Vulnerability and Climate Change Adaptation in Rural Vietnam

- A Study of Natural Resource Management Practices and Social Vulnerability

Integrated Master's Thesis Roskilde University October 2010

Tobias von Platen-Hallermund & Anton Mikkel Thorsen

Vulnerability and Climate Change Adaptation in Rural Vietnam

- A Study of Natural Resource Management Practices and Social Vulnerability

Written by

Tobias von Platen-Hallermund & Anton Mikkel Thorsen

Integrated Master's Thesis
International Development Studies - Department of Society and Globalisation
Geography - Department of Environmental, Social and Spatial Change

Supervisors
Mogens Buch-Hansen &
Thomas Theis Nielsen

Roskilde University
October 2010

Photo on front page:
Farmer in his rice field, Tam Thanh commune, Vietnam (2010)

All photos taken by Tobias von Platen-Hallermund & Anton Mikkel Thorsen

Abstract

This investigation analyses the relation between natural resource management practices and vulnerability in the process of adapting to climate change in Tam Thanh, a rural commune in mid-Central Vietnam. The concept of vulnerability is examined and divided into physical and social vulnerability. Physical vulnerability corresponds to external stress from natural hazards exacerbated by climate change. Social vulnerability is the ability of a given group or individual to cope with and adapt to any external stress. Based on interviews with households the differences of social vulnerability are analysed through the Environmental Entitlements Framework and the Sustainable Livelihood Approach. We find that significant spatial and socio-economic differences exist in access to natural resources and endowments between the households, which result in unequal levels of social vulnerability. These differences are reinforced by the impacts of climate change which are characterised by increased intensity and frequency of typhoons and heavy rainfalls as well as prolonged periods of water scarcity. Natural resource management practices influence social vulnerability. Poorer households dependent on rice production are specifically vulnerable to water scarcity whereas wealthier households endowed with large plantations of production forest to a higher degree are impacted from typhoons. A diversification of income sources reduces the level of social vulnerability. However, alternative income sources beyond climate sensitive natural resources are lacking in the commune. The study concludes that a reduction of social vulnerability is essential for a successful adaptation to climate change.

Acknowledgements

This research has been conducted in close cooperation with the Institute of Geography, a part of Vietnam Academy of Science and Technology (VAST). Roskilde University, Copenhagen University and VAST constitute the parties of a joint research project titled *'Assessing effects of and responses to climate change on environment and socio-economic development in mid-Central Vietnam'*. We have been so fortunate as to be a part of this project throughout the duration of our thesis and the project office in Hanoi has been of great support. We would especially like to thank the project leader Dr. Mai Trong Thong and our interpreter Ms. Nguyen Hai Ha for their support during our three-month fieldwork in Vietnam. We would also like to express our gratitude to the people of Tam Thanh and all other people that have helped and assisted us in the process of finalising this investigation.

List of Abbreviations

CBNRM	Community-Based Natural Resource Management
DARD	Department of Agriculture and Rural Development
DFID	Department for International Development
EEF	Environmental Entitlements Framework
FGD	Focus Group Discussion
HH	Household
IFRC	International Federation of Red Cross and Red Crescent Societies
INGO	International Non-Governmental Organisation
IPCC	Intergovernmental Panel on Climate Change
MARD	Ministry of Agriculture and Rural Development
MASL	Meters Above Sea Level
MONRE	Ministry of Natural Resources and Environment
NGO	Non-Governmental Organisation
SLA	Sustainable Livelihood Approach
VND	Vietnamese Dong

Table of Contents

LIST OF MAPS, FIGURES AND TABLES

Chapter 1: Introduction

Global climate change is already occurring and will continue to affect society over the coming decades (IPCC 2007 B). As the burden of evidence can no longer be ignored, the question of how to reduce the impacts of climate change has received growing attention from the international community particularly since the beginning of the 21st century. Successfully responding to climate variability is as old as mankind but responding to rapid, more unpredictable climate change presents a new challenge (Leary et al. 2008; IPCC 2007 B). The process of *adaptation* has been ascribed as a way to meet this challenge and consequently emerged as a solution to address the impacts of climate change. Most often, adaptation focuses on technical and infrastructural improvements as the means to reduce the adverse impact of climate change which characteristics and scope are still not fully understood (Schipper 2007; O'Brien et al. 2004).

Another key term which has found its place within the climate change debate is *vulnerability* (O'Brien et al. 2004; Adger 2006). Vulnerability may relate to a physical and environmental threat caused by changes in weather patterns and climate. But vulnerability is also a social condition, shaped by prevailing economic and institutional contexts, natural resource management practices and the distribution of resources. Hence vulnerability is unevenly distributed among a population (Chaudhry & Ruysschaert 2007; Adger 1999). Adaptive measures tend to concentrate on reducing the physical determined vulnerability without paying much attention to the issues that control the social vulnerability. In this way, the process of adaptation solely involves technical solutions that maintains existing social vulnerability structures and does little to promote the fundamental social changes needed to effectively adapt to climate change (Schipper 2007; O'Brien et al. 2004). Reducing the socially embedded vulnerability implies to address the fundamental, underlying factors that causes the difficulties in coping with the impacts of climate change. Consequently, it is considered a prerequisite for an adaptation process to take place. This vulnerability approach advocates that the challenge of climate change needs to be addressed in a more holistic way and suggests, that the political, socio-economic and environmental issues, that causes vulnerability should also be addressed, even if they seem to have little or nothing directly to do with the climate (Schipper 2007).

Impacts of climate change pose significant challenges especially for the developing world (Leary et al. 2008; Schipper & Burton 2009). Here, the presence of high levels of vulnerability have been linked to a range of factors including high dependence on natural resources, lack of equity in terms of access to these resources, weak institutional and financial capacity as well as high rates of poverty (IPCC 2001; Leary et al. 2008; Thomas & Twyman 2005). In particular, developing countries are often dependent on climate sensitive ecosystems for a high proportion of their economic activities and livelihoods. Climate change is causing stress and pressure on these ecosystems forcing natural resource-dependent communities to adapt to new environmental conditions. Here, poverty tends to increase vulnerability determined by geographic and socio-economic factors. For example, poor groups of people in a society are often forced to live in more disaster prone areas on marginalized lands, making them even more exposed and vulnerable to risks such as flooding and typhoons. These marginal areas also have higher marginal costs of access and are often located far from assistance and resource support from government. In addition, very often natural resources in these areas are in a degraded state, which in turn increases the vulnerability to climate change of both the resources themselves and the people, who are dependent on them (Tompkins & Adger 2004; Adger 1999; Leary et al. 2008).

These conditions affect the current level of vulnerability regardless of the adverse impacts of climate change which only is yet another obstacle along the way to development. Nonetheless, developing countries are expected to experience the most severe impacts of climate change. In combination with high levels of existing vulnerability, these parts of the world may risk becoming the biggest „losers' as a result of climate change (IPCC 2007 B; Leary et al. 2008; Schipper 2007). This entails that addressing social vulnerability should be seen in its relation to climate change which is of paramount importance to secure a sustainable development and hence to facilitate a process of adaptation. A frequently expressed concern is that such an adaptation process to climate change in many parts of the developing world is hindered by a high dependency on climate sensitive natural resources (Thomas & Twyman 2005; Abramovitz et al. 2001). This concern and the arguments behind it, call for a closer examination of how natural resource management practices influence vulnerability and the process of adapting to climate change.

The Vietnamese Context

Vietnam is often cited as one of the most vulnerable countries in the world to climate change because of its geographical location and characteristics. The country is already experiencing adverse impacts as a result of increased inter-annual climate variability; a tendency that will increase in the future (ADB 2009; Dasgupta et al. 2007; ISPONRE 2009; Oxfam 2008; Phan et al. 2010). Gradual changes such as rising sea levels and higher temperatures are already recorded, while extreme weather events and natural hazards such as severe rainfall, floods, droughts and typhoons are most likely to increase both in scale and frequency over the coming years (Oxfam 2008; Son et al. 2009; MONRE 2007).

Vietnam has gone through dramatic socio-economic change since the late 1980s due to internal political reforms and gradual economic liberalisation. As a consequence of the economic restructuring policy of Doi Moi[1] in 1986 the centrally planned economy has been gradually opened up to a market economy and the decollectivisation of the agricultural sector has led to the return of household-based production. This change has contributed to a dramatic increase in the average household incomes (Chaudhry & Ruysschaert 2007; Folving 2007). The economic growth has also reached the poorest section of the population and between 1993 and 2006, an astonishing 34 million Vietnamese out of a population of 85 million were lifted out of poverty (Oxfam 2008). This process has resulted in far greater levels of economic security through which to respond to external stress such as climate change. However, despite Vietnam's relatively equitable growth, inequalities between rural and urban population still exits. In 2004, 16 million people were still classified as poor and another 28 million lived just above the official poverty line (Oxfam 2008). The majority of the poor is concentrated amongst ethnic minorities in the highlands and in rural areas often located far away from the growth centres around the big cities and coastal land (Oxfam 2008; WWF 2005 A; Chaudhry & Ruysschaert 2007).

As a consequence of marginalisation and the absence of economic security and access to resources, poor people in Vietnam are highly vulnerable to the impacts of climate change and they are likely to suffer the most (WWF 2005 A). Therefore, a key issue is the identification of the underlying causes of vulnerability of these poor communities. As more than 90 % of poor households are located in rural areas in the country, an approach that embraces both rural livelihoods and the causes of

[1] Doi Moi was officially endorsed at the Sixth Congress of the Vietnamese Communist Party in 1986 (Folving 2007)

vulnerability seems relevant. Furthermore, given rural poor households' dependence on agriculture, forestry and other uses of natural resources, it is necessary to focus on the role of natural resource management practices in the search for ways to reduce the level of social vulnerability (CARE 2004; Oxfam 2008).

The inland commune of Tam Thanh located in Quang Nam Province in mid-Central Vietnam illustrates perfectly the great challenges people living in rural areas face as a result of climate change. Here, the main sources of income derive from forestry whereas outputs from agriculture play an essential part in obtaining food security. In this region, climate change in the form of more frequent and extreme typhoons and changing rainfall patterns have already impacted on the livelihoods of the people of Tam Thanh (Phan et al. 2010; ISPONRE 2009). However, existing socio-economic inequalities and geographical factors seem to lead to dynamic vulnerabilities within the commune border, which results in differentiated impacts of climate change among the population. By investigating the relation between vulnerability and natural resource management practices in Tam Thanh it will be possible to reveal the causes of the uneven vulnerabilities and thereby facilitate a successful process of adapting to climate change (Adger 1999; WWF 2005 B). On the basis of the above, the following problem formulation has been developed:

Problem Formulation

What is the relation between natural resource management practices and vulnerability in the process of adapting to climate change in the rural commune of Tam Thanh, mid-Central Vietnam?

In order to fully understand the dynamic factors, which influence this relation and process, the following four research questions have been developed.

Research Questions:

1. What are the impacts of climate change on natural resource management practices?
2. What are the natural resource management practices?
3. How is access and endowments to natural resources influencing vulnerability?
4. How is the level of vulnerability affecting adaptation to climate change?

