broader Thai society (Delang 2002; Hares 2009). It is possible that our informants could have hold something back due to the Hmong/Thai differences.

Politeness is very important in Thai culture, in this culture it is very important to please people and not bother the other. This caused a few problems in our research. First of all, we were not "allowed" to sleep in the village because the University of Kasetsart did not consider appropriate for us their students to sleep at villagers houses. This was also felt, when we suggested this idea to our interpreters and our female interpreter first said she would not spend the night in the village with us because it is not suitable for her as a woman to sleep at another person's house. Furthermore, it was quite delicate for us to repeatedly ask for the headman's help, we could feel our interpreters felt it was not appropriate to be so demanding. When organizing meetings, sometimes, it can be guessed that our ways of demanding were being changed when translated to Thai to a more polite manner because we would never seem to get clear answers from the headman.

To resume, when going to Thailand, we faced a cultural barrier intensified by the language barrier. In addition, the cultural barrier was never really entered as we did not participate in the village life.

Inappropriate approach to farmers

We had planned to do a farm sketch, we did carry one out with one cabbage farmer, however at the end of his cabbage field tour, he did not want to draw the sketch. It was probably because we had not succeeded in making him feel comfortable. It was on the second day and we were three of us going around his farm, probably an intimidating number. Also, he only had one hour making us time pressured and very extractive in our way of interviewing.

Another failure were our PRA's, probably due to a mix of us not understanding the Thai culture. For the community map we had asked the headman to sample farmers for a focus group discussion but when we arrived at his house which should be the meeting point we made the "mistake" of telling him that we wanted the farmers to draw us a map. The headman wanting to help us the most then picked up a formal map of the village for us. When saying that we would still like to do the exercise he took us the most knowledgeable man regarding the village and its history. They said that we should not waste other farmers' time on this since this man would know most. We decided to draw a map just with him and gained a lot of good information but the original aim of the PRA was not met. The two other times we failed doing PRA's was because the headman did not want to gather a group of farmers, as he did not want to take their time, another aspect of Thai culture.

Logistics

Not sleeping in the village, ment we did not integrate or create proper bonds with the villagers. It also meant that we did not have so many informal talks. Having to go to the "field" (the village) made the experience culturally sterile, and villagers our subjects. In addition, the first days we had time restrictions due to the drivers working time being 8-17. This caused problem as farmers do not get back from their fields before 17. Also, it meant that at night time we would work back at the National park, suggesting that our reports might have a top-down approach as it is reflecting more our views.

Gender

When walking around the village trying to start conversations with people it occurred to us that most of the people who addressed us or were easy to get in touch with were men. It seemed that the women were a little suspicious to our presence or at least were not interested in talking to us. This might have given a bias in our information due to our group of informants being mostly men because "the female view on things" might then be missing in our data. We also had some quite characteristic and powerful female informants most of whom were our other informants' wives or

someone we were directed to in another manner. We expect this to be culturally based for instance many of the women were busy embroidering the traditional Hmong dress for new year celebration while taking care of younger children during the day. Another factor that might have contributed to this gender bias is our imagination of a farmer and the head of the household being male - which might not always be the case. Likewise our gender when by coincidence going in either gender-separated or gender-mixed groups the villagers might have had a certain perception of us which would be culturally founded.

Anonymity

We made sure to obtain verbal informed consent from our informants, in line with AAA's (American Anthropological Association) Code of Ethics (2012), whenever possible – though it is not always possible to obtain (Fluehr-Lobban, 1994). This was mainly done by making sure to explain to the people we talked to: what the purpose of the research was, being a learning process for us and that we would make them anonymous in the present report. Anonymizing is done by referring to our informants as informants, farmers or respondents when specific examples from the fieldwork occur. We have chosen to name the people in more public positions such as the headman, the TAO mayor and the TAO member by their titles or correct names because these people are in a position in which they have a public person and can give information based on this. Due to the relatively small number of people living in Ban Santisuk the villagers might be able to recognize themselves or other people in the descriptions anyways but we have been very careful not to use any information which might do our informants harm. It is important to us to do anything possible, again in line with AAA's Code of Ethics (2012) not to cause our informants any harm.

