Reforestation, Relocation and Resources:
A casestudy of forest-based livelihoods in Northeastern Thailand

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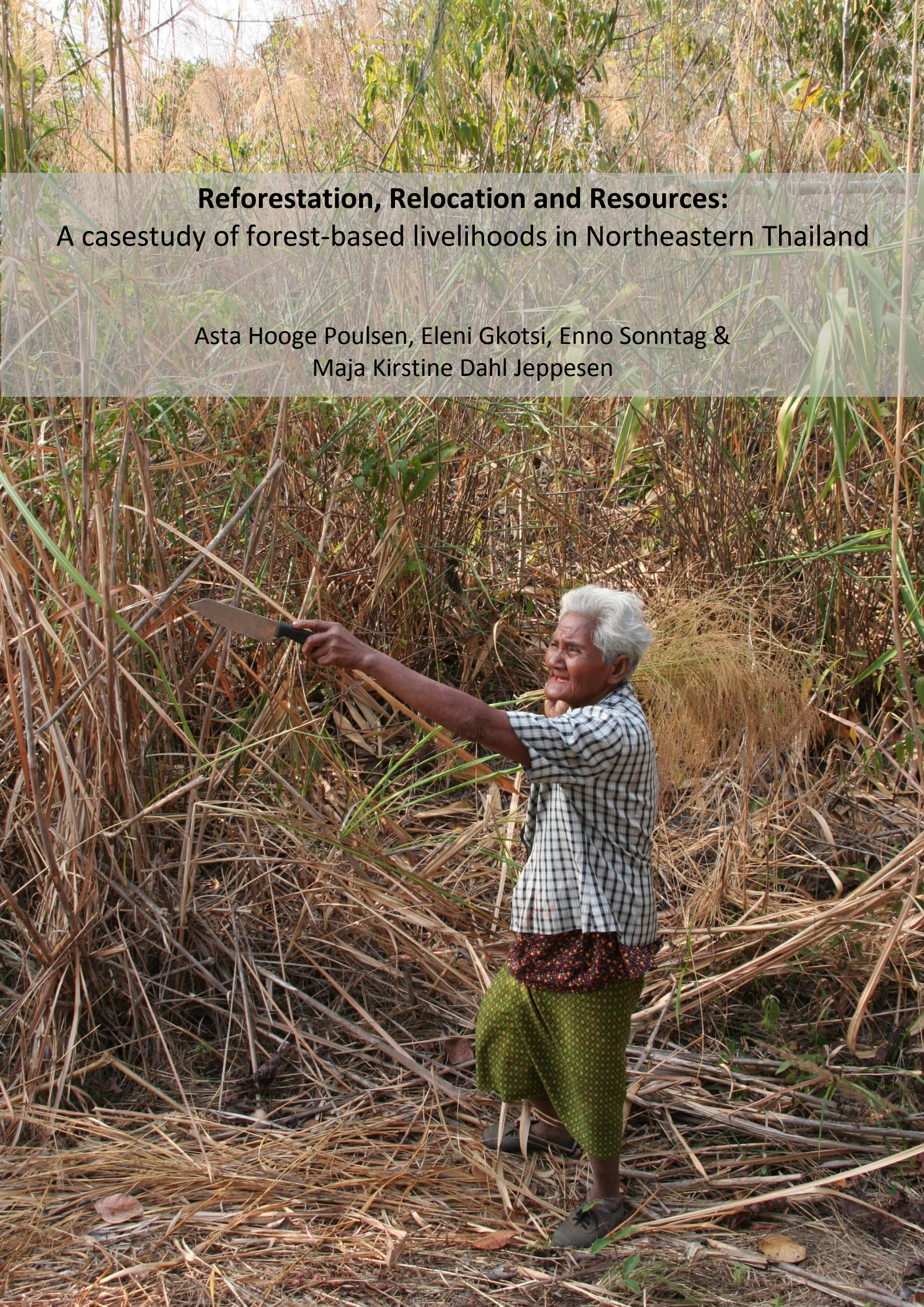

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Abstract

This project examines the ways in which the relocation of the rural Thai village Ban Huai Nam Khem, resulting from increased forest conservation efforts, has influenced the villager's livelihoods. An interdisciplinary approach was chosen to illuminate different perspectives on the issue.

We found that the villagers, most of whom were previously farmers, have adapted their livelihood strategies in a way that made them more dependent on collecting and selling forest resources. Incoherent policies and rules of different institutions creates uncertainty about the future, for example by making it impossible for the villagers to get an official permission to collect forest resources.. The economical dependency on the forest is highest for low income households, but to most villagers the forest also has a symbolic value. The most important resources they collect are mushrooms, bamboo shoots, Litchi, Satoh and broom grass and all are influenced by the environmental changes resulting from reforestation in the area. This process has decreased the availability of broom grasses, but increased the availability of mushrooms and other important resources. Additionally water scarcity is a main issue for the availability of forest resources which may influence this contribution to the villagers' livelihoods.

Furthermore the lack of an official collection permit, together with uncertainty concerning a possible new relocation is also seen as a possible threat by the villagers. They deal with these threats by sharing knowledge on resource collection, bending constraining rules and diversifying their livelihoods, so they are not solely dependent on the forest resources.

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List of Abbreviations

Name / Term	Abbreviation
Carbon	C
Focus group discussion	FGD
National forest reserves	NFR
National park	NP
National research forest	NRF
Nitrogen	N
Royal forest department	RFD
Research centre	RC
Sor Tor Gor (certificate)	STG
Semi-structured interview	SSI
Transect walk	TW
Water holding capacity	WHC

1 Introduction

In the 1980s and 90s Thailand was one of the most rapidly growing economies in the world. This development was accompanied by fundamental changes of land use and land cover, and consequently affected livelihoods and social realities based on the use of natural resources. A complex interplay of inconsistent policies has shaped these processes.

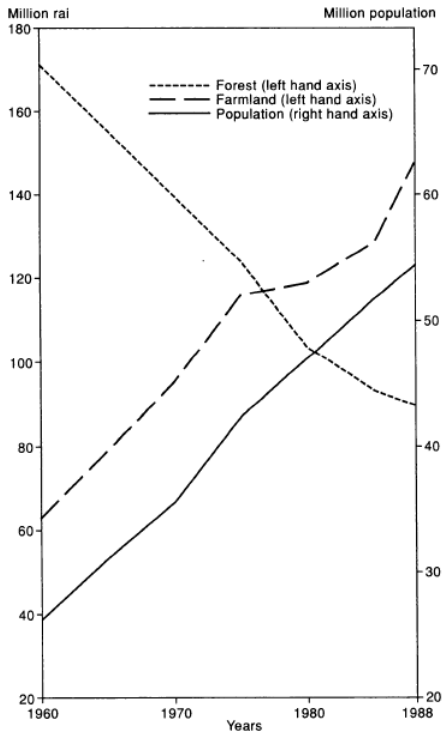

Figure 1: This graphic illustrates the increase in population paralleled by drastic deforestation for agricultural expansion that occurred in Thailand between 1960 and 1988 (Rigg, 1993).

Thailand's rural development has often been described as characterized by two phases (Leturque & Wiggins, 2010; Rigg, 1993). The early policies in the 1960s mainly promoted industrialization, infrastructure and development in the economic centre of Bangkok (Gullette & Singto, 2015). In the rural provinces 70 % of the population was working in the agricultural sector and infrastructure was poorly developed (Leturque & Wiggins, 2010). The most important natural resources, arable land and forest, were abundant and formed the basis of rural livelihoods. In 1961 forests covered 53.33 % of Thailand (Phanurak, 2012). To generate foreign currency and fuel economic development, the central government promoted commercial logging and rice farming for export (ibid). Additionally the drastic population-increase (Figure 1) drove expansion of rice farming and consequently led to a rapidly progressing encroachment on lowland forests (Rigg, 1993).

The second phase of rural development promoted periurbanization and infrastructural improvements which increased accessibility of remote provinces such as our study area in Nakhon Ratchasima (Gullette & Singto, 2015). Starting in 1975, easy credit access encouraged commercialization of agriculture and promoted production of cash crops such as manioc, maize and sugarcane (Leturque & Wiggins, 2010; Rigg, 1993). These are mainly cultivated in the uplands which led to further forest encroachment (Rigg, 1993). Consequently forest cover was reduced to 25.28 % of Thailand's land surface in 1998 (Phanurak, 2012). Growing demands

from urban centers furthermore increased the pressure on natural resources and exacerbated degradation of remaining forests. In the Northeastern Isan region where our research was conducted, forest cover declined dramatically from 93 % in the 1940s to barely 8 % in 2010 (Moreno-Black & Somnasang, 2010).

Forest protection became necessary and was first implemented in the National Park Act of 1961 (Phanurak, 2012). In the same year Khao Yai in the southern part of Isan region was created as Thailand's first National Park (NP) (Rigg, 1993). Following the National Forest Reserve Act of 1964 the legally protected area, including NPs and National Forest Reserves (NFR), increased to cover 63.2 % of Thailand today (Phanurak, 2012). Notwithstanding 20 % of the protected area is under cultivation now and only about one third was initially covered in forest (Rigg, 1993). Additionally about 20 % of Thailand's villages, supporting several million squatter households in the 1980s, are situated within NFR, making forest protection a matter of potential social conflict (Leblond, 2014; Phanurak, 2012). Addressing this issue the Royal Forest Department (RFD) began to offer these families usufruct certificates 'Sor Tor Gor', giving 624,000 farm households temporary cultivation rights by 1985 (Rigg, 1993). The turn to a more aggressive conservation approach in the 1980s, marked by the Forest Policy of 1985, has been seen as measures against communist guerilla who were occupying forests (Leblond, 2014). Consequently at least 55,000 people were displaced between 1986 and 2005 (ibid).

Forests that were once an abundant and easily accessible resource, perceived by villagers as common land, are now legally protected by the government, used for commercial interests or controlled by influential local landowners (Rigg, 1993). Consequently access to forest resources, whose importance in the village economy has often been underplayed, has become increasingly limited (Rigg, 1993). The rural population in Northeast Thailand consumes many different species of non-domesticated plants, fungi and animals (Moreno-Black & Somansang, 2014). These wild foods, which constitute an important component of the diverse Thai diet,

are commonly gathered within the agroecosystem (Photo 1) (Shirai & Rambo, 2014). Since this cultural trait appears to be resilient to urbanization as demand for wild foods is growing in urban centers, it opens up possible livelihood alternatives for villagers without farmland or employment (ibid). Notwithstanding, access is often restricted by the above mentioned factors and permission from the RFD is usually necessary to harvest non-timber forest products (Ting et al., 2010).

Photo 1: We often met boys using long bamboo poles with a plastic bag attached to the end to catch large cicadas in the village. The cicadas are fried and eaten.

Within this socioeconomic, environmental and political context we investigate the interrelations between rural Thai people and the forest. According to Leblond (2010) many cases of conservation induced displacement resulted from stricter forest protection and reforestation policies implemented by the RFD during the 1980s and 90s. Such cases have been reported especially for the Northeastern Isan region, but information on the history and impacts of conservation induced displacement on rural livelihoods still remains anecdotal (Leblond, 2010). Therefore our research focuses on the households of Ban Huai Nam Khem (Moo 11) a village at the border of Thap Lan NP which experienced relocation. We will examine how the relocation has changed the villagers' use of natural resources with focus on forest-based resources since this is one of the most important livelihood strategies in the village. Furthermore we will discuss potential threats to this livelihood. First we investigate (1) how the relocation has affected the villagers' dependency on forest resources. We attempt to reconstruct the historical background of the village and describe the types of forest resources which are most important to the villagers. In addition we investigate which people rely most on these resources and how important collecting is for their total income. We then examine

(2) the state of the used forest and what it indicates about the future security of this livelihood resource basis. Therefore we analyse soil parameters and describe succession states of the forest. Finally we discuss (3) potential risks to the villagers' forest-based livelihood strategies and identify possible coping strategies.

Table 1: Research problem formulation and research questions (RQ).

Problem:	**How has the relocation of Moo 11 changed the villagers' use of natural resources and what are the potential threats to their new strategies?**
RQ1:	How has the relocation affected the villager's dependency on forest resources?
RQ2:	What does the state of the used forest indicate about the future security of this livelihood resource basis?
RQ3:	What are potential risks to the villagers' forest-based livelihood strategies and how do they deal with these risks?

2 Methods

In this chapter we present the methods that we applied in order to generate various kinds of data and approach our research problem from different angles. We discuss the aim of each method alongside with critical reflections and finally the dynamic in our research group.

2.1 Semi-structured Interviews

Semi-structured interviews (SSIs) are the main method we used to obtain contextual and specific information concerning our research questions. SSIs are especially useful as open-ended questions give room for changes in the themes and allowed us to explore different aspects emerging from conversation with the informant (Brinkmann & Kvale, 2009).

We conducted a total of 34 SSIs with 26 informants during our field work. Seven informants were interviewed more than once, as questions arose along the way or to clarify information. A list giving the interview references and short information on all informants can be found in Appendix I. Prior to each interview, we prepared a list of specific topics (Appendix II) we wanted to address and a group member was appointed as the interviewer. The others kept notes and supplied follow up-questions.

2.1.1 Reflections

Many of the villagers were to some extend inaccessible for interviews, because most of them are working during the day. This left us with a bias in the selection of our respondents, since people we interviewed during the day were usually old or without regular employment. We tried to increase the representability of our sample by also interviewing on the weekend and late in the afternoon. Another factor that influenced our sample was that in the beginning we relied on being introduced to villagers by the headwoman. She possibly wanted to introduce us to poor villagers and those who rely on forest resources empathizing the problem of land scarcity they face.

Difficulties we faced during the SSIs were mainly due to linguistic and translational barriers. After our first interviews with the interpreters we realized information can be lost along the way. In our case this was especially apparent for information concerning our respondents' attitude and emotions towards a topic. Scientific terms or concepts were sometimes hard for

the interpreters to translate. In addition, we regularly noticed that we did not receive the whole answer given by the informant, but rather a summarized version. This was often the case when the interpreters struggled with the linguistic barriers presented by local dialect. Hence, the collected data may be biased to some extent.

Finally, we acknowledge the fact that there were times when the informants influenced the flow of the interview, possibly overemphasizing the relocation and use of forest resources after hearing about our research. This worked as an advantage by revealing a lot of data on our topics of interest, but also as a disadvantage when we wanted to go into more depth with another topic.

2.2 Surveys

2.2.1 Questionnaire

On arrival to the field and after our first interviews, we revised the original questionnaire together with our interpreters. We had realized that some of the questions would be hard to answer and not as useful as we initially thought. Therefore we constructed a simple questionnaire to obtain demographic data as well as to get an overview on topics of specific interest, such as collection from the forest, annual income and income from selling forest products (Appendix III). In addition, the questionnaires were often useful to make first contact and based on the answers in few cases we proceeded to SSIs.

After a pilot test with 5 respondents we modified details in some questions. Initially, most questionnaires were filled in at the savings club meeting (04.03.17), to which the headwoman invited us. Additional questionnaires were filled in during SSIs. In total we interviewed 28 villagers from zone 1 & zone 2.

2.2.2 School visit

We conducted a quick survey using show of hands with 17 kids from the 4th, 5th and 6th grade at the village school to investigate the extent to which parents pass on their knowledge on collection of forest resources.