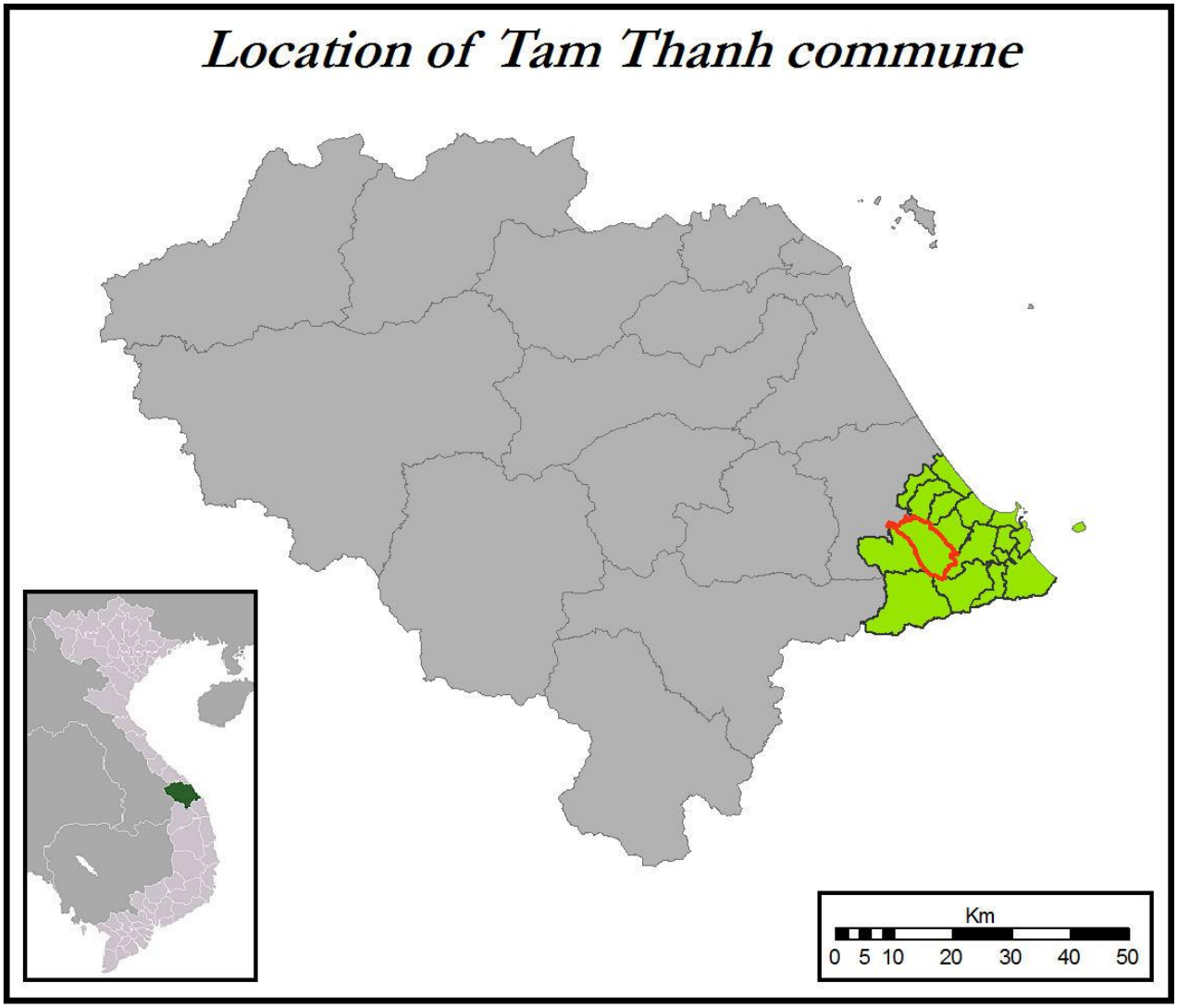
Chapter Overview

Chapter 2 is a short presentation of Tam Thanh commune, which is our area of investigation and where our field work has been conducted. The following chapter 3 is a conceptual discussion of vulnerability which is the central concept of this investigation. The traditions within vulnerability research are examined and it is defined how the term is used in this investigation. In chapter 4 the theoretical framework is presented, which is framing the methodical approach. Chapter 5 outlines the methodological considerations and explains how the framework has been made operational. Moreover, this chapter clarifies how the empirical data has been collected during our field work and finally presents the research design, which forms basis for the subsequent analysis and discussion. Chapter 6 presents the empirical findings and the following four chapters represent the analysis answering the four research questions.

Chapter 7 assesses the present environmental conditions in Tam Thanh and how the impacts of climate change affects the natural resource management practices. In chapter 8 the natural resource management practices of Tam Thanh are presented and analysed focusing on the dependence of and constraint on natural resource management practices as well as institutional influences. Chapter 9 investigates how access and endowments influence vulnerability including the distribution of access and endowments, and how these factors impact the natural resource management practices. The final chapter before the conclusion, chapter 10, is an analysis and discussion of the previous three chapters. Here geographical and socio-economic differences of vulnerability are examined, and vulnerability is linked to the process of adapting to climate change. Finally, chapter 11 presents our conclusions.

Chapter 2: Presentation of Study Area

This study is based on a fieldwork carried out in Tam Thanh commune during the spring of 2010. The commune is located in the central part of Vietnam between 15°23'51" - 15°29'31" north and 108°28'59" - 108°34'46" east in the midland region of Nui Thanh district in the southernmost part of Quang Nam province (see map below).



Map 2.1: Location of Tam Thanh commune. Quang Nam Province indicating Nui Thanh district in green and Tam Thanh commune outlined in red

The province covers 10,438.37 km² of which 54 % is forested and 11 % is in use for agriculture (Quang Nam Statistical Yearbook 2009). Even though the share of agriculture, forestry and aquaculture has been shrinking it still contributed with 35 % of the provincial GDP and accounted

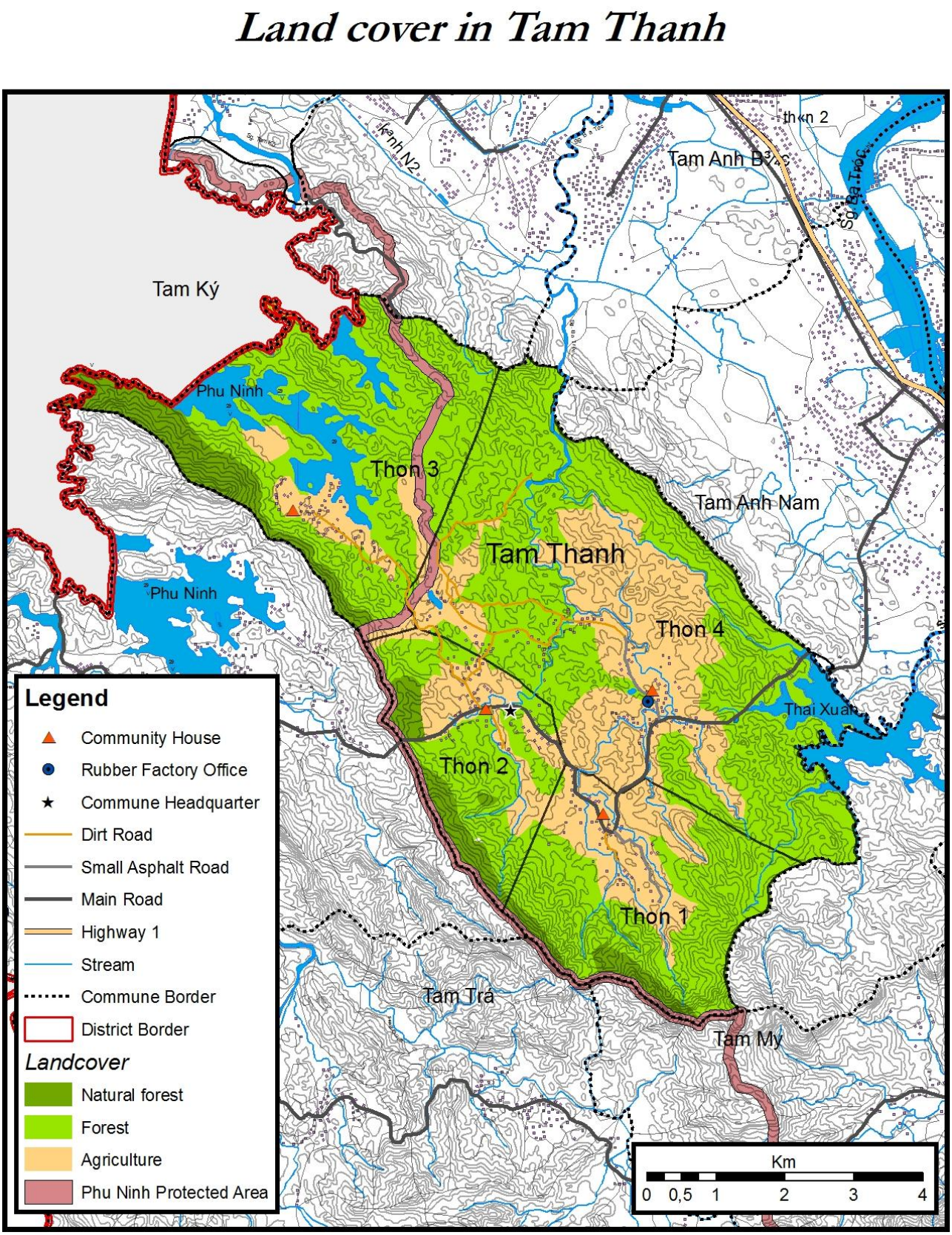
for approximately 70 % of the labour force in 2005 (WWF 2005 A). Provincial policies are to reduce this sector's economic proportion to 13 % in 2015 and at the same time increase the proportion of the industrial and construction sectors along with other service sectors from 61.7 % in 2002 to 87 % in 2015 with the intention of converting Quang Nam into an industrial province by 2015 (WWF 2005 B).

The province is divided into 16 districts and two towns (Hoi An and Tam Ký) and has a population of 1,499,626 (2008) of which around 85 % live in the rural areas (Quang Nam Statistical Yearbook 2009; WWF 2005 A). The human demography correlates to the topography, with the highest population densities in the coastal areas gradually decreasing to the west as the hills turn to mountains and elevation and forest cover increase. Poverty levels also correspond closely with the topography, as the province's six mountains districts have an average poverty rate of 35.5 % in comparison to provincial average of 14.2 % (WWF 2005 A).

Tam Thanh Commune

Tam Thanh is one out of 16 communes in Nui Thanh; a district which has a population of 147,065 and covers an area of 533.96 km² (Quang Nam Statistical Yearbook 2009). The commune stretches approximately 5 km from east to west and 10 km from north to south with its eastern border being around 4 km from Highway 1[2], 10 km from the sea and approximately three hours by car from Danang, which holds one of the main ports of Vietnam. The total area of the commune is 53.93 km² with an elevation from 30 to 300 MASL, and there are 1058 households totalling 4168 people divided into four different thons[3] (villages). Two large reservoirs (Phu Ninh and Thai Xuan) are located in the northern and southern part of the commune and provide water to Tam Ký, the provincial capital, and to Chu Lai industrial zone[4] respectively. In Vietnam forest is divided into three different categories (protection forest, production forest and special-use forest) and the commune holds a large area of production forest and protection forest (within the Phu Ninh Protected Area) while there is no special-use forest in the commune (Interview with commune).

[2] Highway 1 is the main national highway with a total length of 2,300 km running north to south.
[3] In Vietnam the commune is the lowest administrative unit. Below this unit, thons exist to make general management and public information easier. Thons are not formal and have no official boundaries and usually have an elected representative that is the connection between the population and the commune authorities.
[4] Chu Lai is located along Highway 1 in Nui Thanh district and consists of an open economic zone (270 km²) and an industrial zone (8 km²) (Interview with Nui Thanh District).



Map 2.2: Land cover in Tam Thanh (2005). The forest category includes both production forest (mainly rubber and acacia) and planted forest. The Phu Ninh Protected Area is the land west of the indicated line and covers several communes. Land cover division has been provided by the Institute of Geography, Hanoi, Vietnam

The most important income sources derive from acacia production and casual work, mainly the planting, managing and harvesting of acacia. Rice production is for own consumption, and cassava production is mainly used as forage for buffaloes, cows and pigs.

The commune has a relatively high percentage of poor with nearly 26 % in comparison to the general poverty rate of 16 % for the whole country (gso.gov.vn). There are, however, significant income differences between the households (HH) of the thons in the commune as seen in the table below[5].

	Total Population	**%**	**Total HH**	**%**	**Poor HH**	**%**	**Nearly poor HH**	**%**	**Middle HH**	**%**
Thon 1	1086	26	270	26	57	21	70	24	143	29
Thon 2	1176	28	297	28	83	30	80	27	134	27
Thon 3	862	21	206	19	97	36	85	29	24	5
Thon 4	1044	25	285	27	36	13	60	20	189	39
Total	**4168**	**100**	**1058**	**100**	**273**	**100**	**295**	**100**	**490**	**100**

Table 2.1: Division of population in Tam Thanh commune (2009). The table is based on the commune statistics and the percentage indicates number in relation to the total income category of the commune

Apart from income variations, the thons also differ significantly in terms of land cover, geographical characteristics and livelihood strategies, and therefore each thon is presented briefly in the following.

[5] In Vietnam the state categorise all people as poor, middle or rich. However, in Tam Thanh, the rich category does not exist and instead there is a category named nearly poor.

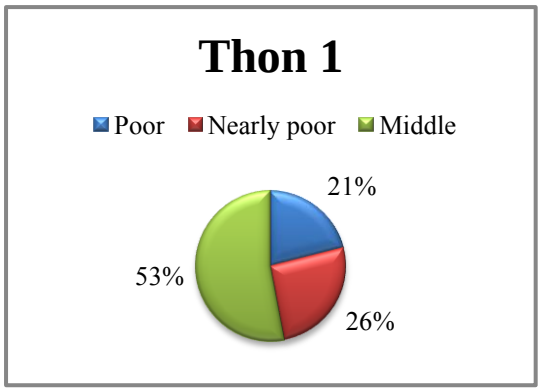


Figure 2.1: Division of income categories in thon 1. The figure is based on the commune statistics and the percentage indicates number in relation to the total number of HH in thon 1

Thon 1 - Phuoc Thanh

Located in the southern part of the commune, this village is relatively rich as it has the second lowest percentage of poor households and second highest percentage of middle households. The most important income sources are forestry and casual work, and apart from acacia and rice production several households cultivate other types of trees as part of government-support programmes. The thon has the privilege of the main road running through the area, as well as possessing a concrete road which runs a few kilometres into the valley contributing to an enhanced level of infrastructure.

Thon 2 - Trung Hoa

This thon is the smallest but also most populated thon in the commune. The office of the commune authorities is located here as well as a small market and a few local restaurants situated just next to the main road that runs straight through the thon. Apart from this concrete road, the thon has a fairly comprehensive dirt road network and with almost no houses located further away than around 2 km from the main road, access to the small market, Highway 1 and Chu Lai industrial zone is relatively good. Income is mainly derived from acacia production and business activities such as transportation of trees and selling of food and groceries.