The questionnaire and ethical problems

This composition of the questionnaire in Denmark may have resulted in heavy biases being incorporated into the questions asked, and the process from the theory we perceived to be the case, to the data collection and analysis was linear (Kalof, 2008). The questions may have been loaded with bias plus the nature of the questionnaire leaves no room for respondents perspective, arguably making it a top-down method. However, the questionnaire was redesigned after the pilot, and during the exploratory phase of the research. Therefore, by allowing theories to arise from the data we receive may have eased the bias of the theories which would have resulted from the liner data collection (Kalof, 2008). The use of Questionnaire resulted in ethical issue being raised mainly

involving the inclusion of questions regarding income, as there was concern that this may cause discomfort to respondents. It could not be concluded if this did cause discomfort during questionnaire application.

Conclusion

According to this study, it was found that Hmongs in Ban Santisuk main source of income comes from agriculture. Agricultural knowledge has been passed on from generation to generation, and is constantly evolving as farmers draw on their own experience and adopt new practices as different opportunities arise with increased access to markets and agricultural inputs. This is suggesting that the Hmong in Ban Santisuk have what Shipron (2006) term a "*dynamic knowledge system*". At the same time many farmers expressed that the level of education amongst the Hmong is very low. A reason for the low education level is maybe the lack of citizenship in Thailand, constraining them in access to high level education and the long distance to higher level education facilities. The lack of education may mean that Hmong do not have many other opportunities, other than agriculture, for sustaining their livelihoods and creating sources of income. Thus one of the primary ways to increase income and improve their livelihoods is by intensifying the farming practices to get a higher yield. This is in line with Riwtong (2015) description of the general agricultural development that Thailand has been undergoing, especially in the northern regions. Thus, it is suggested that land use intensification is correlated with the increased access to markets, restriction on land use by the establishment of the Thung Salaeng Luang National Park and the ban on swidding.

The land scarcity and insecurity in Ban Santisuk may be a result of the Hmong's low status in the Thai society and their lack of citizenship. We suggest that this land insecurity leads to less awareness on the long term consequence of different farming practices on the soil quality.

The farmers describe the soils in the area as being bad, mostly because of overuse, which indicates that the intensification has contributed to the decline in soil fertility. The carbon content of the soils were generally low and the pH's around 5, this supports the farmers perception of the soils as being of low quality.

When growing ginger, the Farmers in Ban Santisuk aim at 7-20 years before they grow ginger on the same peace of land, to avoid ginger diseases. Thus, both the intensification of farming practices, the low soil quality and choice of cash crop can feedback to shortage of land. In the search for land, people seasonally migrate to northern regions of Thailand. The land over there is seen as fertile and described has having black sticky soil, which supports the notion that it is the carbon content that decreases when the soil has been overused by agriculture. As a consequence, of the general low quality of the soil and the land scarcity issue, it is difficult for the farmers to take the soil quality into account when deciding on where and what to crop.

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Appendix 1

Questionniare:

Standard introduction

Location (GPS co-ordinates)	
Date	
Time	
Household number	
Group members present	

Respondent information

First nama	
Last name/clan	
How many people are in the household	

Livelihood

What is your main source of income?	

How do you afford buying the things you need for starting a new crop (seeds, fertilizers , pesticides etc.)	**Own savings**
	From friends
	From family
	From th church

	From the bank	
	By pawning	
	Hiring out machinery	
	Wage labor	
	merchant	
	Selling livestock	
	Village fund	
	Other (specify)	

Ownership

How many pieces of land are you using?	

	Field 1	Field 2	Field 3	Field 4
Is the land owned, entrusted, rented or other? (circle answer)	Owned/rented/ entrusted/other	Owned/rented/ entrusted/other	Owned/rented/ entrusted/other	Owned/rented/ entrusted/other
IF RENTED, who from?				
How much does it cost per year?				
How big is the land?				
What are the crops being grown?				
How many generations do you grow in one year?				

Is the soil in your field good or bad?				
What type of soil it it?				

IF the farmer is renting the land

	Field 1 (note which crop grown)	Field 2	Field 3	Field 4
Do you consider soil type when you rent land? (circle answer)	Yes/No	Yes/No	Yes/No	Yes/No
What type of soil do you prefer when you rent?				

Agriculture knowledge

Who taught you how to farm? (tick answer(s))	Parents Self-taught School
Do you seek advice from the hardware store owner? (circle answer)	Yes/No
IF YES, how many times in a year?	