2.2.3 Reflections

During the savings club meeting we acquired preliminary data with a relatively high number of respondents in short time. The meeting was a nice opportunity for us to get in touch with villagers which beforehand were inaccessible to us due to their working hours. However, the selection of the respondents was biased to some degree as people present were mainly members of the savings club and from zone 1. In addition, the way we filled the questionnaires during the meeting might have affected our data. People were sitting in groups and their answers could have been influenced by the others, as they possibly did not want to stand out. The questionnaires filled in during our days in the village show the same weakness as mentioned above for the SSIs.

When trying to analyse the questionnaire data (Appendix IV) we realized, that the last question concerning the total annual income made by collecting from the forest was asked in an inconvenient way. Unfortunately many who make an income which indirectly depends on forest resources, like the broom makers or people who sell forest products in street stalls, indicated that they had no earnings from the forest. This decreased the forest income in relation to other incomes.

The survey conducted at the school could be biased because the children might be influenced by each other, their teachers and the unusual presence of Europeans.

2.3 Transect walks

This type of tool is a walk around an area of interest, where villagers and project group members talk about observed things (Chandra, 2010). In total we conducted 5 transect walks (TW) for various reasons. Our informants and the specific topics are detailed in Table 2. We used TW as a straightforward approach to see not only the two zones that experienced relocation, but also to understand where and how people collect forest resources. Additionally, we used the opportunity to choose sites for soil sampling. During all TW points of possible interest were logged on the GPS.

Table 2: Informants & Topics from the Transect Walk

Informants	Topics
1. Headwoman (Int. 1)	○ Spatial overview of zone 1 ○ Introduction to villagers ○ Preliminary information on households
2. Headwoman's Assistant (Int. 8)	○ Spatial overview of zone 2 ○ Introduction to villagers ○ Preliminary information on households
3. Forest walk with guy from focus group (Int. 19)	○ Mushroom collection area ○ Fruit collection area ○ Information on forest use
4. Old grass lady (Int. 24)	○ Grass collection area ○ Information on resource use
5. Dr. Duangchai & Dr. Chatchai	○ Specimen collection ○ Landscape succession assessment

2.3.1 Reflections

The information recorded during the TW has to be considered as the subjective perspective of individual informants. This became apparent when two group members discovered a part of zone 1 on the last day that remained hidden during our TW with the headwoman and was left out for the rest of our research period.

2.4 Focus group discussion

We conducted a focus group discussion (FGD) with six to ten villagers of both sexes and different ages. FGD are useful to identify various types of group dynamics and facilitate an open talk about key topics (Chandra, 2010). In our case concerning the collection of forest resources. The aim of the focus group discussion was to identify important forest resources and the way they are used (processing / sale or self-sufficiency). Additionally we asked for collection periods, possible threats and changes to the availability and amount of the resources over the years and how knowledge on collecting is shared between the villagers. The focus group discussion was organized around a resource mapping during which villagers collaborated to draw where different forest resources can be found, indicated by a specific

symbol. We asked them to include the village and significant landmarks such as the highway, NP and RC.

2.4.1 Community meeting

On our last day, we presented our research and findings to about ten villagers of Moo 11, the headwoman and her assistant at a community meeting. We took this opportunity to confirm some of our data with them, creating a sort of focus group discussion.

2.4.2 Reflections

Interviewing several people at once made it easy to obtain a large amount of information in relatively short time. However, detailed information which was mentioned during the discussions amongst people was possibly lost. In addition, the dynamic of the focus group might have affected the data, as some informants especially the younger ones did not express their opinion to the same extent as older people. The FGD took place in an open room next to the temple of the village. Many villagers were present, but not part of the FGD, which could have influenced our informants' answers. However, this also worked to our advantage, as villagers that were present at the beginning of the FGD left and others took their place.

The discussion at the community meeting was mainly dominated by the headwoman, which possibly biased the confirmation of our data. The discussion was also highly focused on the findings we presented, thus limiting possible responses.

2.5 Botanical specimen collection

A list of Thai names of useful plants was made by the focus group informants. With the help of Dr. Chathai a botanical taxonomist we were able to translate most Thai names and identify the species (Appendix V). This approach can on its own not be considered as scientifically sound and was hence backed up by collection of botanical specimens to ensure correct botanical identification and scientific reproducibility.

2.6 Soil sampling

A total of 32 soil samples were taken at eight sites (Figure 2) in order to collect data that we can use to support our observations on the state of the landscape surrounding Moo 11. At

each site we dug six holes and took samples from the top layer (0-30 cm). We mixed them in a bucket, and took three replicas in addition to one bag of extra soil, from each site. All the samples were taken back to Denmark. Consequently soil texture, water-holding capacity (WHC), total Carbon (C) and Nitrogen (N) were analysed in the lab. The sites were first chosen based on where the forest resources were collected. Afterwards more sites were chosen in zone 1 and 2, because villagers talked about their soil being unproductive. This was also done because there was a clear difference between the two zones usage of the area.

Figure 2: Soil sampling sites are depicted in relation to the two zones of Ban Huai Nam Khem. (Image was taken from Google Earth, 2017)

2.6.1 Reflections

All eight sites can be biased and not representative of the area in focus. For the first three sites, we had to rely on our informants from the TW's, to show us places people go to collect forest resources. However, the sample cannot be considered representative as we only took

from one place and villagers have indicated several areas of resource collection. The rest of the sites were chosen without any guidance. The area was new to us which does not make us capable of assessing the best spot for taking the samples.

2.7 Group dynamics

The interdisciplinary work has been challenging throughout our research project. Different educational backgrounds and preferences for different methods were many times an obstacle in conducting our field work. Group discussions about different ways of interpreting the data were often time consuming. However, academic differences also proved useful in gaining a multifaceted perspective on our work.

3 Findings and Analysis

3.1 Research Location and Historical Background

This paragraph presents first hand findings as well as secondary data obtained from Sakaerat Silvicultural Research Station (RC) or additionally found in the literature. It allows us to describe the research location in its climatic, physical and ecological aspects. Particularly our historical and social understanding of the village (Ban) Huai Nam Khem (Moo 11) and the surrounding forest, which are also presented here, form the background for the interpretation of our further observations.

Moo 11 is situated at the Northern border of Thap Lan NP (Figure 3) in Wang Nam Khiao district, Nakhon Ratchasima Province, which is part of one of the poorest areas in Thailand (Moreno-Black & Somnasang, 2010). The NP, outlined in red on the map was established in December 1981 (Phanurak, 2012).

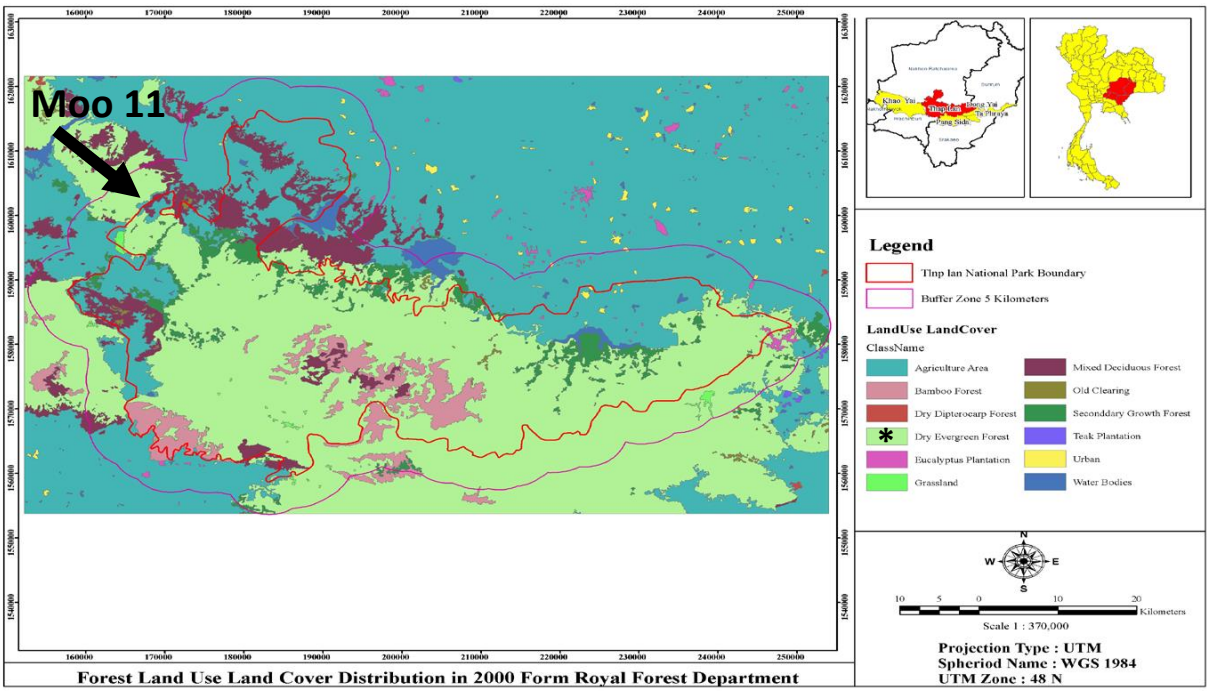

Figure 3: The Map shows the area of Thap Lan National Park divided into different Land Use and Land Cover categories as identified by Phanurak (2012) for the year 2000. The black arrow indicates the location of the Ban Huai Nam Khem (Moo 11) where our research will take place.

3.1.1 Climate

In general the area is known for its pleasantly cool and humid climate which is created by the forested hills that catch and hold moisture. Characteristic are three distinct monsoonal seasons (Phanurak, 2012). We conducted our research in March, in the middle of the hot season (mid-February to mid-May) during which highest temperatures of the year reach 37°C (Appendix VI). It is followed by the rainy season from mid-May to mid-October with high seasonal rainfall of up to 303.2 mm in September (ibid.). The year ends with a four month cold and dry period from November to February reaching minimum annual temperatures of 8°C in January (Appendix VI).

3.1.2 Land use and land cover change

In 2000, the Royal Forest Department classified four forest types in Thap Lan NP: dry evergreen, mixed deciduous, dry dipterocarp, and bamboo forest (Phanurak, 2012). The vicinity of the study site (Figure 3) was covered with dry evergreen forest until the 1960s (Appendix VI). The forest was then encroached by local people, who converted it into

Photo 2: This photo shows the hills around Ban Huai Nam Khem deforested and with tall grass as the only soil cover (recorded by Sakaerat Silvicultural Research Station in 1985).

Figure 4: The autophotos provided by Sakaerat Silvicultural Research Station show the rapid increase of forest cover in the area of Ban Huai Nam Khem following the reforestation efforts which started in 1982.

farmland for cash crop production (Appendix VI). According to the head and second head of RC most of the land was subsequently abandoned and found covered with tall grasses, such as *Saccharum spontaneum* (Photo 2), when the RC was established in 1982 (Int. 7; Int. 9; RC document). The results of the RCs' reforestation efforts in the area are illustrated by Figure 4

3.1.3 Conservation induced displacement

The state-planned conservation efforts, namely the RC and NP, on both sides of the current location of Moo 11 had a major impact on people's access to land and consequently their livelihood strategies.

Photo 3: The head of the Research Centre (RC) is pointing out the former location of Ban Huai Nam Khem which was in the area of the National Research Forest managed by the RC.

The first village by the name of Ban Huai Nam Khem was made up of approximately 100 farming households and located in the area that today is the National Research Forest (NRF) managed by the RC (Photo 3, Figure 5). When the area became protected the government asked the villagers to move to another village named Patiroop. They received monetary compensation for lost fruit trees and 15 rai of land per household, which had been taken from the villagers of Patiroop by the government. The corresponding 'Sor Bor Gor' title allowed them to farm but not to sell the land. This involuntary redistribution created conflict between former and new villagers of Patiroop and as a result the latter got bullied and many were forced to move again. Few stayed at Patiroop, but several moved to other villages to live with relatives and about 20-50 HHs moved to Ban Yai (zone 1). Ban Yai, which back then consisted of only about 10 households, is located across the highway from the RC. The people who moved from Patiroop to Ban Yai had to buy land from the former owners. Some could afford more land than others, which explains the unequal distribution of land noticeable in zone 1. We were told different dates for this relocation varying from 1980 to 1985, but it seems reasonable to assume that it occurred just before or while the RC was established in 1982 (Int. 1; Int. 4; Int. 6; Int. 9; Int. 16; Appendix VI).

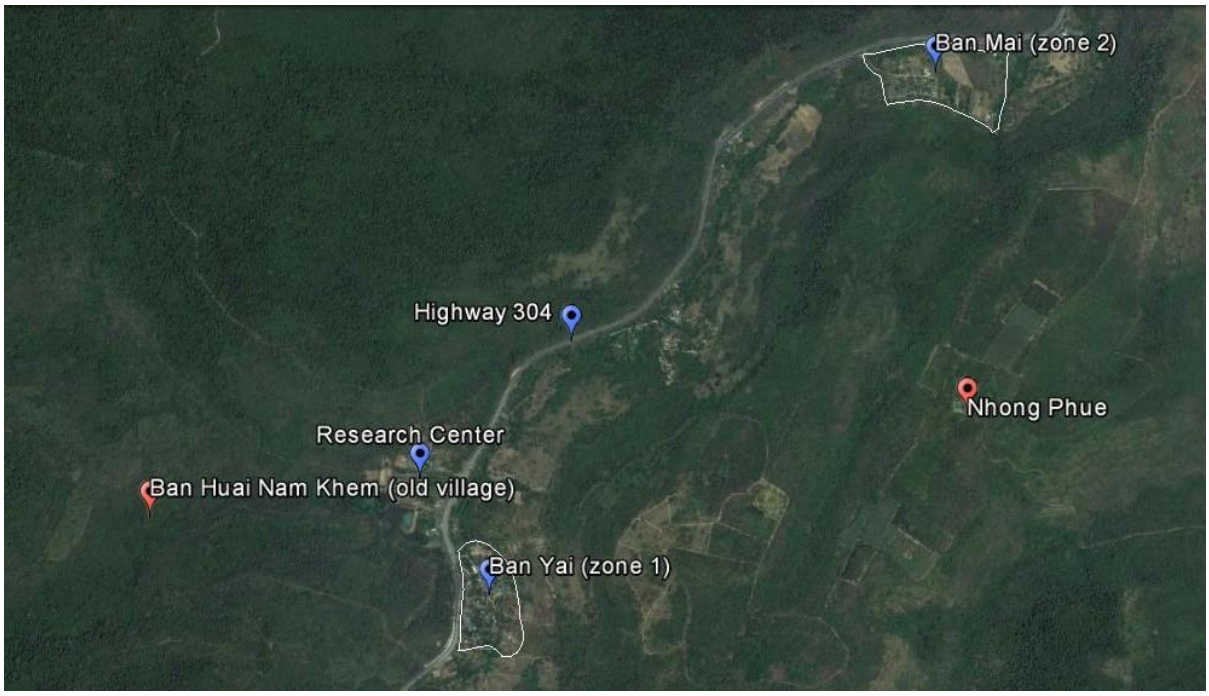

Figure 5: Relocation Map showing highway 304 which separates the Research Centre (RC) and the two zones of today's Ban Huai Nam Khem where our research was conducted. The villagers of the old village of Ban Huai Nam Khem were first relocated to Patiroop and many households then moved back to Ban Yai (zone 1) between1980 and 1985. The 18 households of Nhong Phue were moved to Ban Yai (zone 2) in between 1991 and 2002. (Image was taken from Google Earth, 2017)

Since the establishment of Thap Lan NP in 1981 several expansions of the known boundaries have taken place (eg. 2002 and 2016). For this reason another village by the name of Nhong Phue, consisting of 18 households who were farming maize and manioc on the hill-top across the highway from the RC (Figure 5), had to move. According to our informants the relocation occurred sometime between 1991 and 2002, but it appears to be linked to and therefore likely occurred prior to the 2002 NP-expansion (Int. 1; Int. 4; Int. 7; Int. 21; Int. 28). For compensation the displaced households received 1.2 rai at the location of today's Ban Mai (zone 2) which was partly cultivated before; 0.2 rai for living and 1 rai for farming respectively (Int. 1; Int. 8).