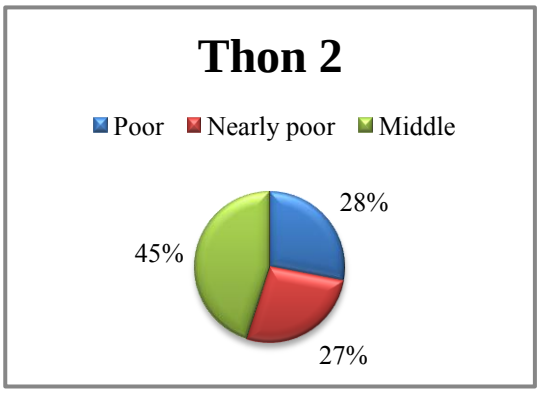


Figure 2.2: Division of income categories in thon 2. The figure is based on the commune statistics and the percentage indicates number in relation to the total number of HH in thon 2

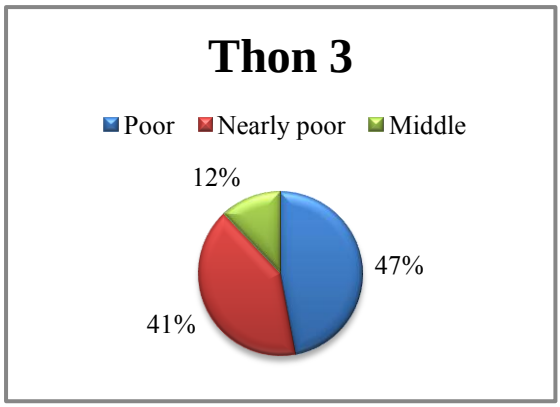


Figure 2.3: Division of income categories in thon 3. The figure is based on the commune statistics and the percentage indicates number in relation to the total number of HH in thon 3

Thon 3 - Truong Thanh

Thon 3 is located in the northern part of the commune and is by far the poorest thon with only 12 % of the households categorised as middle. The Phu Ninh reservoir and its 1,338 ha protected area has significant influence on the natural resource management practices in the area. People with rice fields just next to Phu Ninh only have one season because of high water level in the reservoir during the rainy season, leading to the flooding of their fields. Moreover the thon suffers from not having a concrete road and the 6 km of dirt road that connects the area with the main road is often inaccessible during the rainy season altogether resulting in low level of infrastructure. The main source of income is casual work, but also acacia production, and to a lesser extent breeding of buffaloes, cows and pigs, contributes to the economy of the households.

Thon 4 - Duc Phu

The biggest and richest thon in the commune is thon 4. Located in the eastern part of the commune close to Highway 1, this thon enjoys a relatively high level of infrastructure emphasised by the concrete road that runs northward connecting the major part of the population with the main road. The Quang Nam Rubber Group[6] has its office here, as well as the 980 ha rubber plantation leading to a considerably decrease in the area of available agricultural land left for the people in the thon to cultivate. The commune's other reservoir, Thai Xuan, is also located here but does not seem to affect the natural resource management practices in the thon, mainly because no rice fields are located close to the reservoir. Incomes are primarily derived from forestry and salary from managing the rubber trees.

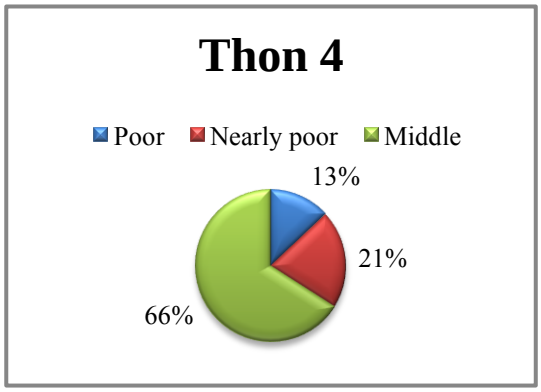


Figure 2.4: Division of income categories in thon 4. The figure is based on the commune statistics and the percentage indicates number in relation to the total number of HH in thon 4

[6] Quang Nam Rubber Group, a state-own company, owns a total of 2000 ha in the commune but is only using 980 ha today (2010) leaving the rest of the land managed by private people in the commune. The plan is to use 1200 ha in 2015 (Interview with Quang Nam Rubber Group).

Chapter 3: Vulnerability – A Conceptual Discussion

To be able to analyse how a community, in this case the commune of Tam Thanh, can respond to the challenge of climate change, it is essential to examine certain key concepts and their relation to each other within this scientific field. In this way it is possible to develop a conceptual framework for understanding the influence of natural resource management practices on the level of vulnerability and the process of adaptation. The concept of vulnerability is to be considered as the overarching frame and benchmark in this investigation and will therefore be the starting point for the following conceptual review and discussion.

Defining Vulnerability

There exists a large and growing quantity of literature on vulnerability in relation to environmental stress and natural hazards as the concept plays an important role in assessing the adverse impacts of climate change and the possible adaptive measures that can be taken to reduce the magnitude of this threat (e.g. Adger 1999; Kelly & Adger 2000; Abramovitz et al. 2001; Brooks 2003; O'Brien et al. 2004; Adger 2006; IPCC 2007 A; Leary et al. 2008). The central and common argument is that the adaptive capacity of a community is determined by the level of vulnerability of this community and the environment around it. In other words, a community with a low level of vulnerability and thus a high level of resilience[7] implies a great adaptive capacity and numerous opportunities for coping with external shocks such as climate change. On the other hand, a high level of vulnerability means low resilience leading also to a low level of adaptive capacity and limited coping strategies (Adger et al. 2005; Adger 1999). From this argument it becomes obvious that resilience and vulnerability are two dynamic antonymous concepts closely interlinked, where a low level of one signifies a high level of the other and vice versa, ultimately determining the adaptive capacity of a community. Adaptive capacity is here understood as the ability of a system to adjust to external stresses including climate change (CARE 2009; Brooks 2003).

[7] Resilience is *"the ability of a community to resist, absorb, and recover from the effects of hazards in a timely and efficient manner, preserving or restoring its essential basic structures, functions and identity"* (CARE 2009, p. 6).

Due to the scope and breadth of climate change a diverse range of scientific fields representing physical, biological and social science are involved in addressing this very complex, multi-scale issue in many different ways (O'Brien et al. 2004). As a result, it is helpful to divide vulnerability broadly into two approaches: physical and social vulnerability. These two different approaches to vulnerability have obvious consequences for how the term is interpreted and which factors that determine the level of vulnerability of a community. **Physical vulnerability** is a function of the frequency and severity of a given type of hazard and may be defined as: *"...the amount of (potential) damage caused to a system by a particular climate-related event or hazard"* (Brooks 2003, p. 3). Emphasis is naturally on the physical dimension of the concept and the understanding of vulnerability as exposure to hazards determined by geographical conditions and location of a given community or nation. Hazards are understood as both rapid onsets on human livelihoods such as droughts, typhoons or floods and slow onsets such as changing rainfall patterns and increasing temperatures (CARE 2009). Consequently, an analysis of physical vulnerability of a community would investigate the nature of the hazards to which it is exposed, the likelihood or frequency of occurrence of these hazards and the sensitivity of the community towards the hazards (Jones & Boer 2003; Brooks 2003).

These are indicators of outcome, and in this way vulnerability represents the net impacts from natural hazards without estimating the state of the community and the socio-economic differences within it prior to the occurrence of the hazard. In this way physical vulnerability is often viewed in terms of amount of damage (money lost), experienced as a result of a natural hazard and consequently the magnitude and duration of these hazards are also of special concern (Brooks 2003; O'Brien et al. 2004). This physical approach to vulnerability is the more traditional and predominant interpretation of the term and is very much in line with the principal definition of vulnerability in the IPCC Third Assessment Report (IPCC 2001), where a vulnerability analysis is the end point striving for assessing the adverse impacts from natural hazards after adaptation of a community has taken place (Kelly & Adger 2000; O'Brien et al. 2004; Adger 1999).

In the second approach, which is the primary focus for this investigation, vulnerability is determined by social factors and is a state that exists within a community before it encounters a hazard (Cutter et al. 2003; Brooks 2003). Rather than being defined by the likelihood of future adverse impacts from natural hazards, **social vulnerability** is the inability of a community to cope with external pressures and shocks, or in this case climate change. In this way social vulnerability

encompasses all the factors of a community independent of possible hazards. These factors mediate the outcome of the hazard and determine which groups that will suffer the most as a consequence of this event (Brooks 2003). As a result of this interpretation of vulnerability, the term is understood as a socially constructed state (Abramovitz et al. 2001; Adger & Kelly 1999).

Social vulnerability may be defined as: *"...the state of individuals, groups, or communities defined in terms of their ability to cope with and adapt to any external stress placed on their livelihoods and well-being"* (Adger & Kelly 1999, p. 254). This definition encapsulates the need to focus on the stress produced by external changes and the fact that vulnerability is not only caused by climate change, but can be caused by all sorts of changes. Moreover, focus is shifted away from the physical aspects of external stress factors and towards the social and political aspects of vulnerability. Hence, social vulnerability represents a starting point in a vulnerability assessment that aims to understand the causes and distribution of vulnerability before the event of a natural hazard. Furthermore, the purpose is to identify the most vulnerable members of a community and the geographical and socio-economic variations in vulnerability.

The political and socio-economic processes of marginalisation and inequality play a significant role in assessing social vulnerability, as factors such as poverty, inequality, resource dependency, access to these resources and diversification of income sources are considered to be the most significant indicators of social vulnerability (Adger 1999; O'Brien et al. 2004; Brooks 2003). It is, however, important to note that this understanding of vulnerability recognises the physical conditions as highly influential on the level of social vulnerability and that environmental and social changes are interlinked. An assessment of the social vulnerability of a community must therefore also examine the characteristics of the physical vulnerability of this geographical area (O'Brien et al. 2004; Adger 2006).

Scales and Dynamics

Social vulnerability is a multi-scale term that often differentiates in level and scope between individuals, households, communities and regions within a nation. Thus, in order to clarify the unit of scale, it is useful to divide the term into two aspects: individual and collective vulnerability. **Individual vulnerability** operates at the individual and household scale and is mainly determined by access to resources, resource dependency, income diversification, the level of poverty as well as

the level of the different capitals[8] of the individual. **Collective vulnerability** of a nation, region or community is determined by institutional and market structures such as the prevalence of formal and informal social security and insurance, as well as by infrastructure and the level of inequality. Both aspects of vulnerability must be examined, as collective vulnerability at community level may strongly influence the individual vulnerability of the members of the community (Adger & Kelly 1999; Adger 1999; Adger 2006).

For individual vulnerability, access to resources is an important indicator due to the fact that even though a community has an abundant amount of resources, resources in themselves do not constitute security, since they are mediated through property rights and access to them. In this context access is defined as: "*involving the ability of an individual, family, group or community to use resources which are directly required to secure a livelihood"* (Adger 1999, p. 253). Resource dependency and diversification of income sources play a central role, since a household strongly dependent on income from production of a single, climate sensitive natural resource such as acacia trees will experience a high level of vulnerability when faced with adverse impacts of climate change (e.g. more frequent and intense typhoons). Moreover, poverty can be used as an indicator of individual vulnerability as it is directly related to marginalisation and lack of access to resource and savings, which are critical in the event of natural hazards (Adger 1999; Adger & Kelly 1999).
When it comes to collective vulnerability, the formal and informal institutional structure is decisive because these institutions determine and implement the legal framework for property rights, access and land division, just as they organise disaster warnings and support in the case of natural hazards. Moreover, the level of infrastructure is an important element, both in relation to access and land division, but also in the event of climate extremes. Lastly, inequality is an essential indicator through its direct link to social vulnerability, constraining the livelihood options of individuals and households, and indirectly through its link to poverty and diversification of income sources on the individual scale. In this way inequality or the concentration of resources in fewer hands and the importance of distribution play a significant role across scale when assessing the level of social vulnerability (Adger & Kelly 1999).

Another key aspect of social vulnerability is the dynamic dimension of the term. It is a dynamic entity constantly in change, because the social processes and the physical conditions that shape

[8] The term refers to the capitals of the *Sustainable Livelihood Approach,* which is presented in chapter four.

social vulnerability are themselves dynamic. Thus the level of social vulnerability will vary with the seasons (e.g. rainy season vs. dry season) or between years, mainly due to the impact from the weather and other external factors such as economic and political circumstances. Consequently, this dynamic aspect of social vulnerability is the most important to capture in an assessment, rather than any measure of vulnerability at a particular point in time (O'Brien et al. 2004; Adger 2006).

Natural Resource Management Practices and the Environmental Entitlements Approach

What becomes clear from the above discussion is that social vulnerability is geographically and socially differentiated because households and communities are unequally endowed with social and environmental assets. *"It is a state of well-being and is not the same for different populations living under different environmental conditions… The causes of vulnerability are related to the environmental threat and fundamentally to the economic and institutional context"* (Adger 1999, p. 250). One way to explain this variation in the level of social vulnerability is to understand the different natural resource management practices performed by individuals and households within the same community. Poor people in rural areas, who are most dependent on natural resources and often live on marginal, physically vulnerable lands, are forced to adapt. Moreover, in cases where natural resources are scarce and in a degraded stage, the level of social vulnerability is most likely to increase, and an enhanced natural resource management practice will consequently play a crucial role (Leary et al. 2008; Tompkins & Adger 2004).