Inputs ***(if farmer grows more than one crop, do for each crop)***

Tick if used and	How much do you use	How much does it

answer questions on right.	per crop for one generation?	cost per crop for one generation?
Herbicides		
Pesticides		
Fertilizers		
Labour		
Machinery		
Irrigation		
Seeds		
Manuer		

What yield (in tonnes) do you get per crop for one generation?	
How much do you sell your crop for (baht per tonnes)?	

Tick if used and answer questions on right.	How much do you use per crop for one generation?	How much does it cost per crop for one generation?
Herbicides		
Pesticides		
Fertilizers		
Labour		
Machinery		

Irrigation		
Seeds		
Manuer		

What yield (in tonnes) do you get per crop for one generation?	
How much do you sell your crop for (baht per tonnes)?	

Tick if used and answer questions on right.	How much do you use per crop for one generation?	How much does it cost per crop for one generation?
Herbicides		
Pesticides		
Fertilizers		
Labour		
Machinery		
Irrigation		
Seeds		

What yield (in tonnes) do you get per crop for	

one generation?	
How much do you sell your crop for (baht per tonnes)?	

Appendix 2:

Results table for Soil analysis

Table 1: Table showing the weight and ring size of each sample from each depth, used to calculate the bulk density

Nr.	Weight (g)	Ring size cm^2	Bulk density, g/cm^2	Comments
Crumble sandy				
CSA1AR	56.0	52.4	1.1	
CSA1BR	45.3	52.4	0.9	
CSA1CR	51.5	52.4	1.0	
CSA2AR	52.1	52.4	1.0	
CSA2BR	46.2	52.4	0.9	
CSA2CR	46.0	52.4	0.9	
CSA3AR	58.4	52.4	1.1	
CSA3BR	51.3	52.4	1.0	
CSA3CR	56.6	52.4	1.1	
Red sticky				
RS1AR	53.0	52.4	1.0	
RS1BR	45.2	52.4	0.9	Hole in bag
RS1CR	58.3	52.4	1.1	
RS2AR	53.7	52.4	1.0	
RS2BR	46.8	52.4	0.9	
RS2CR	58.3	52.4	1.1	
RS3AR	47.0	52.4	0.9	
RS3BR	48.5	52.4	0.9	
RS3CR	54.9	52.4	1.0	
Crumble red soil				
CRS1AR	60.3	52.4	1.2	
CRS1BR	61.4	52.4	1.2	
CRS1CR	49.0	52.4	0.9	
CRS2AR	53.7	52.4	1.0	
CRS2BR	48.4	52.4	0.9	
CRS2CR	58.9	52.4	1.1	
CRS3AR	54.1	52.4	1.0	
CRS3BR	47.7	52.4	0.9	
CRS3CR	53.3	52.4	1.0	
Crumble sandy dark				
CSD1AR	45.1	52.4	0.9	
CSD1BR	56.8	52.4	1.1	
CSD1CR	73.0	52.4	1.4	
CSD2AR	51.2	52.4	1.0	
CSD2BR	51.4	52.4	1.0	
CSD2CR	68.0	52.4	1.3	
CSD3AR	61.0	52.4	1.2	
CSD3BR	51.7	52.4	1.0	
CSD3CR	70.6	52.4	1.3	

Tabel 2: Table showing the results of the FAO table classification for textural analysis

Nr.	texture	description
Crumble sandy		
CSA1A	2.3	scl
CSA1B	2.2	l
CSA1C	2.2	sil
CSA2A	3.2	c
CSA2B	3.2	cl
CSA2C	3.2	cl
CSA3A	2.2	l
CSA3B	2.3	scl
CSA3C	2.2	l
Red sticky		
RS1A	3.2	cl
RS1B	3.2	cl
RS1C	3.2	cl
RS2A	3.2	cl
RS2B	3.2	cl
RS2C	3.2	cl
RS3A	3.3	sic
RS3B	3.2	cl
RS3C	3.2	cl
Crumble red soil		
CRS1A	3.2	cl
CRS1B	3.2	cl
CRS1C	3.2	c
CRS2A	3.2	cl
CRS2B	3.2	c
CRS2C	3.2	c
CRS3A	3.2	cl
CRS3B	3.2	cl
CRS3C	3.2	c
Crumble sandy dark		
CSD1A	3.2	cl
CSD1B	3.2	cl
CSD1C	3.2	cl
CSD2A	3.2	cl
CSD2B	3.2	cl
CSD2C	3.2	cl
CSD3A	3.2	cl
CSD3B	3.2	cl
CSD3C	3.2	cl