The uncertainty about the relocation dates could result from difficulties to remember events which lie far in the past, or from the fact that people really moved in different years. Another explanation could be that the year does not really concern them, as they possibly experienced the relocation as something that one cannot influence and simply has to adapt to.

3.1.4 Today's village and it's people

The turbulent history of Moo 11 is reflected in its multifaceted social and physical structure as well as in the distribution of land among villagers. Today Moo 11 consists of five separate

zones spread out for 8 km along the 304 highway. In our research, only the two zones that experienced relocation (zone 1 & zone 2) were investigated.

According to Udom Sap sub-district office, 226 HHs and 556 people are officially registered in Moo 11 (Int. 4). However, the headwoman informed us that only approximately 100 households are inhabited, housing around 250 people (Int. 1). All land in zone 1 and zone 2 has the official title 'Por Bor Tor 5', which makes it illegal to sell the land. This factually immobilizes the villagers' capital, binding them to the village. In consequence many houses are abandoned by people who manage to raise the necessary financial resources and moved to cities for work or to live with family. Those who stay either work at the RC or have other jobs, such as farming or selling things. Many, especially those who work as seasonal laborers make an additional income by collecting forest resources (Appendix IV).

3.2 Authorities and Moo 11

The relocation involved different authorities like the RC, NP, sub-district, government and the head of the villages at the time. The interrelation between these authorities is quite complex and it is hard to define the responsibilities of each institution.

Moo 11 does not have much land and only some have a small garden to grow fruits and vegetables that they according to the RC can only use for their own consumption (Int. 9). Many people base a part of their livelihoods on collecting forest resources even though it, according to NP law, is prohibited. However regional authorities accept that the villagers collect particular forest resources, and they can relatively freely use the forest as long as they do not cut the trees or hunt (Int. 1; Int. 4; Int. 7; Int. 9). However it is not possible to get an official permit to collect since this would be against regulations of the protected areas (Int. 4; Int. 9).

3.2.1 No authority takes responsibility for the villagers

It is difficult to determine which authorities are involved in deciding the rights and restrictions of Moo 11. The subdistrict office says they are only in charge of utilities and can accordingly not do much about the villagers' situation (Int. 4). The NP seems to be the most powerful institution when it comes to the faith of Moo 11, since it can claim any land as protected area and thereby put it under its regulation (National Park Act 1961). The villagers' land title 'Por Bor Tor 5' reflects this, as it means their land officially belongs to the park and can only be

used for housing. This also means that they are not officially allowed to sell the produce they grow. The interviews gives us the impression that the park is not much bothered with the villagers except when someone breaks the unofficial agreement by illegally logging or hunting (Int. 1; Int. 4; Int. 6; Int. 19). The RC officials seem to have a similar mindset, stating that the villagers are not their concern, but rather of the subdistrict office (Int. 9). It appears that no authority is both capable and willing to secure the villagers' right to collect forest resources and sell things from their land. The villager's interests are simply overshadowed by the reforestation project. It is problematized further by lack of cooperation between different institutions which is exemplified by the disagreement about how the relocation took place and confusion about the NP boundaries (Int. 1; Int. 5; Int. 6; Int. 8; Int. 33). One of the last days of the fieldwork the road department suddenly comes into the picture, when we interview some women selling brooms and fruits by the road (Int. 32; Int. 33). According to them all villagers have been given permission to grow and sell stuff from their gardens by the road department, something other authorities so far have said was illegal. This is a good image of the confusing complexity of institutions not talking to each other, and in this case even making contradicting rules.

3.2.2 Gap between law and practice

Instead of operating within the official law, which is not always clear or enforced, the villagers operate within what is tolerated in practice. People are aware of what is accepted and what is not, despite the lack of written rules. A few days after having interviewed an old lady, we discovered that she was taking care of a manioc field near her house in zone 1 (Int. 14). When we went back to ask more into it she was reluctant to talk about it and said she was just taking care of it for a relative to get some exercise (ibid). According to her she did it herself and neither used chemicals nor weeded it, something the large and nicely tended field contradicted. It seems that cultivating a field went beyond the limits of how far the rules could be bended and was not something you would tell some outsiders about (Int. 13). Another case of a person knowing, that the boundaries of the acceptable were crossed, was the charcoal guy, a seemingly very poor and marginalized old man living in the outskirts of zone 1. It seems quite likely that he cut eucalyptus trees growing in the forest close to his house to make charcoal, though when asked if he ever collected something from the forest he very defensively answered that he never went into the forest because this was not allowed at all

(Int. 11). His daughter being a broom maker collecting grass from the forest (Int. 15), he must have known that going into the forest was accepted. Furthermore, he has a snare and net lying on his roof, which indicate that he hunts in the area. The charcoal guy knew he was overstepping the line of what was tolerated and therefore his livelihood strategy was not something he could talk openly about. Instead he denied it by completely rejecting using the forest as well as giving contradicting and evasive responses when asked about the charcoal business (Int. 11; Int. 12).

Despite the official rules, prohibiting the villagers to collect forest resources and sell produce from their garden, not being acted out in practice, they do compose a risk to the villagers' livelihood strategies. The villagers are very dependent on keeping good relations with the NP, RFD and RC (Int. 1; Int. 2; Int. 4). These relations can be threatened if villagers do not stick to the unwritten agreement by logging or hunting as the RC mentions (int. 7). Changes in the political environment could also pose a threat since a new head of the NP or RC might not be as accepting to the deal (Int. 36). The unpredictability and autonomy of the NP seems to create some uncertainty about the future since the villagers and the headwoman anticipate another relocation (Int. 2). The subdistrict also expects the NP to continue to expand and move the border further into people's lands (Int. 5). If the unofficial permission to collect from the forest is withdrawn it would be fully according to the law and give the villagers no rights for compensation**.** The legal base of the forest resource dependent villagers' livelihoods does therefore seem quite unstable.

3.2.3 Considerations

The people that have the loudest voice and seem quite well off like the headwoman, the shopkeeper and the forest collector, we did the TW with, are those who seem most concerned about the future and possibility of another relocation or lack of official permit (Int. 1; Int. 2; Int. 16; Int. 19). However the people most vulnerable to changes in accessibility of the forest resources, mostly the people who seem poorer, do not mention the problem as much (Int. 11; Int. 15; Int. 25). This could be because they lack the social and cultural resources to protest or perhaps it is not an issue at all for them. We believe it makes sense to listen to those who might have a bigger overview of the situation, but we also have to be careful not to have certain people's opinions take up too much of our analysis. Especially the headwoman seems to stress the unfairness in the villager's situation in her agenda to get more land for the

villagers. It was not until the last day that we realized zone 1 was a lot larger than what we saw when the headwoman showed us around. She only showed the part of the zone with the houses which were in the worst state (Photo 4). This might be intentional, so that the people we talked to from zone 1 only were the people, who actually use the forest, but nonetheless promotes a particular image of the village.

Photo 4: This pictures shows one of the poorest households we encountered in zone 1 of Moo 11.

There might have been a misunderstanding in relation to the road department giving people permission to sell things from the garden. Something might have gone wrong in the translation or the women misunderstood the question. It seems more likely that the road department just gave them permission to sell by the road, not caring where the products came from. However several women told us that it was not just the selling by the road that the department had allowed, but also selling from their houses. It could be that the women, since they had been given permission to sell by the road, just interpreted this as a general permission to sell from their gardens.

3.3 The Use of Forest Resources

As discussed in the previous chapter the rules and boundaries in Moo 11 regarding the collection of forest products are far from clear. This has in the past often created conflict between institutions concerned with conservation and the local people who are economically dependent on the forest (Leblond, 2010). Therefore we investigate the importance of forest resources for Moo 11 analysing data from SSIs, the FGD and resource mapping exercise. We were able to compile a list of different species (Appendix V) of plants and mushrooms that were indicated by the villagers as useful (Int. 38). They also identified the economically most

important species, corresponding collection periods and whether it is allowed to collect them or not. Our findings on important forest plant resources including the utilized plant parts are presented in Table 3. Out of 28 questionnaire respondents 18 say they collect forest resources and 17 generate income by selling or processing them which underpins the economic relevance of this activity. The most commonly mentioned and apparently most important resources were mushrooms and bamboo shoots (Appendix IV).

Photo 5: On a transect walk the old grass lady shows us where and how to harvest the late type of broom grass (Thysanolaena latifolia). The collected inflorescences are visible beside her.

Table 3: This table presents collection period and utilized parts for plants indicated as economically important and allowed for collection by the villagers. The botanical species were derived from their Thai names and had to be validated by identification of collected specimens or photos (Appendix V). The asterisk (*) indicates species where this was impossible.

Economically Important Plant Species				
Name:	**Species:**	**Family:**	**Collection period:**	**Utilized part:**
Bamboo	- *	Poaceae	July – Oct.	Shoot
Satoh	Parkia speciosa	Fabaceae	April – June	Seedpod
Rambutan	Nephelium lappaceum*	Sapindaceae	?	Fruit
Litchi	Litchi sinensis	Sapindaceae	April – June	Fruit
Broom-grass	Saccharum spontaneum	Poacea	Oct. – Dec.	Inflorescence
Broom-grass	Thysanolaena latifolia	Poacea	mid. Dec. – Feb.	Inflorescence

Table 4 shows the amount of different types of mushrooms collected on NRF land in 2016 including prices at the street stalls along the highway. Mushrooms are very important as they are collected by 16 out of 18 people who stated to use forest resources (Appendix IV).

Table 4: The total amount collected on NRF land by villagers for different types of mushrooms was recorded in the year 2016. Species names are unconfirmed translations from Thai terms. Prices were indicated by street stall sellers. According to them the value of 'Hed ra-ngoke' varies significantly depending on precipitation and its availability.

Economically Important Mushroom Species				
Thai name:	**Species:**	**Family:**	**Amount collected (kg):**	**Price (TBH / kg):**
Hed khom	Boletus griseipurpureus	Boletaceae	747.5	-
Hed ruam	-	-	114.3	60
Hed pluak	Termitomyces fuliginosus	Lyophyllaceae	1.0	-
Hed takrai	Russula delica	Russulaceae	10.3	-
Hed khone	Termitomyces spp.	Lyophyllaceae	2.5	-
Hed phueng whan	Boletus edulis	Boletacea	1.0	-
Hed nahm mark	Russula emetica	Russulaceae	3.7	300
Hed ra-ngoke	Amanita hemibapha	Amanitaceae	15.9	60 / 280 - 300
Hed kra-ti	-	-	1.0	-
Hed pos	Astraeus hygrometricus	Diplocystaceae	270.2	-
Hed than	Russula densfolia	Russulaceae	-	60

The fruits of Rambutan and Litchi and the immature seedpods of Satoh are sold fresh. Because their season lasts for three months (Table 3), they generate income only for a relatively short time. Bamboo shoots, which are harvested for three month during the rainy season (Table 3), on the other hand are conserved by boiling or pickling (Int. 22) to extend the period of income generation (Photo 8). The early broom grass can be collected from October until December and is followed by the late variety which can be collected until February (Table 3). Photos 5 to 8 show the different steps involved in making and selling the brooms. This work is generally

Photo 6: After the harvest the dried inflorescences are rubbed on a rough surface to remove the husks and seeds, then cut to length and put away for storage.

done by women in times when no other labour is available and brooms are sold for around 50 TBH a piece throughout the year, most during weekends and public holidays (Int. 22; Int. 24). Mushrooms are commonly available throughout the rainy season from May until November. The most collected species in the NRF area in 2016 were Hed khom, Hed ruam and Hed pos (Table 4). Prices of valued species are higher and some vary depending on their abundance (Table 4). A successful collector can make up to 5000 TBH a day during the season (Int. 19).

Photo 7: Here we see one of our informants at work in front of her house. The brooms are made from previously prepared grass bundles and young bamboo sticks.

Photo 8: In most cases the broom makers sell the finished product to a street stall owner who then sell it to Thai tourists as a local speciality. At the far right end of the stall the pickled bamboo shoots are visible in jar, while the boiled ones are hanging in plastic bags from the roof.

The resource map (Figure 6) shows where the villagers find different forest resources. Interestingly they mentioned that changes of the environment affected the availability of two important resources, mushrooms and grass, around the village, so they now have to go further to find them (Int. 38). During the TWs we realized that different types of vegetation are linked with certain resources. The broom grasses only occurs in open areas (Photo 9; Int. 25), while mushrooms grow best under native tree species (e.g. *Hopea odorata*, *Dipterocarpus alatus*) (Int.19). Litchi, Rambutan and

Satoh are collected in native forest that grew up around the former location of Nhong Phue (Int. 19) and bamboo grows well in heavily disturbed forest areas (Photo 10; Gardner et al., 2007; Int. 25). This is in line with the findings from the resource mapping, since changes in the type, extent, or succession state of the re-growing forest affects the availability of certain resources.

Photo 9: The area below the powerline is frequently cleared so that the late broom grass (Thysanolaena latifolia) dominates over forest vegetation which is suppressing it elsewhere.

Photo 10: A view from Saladdai cliff overlooking a bamboo forest where villagers collect bamboo shoots. This type of forest indicates that the area was deforested until recently and only became protected within the last 30 years, since the native forest is only starting to re-grow.

Our findings reveal the most important forest resources collected by the villagers as well as a seasonal variation in the dependency on these resources. We also found that resources are influenced by environmental factors and they particularly occur alongside specific vegetation types. This connection will be further explored in the next chapter.