In the rural areas of Vietnam, people highly dependent on climate sensitive natural resources are especially exposed to climate change, and a sustainable[9] natural resource management practice, is therefore essential in the process of reducing the social vulnerability. This will lead to an enhanced adaptive capacity (Abramovitz et al. 2001; Leary et al. 2008). The evident relation between natural resource management and the level of social vulnerability has been recognised by several studies within the last decade and plays an increasing role in the IPCC assessment reports (IPCC 2001; IPCC 2007 A; Adger, 1999; Abramovitz et al. 2001; Abramovitz 2001; Folke et al. 2002; Tompkins & Adger 2003; Tompkins & Adger 2004).

[9] See more on sustainability under the *Sustainable Livelihood Approach* in chapter four

The environmental entitlements approach is a helpful tool to analyse the variation in social vulnerability and possible options for different natural resource management practices of social groups and linking these practices to social vulnerability. Based directly on the indicators already mentioned, this approach considers the extent to which individuals, households or communities are „entitled' to make use of different resources. Entitlements are defined as: *"...the actual and potential resources available to individuals based on their own production, assets or reciprocal arrangements"* (Adger 2006, p. 270). Within this understanding social vulnerability is seen as lack of entitlements and an examination of the reasons for this vulnerability will consequently focus on the availability, access and distribution of entitlements as well as how they are changed over time. The political and socio-economic factors which determine the level of social vulnerability also define how the pattern of access to resources is constructed, and this construction is termed the „architecture of entitlements'. This construction is therefore essential to understand in order to assess the dynamic level of social vulnerability of a household or community. Within this framework, vulnerability to natural hazards and climate change occurs when people have insufficient entitlements, and when there is a significant loss in the amount or quality of these entitlements (Adger & Kelly 1999; Kelly & Adger 2000; Adger 2003 et al.; Adger 2006). A more comprehensive presentation and discussion of the environmental entitlements framework will be carried out in the next chapter.

Climate Change Adaptation

The importance of adapting to climate change has emerged as a solution to the adverse impacts of climate change that are already evident in some countries of the world, among them to a large degree Vietnam (Oxfam 2008; Dasgupta et al. 2007; ISPONRE 2009). Adaptation to climate is not new, however, as people and nature have always been at risk from climate extremes and variability and continually have sought ways of adapting. What is new is the frequency, variability, seasonal patterns and characteristics of climate events which will be less familiar and much more unpredictable (Leary et al. 2008). Consequently, climate change adaptation will become increasingly significant, and according to the IPCC Fourth Assessment Report: *"adaptation will be necessary to address impacts from the warming which is already unavoidable due to past emissions"* (IPCC 2007 B, p. 19).

The literature on adaptation is immense and constantly increasing with diverging interpretations of the term and understanding of the process of climate change adaptation (e.g. Abramovitz et a. 2001; Adger et al. 2003; Brooks 2003; O'Brien et al. 2004; IPCC 2007; Schipper 2007; Leary et al. 2008; Schipper & Burton 2009). In this investigation, as also discussed in chapter one, the relation between vulnerability and adaptation is that a reduction of vulnerability is a prerequisite for a successful adaptation. By reducing the level of social vulnerability, the impacts of natural hazards and climate change are also reduced, and this development is then translated into the process of adaptation to climate change (Schipper 2007). This is in line with the understanding of vulnerability as the starting point, where vulnerability determines the adaptive capacity and hence adaptation, and not as an end point, where adaptation determines vulnerability. Adaptation is a process for reducing impacts, not vulnerability, and consequently it is only a short-term solution to climate change. A crucial point here is, that if climate change is characterised by increasing climate variability, then it is likely that some adaptations may, at some point in time, be considered maladaptations. Instead of focusing on how to adapt to the specific impacts of climate change, emphasis should therefore be foremost on reducing the social vulnerability of a community, which would address the fundamental and underlying issues that cause these impacts which often have little to do with climate. This vulnerability approach would be a long-term sustainable answer to climate change and enables conditions for a successful climate change adaptation (Schipper 2007; O'Brien et al. 2004).

Adaptation has many definitions but is here defined as *"adjustment in a system's behaviour and characteristics that enhance its ability to cope with external stresses"* (Brooks 2003, p. 8). The understanding of the term may be divided into the structural and non-structural approaches that are directly linked to the „end point' and starting point' view on vulnerability. The **structural approaches** are concerned with physical interventions, engineering and technical measures such as buildings, infrastructure and public facilities and represents the end point view. On the other hand, the **non-structural approaches** advocate for more socio-economically and politically determined factors, such as distribution of and access to resources, poverty reduction, diversification of income sources and sustainable natural resource management, to facilitate adaptation. Hence this represents the starting point view. These two different approaches to adaptation have implications for whether adaptive capacity is enhanced by carrying out specific technological measures or by political interventions and changing livelihood strategies. This investigation is primarily concerned with the non-structural measures to enhance the adaptive capacity. By following this approach it becomes

possible to strengthen the ability to respond to present day natural hazards and consequently also enhance the adaptive capacity to future uncertain impacts of climate change (O'Brien et al. 2004; Abramovitz et al. 2001).

Summary

From the above discussion it is clear that there exist numerous interpretations, understandings and approaches to vulnerability and climate change adaptation and how these two concepts are related. It is acknowledged that Vietnam and the geographical area of this investigation, the commune of Tam Thanh, are physically vulnerable to natural hazards and climate change. Therefore the character and scope of this physical vulnerability is assessed and discussed in chapter seven, as it makes little sense to talk about social vulnerability without being aware of which hazards and climate extremes a community is exposed to. Special emphasis is placed on the social aspects of vulnerability and how the political and socio-economic factors that determine the level of social vulnerability are constructed with special attention paid to the role of natural resource management practices. The individual vulnerability will be analysed with focus on access to natural resources and to a lesser degree also the collective vulnerability is analysed with special attention paid to the role of infrastructure and inequality. Vulnerability is understood as a starting point; as a state that exists within a community before it encounters a hazard. The objects of examination must be the social and geographical variations in the level of social vulnerability and the non-structural measures that might be helpful to the most vulnerable people. The entitlement approach functions as a helpful framework for examining the social vulnerability and how it differentiates socially and geographically within a population in the commune of Tam Thanh.

Chapter 4: Environmental Entitlements

Two different theoretical approaches will form the frame and focus of this investigation. The Environmental Entitlements Framework (EEF) is used to expose differences and inequalities within a community and to find solutions for how a community can improve the management of its natural resources and thereby reduce social vulnerability and enhance the adaptive capacity. This theory will form the core of the framework supported by the Sustainable Livelihood Approach (SLA). The SLA is used to conduct a socio-economic analysis of a community and thereby obtain an understanding of the standard of living. An examination of the socio-economic conditions is necessary to analyse the connection between vulnerability and natural resource management practices within a community. Furthermore the SLA is used to analyse and expose constraints in the process of obtaining environmental entitlements. Using this approach will along with an elucidation of the alterations caused by climate change enable an identification of constraints in the management of natural resources.

Environmental Entitlements Framework

This section will initially provide an overview of the environmental entitlement framework's concepts of community and environment. The basis and essential elements of the framework will be presented and discussed, followed an exploration of the central role institutions play in natural resource management practices. From this discussion a new and revised version of the environmental entitlement framework is developed and will consequently be presented with special focus on its practical use in assessing the social vulnerability of a community.

To analyse the connection and relation between social vulnerability, natural resource management and climate change, it is crucial to establish a framework that seeks to embrace all the most important factors that may influence this linkage. Building on a critique of the community-based natural resource management (CBNRM) approach, the environmental entitlements framework focuses on the implications of social intra-community and ecological dynamics as well as the central role of institutions. CBNRM initiatives have gained increased attention as consensus in the

wake of the 1992 United Nations Conference on Environment and Development[10] (UNCED) suggested that implementation of sustainable development should be based on local-level solutions derived from community initiatives (Ghai & Vivian 1992; Ghai 1994). This reasoning has also been supported by the Brundtland Commission (WCED 1987) and Agenda 21, all strongly focusing on a combination of government decentralisation, transfer of responsibility for natural resources to local communities and community participation to achieve sustainable development (Holmberg et al. 1993). However, the CBNRM approach has also been criticised for its understanding of the environment and community as static, non-dynamic concepts and beneficiaries as passive recipients of project activities (Pimbert & Pretty 1995; Leach 1999). One of the objectives of the environmental entitlements framework is to modify the understanding of these two concepts and in that way improve the practice of CBNRM through a particular focus on institutions as mediators of people-environment relations. The central issue and concern is not the aggregate natural resources of a community but the access to and control over those natural resources that are available. Consequently, focus is shifted away from natural resources themselves and towards an understanding of the institutions that mediate the use and control of natural resources in intended and unintended ways (Mearns et al. 1997; Mearns 1996; Leach et al. 1999).

Intra-community and Ecological Dynamics

The environmental entitlement framework seeks to explain and understand how social and ecological dynamics influence the natural resource management of a diverse group of people in a community and how this management produces particular types of environment. In contrast to the CBNRM approach, in which a community is seen as relatively homogeneous with common characteristics different from "outsiders", the EEF regards a community as a unit often with divergent areas of interest and internal power relations. Thus, the concept of community as a static unit with mutually dependent people sharing common interests must be modified and altered to a more nuanced perception. Communities are "*composed of people who actively monitor, interpret and shape the world around them"* (Leach et al. 1999, p. 229), and one must keep this in mind when analysing the management of natural resources in a given community. Gender, wealth, age, origin and other socially, historically and culturally determined factors all contribute to social dynamics and may act as barriers in obtaining consensus within a community. Nevertheless, as there may be several examples of relatively socially coherent communities sharing common interests and

[10] Also known as the Rio Summit or Earth Summit held in Rio de Janeiro in 1992

promoting equity and consensus when trying to achieve shared goals, the notion of "community" still persist. Whether or not a community appears coherent and unified also depends on the scale of analysis. A divergent and divided group of people may appear as a united community to the national authorities, but at a much lower scale of analysis differentiated areas of interest become visible. As the scale of analysis of this project is on the commune and household level, an understanding of the possible diverging interests and power relations of a given community is crucial, and these social differences and their implications must be taken into consideration (Mearns et al. 1997; Leach et al. 1999).

A similar alternative understanding of the concept of environment is also developed through the EEF. In contrast to CBNRM's often static and linear approach focusing on the equilibrium of ecological systems, this framework seeks to alter the determinants of environmental change. Rather than considering environmental change and problems as aggregated population pressure on scarce natural resources a more disaggregated approach building on non-equilibrium processes is developed. Consequently, a local environment should be divided into its constituent parts and viewed as a dynamic unit and seen as a landscape under constant transformation, emerging from both social and ecological history. The CBNRM approach contains a flawed assumption: That a relatively stable local environment, which may have experienced degradation, has the potential to be restored and managed sustainably by a community with common environmental interests and a capability for collective action. Also, it builds on a conventional equilibrium view on succession theory seeing forest as closer to natural climax vegetation than e.g. grassland. In this way, the presence of grassland is true evidence of the degradation of an area that once had forest, but it does not take the history of the area into account, nor the multiple factors that may have contributed to this change of vegetation (Mearns et al. 1997; Leach et al. 1999).

According to the EEF this people-environment relation is an oversimplification of the real social dynamics present within a community. Firstly, forest may be an alternative vegetation of an area that was once grassland but which through social dynamics and human actions were transformed into forest. Secondly, as mentioned above, a community is seldom fully characterised by consensus with common environmental interests but has diverse and often conflicting priorities resulting in a more complex view on the reasons for environmental change and how the natural resources should be managed. And thirdly, environmental problems should not only be seen in terms of availability

or scarcity of natural resources in relation to the total population. Instead the distribution and access of the available natural resources for the different households within the community must be assessed, as there may be environmental problems for certain groups despite a relative abundance of natural resources (Mearns 1996).

As the understanding and perception of both community and environment is now altered, different questions need to be asked when taking on an analysis of the people-environment relation. These questions deal with the access to and control over natural resources, natural resource management practices, transformation of environmental goods and the role of institutions; all topics which the environmental entitlement framework seeks to examine (Mearns et al. 1997; Leach et al. 1999).

Endowments and Environmental Entitlements

The environmental entitlements framework *"seeks to elucidate how ecological and social dynamics influence the natural-resource management activities of diverse people, and how these activities in turn help to produce and to shape particular kinds of environment"* (Leach et al 1999, p. 226). Consequently, this investigation uses the notions of endowments and environmental entitlements to explain different people's access to and control over natural resources and the influence on social vulnerability. **Endowments** are derived from natural resources and are a person's "initial ownership", for instance of land, livestock or labour power and are defined as *"the rights and resources that social actors have"* (Leach et al. 1999, p. 233). Endowments can be transformed into a set of **environmental entitlements** which are defined as *"alternative sets of utilities derived from environmental goods and services over which social actors have legitimate effective command and which are instrumental in achieving well-being"* (Leach et al. 1999, p. 233). Environmental entitlements can, in turn, enhance people's **capabilities,** which are *"what people can do or be with their entitlements"* (Leach et al. 1999, p. 233). These capabilities eventually determine people's social vulnerability.