Table 3: Table showing the pH measurements of each sample

Nr.	pH
Crumble sandy	
CSA1A	5.57
CSA1B	5.58
CSA1C	5.53
CSA2A	5.3
CSA2B	5.45
CSA2C	5.46
CSA3A	5.04
CSA3B	5.33
CSA3C	5.23
Red sticky	
RS1A	5.03
RS1B	5.19
RS1C	4.81
RS2A	4.95
RS2B	5.02
RS2C	5.18
RS3A	4.89
RS3B	4.96
RS3C	5.25
Crumble red soil	
CRS1A	5.2
CRS1B	4.18
CRS1C	5.07
CRS2A	4.67
CRS2B	5
CRS2C	5.73
CRS3A	4.7
CRS3B	5.35
CRS3C	5.18
Crumble sandy dark	
CSD1A	5.91
CSD1B	5.97
CSD1C	6.27
CSD2A	5.66
CSD2B	5.45
CSD2C	5.46
CSD3A	6.23
CSD3B	6.05
CSD3C	6.53

Table 4: Table showing the abs and measured concentration for each soil type sampled, used to calculate the POX-C

Crumble sandy	abs 550.0nm	Measured concentration, a	MnoxC (mg/kg)
CSA1A	1.808	0.017	216
CSA2A	1.634	0.015	360
CSA3A	1.933	0.018	144
CSA 123 B	1.723	0.016	288
CSA 123 C	2.422	0.023	-216
Crumble red soil			
CRS 1A	1.612	0.015	360
CRS 2A	1.73	0.016	288
CRS 3A	1.735	0.016	288
CRS 123 B	1.827	0.017	216
CRS 123 C	1.915	0.018	144
Red sticky			
RS 1A	2.459	0.023	-216
RS 2A	1.839	0.017	216
RS 3A	1.933	0.018	144
RS 123 B	1.848	0.017	216
RS 123 C	2.019	0.019	72
Crumble sand dark			
CSD 1A	1.357	0.012	576
CSD 1B	1.698	0.016	288
CSD 1C	1.695	0.016	288
CSD 123 B	1.769	0.017	216
CSD 123 C	1.908	0.018	144

Table 7: Table showing the average POXC, C%, N% for each layer of each soil type, and the standard deviation

	POX-C mg/kg	POX-C %	C %	PoX-C % to C% ratio	N % average	N % Sd	C % sd
CSA A	240	0.024	0.79	0.030	0.10	0.00	0.10
CSA B	288	0.029	1.02	0.028	0.12	0.02	0.23
CSA C	-216		0.67		0.10	0.00	0.14
RS A	312	0.031	0.97	0.032	0.13	0.01	0.04
RS B	216	0.022	1.08	0.020	0.13	0.01	0.04
RS C	144	0.014	0.66	0.022	0.12	0.00	0.04
CRS A	180	0.018	1.19	0.015	0.14	0.01	0.12
CRS B	216	0.022	0.75	0.029	0.10	0.00	0.09
CRS C	72	0.007	0.59	0.012	0.09	0.01	0.04
CSD A	384	0.038	1.31	0.029	0.17	0.04	0.41
CSD B	216	0.022	1.08	0.020	0.13	0.01	0.16
CSD C	144	0.014	0.53	0.027	0.09	0.01	0.10

Appendix 3

Synopsis:

How do different social factors influence the decision-making around the farming practices and how do these practices interrelate with the soil quality in Ban Santisuk (MOO-12)

Student number	***First name***	***Last name***
qrz542	*Carina*	*Sloth*
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Contents

Appendix 8: Field calendar

Context

Figure 1: Satellite image of MOO 12 from google earth

Description of area

Ban Santisuk (Moo 12) is located in Khek Noi sub-district in Phetchabun in northern Thailand, figure 1. The village was categorised as a village in 2007, after a separation from Moo 11, however it has existed in the location since 1997. According to Khek Noi sub-district, 2015, there are 307 household in Moo 12, with a total of 1784 inhabitants. The people of the village is of Hmong ethnicity (Khek Noi sub-district, 2015). The Hmong people has traditionally lived of shifting cultivation: (Delang, 2002), but this practice has been forbidden by the Thai government in 1989 (Kaosa-ard & Rutherford, 2002). The climate of Thailand is humid tropical with a distinct dry (nov-march) and wet (may-october) period (Thai Meteorological department, 2015).