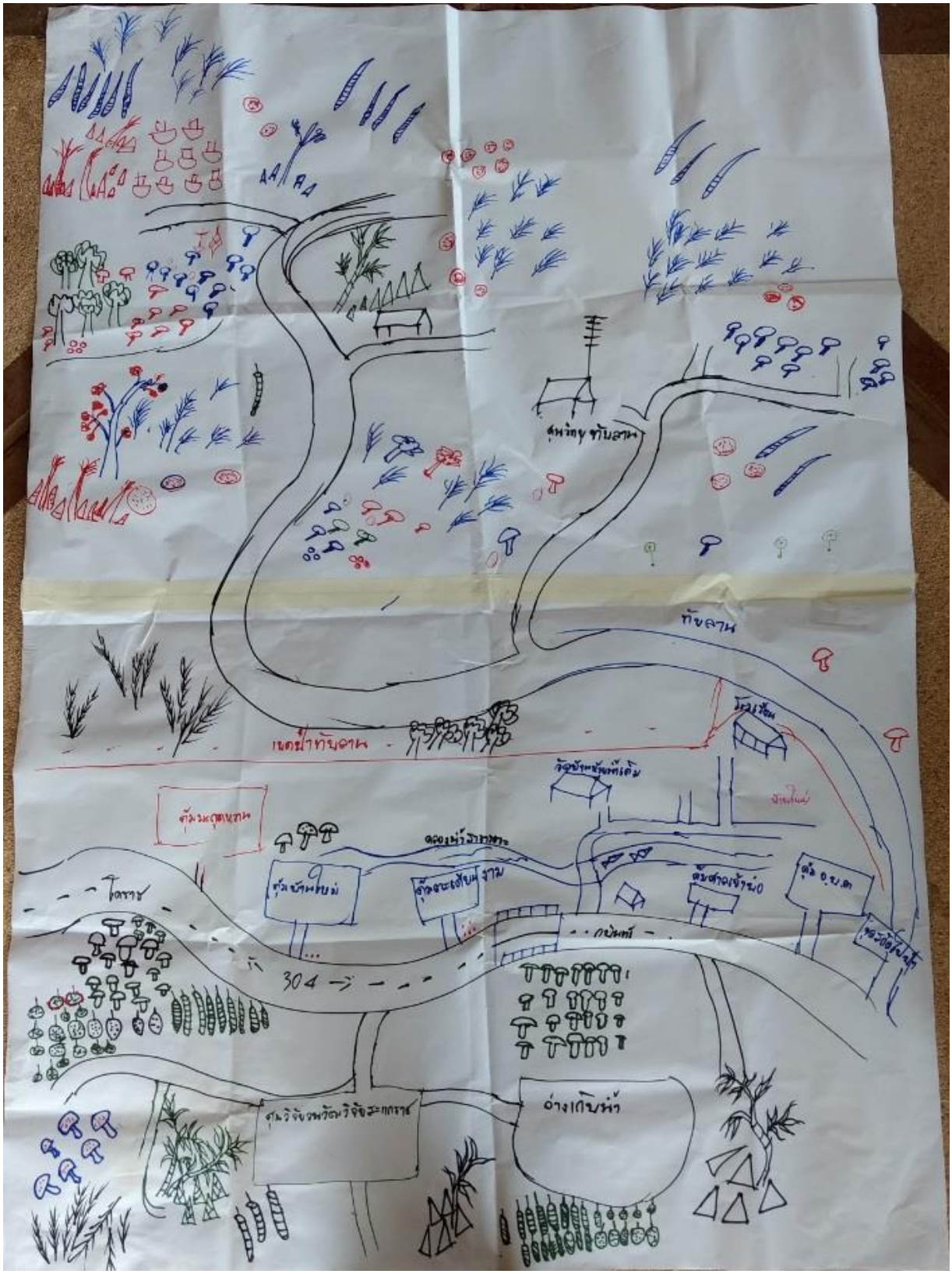

Figure 6: This resource map was created by villagers who collect resources from the forest. Symbols indicate the five most important resources (mushrooms, bamboo shoots, broom grass, Satoh and Litchi). The highway (route 304) separates the RC from Moo 11. Squares indicate the different zones of the village. And the headwoman's house. Roads are indicated by to lines.

3.3.1 Considerations

With the help of Dr. Chatchai the botanical species names were derived from the Thai terms listed during the FGD, who told us that this approach alone is not scientifically sound. To ensure the validity and reproducibility of our identification botanical specimens or photos were collected (Appendix V). For lack of time we were only able to do this for most of the important species (Table 3). For the mushrooms species names were translated by our interpreters who have no taxonomic expertise. Accordingly the given species names should be treated as estimates.

3.4 State of the Forest

In this chapter there will be given an overview of the relation between the state of the forest and the availability of forest resources. In the initial phase of reforestation fast growing tree species such as *Acacia mangium*, *A. auriculiformis* and *Eucalyptus camaldulensis* were planted to increase nitrogen levels and soil organic matter. These trees use a lot of water, mature quickly and die after 15-25 years, which we observed in much of the surrounding forest plantations (Photo 11). They are then replaced by native forest (Int. 9; Int. 19; Int. 37). As mentioned in chapter 3.3 the availability of some resources is influenced by the changing environment, especially the forest.

Photo 11: We observed that much of the Acacia forest plantations around Moo 11 was starting to die. It will then be replaced by native

In order to investigate how different stages of forest succession (grassland, acacia, secondary native forest) are linked with the availability of important forest resources, we analyse soil from different sites (2.6 Soil sampling). Soil analysis might give an indication of the conditions of the area, and if the condition of the soil is supporting the growth of the resources. An

overview of the soil analysis results is shown in Table 5. Total C and N gives an indication of soil fertility, where WHC is related to plant available water.

Table 5: Different site names with the results from the soil analysis.

Site name	Texture	Water- holding capacity (%)	Total C (%)	Total N (%)
Grass	Sandy clay loam	30,13	1,11	0,12
Acacia	Silty clay	35,48	1,35	0,16
Zone 1 field	Sandy clay	27,70	1,07	0,13
Zone 1 forest	Silty clay loam	33,71	1,25	0,15
Zone 2 field	Sandy clay loam	26,04	0,40	0,08
Zone 2 forest	Sandy clay loam	30,69	1,07	0,17
Mushroom	Silty clay	39,45	1,10	0,12
Fruit	Clay loam	32,47	1,66	0,18

Table 6: Field capacity for different soil texture (Decagon Devices, 2015).

Texture	Field Capacity (v%)
Sand	10
Loamy Sand	12
Sandy Loam	18
Sandy Clay Loam	27
Loam	28
Sandy Clay	36
Silt Loam	31
Silt	30
Clay Loam	36
Silty Clay Loam	38
Silty Clay	41
Clay	42

The most common soil texture found at sampling sites is sandy clay loam (Table 5). This is in compliance with the information stated in the RC document. In sandy clay loam, sand is dominating, which increases the necessity for water input to the soil for healthy plant growth (Petersen, 1994). Soil texture also influences WHC (Zotarelli, Dukes, & Barreto, 2010) which gives an indication of the field capacity for the different sites (Table 5). A lower field capacity indicates a lower amount of water available to the plants (Petersen, 1994). In relation to Table 6 it appears that the sites' WHC in general are below the field capacity expected for the soil textures. Since the WHC in general is low the plant available water in the soil is quickly depleted. In combination with precipitation being unevenly distributed over the year (Figure 7) this renders the soils prone to drought.

The C and N content is closely linked to the fertility of the soil, and therefore may influence growth of different species in the forest (Petersen, 1994). For all soil samples N was below the detection line of the analysis, where measurements can be inaccurate. This means that N

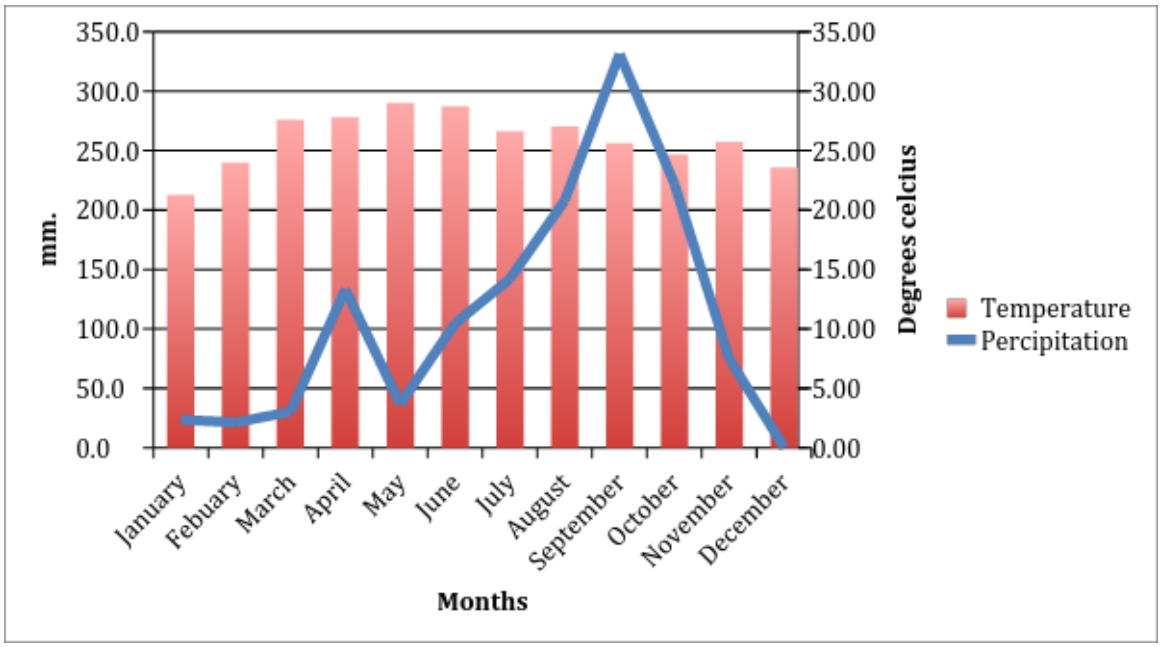

Figure 7: Overview of temperature and precipitation measurements at Sakaerat Silvicultural Research Station in 2016 (Appendix VI).

values given in Figure 7 might be lower than the detected level. Furthermore C was only below the detection line for *Zone 2 field*. A one-way ANOVA, which was conducted to determine differences between the samples, indicates that there is a significant difference in both C and N values between the sites. This is in line with the fact that the sites vary a lot in surrounding conditions and land use. For all samples there are however generally low contents of C and N, which indicate a low fertility of the soil (Evert & Eichhorn, 2013; Petersen, 1994).

It appears that C and N values increase as a result of the succession to native forest (Table 6). *Grass* with lowest C and N values represents the area before reforestation. The *Acacia* plantations possibly increase soil N and C, which seems to drops a little when native species are introduced after this type of forest dies. The *Fruit* area likely has the highest C and N values because it was never completely deforested and native forest regrew since the relocation of Nhong Phue. This likely explains the higher organic matter in the soil and hence the fertility.

3.4.1 Impacts on forest resource availability

As mentioned in chapter 3.3 the state of the forest has an influence on the forest resources available to the villagers. A threat that was often mentioned is water scarcity (Int. 10; Int. 19; Int. 24; Int. 38). As shown in Figure 7, precipitation is not evenly distributed over the year which in combination with low WHC possibly increases the risk of drought. Five years ago there was a big drought, which significantly decreased the amount of resources available (Int. 37). As shown in Figure 8 all resources are influenced by drought.

Close to the village acacia forest been planted, which suppresses the broom grass and limits the amount of mushrooms that can be found because the trees reduce the water availability (Int. 19). The villagers also stated this effect of the acacia forest plantations for all other important resources (Figure 8). We observed that much of the acacia forest that was planted in the area 20 to 30 years ago is dying and consequently turned into native forest. This could be an improvement for the villagers as mushrooms, Litchi and Satoh grow well in this type of forest and their availability will likely increase (Figure 8). Although the grass will permanently be suppressed by the reforestation efforts (Int. 9) in the villages surrounding as it cannot compete with the dense forest (Figure 8). When we presented our finding at the village meeting and proposed that overuse might potentially affect the availability of mushrooms they disagreed (Figure 8).

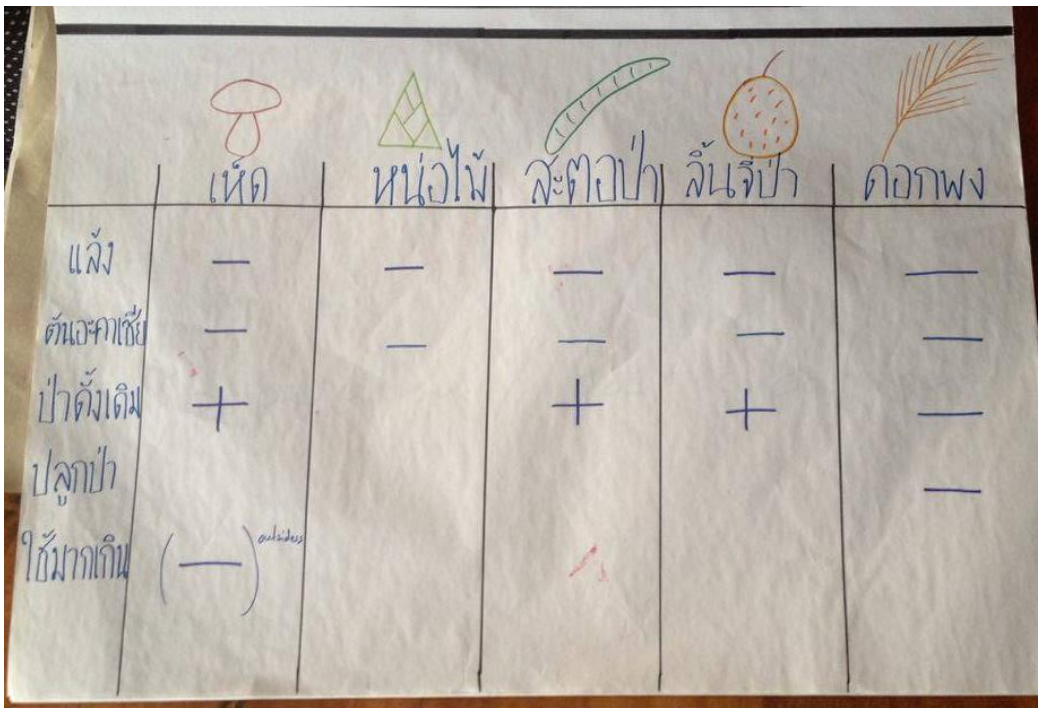

Figure 8: The symbols indicate the 5 most important resources for the villagers (mushrooms, bamboo shoots, Satoh, Litchi, broom grass). On the left the following threats are listed from top to bottom: drought, increase of acacia forest, increase of native forest, reforestation and lastly overuse of resources. This table was validated by the villagers at the community meeting (Int. 35), whereas data for the table was collected during interviews.

Overall it seems as if the increase in forest area might change the availability of the resources. Bamboo and grass for example rely on conditions that were present before the NP was established (see chapter 3.1). This might be because most villagers gained knowledge about the resources from their parents, who lived in the area before the reforestation (Int. 10; Int.

15; Int. 26). This means that some of the forest resources aren't actually related to the current forest, but to the landscape before the reforestation and therefore likely to become less abundant.

3.4.2 Considerations

The threats in this chapter are based on the villagers' current knowledge about the growth conditions for the resources, which are then set in relation to the changes in forest area in the future. Since they do not have complete knowledge about how changes in weather and forest growth conditions may influence the resources, there is an uncertainty related to the future availability.

The determination of soil texture has been based on a very subjective method, which may have influenced the outcome of the analysis. The fact that the soil samples have been taken from very different places makes them difficult to compare. They were influenced by not only vegetation, but also slope and historic land use. The results can therefore be very biased. In addition to this the results from analysis of WHC could have been strengthened by increasing the sample size and also determining the wilting point. By doing so it would have been possible to determine the actual amount of plant available water.