Various factors across scales may influence the environmental entitlements of particular groups and households within a community in regard to both the access to natural resources and people's ability to make effective use of them. Consequently, national and local policies, natural resources tenure rights, social institutions and human and financial capital, among many other factors, shape a person's environmental entitlements. People's environmental entitlements or use of natural resources are just one among several livelihood strategies for poor rural people, but often play an

important role because of the lack of alternative choices. The environmental entitlements are dynamic and may improve or decline over time as a result of the mentioned factors, thus contributing to altered livelihood strategies. These variable and changing strategies directly affect the income sources of poor people, and it is an analysis of this variability that is the point of departure for a social vulnerability assessment. In this way, the link between environmental entitlements and social vulnerability becomes evident. An analysis of social vulnerability is an understanding of people's use of resources. The extent to which individuals or households have access to and are "entitled" to make use of these resources determines their ability to adapt to external stress factors such as climate change. Environmental entitlements are only one among several kinds of assets that people can use to adapt to climate change, but they are considered crucial in poor rural areas where the dependency on natural resources tends to be high. To understand and assess social vulnerability to climate change through an environmental entitlements approach, one must focus on the availability and distribution of natural resources, the access to and control over these resources, the ability of people to transform these entitlements into assets, and the institutional structures and governmental policies that shape these factors and conditions (Mearns 1996; Mearns et al. 1997; Leach et al. 1999; Adger & Kelly 1999; Brooks 2003).

The figure presented in the following is a visual overview of the endowment and entitlement processes that shape people's livelihoods and social vulnerability. The figure originates from the theory of environmental entitlements (Leach et al. 1999), but has been developed and modified for this investigation. It illustrates the theoretical approach of this investigation and the endowment and entitlement mapping, which ultimately is essential to understand the ability of people to adapt to climate change. The aim of this framework is to work as a guideline for the collection and analysis of data, and in this way ensure that the most important factors determining the social vulnerability of the people are considered and analysed. Hence it is used to investigate the relation between vulnerability and natural resource management practices in the process of adapting to climate change. Consequently climate change has been put at the very top, as it is in focus as the external stress factor affecting natural resources. In this framework impacts of climate change represent physical vulnerability. The subsequent factors in the boxes are areas to be focused on if social vulnerability in relation to the physical vulnerability is to be reduced. This is visualised by adding social vulnerability as the last link in the figure. Furthermore, access has been added to this framework, given it is seen as essential for an understanding of inequalities and natural resource

management practices. Also, endowments and natural capital have been joined. This is done because natural capital is perceived as the natural resources that people have endowments over and therefore the two are in practice the same. The Sustainable Livelihood Approach has been added by applying the different capitals because it is thought to have an influence on the entire process just as institutions are external factors that influence the process.

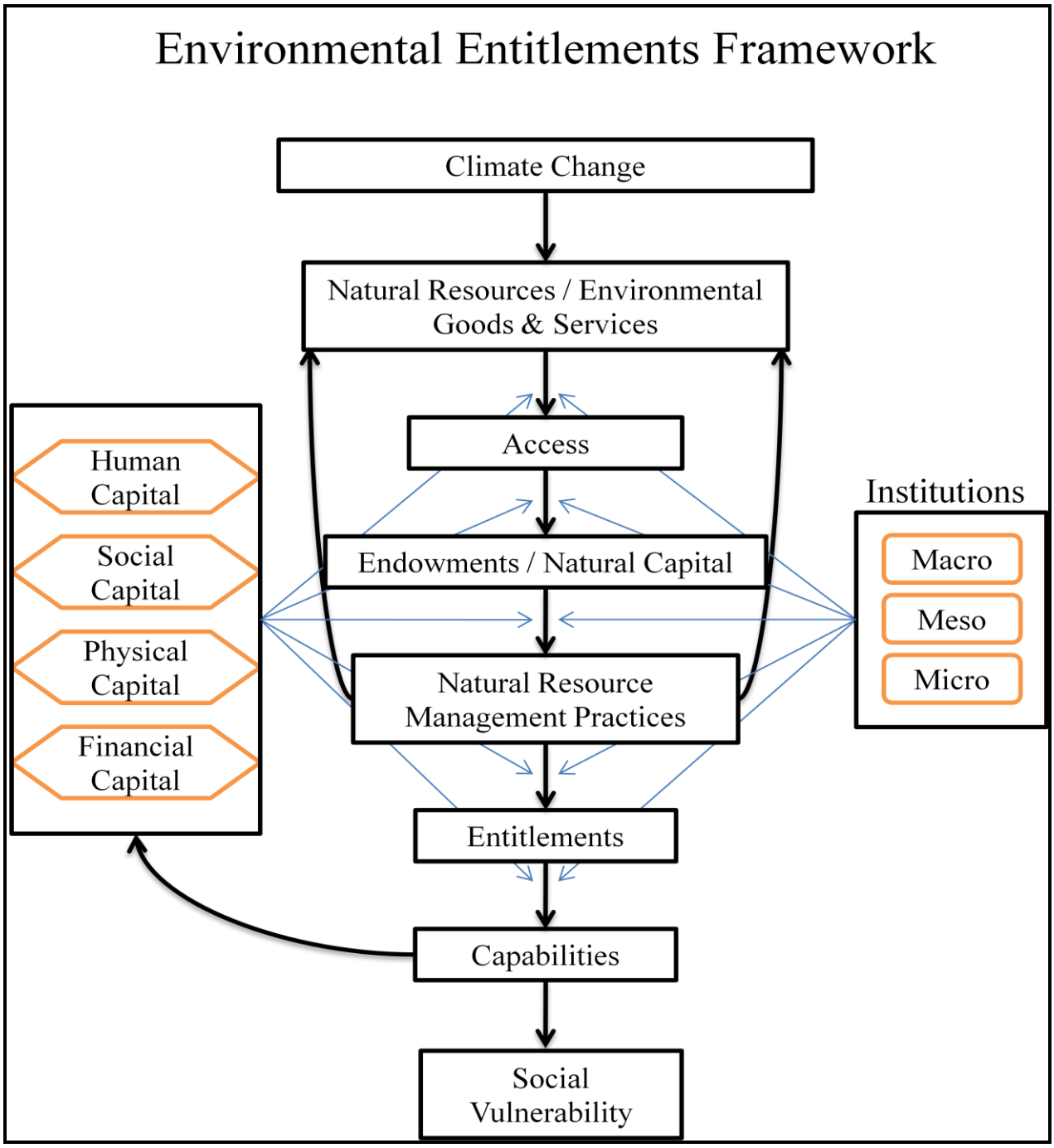


Figure 4.1: Environmental Entitlements Framework. The framework is originally from Leach et al. (1999) but has been further developed to be operational for this investigation

From the framework it becomes obvious that a wide range of differentiated conditions affect the process of transforming possible endowments into environmental entitlements. A given local environment has an aggregated amount of natural resources or environmental goods and services that various households of a community may have access to. The quantity and quality of these resources are determined by different external and internal factors; among these climate change and natural resource management practices. Access to these environmental goods may be highly varied within a community and consequently needs to be looked upon with a disaggregated and micro perspective in order to analyse how individuals may be able to take control of these goods. Control then leads to rights over the natural resources, which become endowments and determine the natural resource management practices. Through this practice, endowments are transformed into various environmental entitlements and ultimately result in capabilities that define the level of social vulnerability. Moreover, institutions play an important role in the process of obtaining entitlements, especially in Vietnam where the state plays an important role (Adger 1999).

Role of Institutions

The multiple-scale institutions from micro to macro level influence the transformation of endowments to environmental entitlements and through government policies legitimise and determine how different individuals access and use natural resources. A distinction can be made between formal and informal institutions. While formal institutions such as the rule of law or bureaucracies may change quickly, informal ones as for example a mutual agreement between individuals within a community tend to change slowly. These informal institutions may appear as social hierarchies leading to natural resource inequalities and are because of their nature and strong grounding in the society rarely transformed or altered (Mearns 1996; Mearns et al. 1997; Leach et al. 1999; Adger & Kelly 1999).

The concept of institutions is incorporated into the framework with the aim of pointing to the significant influence from the macro and meso institutions[11]. In Vietnam institutions at these levels have significant influence because of the political system (Adger 1999; WWF 2005 A; Chaudhry & Ruysschaert 2007). An understanding of these interactions and how institutions affect the endowment-environmental entitlements process is therefore of concern for this project. Consequently, institutions from macro level (government policies and legislation) to the meso level (local authorities) that impact the social vulnerability will be investigated.

[11] Micro institutions are not examined in this study

The Sustainable Livelihood Approach

In the course of this entire process the different capitals a person or household possesses plays an essential role. Thus, the SLA is incorporated into this framework and works as an important factor when examining opportunities and constraints individuals have in accessing endowments (natural capital) and gaining environmental entitlements. The condition of human, physical, social and financial capital to a large extent determines which options for natural resource management practices are feasible. In relation to an investigation of different natural resource management options, it is also necessary to look at diversification of livelihood strategies to find if there are income alternatives that can help reduce vulnerability and ease the adaptation process. Livelihood diversification is important to reduce vulnerability as for instance dependence on one crop makes the producer more vulnerable to external factors such as disease or price fluctuations (Ellis 1998; Baumann 2002). Livelihood diversification will therefore be investigated along with the natural resource management practices.

As recognised earlier, climate change is only one of many challenges facing rural poor people. This means that to effectively reduce social vulnerability, an isolated focus on the stress caused by climate change is not sufficient. Instead climate change must form part of a more holistic approach that can reduce social vulnerability to the whole range of stresses that households can be exposed to (CARE 2009).

Livelihood Resources

The SLA identifies five forms of capital (social, human, physical, financial and natural) that have to be investigated in order to gain a sufficient understanding of the livelihoods and socio-economic conditions of a household (DFID 1999). **Social capital** is defined as the social resources upon which people draw; this is typically different kinds of formal or informal networks. **Human capital** is made up by health status, level of education and skills; factors that define a households' amount and quality of labour. **Physical capital** comprises the basic infrastructure and producer goods necessary to support a livelihood. **Financial capital** is defined as the financial resources that people use to achieve their livelihood objectives and can be divided into available stocks (savings and loans or the possibility of taking loans) and the regular inflow of money. **Natural capital** is made up of the natural stocks from which resources derive and of the ecosystem services useful for a livelihood and equal endowments in the framework. As the different capitals are interrelated,

increasing one of them is likely to increase the others and thereby strengthen the livelihood (DFID 1999). The idea is that a stronger and more broadly based livelihood will reduce social vulnerability, enhance the resilience and adaptive capacity of the livelihood and make the achievement of a more sustainable livelihood possible. A sustainable livelihood is defined as: "*A livelihood* [that] *comprises the capabilities, assets (including both material and social resources) and activities required for means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base*" (Scoones 1998, p. 5).

In this investigation, where the focus is on the link between vulnerability and natural resource management practices in relation to climate change, stresses and shocks mainly originate from changes in the climate. The mapping and analysis of the socio-economic situation therefore focuses on natural capital, but also includes the human, physical and financial capitals to obtain a better understanding of the constraints related to natural resources management practices. By mapping the socioeconomic situation the enabling and constraining factors in the livelihood strategies are revealed, which makes a facilitating process of obtaining entitlements possible. This is incorporated into the Environmental Entitlements Framework where it works as a tool to analyse individuals' strengths and weaknesses in obtaining the environmental entitlements that can lead to a reduced social vulnerability.

Summary

The theoretical background for this investigation is a combination of the Environmental Entitlements Framework and the Sustainable Livelihood Framework. The EEF seeks to encapsulate that there can exist large differences within a community and that it therefore is important to identify those differences and their causes. It focuses on natural resources and the importance of endowments and entitlements to these resources. The SLA is used to assess the different capitals that are seen as essential for the EEF. Furthermore, the SLA considers the socio-economic situation in Tam Thanh where the focus is on the human, financial, physical and natural capitals. The theoretical background has been used in the data gathering and in the analysis of the collected data. In our methodological considerations in the following chapter it becomes clear how the theoretical foundation is made operational.

Chapter 5: Methodological Considerations

This chapter will give an insight into the processes and methods of our data collection. Firstly, the interaction between our theory and empirical data will be discussed. Thereafter the theoretical framework will be put into practice and the parameters to assess social vulnerability in our study area will be introduced. Subsequently some notes on the practical data collection and selection of study area will be given. This leads to a presentation of our sampling strategy, the reliability of the collected data and a brief section on our data analysis. The generalisability of the research will thereafter be discussed and finally the research design is presented.

The Interaction between Theory and Empirical Data

This investigation is, as mentioned in chapter three, criticising the existing approach that tends to see adaptation as a mean to reduce vulnerability and thereby views vulnerability as an end point. Rather vulnerability is to be seen as the starting point for analysis. Hence vulnerability is understood as a result of multiple factors and processes and therefore these factors and processes, and the causes that lead to them, have to be identified. Vulnerability is to be seen as socially constructed, yet often affected by physical vulnerability and exacerbated by extreme weather events. We therefore work with an ontology that acknowledges an already existing contextual vulnerability, and not with vulnerability as an outcome of climate change. This has also been expressed in the environmental entitlements framework where focus is on the differences in access, endowments and entitlements within a given community. This framework thereby works with the social construction of vulnerability as its ontology. The EEF framework emphasise that a community is not to be seen as an unity but that each household or individual are exposed to different stresses and has different understandings of their natural resources and vulnerability situation and the factors affecting the households.