Land uses

Agriculture was identified to be the major land-use in Moo 12 (University of Copenhagen, 2016). The main crops grown are; upland rice, ginger and cabbage. The farming systems of each crop are distinct; the rain-fed upland rice is believed to be grown continuously and with high inputs being fed into the system, such as inorganic fertilizers and pesticides, also there is an intensive tillage

practice using rented machinery. In contrast ginger is only cultivated once every 20 years on the same field. Finally cabbage is grown under irrigation. Furthermore rice is being grown for both consumption and sale, and the ginger is grown primarily for sale (ibid.). Due to problems with soil fertility in the area, intercropping and crop rotations with legumes, such as mung beans, and the incorporation of chicken manure into the system may have been adopted by farmers in the area with the aim of improving soil fertility (ibid.).

Livelihoods

The main source of income in Phetchabun is believed to be through agriculture (University of Copenhagen, 2016). However, fluctuations in market prices (ibid.), a halt to rice subsidies due to a new political environment (Webb, 2015), and land ownership issues (Chankrajang, 2015) may be reasons for changing livelihood strategies. The changing livelihood strategies could be in the form of diversifying into activities other than agriculture, thus the number of individuals involved in other areas of employment is increasing (Walker, 2012) and migration to urban areas is increasing (International Organization for Migration, 2011).

Outline of the problem

We are interested in how the land is managed by the villagers and how it might affect the soil quality and decision-making regarding land use. Different social factors as for instance livelihood strategies and the problems surrounding tenure might influence the farmers to only make short-term decisions about land use and farming practises which again might influence the soil quality.

Research question

How do different social factors influence the decision-making around the farming practises and how does these practises interrelate with the soil quality in Ban Santisuk (Moo 12)?

Sub questions

1. What are the social factors influencing decision-making on farming practises?
    a. How does different forms of access to land influence the farming practises?
    b. How does the assets owned by individuals affect their decisions concerning land-use?
    c. How are power structures within the households and between households and do power structures influence decision-making?

    d. How does household composition influence decision-making at the household level?
    e. How is the farmers' access to natural resources (land, inputs)?
2. Which farming practises are used and on which crops?
    a. Which crops are grown and what are the cropping systems?
    b. How does the access to markets and market prices influence the farmers' crop choice?
    c. Are farmers being influenced by external organizations?
3. How is the soil quality?
    a. What is the local perception of soil quality?
    b. What is the soil quality according to the soil samplings?
    c. What is the effect of farming practices on the soil quality?
    d. How does soil quality affect decision-making processes?

Methodology

The data required to answer the research question is outlined in detail in our data matrix (appendix 1). The methods chosen will be applied on different levels (appendix 1). We will start applying exploitative methods, like participant observation and community mapping, to gain overall information about the village and the farming systems. Then, we will choose 4-5 households with which we will create a farm and nutrient flow sketch and conduct soil sampling and plant deficiency assessment.

Social science methods

Small-scale questionnaire

A questionnaire survey will be used to gather quantitative data on some social factors of village households and the farming practices present in the village. The data collected from 30 households will also be used in statistical analysis to possibly identify patterns. In order to make reliable conclusions from the data received, the questionnaire design and application practices will have to be considered (Reardon, 2000). A random sample is required and will be obtained by first identifying the sampling frame as the number of households in the village (307, (Copenhagen University, 2016)). Next a random sample will be taken by asking every 10th household in the village to complete the questionnaire. The questionnaire will be designed to be short and have pre-coded questions, to complete statistical analysis on the data received. The questionnaire will be

translated into local language and pre-tested on arrival in the field, before the full survey (appendix 3).

Semi structured Interviews

During a semi structured interview (SSI), the interviewer has a guide of "open ended" questions. The use of semi structured interviews will create room for flexibility during the course of the discussion between the interviewer and the participants. The interviewer has the the opportunity to create new questions as relevant information is being discussed in order gain more clarity on the subject discussed (Mikkelsen, 2005). The semi structured interview will be carried out with the village headman, hopefully a local government officer and extension officer, and possibly other key informants that will be identified in the field. Likewise will we conduct SSI with minimum 3 farmers from the village engaged in different farming activities. The qualitative data gathered will give insights in the factors that might be influencing farming practices (appendix 4).