The soil samples cannot on their own give a complete indication of the state of the forest. It was the idea that soil samples should be compared with the growth conditions of important resources. However it was not possible to get this information for the species, which in the end has influenced the use of the soil samples in the project

3.5 Perception of the Forest

3.5.1 Importance of the forest

The importance of the forest has been stressed by the villagers and authorities throughout our stay in Moo 11. Our first interview was with the headwoman, and we started off by introducing ourselves as students investigating use of natural resources. Before we asked any questions, she began a long talk about the villagers' lack of land, their great dependence on the forest and their difficulties with getting an official right to collect (Int. 1). The villager's use of the forest was obviously something she was very passionate about and we experienced for the rest of the fieldwork that most people, as soon as we mentioned natural resources, were

quite eager to talk about how important the forest was to them,, an impression that was confirmed at the community meeting (Int. 36). So the forest is undeniably important to many of the villagers in Moo 11, however exactly why this is, is more ambiguous.

3.5.2 Forest dependency

Many of the villagers including the headwoman say that the forest is their way of surviving (Int. 1; Int. 13; Int. 15; Int. 24). As one villager puts it: "If I can't have access to the forest, I will die" (Int. 28). Furthermore the assistant of the headwoman claims that around 70 % of the villagers are dependent on the forest as their main income, which at first gives the image that forest resources are crucial for most of the villagers' livelihoods (Int. 8). However, looking at our questionnaire and digging into how important the forest resources are as a source of income, we see that the villagers might not be as dependent on the forest as they express, at least not economically. Comparing forest income with total income data from our questionnaire shows that the forest resources only make up a smaller fraction of the respondents' income (Figure 9). On the other hand, as discussed in chapter 2.2.1, more people generate income from the forest than our questionnaire was able to capture.

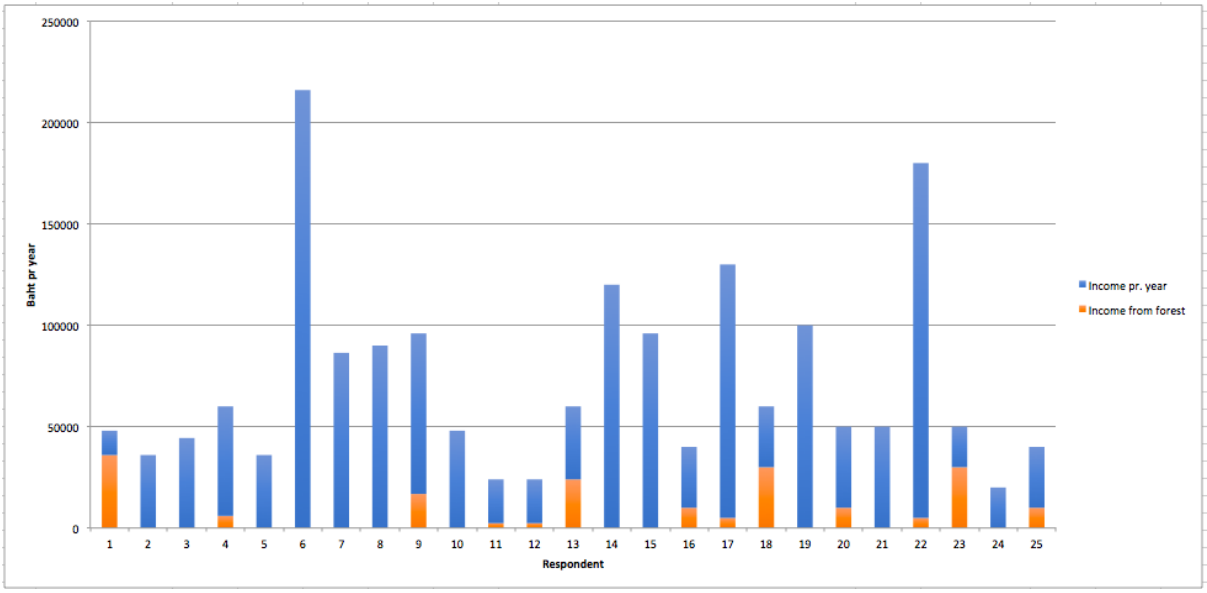

Figure 9: Annual income for 25 respondents from questionnaire. Some people are more dependent on the forest than others. First respondent has the highest dependency and doesn't have a high income, whereas villagers with high income doesn't use the forest very much.

It is apparent here and confirmed in our interviews as well that the poorer people are the most dependent on the forest resources. Yet even for those most dependent, the forest income generally does not make up more than half of their total income (Figure 9). For the many people who collect in addition to their regular employment, the contribution to their

income is even less. The shopkeeper, for example, has what seems to be a quite successful business with a continuous flow of customers, but he still collects and sells mushrooms (Int. 16). Many people also just collect things for their own use. At the school visit we found that 9 out of the 17 children's parents, who all collect from the forest, only did so for domestic use (Int. 34). Since it is not a crucial source of income for all villagers of Moo 11, the value of the forest cannot only be accounted for in economic terms.

Dependency on the forest appears to be a question of village identity. Being dependent on the forest seems to unite Moo 11 in a way and several informants mention that they have to stick together and help each other collect, now that they have no land (Int. 1; Int. 24; Int. 19). They thereby directly link the dependency on forest resources to the relocation. Many of the villagers used to be farmers before the relocation and the constant mentioning of land scarcity when we ask about forest resource use (Int. 1; Int. 13; Int. 16; Int. 21), indicates that for some collection of forest resources is a way to substitute farming and to hold on to the use of natural resources. Furthermore, stressing their dependence could be seen as a justification for the collection practice, as well as an argument for an official collection permit.

3.5.3 Considerations

The way we have distinguished between poor villagers and those better-off in the interview is based mainly on indicators like the clothes they are wearing, the house they live in and their job. The disadvantage of this approach is that it is not as accurate as using income and based on a more subjective perception of what constitutes wealth. However, since there was a very obvious difference in for example how nice and big the house of a person working at the RC was, compared to a broom maker, we believe it to be a decent indicator. Furthermore, people might not be very accurate in determining their incomes especially those where it varies a lot throughout the year along with the availability of forest resources and labour jobs.

To emphasise their dependency on forest resources people may say that they earn more money from collecting than they actually do. Another possibility is that we underestimate the economical relevance of forest resources since people were sometimes unable to estimate their income from this activity. Another issue is that some people who make an income from processing forest resources or selling them at the street stalls did not state a forest income because of the way we asked this question in the questionnaire.

3.6 Strategies

Above several threats to the villagers' forest resource based livelihoods such as the uncertainty about rules and borders, the perceived increase of drought and the reforestation have been discussed. In this chapter we have identified the most important strategies that help the villagers cope with these factors.

Many villagers help each other and share their knowledge about forest resources. They do this because they feel they have to stick together under tough circumstances (Int. 1; Int. 8; Int. 19; Int. 24). The older people help each other by sharing knowledge about the resources and the younger people help collect forest resources for elderly (Int. 13; Int. 27). However it is not everyone who wants to be, or perhaps can be part of this social network. The broom lady for example is not interacting with the other villagers and has a very limited social network, rendering her more vulnerable to possible changes (Int. 15). Instead she perceives a competition between the villagers over the available resources, and will not share her knowledge about where she goes. Other villagers, on the other hand, are very open about where they collect (Int. 19; Int. 25). So the villagers do stick together and help each other but it is restricted to a certain social network.

The headwoman has also started various clubs in the village (Int. 3). One of these clubs is the savings club, of which the majority of villagers are members. The savings club creates an economic safety net for the villagers. They can borrow money from the club at a lower interest rate (2%) than from the banks (Int. 1). By allowing villagers to circulate their loans from one club to another this system increases the liquidity in the village and solves the problem of debt mentioned by the headwoman (Int. 3). For poor villagers this is the only way to sustain their family in times when no labour and no forest resources are available (Int. 15).

Another way the villagers deal with their relatively difficult living conditions is by efficiently utilizing the resources available. For example villagers grow fruits and vegetables on whatever land they have available (Photo 12) and sell products they cannot eat (Int. 10). Some of the villagers state that if they were not able to grow food in their garden, they would not be able to keep up their living conditions (Int. 28). Some villagers also grow Satoh and bamboo in their gardens (Appendix V), as a supplement to forest collection (Int. 21). For some resources this appears to be a useful strategy if the availability in the forest should decrease.

Another strategy we have identified is bending the rules in favor of the villagers' interest. As shown earlier, some of the villagers utilize the resources available even though it might not be allowed, like the old lady with the cassava field (Int. 14). Other examples of bending the rules are the fancy vest guy who "gave himself permission" to grow a banana plantation and selling the products, the charcoal guy who is hunting and possibly cutting trees in the forest and people buying and selling pieces of land, even though the land title does not permit it (Int. 1; Int. 12; Int. 23). Knowing the right people seems to be important in order to bend the rules. The fancy vest guy did not have to hide his plantation in any way, possibly because of his friendship with a local police officer. To what extent you can bend the rules also depends on the specific rule. The charcoal guy was seemingly very paranoid about his activities which makes sense since cutting trees and hunting has been mentioned as the two things that are in no way accepted by the NP.

Photo 12: This picture shows the herb garden of a family that appeared especially well kept and contained many different species.

A way the villagers adapt to the mentioned insecurities is by diversifying their livelihoods. As shown in chapter 3.5, no villagers solely depend on forest resources. The ones that collect from the forest also take day to day labour jobs, resell trash found by the road, fix broken things and so on. Many also go to other villages or even provinces to work for periods of time. All in all this decreases the dependency on forest resources.

3.6.1 Considerations

As we discussed in chapter 3.2 the official rules and restrictions regarding the villagers are not very clear and there could therefore be some implications saying the villagers *bend* the rules as a strategy. Given the relative character of law in the area where rules are not always clear and not always being enforced, people are most likely not always bending the rules consciously, since the distinction between allowed and not allowed is difficult to determine.

4 Conclusion

In this project we investigated how the relocation of Moo 11 has changed the villager's use of natural resources and examined potential threats to this contribution to their livelihoods. The relocations of Moo 11 was a complex process which was shaped by the incoherent action of different institutions. Many of the villagers used to be farmers, but most now own only a small parcel of land only to be used for housing. This means that some villagers find it necessary to collect forest resources to sustain their livelihoods, thereby breaking the rules of protected areas.

The forest can provide several resources but only some are unofficially accepted to be collected. Economic considerations seem to be the primary reason for the choice of collected forest resources, since those with a long season or storability are collected by most villagers. Accordingly, different kinds of mushrooms, bamboo shoots, Satoh and grass for making brooms are the most important forest resources. Although many people collect forest resources, this activity only seem to have a crucial economic importance to people who are unemployed and do seasonal labour. The villagers seem to promote an image of being more forest dependent than they actually are. This might indicate a non-monetary value of the forest to the villagers or be a way to justify breaking the rules of the national park and national research forest. Several threats in relation to the lack of an official collection permit, uncertainty of boundaries, rules about farming and the possibility of renewed displacement are perceived by some villagers.

A changing environment with regards to drought and reforestation influences the availability of forest resources. Some villagers complain about the fast growing, exotic trees, which are planted in the first step of reforestation, are using a lot of water thereby decreasing water availability limiting growth of important resources.

To reduce the potential impact of these threats the villagers developed different strategies. They are aware of some of the changes in resource availability and help each other collect. A strong social network helps them deal with insecurities concerning resources, because they share knowledge about collection. Some villagers also grow some of the important resources in their gardens, decreasing the dependency on the forest. Overall the villagers have

intensified their use of the forest after the relocation and they cope with the rules limiting their resource availability, by bending them in their favor.

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Appendix I – List of Informants

Number	Description	Age	Zone / institution	Date of interview
Officials				
1	Head-woman, first interview	45	Headwoman	02/03/17
2	Head-woman, second interview			11/03/17
3	Interview with head-woman after community meeting			12/03/17
4	Head of sub-district, first interview		Head of sub-district office	06/03/17
5	Head of sub-district, second interview			09/03/17
6	Head of research centre		Head of research centre	08/03/17
7	Head of research centre, second interview			09/03/17
8	Head assistant, middle-aged male		Assistant to headwoman	04/03/17
9	Second head of research centre, spoke english		Second head of research centre	07/03/17
Zone 1				
10	Lady with egg business and big garden	46	1	08/03/17
11	Charcoal guy. Poor old man in the outskirts of zone 1 who makes charcoal. First interview	-	1	04/03/17
12	Charcoal guy, second interview	-	1	07/03/17
13	Old lady with blind husband	-	1	04/03/17
14	Old lady with blind husband, second interview when we found out she was taking care of cassava field in zone 1 and we wanted details on that	-	1	07/03/17
15	Lady making brooms	-	1	04/03/17
16	Shop owner, owns seemingly successful shop in zone one, angry about not having any land	51	1	03/03/17
17	RC root cutter lady, lives in big nice house in zone 1	48	1	07/03/17
18	Vicious dogs man	-	1	07/03/17
19	Forest walk with guy from focus group	-	1	08/03/17
20	Wife of shop-owner	-	1	09/03/17
Zone 2				
21	Dog lady, grows bamboo and beans and work at the RC, first interview	-	2	04/03/17
22	Dog lady, grows bamboo and beans and work at the RC, second interview	-	2	09/03/17

23	Street stall lady 1	50	2	06/03/17
24	Fancy vest guy, guy we met at wedding who was dressed more extravagant than the rest, owns a banana plantation in zone two	-	2	07/03/17
25	Old grass lady, we convinced her to take us out collecting grass, was relocated from up the hill	76	2	07/03/17
~~26~~	~~Vicious dogs man~~	~~-~~	~~2~~	~~07/03/17~~
27	Old lady who can't count	-	2	08/03/17
28	Young smiling woman	29	2	08/03/17
29	Very poor guy	46	2	08/03/17
30	Young pond guy	25	2	08/03/17
31	Sister of very poor guy	35	2	08/03/17
Other zones				
32	Street stall lady 2	-	?	08/03/17
33	Street stall lady 3	-	?	08/03/17
34	Zone 3 lady	40	3	08/03/17
35	"Show of hands" interview with 17 kids at the school			09/03/17
36	Community meeting		1 & 2	12/03/17
37	Savings club meeting		1 & 2	05/03/17
38	Focus Group Discussion		1 & 2	05/03/17

Appendix II – SSI Topics

Informants from the SSIs:

1. Headwoman
2. Headwoman's Assistant
3. Head of sub-district
4. Research Center officials
5. Villagers of Moo 11
6. Road Shops

1. Headwoman

Our first SSI was a preliminary interview with the Headwoman of Moo 11. The focus of the interview was to touch upon different topics related to our research, such as the relocation, overview of the villagers and their livelihoods, collection of natural resources from the villagers and their dependency on them, villagers land titles. This interview gave us the opportunity to assess early on whether our research questions were relevant or not.

In addition, we had another SSI with the Headwoman, the day before we leave. Our goal was to have a comprehensive interview assessing the accuracy of our findings, and double checking those we found along the way, like how the relocation took place, if the borders are clear to them and, compensation after the relocation.

Finally, we had the opportunity to have a short SSI with the Headwoman, on our last day, after the community meeting, in regards to the different clubs that exist in Moo 11.

2. Headwoman's Assistant

A SSI with the Headwoman's assistant followed the next days, while having a transect walk, in zone 2. The focus of this interview was the relocation and an overview of the second zone that was part of the relocation.

3. Sub-district Head

Initially, a SSI was conducted with the head of the sub-district office, to discuss about the relocation, and border issues that occur in the area. Subsequently, we had a second SSI, as few questions arose, in regards to the expansion of the National Park and changes in the borders.