This has the epistemological implication that when we are to investigate the vulnerability situation in the commune of Tam Thanh it is not sufficient to identify what extreme climate events that can be expected to hit the commune. We also have to investigate vulnerability as a social construction. Such an investigation has to be done by interviewing the people that inhabit the commune and implies that we have to interpret the knowledge that is produced. It is therefore important to

acknowledge that there are various perceptions of reality and that various underlying factors can influence this reality.

In order to expose these different perceptions and to investigate the social vulnerability of the different households a survey based on semi-structured interviews has been carried out. Moreover, four focus group discussions have been done with the aim of complementing the household survey. By assembling several people from the same thon a more dynamic setting was created. This resulted in discussions among the participants about local challenges regarding income and natural hazards and lead to an additional perspective on the vulnerability situation in the different thons. Lastly, in-depth interviews were completed with key informants including district and commune authorities and representatives from NGOs engaged in developing and environmental issues in Vietnam. These key informants interviews have added a more general view on the perceptions of the local villagers and understanding of the Vietnamese context. The methodological considerations related to the collection of these interviews will therefore now be discussed and by showing how the theory has been practically used we aim for methodological transparency in the investigation which underpins the validity of the study.

Operationalising the Theory

Our focus is on special parts of the environmental entitlements framework. Climate change strongly influences physical vulnerability and is an external factor that impacts the social vulnerability. Moreover, the focus is on access, endowments, natural resource management practices and on the capitals and macro and meso institutions influencing the process. We will, however, not focus on social capital nor on the micro institutions since such an investigation would demand a more anthropological study that has not been the focus of this research.

The following parameters are operational definitions that serve as surrogate measures when the theoretical framework is practically used and indicators for vulnerability examined through the household survey and key-informant interviews (McGrew & Monroe 2000). By making the relationship between the ontology, epistemology and parameters clear, we secure that the data obtained during the fieldwork has been produced in accordance with the ontological basis and is valid for the conclusion of the investigation.

These parameters are strongly related to the indicators of social vulnerability discussed in chapter 3, which are primarily inequality, access to natural resources and diversification of income sources. The EEF framework also aims at uncovering inequalities within a community and diversification is closely linked to natural resource management practices.

The parameters needed to assess social vulnerability will now be presented. The parameters are then sub classified, explained and given their own specific parameters in relation to the focus of the research. In this way we give a precise and transparent presentation of how social vulnerability will be examined. The parameters have been used as a guideline for the empirical data collection, especially in the making of the household survey, and thereby secured that all relevant data has been collected. In cases where a figure or table can be related to the parameter, these will be indicated in brackets and presented in chapter six.

Social Vulnerability

The following parameters are seen as decisive for a comprehensive analysis of social vulnerability (see figure 4.1). The main focus is on the first five parameters where natural resource management practices have special attention as the focus of this investigation is the relation between vulnerability and natural resource management practices in the process of adapting to climate change. The last two of the parameters influence the entire process and are therefore also investigated however not to the same degree.

Parameters:

1) Climate change
2) Natural resources
3) Access
4) Endowments / natural capital
5) Natural resource management practices
6) Transformation of environmental entitlements
7) Amount and distribution of capitals
8) Influence of institutions

Climate Change

The impacts of climate change strongly affect the livelihood strategies of rural natural resource-dependent people. Rural people with a high proportion of their income generated from natural resources experience a highly climate-sensitive livelihood and are consequently very vulnerable to changing climate conditions. The following parameters are the ones essential for investigating the climatic impacts in Tam Thanh.

Parameters:

1) Historical/future climate conditions
2) Climate change impacts on natural resources
3) Climate change impacts on the natural resource management practices

Historical climate conditions are investigated by looking at changes up to 50 years back in time whereas future climate changes are assessed through climate predictions stated by various scientists in the field. Impacts on natural resources and management practices not only encompass climate change but also the more short term influence and stress from general climate variability.

Natural Resources

Natural resources are materials available in nature that can be transformed into endowments of individuals. The parameters listed below, however, represent the situation for the entire commune and are selected in order to obtain sufficient information about the natural resource situation in the commune.

Parameters:

1) Area and classification of forest (map 2.2)
2) Area and condition of agricultural land
3) Water availability
4) Erosion situation

Classification of forest is understood as the official division of forest (e.g. production forest) and the area is understood as area in hectare and is in absolute amounts for the entire commune whereas endowments applies to the individual household. With agricultural land, area is understood in the same way as forest whereas information on condition of land is dependent on interviews with the

households. Water availability means whether there is sufficient water for domestic and agricultural use and is also defined by the statements of each individual household together with opinions expressed by the commune.

Access

Access is closely linked to endowments and is the possibility to access the resources which are directly required to secure a livelihood. This involves the institutional settings facilitating the use of land and practical access such as distance to land in time defined by the actual geographical distance and by the means of transportation.

Parameters:

1) Access to land
2) Distance to market
3) Distance to main road

Access to land is both understood as the possibility of obtaining land and as the physical accessibility to the field. The distance to the market and main road is significant for the amount of agricultural work that has to be done and for the prices that the farmer receives from forest and agricultural products. This is due to longer transport which entails increased expenses and demands more time for the transport of agricultural output. The distance is examined in time and space based on statements from the households.

Endowments / Natural Capital

Endowments are the natural resources that a given individual in a community has legal rights to, such as land. To obtain endowments, access to natural resources is essential. As seen above endowments are closely related to natural resources and access but endowments are more linked to the institutional setting. The parameters both focus on what the individual actor has legal rights to and the institutional settings influencing these legal rights.

Parameters:

1) The division of land in the commune (figure 6.5)
2) Area and condition of land

3) Legal land-use rights (table 6.1)

The area of land is the total area that the individual household possesses and will be seen in relation to the division of land in the commune. The condition of land is defined by the individual households and their explanations about the quality of their land. Legal land-use rights are generally seen as being crucial for rural people and will also be addressed in this research.

Natural Resource Management Practices

The management of natural resources is determined by the natural resource situation as well as access to and legal command over the resources (endowments). Moreover, institutions on various scale-levels and the capitals of a person have an essential impact on the natural resource management practice and ultimately lead to a given environmental entitlement.

Parameters:

1) Variation of natural resource management practices
2) Natural resource management practices impact on natural resources
3) Dependency on natural resource management practices
4) Number of livestock (figure 6.2)
5) Institutional influence on natural resource management practices

The natural resource management practices will be analysed to find the constraints that the farmers experience in relation to climate change and how these practices impact the natural resources in the area. Furthermore, to give an idea of the importance of these practices, dependency of natural resource management practices will be analysed through the amount of income derived from natural resources and the sources of income (diversification). Number of livestock has interest as it is part of the natural resource management practice and because it is a way to income diversification. Finally institutional influence is briefly investigated through an examination of government policies.

Environmental Entitlements

Environmental entitlements equal what an individual can derive from his/hers endowments and in this case the focus is on the products derived from the natural resources that each individual has

legal rights to. Entitlements determine the final value of the natural resource management practices and are therefore relevant for this investigation.

Parameters:

1) Agricultural products/utilities derived from the endowments
2) Timber products/utilities derived from the endowments

These parameters are used to investigate all the different utilities that the farmers acquire from their agricultural products, including products that cannot be directly measured from income sources or direct output from harvests such as food and financial income.

SLA Capitals

Human Capital

In this investigation, human capital mainly consists of the level of formal education due to the fact that education is generally seen to have significant influence on the livelihood strategies that people choose and for their economic conditions (DFID 1999; UN.org).

Parameters:

1) Level of formal education (figure 6.4)

This parameter is understood as the head of household's years of formal education.

Physical Capital

Physical capital is the basic infrastructure needed to support livelihood strategies and in this analysis consists of roads and adequate irrigation.

Parameters:

1) Quantity and quality of roads
2) Adequate irrigation

The quality of roads is here narrowed down to the difference between asphalt and dirt roads. Adequate irrigation is a question of whether the farmers have sufficient water to irrigate their fields, in relation to the absolute amount of water in the commune. In addition adequate irrigation covers

whether agricultural output is diminished because of lack of water.

Financial Capital

Financial capital comprises the financial resources that people use to follow their livelihood objective. There are two main sources of financial capital: available stocks (different forms of savings and loans) and regular inflows of money (income from agriculture and forestry, salary, pensions, support from the state and remittance).

Parameters:

1) Sources of income (figure 6.7)
2) Material assets (figure 6.8)
3) Savings
4) Access to financial loans and support

Sources of income are for instance salary, support from government and income from forestry and agriculture. Material assets are such things as a motorbike, refrigerator and television. Savings are often cash or bank deposits but can also be in alternative forms such as livestock. Access to financial loans and support is assessed by interviewing the households about loans.

Institutions

There are no set of parameters defining institutions as institutions are, contrary to capitals, already existing and are not a concept defined by a set of parameters. The institutional focus is on the policies that influence the natural resource management practices and livelihood strategies in Tam Thanh and not on specific institutions. These policies are found through secondary literature, interviews with key informants in Hanoi and Tam Thanh and the household survey.

Practical Data Collection

Except for literature reviews the data has been collected during fieldwork in Tam Thanh commune and Hanoi in Vietnam, from February 4th to April 1st 2010. The essential part of the empirical data has been conducted during a two-week stay in the commune. Tam Thanh was selected among three communes in Nui Thanh District that form part of a larger Danida funded research project of which this investigation is a part of. The research project is a collaboration between the Institute of

Geography at Vietnam Academy of Science and Technology, University of Copenhagen and University of Roskilde. The research project is assessing effects of and responses to climate change on environment and socio-economic development in mid-Central Vietnam and is operating in Quang Nam province where Nui Thanh District is one of the selected districts (for more information see the research project's homepage ecoenvi.org). Hence we have chosen a commune in the district located in the midland due to the fact that there is already a significant focus on adaptation for coastal areas and because people are in general poorer and more marginalised in the midlands and highlands. A highland commune was first selected but was rejected as our research area by the Vietnamese authorities and therefore Tam Thanh was finally chosen.

The parameters presented above indicate the information needed to be able to give a fulfilling answer to the problem formulation and have on that background been used as a guideline to design the household survey. The household survey contains both quantitative and qualitative questions and was divided into four sub-sections: personal information and socio-economic classification (Section A of the survey), land-use and natural resource management practices (Section B), impacts from natural hazards and climate change (Section C) and finally income and economic conditions (Section D). As such, the aim of section A is to note the basic personal information of the respondents and in this way being able to categorise and compare the different interviews. Subsequently section B is made with the aim of answering research question 2 about the natural resource management practices, section C to answer research question 1 concerning the impacts of climate change and section D with the focus on the economic situation is responding to research question 3 about access and endowments.

In addition to the household survey five key informant interviews were carried out in Hanoi with FINNIDA[12], CARE Denmark, the International Federation of Red Cross and Red Crescent Societies, WWF Vietnam and Spatial Decisions[13]. Furthermore, interviews with CARE Vietnam in Tam Ký and Quang Nam Rubber Group in Tam Thanh were completed, as well as interviews with authorities of Nui Thanh District and Tam Thanh commune. Apart from contributing with valuable knowledge for the preparation of the fieldwork and the making of the household survey, these key informant interviews have served as a measure for triangulation in relation to the household survey

[12] The Finnish Ministry of Foreign Affairs Department of International Development Cooperation
[13] Spatial Decisions is a planning, engineering and information solutions firm with expertise in regional and environmental systems.

which forms the empirical core of this investigation. The triangulation has furthermore been supported by transect walks and a focus group discussion in each of the four thons. The template of the household survey is to be found in appendix A1, notes from focus group discussions in appendix A2 and information from key informant interviews in appendix B.

The focus group discussions were done by gathering four people from different social levels in the same thon. They were presented for a vulnerability matrix (see appendix A2). The aim of the vulnerability matrix exercise was to indentify the natural hazards or other external factors that have most serious impact on important income sources in a local community such as a thon. The participants were then asked jointly to fill out their four main sources of income on one side and the four main obstacles for these income sources on the top and then rank them and explain their reasons for the ranking.. The problems experienced with this method were that the poor people tended to let the richer and more powerful ones speak. There was particularly one focus group discussion were we experienced problems. This seemed to be due to lack of education and because one of the participants was deaf and almost blind while another had a small child interrupting the setting. The impression was, however, that in the four focus group discussions they all seemed to agree with the results from the matrix.

Sampling Strategy

The sampling strategy is based on the theoretical framework and is in line with the aim of the research, which is concerned with identifying the variations in vulnerability between geographical and socio-economic units. The sampling strategy is hence both spatial and non-spatial and as a consequence geographical location and income category has been the main criteria for the selection of households to be interviewed. In both the spatial and non-spatial sampling a stratified sampling approach has been used. Within each of the strata there has been a random selection so that each unit in the strata has a known chance of being selected. Such a probability sampling method has been used as it is generally assumed that a representative sample is more likely to be the outcome when this method is applied (Bryman 2004; McGrew & Monroe 2000).