Walkabouts

Walkabouts can be used to orientate our research and give information on what social factors could be influencing farmers on their decision making of farming practices. Walkabouts consist in taking an informal walk with an informant to places he values has important. Information will be taken from the person's interaction with the chosen places. (Strang 2010). The data gathered will possibly give insight on what social aspects to look at more in depth.

Participant observation

Participant observation is a method where the researcher becomes an active part of the studied community by participating in activities while observing at the same time (Hastrup et. Al. 2013). Participant observation gives the the researcher an insight and bodily knowledge on the studied subject's perspective (ibid.; Baarts 2010). We wish to gain deeper knowledge on how the villagers in Moo 12 live their lives and perceive the world. We are going to make individual logbooks of our participant observations, informal talks and encounters with the villagers every day in the field. We will do so in a standardized way with our notes and thematic labels thus we can after the fieldwork share our notes for use in the analytical phase (appendix 5).

Participatory rural appraisal methods

Participatory mapping

Participatory mapping is a method whereby the participants, in this case the local farmers, in collaboration with the facilitator draw one or more maps of the village and its surrounding areas (Mikkelsen, 2005). This is a quick and reliable method through which the distribution of resources in an village can be obtained (ibid.). At the same time it can, in the process of drawing and movement through the landscape, reveal people's historical and contemporary relationships with the local environment (Strang, 2010).The participatory mapping can thereby be a frame where through information of social structures, norm and traditions influencing land use and access to land can be obtained (Strang, 2010). Accordingly the goal of participatory mapping is to : 1) to get concrete information about the land use and distribution of fields (location, crops grown, soil types) and other natural resources (forest, water) in the area and 2) to carry out cultural mapping exploring the historic land use and social structures and norms surrounding the land use choices (appendix 6.1).

Ranking

Ranking methods will possibly be used to rank wealth of different farms, and to rank crops in relation to the income they bring. The definition of wealth will reflect the farmers perception of it, we therefore need to think about what is meant by that term: (e.g: income, wellbeing) (Mikkelsen 2005) (appendix 6.2). To rank crops, we will use matrix scoring. Crops will be represented on the top of columns and beans will be given to a sample of farmers. These farmers will put the amount of beans necessary in each column, giving a visual idea of what crops bring in the most income (appendix 6.3).

Transect walks (Community transect)

In order to figure out different land management practices throughout the community, a transect walk will be carried out. This consists by determining a walk using the community map, to make sure that it passes through different types of farms within the village. During the walk we will be accompanied by a group of local inhabitants. We will be observant and take notes concerning types of crops being grown, soil and water management practices being carried out. The diagram is made after the walk, by memory and with help of the notes taken by the facilitator, in relation to the topography of the walk (Selenar et al, 1999) (appendix 6.4).

Farm sketch

To get information on the crops cultivated, land use and animal raised we will make farm sketches with farmers showing the main farming systems identified with the community map and using GPS measures to quantify sizes of the chosen farms (appendix 6.5).

Nutrient flow

Using the farm sketches we can analyze nutrient flows at a farm level. The drawing of flows and pools are done in a participatory manner in collaboration with representatives of different household members combined with a walk in the fields. Flows of Carbon and Nitrogen, will then be quantified using the methods described in Defoer (2000). The content of C and N in crops, manure and other inputs and outputs will be assessed by using empirical data (Defoer, 2000). The quantification of flows are only approximate, but give an idea on the sustainability of the farming system, by showing where there is a possible deficit of nutrients at the farm level (Defoer, 2000). Furthermore, it will enable comparison of the nutrient flow of the different farming system and give an understanding of the dynamics behind the observed soil quality.

Cropping calendar

A cropping calendar will be created at farm level by asking the farmer; when each crop is sown and harvested, when inputs (tillage, herbicide, pesticide, and fertilizer) are applied, and times of severe pest and disease impacts (appendix 6.6).

Cropping history

The farmer will be asked to recall the history of what has been planted in the fields we have specified for soil sampling for the past 10 years, to create a timeline of crop history on a plot basis (appendix 6.7).