4. Research Center Officials

A total of three SSIs were conducted with officials of the RC. Two with the head of the RC, who is also an officer at the Royal Forest Department, and one with the second head of the RC. Our objectives from these interviews were to obtain information on the relocation, the history of the RC and National Park, the reforestation, collection permit, and documents indicating the rainfall and temperature patterns.....

5. Villagers of Moo 11

SSI were conducted with villagers of the two zones, X in zone 1 and X in zone 2. The focus of these interviews was about the relocation, and how their life has been affected by it, the use of natural resources from the forest, in what extend they rely on these resources, alternative if they lose their access to the natural resources. Furthermore, one SSI was conducted with a villager from zone 3, to get an overview of the way people from zones that did not get relocated are living.

6. Road shops

We conducted three SSI with people that have shops by the road (304). It was an easy way for us to see which natural resources people sell and the prices.

Appendix III – Questionnaire

Project group fills out before handing out questionnaire
Household no:_____
Date:_____
Interpreter
name:_____
Group member
name:_____

1. Name:_____
   _____
2. Sex: Male ☐ Female ☐
3. Age:_____
4. The number of people in household:_____
5. In which zone do you live?
   _____
6. Has anyone from the household moved away for work? Yes ☐ No ☐
7. Which activities contribute to the food on the table? (Such as, job, gardening, etc.)
   _____
   _____
   _____
   _____
8. Do you collect anything from the forest? Yes ☐ No ☐
   a. If yes, what do you collect?
      _____
      _____
9. Are you a member of a club? Yes ☐ No ☐
   a. If yes, which club(s)?
      i. Savings club ☐
      ii. Broom club ☐
      iii. Other club? ☐
      _____
      _____
10. Do you grow something in your household? Yes ☐ No ☐ (Such as fruits, vegetables, herbs)
11. How much do you earn pr. Year? _____
12. How much money do you earn from stuff you collect from the forest?
    _____

Appendix IV – Questionnaire Results 1

nr.	Name	Sex	Age	Ppl. In HH	Zone	Moved away	Income sources
1	Sompam	F	34	5	1 (behind headman	Y	collect forest, labor
2	Maam	F	39	2	2	n	labour
3	Rot	M	73	4	2	n	Gardener, sells fruit on street, pension
4	Somwang	F	53	2	1	y	RC, mushroom bamboo
5	Bian	F	36	7	no zone	y	labour, selling vegetables
6	Prayong	F	57	1	1	y	sells broms bamboo along road
7	Sompang	f	55	2	1	n	RC
8	somjai	f	33	4	1	y	RC
9	yubol	f	45	3	1	y	government official, rents out guesthouse
10	tongploy	f	47	2	1	n	restaurant
11	suda	f	37	7	1	n	doesn't work
12	prathoomthip (HW)	f	44	2	1	n	HW, gardening
13	sauhai	m	70	6	1 (temple)	n	labour, pension
14	suprahn	f	76	3	2	y	brooms, fruits, pension
15	thang low	m	71	3	2	y	brooms, fruits, pension, collect old stuff by road (bottles)
16	noppart	m	20	4	2	y	collect forest, labor
17	mantia	m	40	2	3	n	sells broms, bamboo
18	nikhom	m	30	4	2	n	unemplyed (income is from before)
19	pramool	m	57	4	2	n	sell things in shop and on road (groceries + fruit)
20	parichat	f	61	1	2	y	sell broom + fruit, children send money,
21	kaew	m	52	4	1 (near HW)	n	labour, collect forest

22	toy	f	50	4	2	n	faming, selling,
23	duendara	f	56	3	1	y	sells bamboo, brooms, stuff from garden, collect stuff by road,
24	gimnaree	f	41	8	4	n	sells bamboo, brooms, collect stuff by road
25	sittisak	m	23	4	2	y	restaurant, money from fathers brother, who moved away
26	pratoonthip	f	30	7	4 (not really zone)	n	fixing car, sells food, collect forest, collect/buy old stuff
27	chan	f	76	3	2	n	money from childen, pension
28	hoy	f	30	2	2	n	labour, collect, make brooms

Appendix IV – Questionnaire Results 2

Collect forest	Types of stuff from forest	Member of club?	Which clubs	Grow in garden?	Income pr. Year	Income from forest (pr. Year)
y	mushroom, vegetables, bamboo,	n	-	y	48000	36000
y	mushroom,	y	savings	y	36000	0
n	-	n	-	y	44400	0
y	mushroom, bamboo	n	-	n	60000	6000
y	fruit, bamboo, mushrooms,	n	-	y	hard to say	200-300 pr time
y	bamboo	y	savings, million club?	n	no idea	-
y	mushroom, bamboo	y	savings	y	36000	-
n	-	y	savings	n	216000	0
n	-	y	savings, broom	n	86400	0
n	-	y	savings	n	90000	0
n	-	y	savings	n	0 (husband 120000)	0
y	mushrooms	y	savings, broom	y	96000	16800

n	-	y	savings	y	48000	0
y	grass, mushrooms, bamboo	y	savings	y	24000	2400
y	mushrooms	n	-	y	24000	2400
y	mushrooms, beans, labour	y	savings	y	60000	24000
n	-	y	savings	n	120000	0
n	-	y	savings	n	96000	0
y	mushroom, bean	y	savings	y	40000	10000
y	grass, mushroom	y	savings	y	130000 (100000 from children)	5000
y	bean, mushrooms, bamboo	y	savings	n	60000	30000
n	-	n	-	y	100000	0
y	mushrooms	y	savings	y	50000	10000
y	bamboo	y	savings	y	50000	0
y	mushrooms	y	savings	y	180000	5000
y	mushrooms	y	savings	y	50000	30000
n	-	n	-	y	20000	0
y	mushrooms, bamboo, grass	n	-	y	40000	10000

Appendix IV – Questionnaire Results 3

HH number	Date	Interviewers	Interpreter
24	05. Mrz	A M	N
158	06. Mrz	E E	N
208	06. Mrz	E E	N
3	05. Mrz	E E	P

24	05. Mrz	E E	P
14	05. Mrz	E E	P
97	05. Mrz	E E	P
96	05. Mrz	E E	P
148	05. Mrz	E E	P
1	05. Mrz	E E	P
80	05. Mrz	E E	P
136/1	05. Mrz	E E	P
92	05. Mrz	A M	N
12	05. Mrz	A M	N
12	05. Mrz	A M	N
148	05. Mrz	A M	N
191	05. Mrz	A M	N
17	05. Mrz	A M	N
80	05. Mrz	A M	N
70	05. Mrz	A M	N
197	05. Mrz	A M	N
don’t remember	06. Mrz	E E	N
147	05. Mrz	A M	N
19	05. Mrz	A M	N
37/11	05. Mrz	A M	N
13	05. Mrz	A M	N
120	06. Mrz	E E	N
204	06. Mrz	E E	N

Appendix V – List of Useful Species

Species name:	Family:	Allowed:	Important:
Mushrooms		!	!
Tiliacora triandra	Menispermaceae		
Toddalia asiatica	Rutaceae		
Ficus foveolata	Moraceae		
Cinnamomum spp.	Lauraceae		
Croton cascarilloides	Euphorbiaceae		
Myriopteron entensum	Apocynaceae		
Bamboo shoots	Poaceae	!	!
Elephantopus scaber	Asteraceae		
Parkia speciosa	Fabaceae	!	!
Musa acuminata	Musaceae		
Baccaureae ramiflora	Phyllanthaceae		
Magnifera caloneura	Anacardiaceae	!	
Careya arborea	Lecythiataceae		
Melientha suavis	Opiliaceae		
Amorphophallus	Araceae		
-			
Lasia spinosa	Araceae		
Diaplazium esculentum	Athyriaceae	!	
Passiflora foetida	Passifloraceae		
Syzygium gratum	Myrtaceae	!	
-		!	
-			
-			
Dracaena loureirai	Asparagaceae		
Thunbergia laurifolia	Acanthaceae		
Eurycoma longifolia	Simaroubaceae		
Barleria lupulina	Acanthaceae		
Centotheca lappacea	Poaceae		

Glycyrrhiza glabra	Fabaceae		
Phyllanthus emblica	Phyllanthaceae		
Andrographis paniculata	Acanthaceae		
Terminalia chebula	Combretaceae		
Averrhoa bilimbi	Oxalidaceae		
Mimosa pudica	Fabaceae		
Nephelium lappaceum	Sapindaceae	!	!
Litchi sinensis	Sapindaceae	!	!
Sandoricum koetjape	Meliaceae		
Dimocarpus longan	Sapindaceae		
Nephelium hypoleucum	Sapindaceae		
Senna siamea	Fabaceae		
-			
Saccharum spontaneum	Poaceae	!	!
Thysanolaena latifolia	Poaceae	!	!

Photo 13: The Satoh tree (Prakia speciosa) can be found in most gardens of zone 2 as well as in the native forest which is regrowing between the old fruit trees of Nhong Phue.

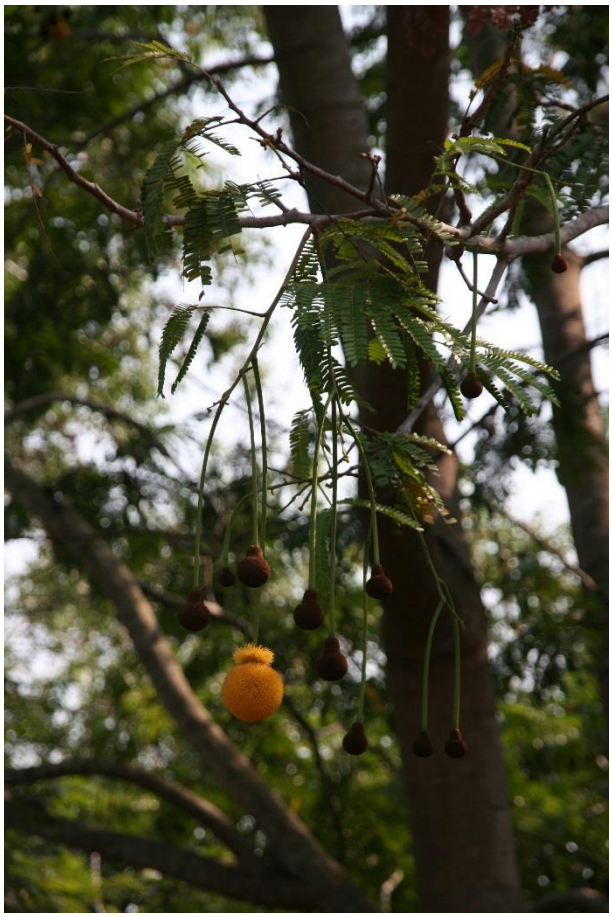

Photo 2: The conspicuous leaves and inflorescence of Satoh (Parkia speciosa) identify it as a member of the Mimosaceae. The brown balls are immature inflorescences, while the yellow ball is flowering.

Photo 3: The immature seedpods of Satoh (Parkia speciosa) are collected from April until June and sold as vegetables.

Photo 4: This image shows dead plants of the early broom grass (Saccharum spontaneum). The inflorescences are harvested from October until December.

Photo 5: This image shows the leaves and the pseudo-stem of the late broom grass (Thysanolaena latifolia).

Photo 6: One of the several types of bamboo, from which the shoots are harvested from July until October, is also grown in a fire protection strip between the forest and zone 2.

Appendix VI – Sakaerat Silvicultural Research Station

11.1. Location

Sakaerat Silvicultural Research Station is situated on the highway No. 304 in Udonthrab Tambol, Wang Num Khiao District, Nakornrachasima Province, between 14° 25' – 14° 33' latitude and 101° 48' – 101° 58' longtitude. The location of the Project is, on the other words, the east of Pu-Luang National Park (Figure 1). The vicinity of the study site was covered with dry evergreen forest until the 1960s. The forest was then encroached by local people, who converted it into farmland. Although the farmland was cultivated for a couple of decades, most of it was subsequently abandoned and covered with tall grasses such as *Imperata cylindrical* and *Saccharum spontaneum*. The Research and Training in Re-afforestation Project (RTR Project) conducted by Japan International Cooperation Agency (JICA) and the Royal Forest Department (RFD) was initiated in 1982 with the planting of exotic fast-growing tree species over 2300 ha by 1994. The area is currently covered with mature fast growing tree plantations mainly composed of *Acacia mangium* and *Eucalyptus camaldulensis* (Figure 2).

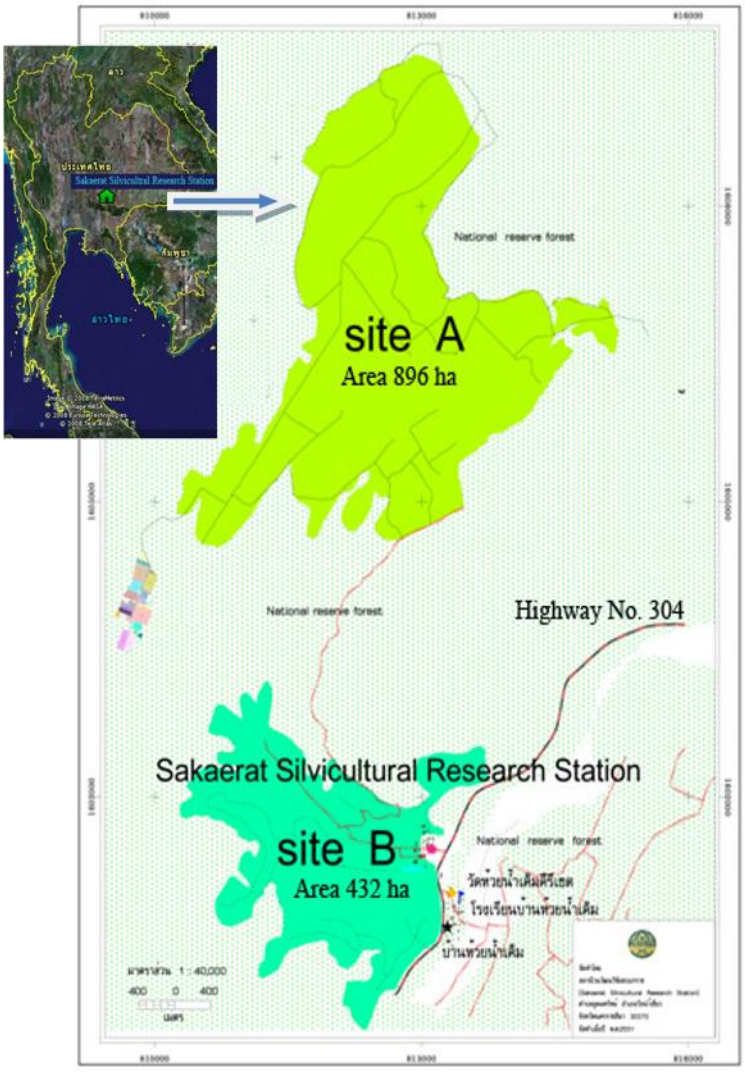

Figure 10: Location of Sakaerat Silvicultural Research Station in Udonthrab Tambol, Wang Nam Khiao District, Nakorn Rachasima Province

11.2. Physiography

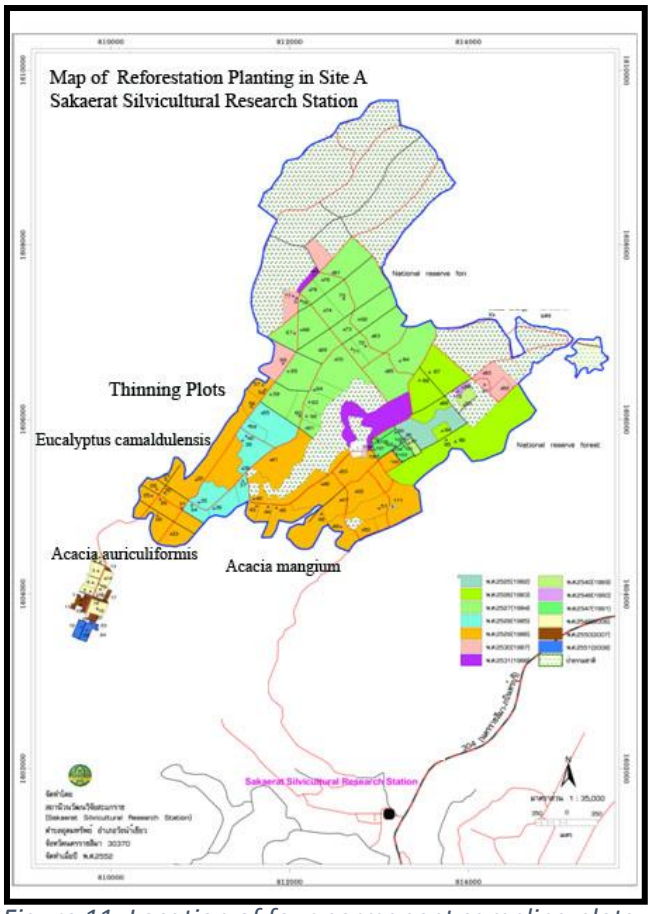

Figure 11: Location of four permanent sampling plots in plantation.