The non-spatial part of the sampling design is based on a target population, which is the population of Tam Thanh (see table 2.1 for details). Based on the income division by the state, the target population has been stratified into income categories of poor, nearly poor and middle, of which a

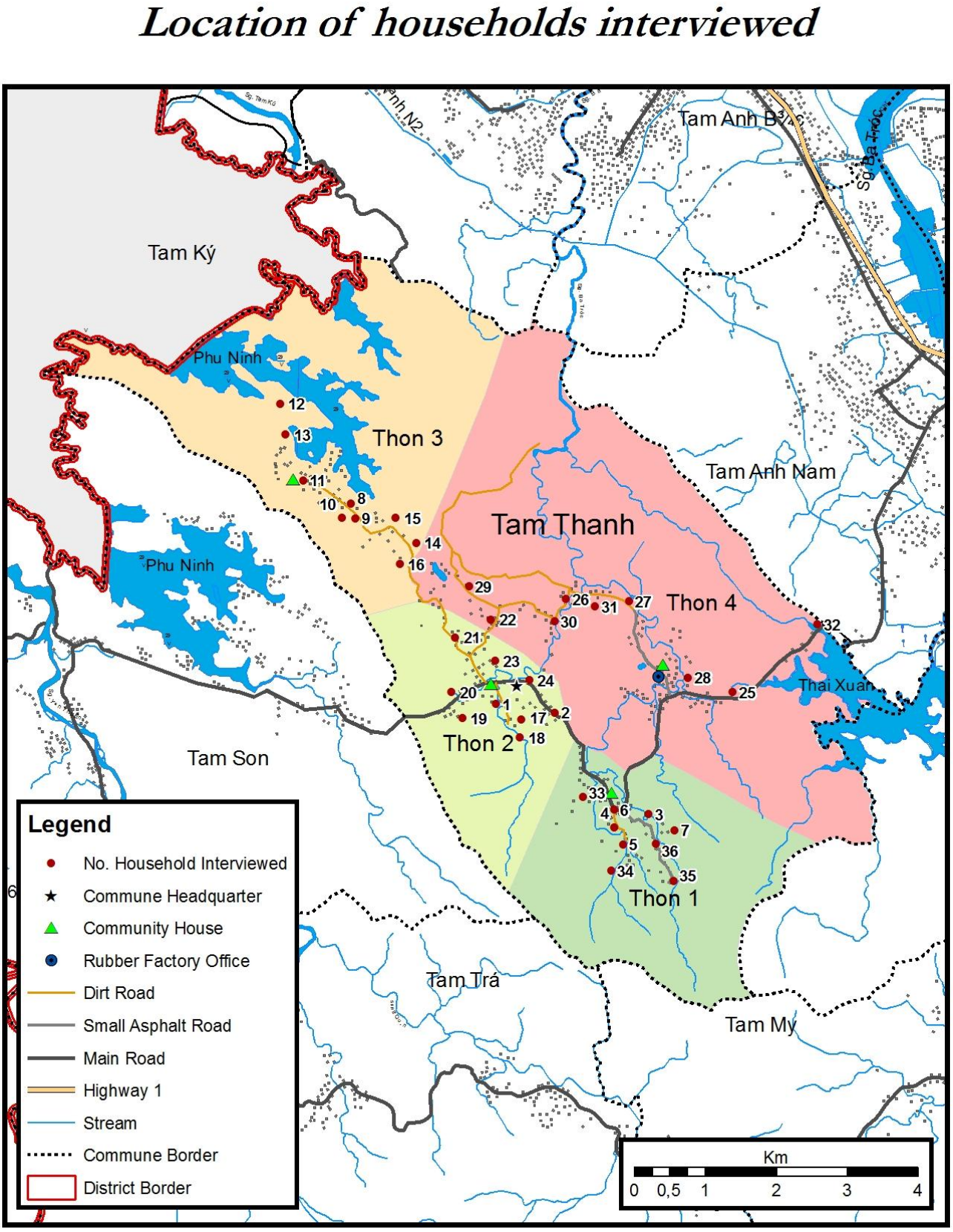
sampled population of 36 households have been chosen. The table below is the sampled population and illustrates the stratification of the 36 households in number for each stratum and divided by thon. There is an oversample of poor households as they are thought to be particular socially vulnerable and on the contrary nearly poor households are undersampled mainly because they have been hard to localise (McGrew & Monroe 2000).

	Income Categories			
	Poor	**Nearly Poor**	**Middle**	**Total**
Thon 1	4	2	3	**9**
Thon 2	4	1	4	**9**
Thon 3	4	1	3	**9**[14]
Thon 4	4	0	5	**9**
Total	**16**	**4**	**15**	**36**

Table 5.1: Division of income categories of the interviewed household

Besides the sampled population a spatial part of the sampling design is significant to attain reliable results in relation to our framework. The target area, Tam Thanh commune, has been divided into the four thons according to the division of the state. The four thons together represents the commune and in each of these thons 9 interviews have been conducted. As such, when the data is analysed the 9 interviews conducted in every thon each represent their thon whereas the 36 interviews altogether represent the commune. The map below illustrates the four thons and shows where the interviews for the household survey have been conducted. Every number represents an interview and indicates the order of which the interviews were performed. We have aimed at obtaining the largest geographic spreading possible and the large patches on the map without interviews, such as the north and northeast, exist because there are no households in those areas.

[14] One household has not yet been classified but define themselves as being poor.



Map 5.1: Location of households interviewed

Reliability

In the completion of the interviews it was sought to obtain the most representative sample possible to get the most reliable results for the analysis and conclusion. The methods for conducting the interviews will be the subject for the following discussion.

The oversampling of poor households has been carried out to obtain a higher representation in this income category as the relationship between poor households and other income categories is the main focus. Furthermore, the high variation of geographical locations of the interviews and the number of respondents has entailed that we have considered to have reached a sufficient amount and distribution of interviews performed for the household survey to be reliable. This is underlined by the fact that the average amount of land among the respondents corresponds to the average amount of land possessed by the household in the entire commune[15]. Thus the 36 interviews that altogether form the household survey are used as representatives for the whole commune. When we explain and analyse aspects of the commune, the data will therefore, if nothing else is stated, originate from the household survey.

The interviews for the survey were done by the two authors of this report and an interpreter from the larger Danida funded research project. It was a matter of great concern that both authors participated in the interviews. One did the interviewing and another made sure that all additional questions were followed up. This method was adopted to prevent misunderstandings and to ensure that all important data was collected correctly. As a consequence it took longer time to carry out the interviews than if the interpreter had asked the questions without having to translate everything and we therefore ended up with a lower sampling size. This has however been seen as a necessary process to achieve a high quality of the interviews.

Due to the duration of the fieldwork in the commune we were only able to get a snapshot of the social vulnerability situation. This might have implications for questions related to acacia production as Ketsana, the strongest typhoon in many years, hit the commune only months before we arrived. Hence we could have formed another picture had we visited the commune before this typhoon hit leaving severe damages. On the opposite, had we visited the commune in a later period

[15] The total area of the commune is 5,393 ha. Subtracted the area owned by Quang Nam Rubber Group (2,000 ha) 3,393 ha is left for the 1058 households. This corresponds to an average land area of 3.2 ha per household. The average land area of the sampled population is 2,4 ha

more people would have sold their trees and income from acacia production would tell a different story. We are, however, unable to return to the commune and therefore we have chosen to work with the snapshot we got instead of trying to make up for the consequences by asking about future income from acacia production.

Regarding the reliability of the answers received from the respondents we have at stages had some doubts as to whether they have understood the questions correctly, and having understood the questions, whether they had sufficient knowledge to give satisfactory answers. These doubts have especially occurred during interviews with old and poor people and with people with lack of education and have been most severe in questions concerning economy. It was often the impression that when the respondents did not give a fulfilling answer it was simply because they did not know how much they actually earned in a year. Consequently this part of our data might suffer from some lack of information. Yet in general the impression is that the respondents have given honest answers and all the answers have sought to be triangulated and the general information from the interviews is on that background believed to be reliable.

Data Analysis

The analysis of the collected data is primarily based on the utterances and opinions expressed in the household survey. We have chosen this approach because a community cannot be seen as homogeneous but have internal inequalities and diverged areas of interest. A bottom-up approach in the collection and analysis of data is therefore essential to find the differences in social vulnerability within the commune. Therefore when the collected data is analysed the findings are based on statements from the household survey.

However, not all the collected data from the household survey has been used in the analysis because of the problem of non-response: that for several reasons some individuals cannot be interviewed or are not capable of answering all questions in the questionnaire (Bryman 2004). Only the latter reason was present during the fieldwork and consequently several questions obtained an insufficient number of answers and on that background prevented comparisons and discussions of these parts of the questionnaire.

In the analysis of the data innumerable relations have been encountered and thereby groups that are especially vulnerable have been identified. As the investigation is not build on an experimental design it has, however, not been possible to establish the causal links for these relations (Bryman 2004). Instead the identified relationships are used to uncover socially vulnerable groups and connections.

Generalisability

The objective of this investigation is not merely to reach conclusions about the commune of Tam Thanh but also to locate the main obstacles for an enhanced natural resource management that can lead to a reduced vulnerability and thereby a stronger adaptive capacity in relation to climate change for various communes in Vietnam. Therefore this section will identify a set of characteristics that makes it possible to draw the conclusions from this investigation to other communes in Vietnam with the same set of characteristics.

It is not appropriate to apply the findings from this research to another geo-political scale as the approach used for this research in its very nature is based on identifying the differences within a smaller community. In addition it is difficult to compare characteristics at a commune level as this data is not available in Vietnam. Therefore the assessment of generalisability will be done at province level which is the lowest level where data is available. This is not to say that results should be used to identify problems within a province but rather that if there are sufficient indicators pointing for a comparison it must be assumed that similar communes exist in such a province.

First of all, in order to compare another area with the results from this investigation the area has to be located in Vietnam. This is because the Vietnamese government intervenes to the lowest level of society and therefore it will be problematic to compare areas located outside Vietnam assigned to the same intervention. Secondly, a commune that is selected for comparison has to have the same geographical characteristics. This is, a midland commune with same climatic stress, a fairly good accessibility and not containing steep slopes, thus not located in the high mountains or by the sea where climatic stress will contain different forms. The rainy season in Quang Nam varies from other regions where it is extending roughly from May to October but in Quang Nam it is approximately from August to January (dmi.dk). The most important climatic factor is, however,

the intensity and strength of typhoons as they are capable of destroying entire plantations and often bring severe rainfall and floods in their aftermath. These aftermaths can destroy both houses and fields and therefore typhoons are one of the most severe climatic occurrences.

Thirdly, forestry is to play a major role in the economy, as is the case in Tam Thanh, because forestry typically causes different problems than other crops. In 2008, 3,562,000 m^3 of wood were produced in Vietnam and of this 206,000 m^3 were produced in Quang Nam. Ten provinces produced more than a 100,000 and a whole range produced between 50,000 and 100,000 m^3 (gso.gov.vn). Since there are so many provinces producing a significant amount of wood it seems possible to find other communes for comparison for this characteristic.

Lastly the poverty rate has to be more or less the same. There seem to be a clear poverty division where the Red River Delta, the South East and the Mekong River Delta are significantly better off than the rest of the country. Quang Nam province has more or less the same poverty rate as all other regions in the country apart from these three mentioned regions (gso.gov.vn).

The results from this investigation should only be applied to communes with the approximately same characteristics. The more comparable a commune is, the higher a transferability can be expected.

Research Design

The research design (see figure 5.1 below) presents an overview of the structure and design of the analysis and shows how each of the research questions is to be answered. After the problem formulation the four research questions and their additional objectives are presented and afterwards which methods that are used to assess and answer each of them. The additional objectives are added to clarify the content of the research questions.

For research question 1, which is the first part of the analysis, the aim is to assess the impact of climate change on the natural resources. This has been divided into two parts; a more dynamic and varied one that focuses on the changes in weather patterns and one which identifies the actual physical vulnerability of Tam Thanh. This chapter is mostly based on statistical weather data and literature review including IPCC reports and statistical yearbooks from Quang Nam because physical vulnerability only represents external factors. However it also includes data from the

household survey to check if the local perception is the same and to assess which natural hazards people find most devastating for their livelihood.

Research question 2 addresses the natural resource management practices in Tam Thanh. Firstly it is critical to identify the actual importance and dependence of the natural resource management practices which is done by looking at how much these practices contribute to the household economies and the sources of income. Secondly, institutional influence on natural resource management practices is significant and hence is the focus of the second additional question. The actual importance of the natural resource management practices has been investigated through the household survey part that concerns the economic situation of the informant and his/hers household. Institutional influence is answered by analysing data from the household survey that contains a large part which focuses on the influence from different institutions and policies. Data from interviews with the commune is also included because this is highly relevant as the commune is the lowest administrative unit within the state. Furthermore, government folders and guides and general literature concerning the state interference have been analysed.