Natural science methods

Satellite images

Images of the villages and surrounding areas will be obtained by google earth, figure 1. These will be used for analysis of the spatial distribution of houses, field and natural resources in the area and compared with the participatory maps.

GPS measurements of areas/tracks/points of special interest

To obtain information about location of soil samples, interviews, household investigations, walked tracks and size of fields under investigation GPS, a GARMIN eTrex 10 with a precision of ±3 m horizontal and ±15 m vertical, will be used. The measurement can be visualised on satellite images and compared with the participatory maps.

Soil Sampling

The aim of soil sampling is to measure soil quality of different fields. The data to be collected from soil samples will include, soil pH, carbon content in the form of Permanganate Oxidizable Soil Organic Carbon (pox-C), Nitrogen content (N), texture and electrical conductivity (EC). As nutrients are most available at the neutral pH range the pH is an important indicator for soil fertility (Brady & Weil, 2014). Nitrogen is a macronutrient for plant growth and is very mobile, thus the nitrogen balances of fields can be difficult to asses but is very important for the quality of the crops (Defoer, 2000). It is important to be aware that other nutrients can be limiting plant growth (Brady & Weil, 2014). pox-C is a way of measuring a part of the soil organic carbon (SOC). SOC is an important soil quality indicator, as there is a direct relation between SOC and soil organic matter (SOM) (Brady & Weil, 2014). The SOM content of soil affects the nutrient pool, the cation exchange capacity and the water holding capacity of the soil (Brady & Weil, 2014).

Soil sampling strategy

Due to differences in fields combined with differences in management, we expect variations in soil quality for the soil quality parameters that changes (Soil carbon content, pH, nitrogen content, and EC). Each soil sample will be carefully collected with a purpose of addressing the research questions. Sampling sites, at the field level, will be randomly selected by taking considerations on the slope, field variations based on soil color, crops visual appearance and after knowledge of the land use history. These will then be georeferenced using a GPS. Sampling procedures will be to collect a specific volume of soil using a ring, to collect samples of uniform bulk density, to analyse for; pH, soil texture, Pox-C and EC in accordance with the method described in Anderson and Ingram (1993). In addition, loose samples will be taken for nitrogen content analysis (soil total nitrogen) (appendix 7).

Preliminary analytical framework

Figure 2 shows how we assume the processes between social structures, decision making, farming practices and soil quality might be linked. This flowchart will be the frame through which we expect our analysis to be carried out and the research question will be addressed.

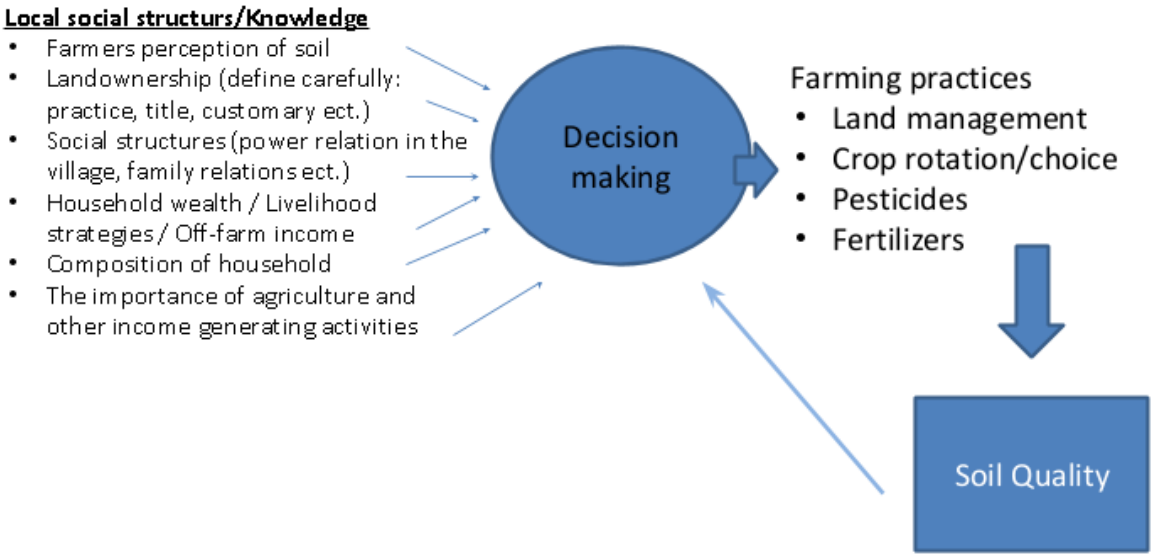

Figure 2: Preliminary analytical framework to analyze the research question

The overall assumption is that local social structures and local knowledge of the area will influence the household decision-making about which farming practises are carried out. The choice of farming practices will have different effect on soil quality and at the same time we assume that the soil quality makes a feedback loop to the decision-making.