Most of the areas are mountain of which the slope is not so steep, small hills and flat land where can be slightly found in the high mountainous area, the slope is around 10-30% and the slope in some places may reach to 30-45% or more than this. In addition, the height from sea level is ranging from 200 to 770 m; especially, the areas at Khao Khiat are around 760 and 730 m high from the sea level respectively. The high slope area can be found in the southeast adjacent to highway No. 304. For the small flat area, it is in the northeast of the experimental site. The small stream here is classified into intermittent design; that is, the water flows in particular seasons and in the dry season, the brook is dry. At the middle of the experimental site, there are 2 important streams: Huay Nm Kem and Huay Pae. Huay Nam Kem has water flow all year.

11.3 Climate

The mean annual air temperature was 25.6 °C and the mean annual rainfall was 1395 mm according to meteorological data collected at the administrative office of the station over the last 10 years (1999 to 2009). Generally, it rains during the middle of April and October and it may slightly rain in December and February. While, the cold season is during November and March. This area has a monsoon climate with highly seasonal rainfall and a roughly 4-month-long dry period from November to February. The maximum temperature is about 37^{o}c in March and the minimum temperature is 8^{o}c in January. Additionally, the relative humidity in the whole year is 74.35%.

11.4. Geology

The Project site is located on the foot slope of Pu Luang at Korat Plateau. The stone characteristic is sandstone which is the same set as Phra Wihan formation and is also in Korat group. Shale can be also found but in a small amount. The stones are mostly rotten sandstones which bury in soil, the stones do not stick to the streams overlap in pieces and it generally has splits from side to side. The soil type is mainly Korat soil type soil texture is coarse singe grain; mostly, it is sandy clay loam, while the others are sandy loam and clay loam. Moreover, it is composed of every soil class: class A (10-20 cm thickness), class B (20-25 cm thickness), class C of which its thickness is uncertain, but it is usually not more than 80 cm thick. At the lower class than this, it is the hard stone class of which the soil is unfertile, and the water can absorb moderately or the absorption ability is very low. Generally, the soil in dry dipterocarp forest is very shallow having sandstones emerge from the soil surface, and the soil components are similar to the dry dipterocarp forest. Therefore, the plants do not much cover the area. In addition, forest fire occurs in the dry season every year and always damages the covers.

According to the Department of Underground Resources, the geological characteristics in this area can be classified into 3 groups:

1) Calcareous, purplish-brown, purplish-gray and reddish-brown and yellow-brown sandstone
2) Thick-bedded, crossbedded, quartz, quartzitic white-brown and yellow-brown sandstone
3) Calcareous, micareous, reddish-brown, purplish-red siltstone, greenish gray to yellow-brown, sandstone and local conglomerate

11.5. Soil

The soil is deep loamy acrisol formed on sandstone laid down in the Triassic to Cretaceous periods and generally contains a small amount of organic matter. RFD (1987) classified into 3 soil groups and 8 soil types as follows table 1.

Table 1 Soil classified at Sakaerat Silvicultural research station (RFD, 1987)

Soil group	Soil type
1. Red and yellow podzolic soils	1. Dry red and yellow podzolic soil
	2. Slightly dry red and yellow podzolic soil
	3. Moderately moist red and yellow podzolic soil
2. Lateritic soils	4. Lateritic soil
3. Surface gleyed red and yellow soils	5. Strongly surface gleyed red and yellow soil
	6. Weakly surface gleyed red and yellow soil
	7. Strongly bleached red and yellow soil
	8. Weakly bleached red and yellow soil

11.6. Vegetation

1) Dry evergreen forest

In the southwest of the area is the dense forest the top crown density covers 85% of the area, and the density of trees is about 765 trees/ha. Due to the plump line structure of the forest, it is divided to 4 classes:

(1) The 1st hoizon

The height is around 21-40 m. The important tree species are *Hopea ferrea*, *Hopea odorata*, *Shorea sericeiflora* and *Irvingia malayana*.

(2) The 2nd horizon

The 2nd horizon is 15-20 m high and main tree species are *Hydnocarpus ilicifolius, Memecylon edule* and *Walsula aqualata.*

(3) The 3rd horizon

The height is during 4-14 m and the tree species *are Baccuarea sapida, Olea salicifolia* and *Apodytes dimidiate.*

(4) The 4th horizon

This class is composed of under-planted tree species and small young trees of which the height is lower than 4 m. *Ardisia species* and *Canthium brunnescens* are the main species in this horizon.

2) Dry dipterocarp forest

The dry dipteracarp forest covers the northeast area, which can be observed from sandstones appearing out of the ground. The soil is mixed with laterite stone. This forest type is the forest of which the trees' leaves fall in the dry season and the forest fire often occurs every year, this affects on the tree growth – the stem is stunted, crooked and has many swellings. Due to the plump line structure, this forest can be classified into 3 horizon:

(1) The 1st horizon

The first horizon is 21-35 m high and the important species are *Shorea obtuse, Shorea siamensis, Dipterocarpus intricatus* and *Dipterocarpus tuberculatus.*

(2) The 2nd horizon

The height is around 11-20 m. Major tree species are *Quercus kerrii, Gardenia sootepensis, Gardenia obtusifolia* and *Randia fomentosa.*

(3) The 3rd horizon

The tree species of this horizon are *Arundinaria pusilla* and *Imperata cylindrica.*

Besides, *Pterocarpus macrocarpus* and *Xylia xylocarpa* also grow both in the dry evergreen and dry dipterocarp forests. Furthermore, there is bamboo forest along the gorge and at the steep slope, the tree species growing at these areas are *Bambusa arundinacea, Dendrocalamus strictus* and *Oxytenanthera allciliata.* The density is around 25 trunks per 1 cluster of bamboos.

Appendix VII – Synopsis

Between Forest Conservation and Urbanization: Changing Livelihood Strategies in Ban Huai Nam Khem, Nakhon Ratchasima Province

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1 Introduction

In the 1980s and 90s Thailand was one of the most rapidly growing economies in the world, but this development did not come without fundamental changes for the country's socioeconomic and ecological foundations. Thailand's first National and Economic and Social Development Plan (NESDP) was implemented in 1961 and mainly promoted industrialization, infrastructure and development in and around the economic centre of Bangkok (Gullette & Singto, 2015). In the rural provinces 70 % of the population was working in the agricultural sector, infrastructure was poorly developed and livelihoods mainly relied on natural resources such as forests. These natural resources were heavily overused as the rural population struggled to catch up with urban livelihoods and in order to fuel the booming economy of Bangkok. Thailand's National Economic and Social Development Board (NESDB) acknowledged and tried to address these inequalities when the seventh National Development Plan was implemented in 1992 (Rigg, 1993; Gullette & Singto, 2015). In addition to paying great attention to environmental issues, such as deforestation, this plan included expanding urban development, infrastructure, social services, and capital availability for agricultural investments to rural regions of the country (Rigg, 1993; Gullette & Singto, 2015).

As typical for developing tropical countries, Thailand experienced major Land Use and Land Cover Chances (LUCC) due to deforestation for agricultural expansion, cash crop production and commercial timber extraction, as well as urban sprawl (Phanurak, 2012). With increasing population in rural areas and growing pressure on natural resources, forest protection became necessary and was first institutionalized with the National Park Act of 1961. One last year later Khao Yai National Park in the North-eastern Isaan region was created as the country's first national park (Rigg, 1993). Since then area under the same legal protection status has increased to cover 17 % of Thailand's national territory at present (Phanurak, 2012). Together national parks and national forest reserves cover 63.2 % of the total land surface, although about 20 % of Thailand's villages are situated within national forest reserves, making their protection a matter of potential social conflict. Forest conservation, limiting access to this important resources basis of many rural households, was not the only factor that impacted livelihoods. Following the NESDP of 1992, infrastructural development and urbanization of secondary economic centres in the rural provinces and strongly influenced rural livelihood strategies. Smallholders now often rely on remittance sending by household members working in the city (Gullette & Singto, 2015). At the same time divestment from agriculture as well as abandonment of rice fields are frequent (Gullette & Singto, 2015).

It is within this socioeconomic, environmental and political context that we want to investigate the interrelations between rural Thai people and the forest. At the centre of our research will be the households of Ban Huai Nam Khem (Moo 11), a village at the North-western End of Thap Lan National Park (see Figure 1). The National Park covers parts of Nakhon Ratchasima, Buri Ram and Prachin Buri Provinces and was established as the country's 40th national park in December 1981 (Phanurak, 2012). The village consists of 226 households spread out along the important Kabin Buri - Pak Thong Chai Rd (route 304) which connects the city of Chachoengsao, capital of the province with the same name, with Nakhon Ratchasima. Ban Huai Nam Khem is situated in Udom Sap sub-district, Wang Nam Khiao district of Nakhon Ratchasima Province. This area is part of the southern Isaan region (Northeastern part of Thailand) and although some economic development has taken place since the 1992 NESDP, it is still one of the most rural and poorest areas of Thailand. From the little information we have beforehand we know that the village or part of the village agreed to be relocated to its

current position from its previous location within Thap Lan National Park. This likely occurred between 1986 and 2005 when, according to Leblond (2014), at least 55,000 people were displaced from protected areas. The villagers now live on small parcels of land that were allocated to them by the Royal Forestry Department with the "Sor Tor Gor" title, meaning that it can only be used for housing, not for farming. It also means that the villagers are threatened by a possible second relocation if the political climate changes.

In this complex situation many of the previously mentioned factors are likely to impact on the villagers' livelihood options and decisions. We also know that at least some households in the village are somewhat dependent on non-timber forest products. Therefore we want to study how the villagers of Moo 11 have adapted their natural resource based livelihood strategies to the relocation. We will first investigate (1) how the relocation or other important historical events have affected resource availability and accessibility from the forest. This will allow us to pinpoint crucial resources and their collection sites where, through an assessment of forest type and state of succession, we hope to (2) gain insights into the potential future security of this livelihood resource basis. Another aspect that is likely to play an important role for livelihoods in the area is labour migration and remittance sending by younger household members. Hence we want to set the natural resource based livelihood strategies in relation to other important resources and income sources to find out (3) what the villagers' capacities are to adapt their livelihoods to change. We will also be looking at the different constraints there might be for the villagers to adapt.

Research Problem: How have the villagers of Moo 11 adapted their land-based

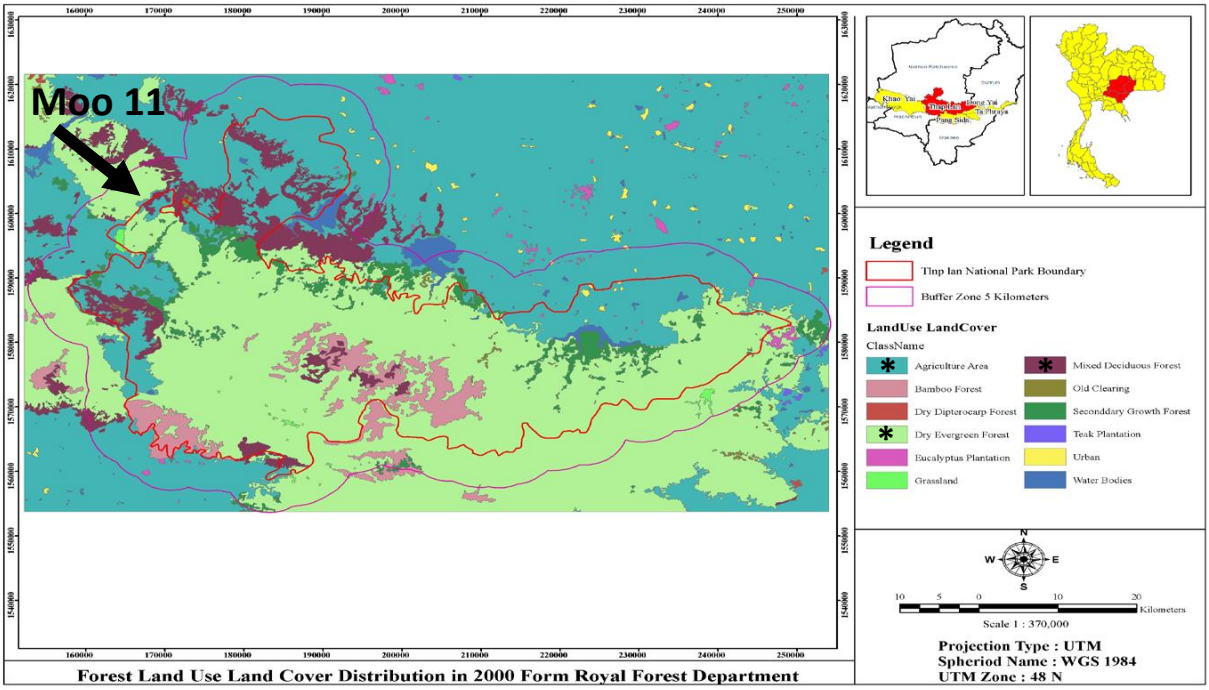

Figure 12: The Map shows the area of Thap Lan National Park divided into different Land Use and Land Cover categories as identified by Phanurak (2012) for the year 2000. The black arrow indicates the location of the Ban Huai Nam Khem (Moo 11) where our research will take place.

livelihood strategies to the relocation?

(1) How has the relocation affected resource availability and accessibility from the forest?

(2) What does the state of the forest indicate about the potential future security of this livelihood resource basis?

(3) What are the villagers' capacities to adapt their livelihoods to change?

Methodology: the Livelihood Strategy Framework

In order to examine the villagers' livelihood strategies and their capacities to adapt these to change we will use the Livelihood Strategy Framework (LSF). A part of the LSF is to determine the different assets the villagers have. Ellis (2000) categorizes assets as different sorts of capital; natural, physical, human, financial and social capital (Ellis, 2000:32-36). We focus on the natural resource based livelihoods and the natural capital, such as different natural resources available, will therefore be our main asset of scope.

When examining people's livelihood strategies it is important to not only look at the assets people have but at the mediating factors, roughly said the context, for these strategies as well. The mediating factors can be things like social relations, organisations and institutions and determine the interrelationship between the assets (Ellis, 2000:39). The mediating factors can be harder to grasp and examine than the assets, and we do not expect to disclose every single factor influencing the villager's livelihoods within the 10 days in the field. We believe, though, that it is possible to determine a general social structure and power relations in the village and the most important factors influencing the ways in which the natural capital is gathered, controlled, distributed and sold.

Ellis (2000) argues that there are many different livelihood strategies within a village and we will therefore see the household as the main unit of our analysis (ibid::31). However, we will try to look for some general tendencies in the village or perhaps within socioeconomic groups in Moo 11. By looking at the villagers' possibility of substitution of their assets, we will try and determine their vulnerability to change (ibid:42). This will be a part of examining their capacity for adaptation along with social relations and networks that might give the villagers agency to improve their livelihoods and adapt. Agency is here understood as the ways in which people handle and manipulate constraining and opportunity giving elements.

The relocation is perhaps not an issue in Moo 11 but in that case it would still be interesting to examine the livelihood strategies of people who come from a farmer tradition but now have neither land to cultivate nor proper access to the forest. We are also aware that other sorts of capital might turn out to be of greater importance than the natural capital, when we get to the field, so we are ready to alter our focus if necessary.

Methods

This chapter will contain an introduction to the methods applied to answer the problem formulation.

Semi-structured interview

This type of interview can be used to investigate a broader spectrum of themes during an interview. There is given room for changes in the themes as a response to the interviewed. This allows the respondent to come with inputs to the themes of the interview during the conversation.
In this project a range of semi-structured interviews will be set out.
As things are now we would like to talk to

- *The chief of Moo 11*: details about relocation, general overview of villagers and their livelihoods (and powers dynamics), decision-making processes in the village
- *Park officials*: the plans for the national park and actors influencing them, plans for villages close to the park, potential problems with the forest (exploitation, reduced afforestation etc)
- *Government officials*: plans for the national parks and area in general, plans for nearby villagers, who is included in the decision-making processes for these plans,
- *Villagers who..*
    - might have benefitted from relocation
    - whose living standards decreased from the relocation
    - use natural resources from the forest
    - are involved in decision-making in the village
    - are chosen by "random sampling": to get overview of village resources and everyday life.

Questionnaire

The questionnaire will be focused on getting an overview of the villagers in connection to their livelihood. This will include questions connected to the villagers' income, education, gender, age etc. to collect quantitative data for future analysis. Approximately 50 randomly chosen households in our sample, one questionnaire for each household.

Participatory Rural Appraisal

In Participatory rural appraisal (PRA) there is a focus on local stakeholders and bottom up development (Chandra, 2010). Through the focus on participation of local stakeholders, this method can increase empowerment of locals in decision making processes (Chandra, 2010). This method will be used to collect knowledge from the villagers about their livelihood, resource use and access to resources in the village.
Various tools in PRA will be used to collect data concerning livelihood and natural resources. These are:

- Focus group discussion
- Historical timeline
- Resource mapping
- Transect walk
- Trend line
- Pie chart
- Seasonal calendar
- Ranking

Participant observation

As a part of getting an overview of the use of resources in the village the project group will try and follow selected villagers through their daily tasks and routines. It will include participatory cooking. This is a way to identify key natural resources used in the everyday life and will help to identify to which extend the villagers use the forest. Participant observation is an ongoing method.

Land Use and Land Cover Change Assessment (LUCC)

Geographic information System (GIS) will be used to map the data collected by GPS and satellite images for land use change in the area. GIS can be used to analyse changes in the landscape (Donnelley, 2015), which can help to determine the villagers influence on the forest or the changes occurred as a result of the creation of the national park. The GPS mapping can be used in relation to the resource mapping made by the villagers, to possibly compare the available resources in the area. Furthermore GIS can be used to get an overview of the area and the way the villagers use the forest, if combined with different transect walks.

Forest Resource Assessments

Forest resource assessments (FRA) can be used to give an estimate of the condition of a forest, based on the biomass. This can give an indication of the resources available in the forest (FAO, 2016). In the field the FRA will be conducted by measuring the diameter at breast height (DBH), height and density of trees in an outlined plot (Ting et al., 2010). This data yields an approximate biomass for the plot, which through interpolation can be used to estimate the biomass for the surrounding forest. Botanical identification will give an estimate of the species richness and biodiversity. This will be accompanied by a visual assessment of the forest type and disturbance level (Gardner et al., 2007).

Soil-sampling

A larger range of soil analysis will be integrated in the project. This is to understand the effect the foundation of the national park has had on the forest and how the village affect the soil in the forest and surrounding areas around the village. Main focus will be on the fertility of the soil, where analysis connected to carbon sequestration will be made. Depending on how intensified the villagers usage of the forest is, more or fewer soil analyses will be done. This will amongst others involve analysis of bulk-density to investigate if the compaction of the soil is related to the villagers' use of the forest. Furthermore Total C & N analysis and Permanganate Oxidizable Carbon analysis will be conducted to determine the C content of the soil. This will give an indication of the biological active C in soil. The procedure is sensitive to management practices, which will help to investigate if the villagers' usage of the forest influence the soil fertility (Weil, Islam, Stine, Gruver, & Samson-liebig, 2003).
By conducting a pH-analysis it will be possible to determine the mineral nutrients available to plants in the soil (FAO, 2006). The pH also influence the degradation processes of organic matter, since the microbial activity is influenced by how acidic the soil is (Berthelsen & Fenger, 2005).

Ethnobotanical survey

By collecting voucher specimens, transcribing local names and talking to different informants central to rigorous ethnobotanical research, we seek to assess the variety of plants (and possibly other resources like fungi and animals) utilized by the villagers for self-sufficiency or

marketing. We will try to collect and photograph as many useful plants with the villagers as possible, note the location of collection (GPS), type of surrounding vegetation, habit of plant (herb, vine, shrub, tree, etc.) and document their use and local name, as well as the name of the informant. Scientific species names will be identified from the literature. Hopefully collection can be done with at least three different people from the village who commonly involved in plant collection. The informants will be selected based on information gathered from questionnaires, semi-structured interviews and participatory cooking.

Appendix I: Research Schedule

Week 1	Mo 27.02.	Tu 28.02.	We 01.03.	Th 02.03.	Fr 03.03.	Sa 04.03.	So 05.03.
Morning	**Group 1**				SSI & transect walk w. chief	Questionnaires	Visit to market (day?) - interview with retailers - identify species
	Group 2					Transect walk in village w. villagers	
Afternoon	**Group 1**				Group interview & historical timeline w. chief and elders	SSI w. park official (day?) OR transect walk w. villager	SSIs about natural resource use (2 people)
	Group 2			- walk in area - inform translators	Questionnaires	Participatory cooking (time of day?)	Participatory cooking (time of day?)
Evening	**All**				time to restructure	- field notes - review of questionnaires	- field notes - dry specimens
Week 2	**Mo 06.03.**	**Tu 07.03.**	**We 08.03.**	**Th 09.03.**	**Fr. 10.03.**	**Sa 11.03.**	**So 12.03.**
Morning	**Group 1**	Specimen collection w. person 3	SSI w. park official	PRA-Session 1: ranking matrix / trend line	FRA	FRA	FRA
	Group 2	SSIs about natural resource use (2 people)	SSIs about natural resource use (2 people)	SSI & Pie chart on other income sources / substitution	Soil sampling	Soil sampling	Soil sampling
Afternoon	**Group 1**	Specimen collection w. person 3	Prepare PRA-Session methods	PRA-Session 2: resource / seasonal calendar	Plant recognition game	Plant recognition game	
	Group 2	Participatory cooking (time of day?)	Prepare SSI & Pie chart	SSI & Pie chart on other income sources / substitution	SSI & Pie chart on other income sources / substitution		

Evening	**All**	- field notes - dry specimens	- field notes	- talk about PRA results	- field notes		

Appendix II: Data Matrix

Problem Formulation	Research Question	Subquestion	Data	Method	Limitations	Alternative Approach
Context and overview				Questionnares	time consuming	
				Historical timeline	information blurry	
				Transect walk	very subjective	
				Participatory observation	very subjective	
How have the villagers of Moo 11 adapted their land-based livelihood strategies to the relocation?	How has the relocation affected resource availability and accessibility from the forest?	Which natural resources do the villagers use now (subsistance / market) compard to before the relocation?	Natural resource use by households	Semi-structured Interviews	Villagers not willing to talk about the resources they use, or they don't use any	Follow daily routines and identify resources used during the day
				Participatory cooking	No wild species used	Ask about other plants they use for cooking, or perhaps medical treatments.
				Specimen collection / GPS mapping	Difficulties collecting speciments	Transect walk to get overview of some speciments
				Participant observation - follow daily tasks	They don't use the forest in the amount or way expected	Change approach to RQ and possibly look at how the village is influenced by the forest in other ways

				Visit market (transect walk)	maybe only possible on certain days	Conduct more transect walks, use different people for FGD to get different persepctives
			PRA-Session: Most crucial natural resources for the villagers	Ranking matrix	Somewhat time consuming	Only do ranking or post-it categorisation
				Trend line	Somewhat time consuming	Not go much in depth. But just use it to get a broad overview
				Resource mapping (by villagers)	Somewhat time consuming	Not go much in depth. But just use it to get a broad overview
		How does the dependency on important natural resources vary over the year?	PRA-Session: Seasonal variation of natural resource use	Seasonal calendar	Somewhat time consuming	Not go much in depth. But just use it to get a broad overview
	What does the state of the forest indicate about the potential future security of this livelihood resource basis?	What is the status of used forest areas?	Data on biomass and species richness	FRA	Timeconsuming	Focus on smaller or fewer plots
		What do soil parameters indicate about forest status?	soil profiles & parameters	Soil analysis on SOC, bulk density, soil texture, pH	Timeconsuming	Only look at SOC (Soil organic carbon) in forest close to village and further into forest
		How has the land cover changed?	Satellite imagery of LUCC (resettlement to now)	LUCC mapping	Access to satellite data showing change over time	Use GPS to map changes based on villagers memory (may be biased)

			GPS mapping of collection area	GPS-mapping	Undefined boundaries	Use GPS to map available changes based on villagers memory (may be biased)
	What are the villagers' capacities to adapt their natural resource based livelihoods to change?	What are the most relevant forms of capital cf. LSF	Other important resources (income & different capitals) in relation to natural resources	Semi-structured interviews	Timeconsuming	reduce amount of questionnaires
				Pie charts	Timeconsuming	Use smaller amount of interviews to gather information about the natural resources
		Is it possible to substitute crucial natural resources?	scarse crucial resources and possible other resources	Semi-structured interviews	villagers knowledge about alternative resources	Gives indication of the amount of alternatives they think are available
		What does the young generation know about natural resource use and what are their aspirations?	test specific knowledge relevant for use of natural resources & ask about apsirations	Small questionnaire, or game about plant recognition	They don't have any knowledge about the use of natural resources	Gives indication of the amount of knowledge that is given to the children about the use of forest
		What are the mediating factors for the livelihood resources (context of livelihoods) ANALYTICAL QUESTION	-	No specific method - the whole project is a part of disclosing the context	-	-

Appendix III: Participatory Rural Appraisal Tool

1.1.1 Focus group discussion

Focus group discussion (FGD) is used to facilitate an open talk about key topics. This type of tool can also be used to identify various types of group dynamics (Chandra, 2010). Two FGD's with app. 5 people in each - one group does the resource mapping and one the trend line. In the FGDs focused on the crucial resources in the village there will be made a post-it categorisation of the important resources in the community. The groups are randomly chosen (if we don't see any problem with mixing the genders). If there is a problem with inequality between genders, then there will be two FGD's for each of the topics. One with the females and one with the males, conducted at the same time.

1.1.2 Historical timeline

In order to get an overview of the history of the village and the relocation we will on the first or second day sit down with some villagers and make them plot important events concerning the village into the timeline. We can ask the chief for some reference points (like a huge storm or other important events) that we can plot in before to make it easier for the villagers to locate the different events in time.

1.1.3 Trend line

A trend line can be used to investigate long term changes in a community, based on the villagers own memory of the relocation (Chandra, 2010). This can give an overview of the different development trends in the village and how the villagers experience the outcome of the relocation. This can be done through semi-structured interviews or FGD. Through the FGD a piece of paper will be spread out in front of the participants. The task is for them to outline a timeline with some specific events relating to the resettlement. This is amongst others changes in population, farmland, education, cropping patterns, land use, etc. depending on the important variables for the relocation. These key factors should also be identified by the participants, however facilitator should have some key subjects to possibly open the discussion. Furthermore the discussion should also be focused on the main causes of changes (Chandra, 2010).

1.1.4 Resource mapping

Resource mapping can be used to identify valuable resources in the community and the spatial distribution of these. Furthermore this tool can be used to investigate the villagers own knowledge about the resources available to them in the surrounding areas (Chandra, 2010). This mapping will be conducted in the same way as the trend line, with focus on the location of natural resources.

1.1.5 Transect walk

This type of tool is a walk around an area of interest, where villagers and project group members talk about observed things (Chandra, 2010). This tool can help to identify problems connected to livelihood and resources. A wide range of transect walk will be used in the project. This is to get an overview of the area and the use of natural resources. Transect walks will amongst others include visits to the market, a walk around the village, the nearby areas and the forest. Interviews can be started off by doing a transect walk around the area to create a relaxed atmosphere and

puts the interviewed in the position as an expert in the development in their community. Through the transect walks it is important to meet people, ask questions, listen, discuss and identify different types of technologies, land zones, and opportunities for change (Chandra, 2010).

1.1.6 Pie chart

Pie chart is used to present in a straightforward way obtained data, of items or categories that have been compared, by a group or individuals (Narayanasamy, 2009). The pie chart will be used to visualize time allocation to different livelihood activities. In this way, we will be able to see the importance of each of these various resources. After the SSI about other sources of income, the interviewees will draw a pie chart, where each piece of the pie will indicate the time they spent in this source.

1.1.7 Seasonal calendar

Seasonal calendar is a PRA tool that can be used to allocate through a diagram different activities or items over the year (Narayanasamy, 2009). This tool of PRA will enable us to assess the villager's dependency on the different natural resources they use. A line with the months will be draw in a sheet of paper and villagers will place in each month which natural resource or resources they obtain. The information regards the natural resources that the villagers use will be gathered from the triangulation of the SSI with villagers, participatory cooking, participant observation, specimen collection and transect walk in the market.

1.1.8 Ranking

Ranking is used to assess how groups or individuals value a list of different items (Chandra, 2010). The different natural resources that are used by the villagers, and have been identified by previous methods like in seasonal calendar, will be placed in order in a sheet paper, and then ranked by them, based on which one they think as more and less important. Hence, a clear view of the natural resources that are crucial to the villagers will be attained.

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