We are going to analyze the social structures affecting decision making about farming practices at the household level through the sustainable livelihood framework, figure 3.

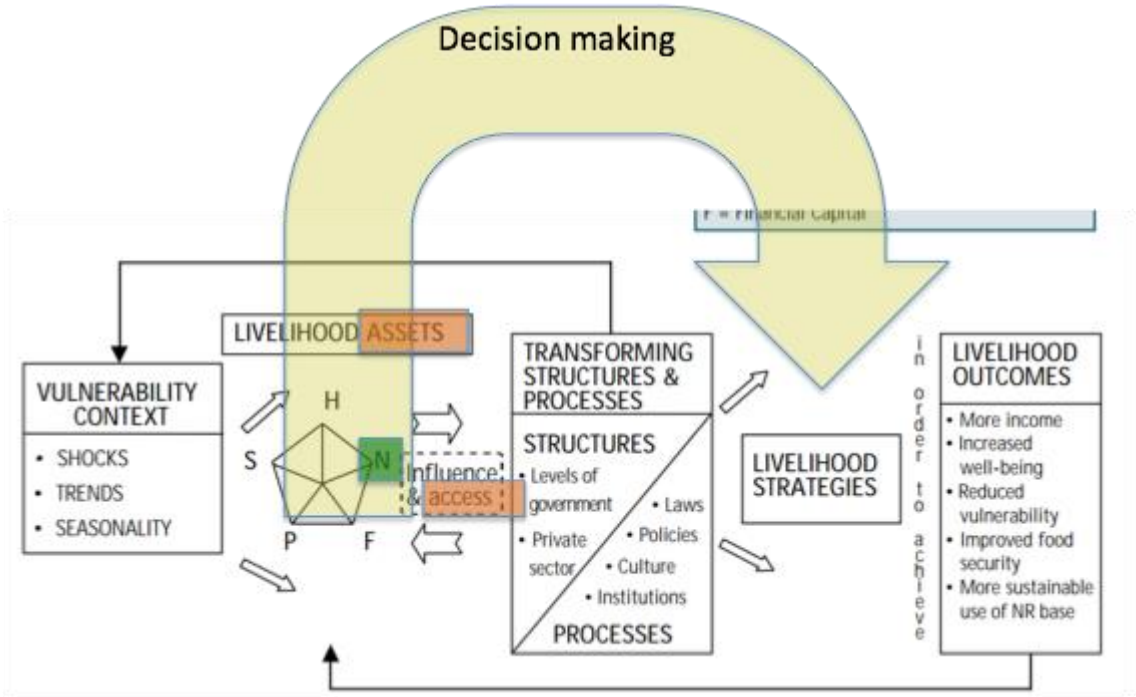

Figure 3: The sustainable livelihood framework with our focus points: Access, Assets, natural capital and decision making highlighted. We will only be investigating the farming activities and will therefore only focus on this part of the livelihood strategies. (Adapted from DFID, 1999)

The sustainable livelihood framework highlights the connections between access and assets, and their influence on livelihood strategies (DFID, 1999). In the analysis we will focus on how the access and assets affects the decision-making on farming activities and how this is forming the livelihood strategies of the different households. This will be concurrently with an analysis of the nutrient flow of the selected farming systems. To analyze the connection between soil quality and farming practices the local knowledge and perception of soils and their management will be assessed drawing on the concept of etnopedology (Barrera-Bassols & Zinck, 2003). This is done in a combination with chemical and physical investigations of soil samples taken from different fields. Drawing on these different analytical and methodological approaches it will be possible for us to investigate the research question from many different angles and hopefully make us able to assess the diversity of linkage between the social factors, decision-makings processes, farming systems and soil quality.

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