Our third research question concerns access and endowments as they have major influence on the differences in the vulnerability situation. Therefore it is also important to identify the differences within access and endowments in the community. Endowments and access are mostly investigated with focus on land but also considers such things as access to financial resources and contains and operates with the various capitals. This is examined through the household survey, interviews with key informants in the commune, mapping and own observations. Moreover, access and endowments are considered to have decisive influence on natural resource management practices and therefore is the centre of interest in this research question. The methods used for this part are mainly the household survey, the focus group discussions, transect walks and interviews with key informants.

The last of the research questions is a discussion of the first three research questions. The first part outlines and maps the socio-economic and geographical differences and identifies the relationship between natural resource management practices and vulnerability in relation to climate change within the commune. Based on the first part, the second part analyse how to facilitate an adaptation to climate change. Finally this results in the conclusion of the research.

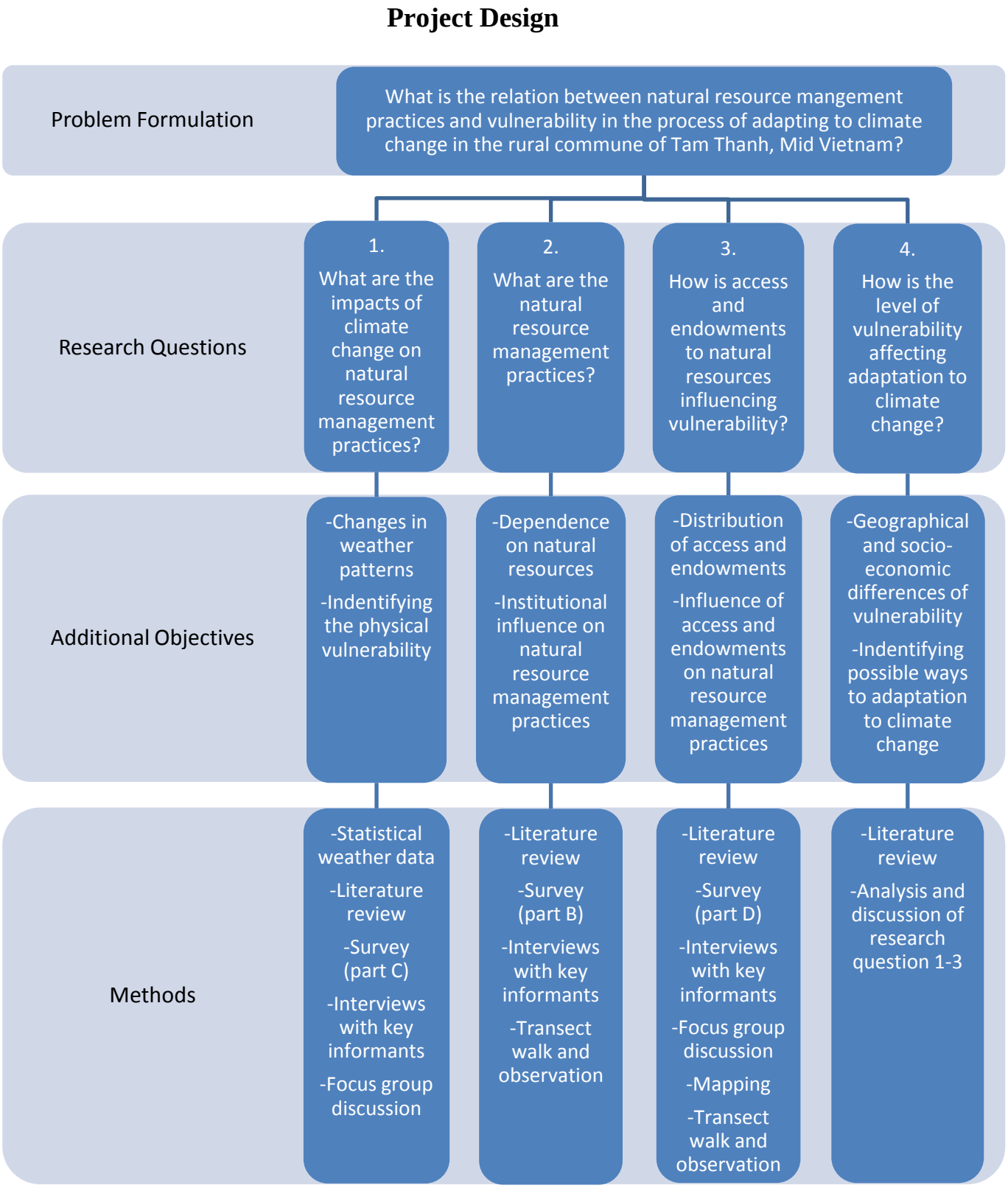


Figure 5.1 Project Design

Chapter 6: Presentation of Empirical Data

This chapter provides an insight to the major findings of the household survey with the objective of creating an understanding of the empirical data before the research questions and problem formulation is discussed and answered. The part of the data from the survey that can be quantified is presented below in tables or figures. Thus, other primary data such as qualitative information from the household survey, focus group discussions as well as information from key informant interviews and secondary data from literature review, is not included but will be incorporated and discussed in the following chapters. The empirical data is, as mentioned before, collected on basis of the parameters presented in the previous chapter. However, due to the parameters' different characteristics, only the parameters that can be illustrated in tables and figures are included in the following.

The data below has, due to the structure of the investigation and for convenience, been placed under the four research questions well aware of the fact that much data can be used to discuss and answer several research questions.

Research Question 1

What are the impacts of climate change on natural resource management practices?

To answer this research question the characteristics and scope of climate change is crucial to understand and therefore secondary data such as literature review and statistical data connected to the geographical area are of high importance here. The household survey, nonetheless, also contributed by relating impacts of climate change to other external factors, which may also influence livelihoods. This is shown in the figure below.

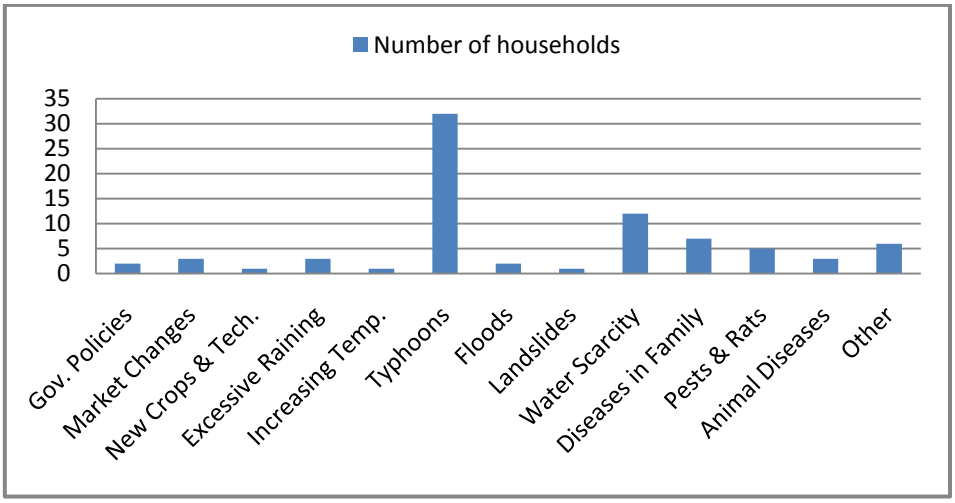


Figure 6.1: Factors Impacting Livelihoods

Respondents were asked which major events that had impacted their livelihoods the most within the last ten years and they were free to choose more than one from a list containing 13 different factors. The category „Other' includes four respondents mentioning the condition of the road as being a factor impacting their livelihoods and two mentioned bank erosion.

Research Question 2

What are the natural resource management practices?

All the respondents do agriculture and forestry with acacia production being by far the most common practice and hence acacia contributes significantly to the income of the households. Only one respondent does not have an acacia plantation. Meanwhile a great variation exists between the sizes of the acacia fields of the different households from 200 m^2 to 130,000 m^2 and with an average area of almost 20,000 m^2. Apart from acacia 29 of the respondents have a small rice field for own consumption with an average area of nearly 2,000 m^2. Moreover, 20 of the interviewed households keep livestock, which is distributed like the following figure shows (the number indicates how many households possess any of these three livestock and poultry is not included in the data).

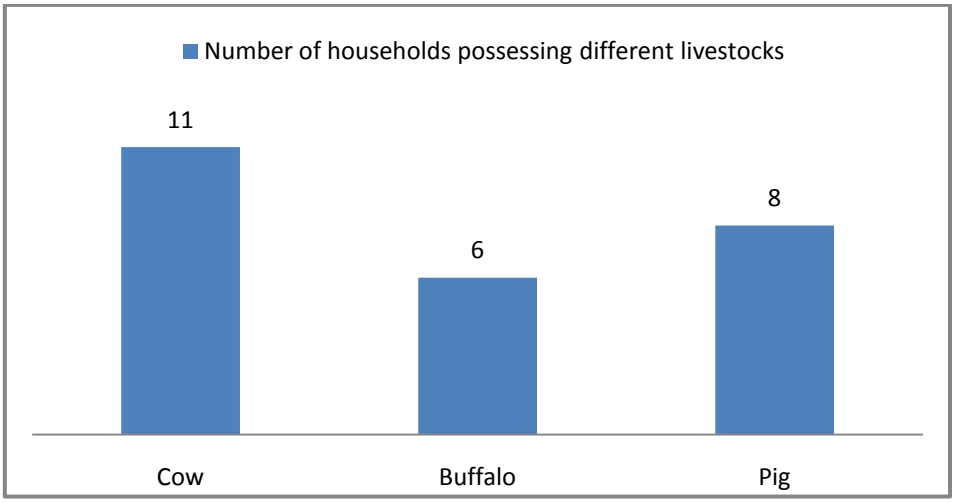


Figure 6.2: Livestock

Within the last ten years there has been a significant land-use change from mainly tea and pineapple production to acacia production, and today acacia covers a large area of the commune. The reasons for this change are summed up in the figure below.

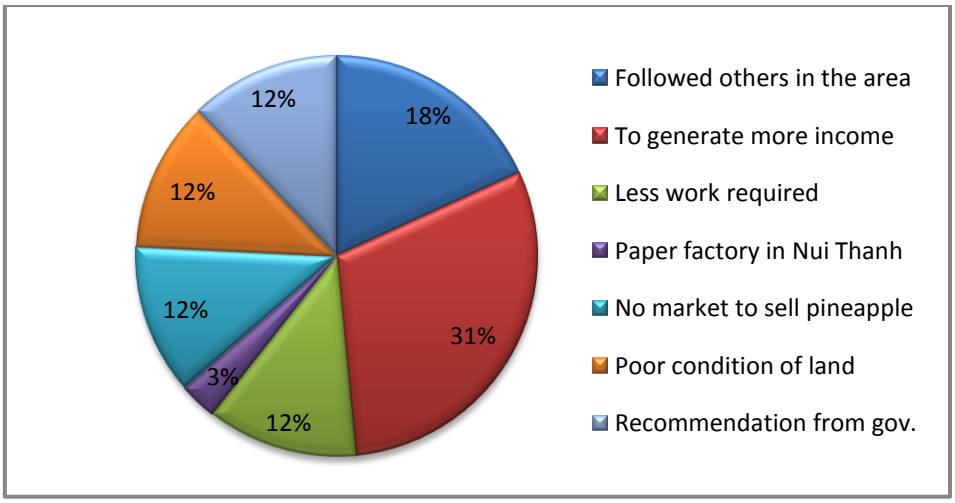


Figure 6.3: Reasons for changing to acacia

Level of education may play a significant role in livelihood strategies and the natural resource management practices. The relation between number of years of formal education and income category is illustrated in the following figure.

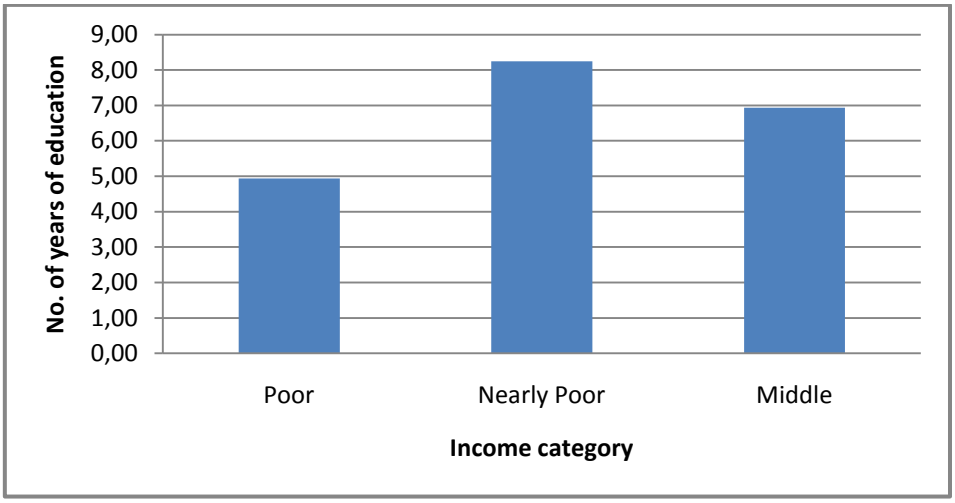


Figure 6.4: Level of education and income category

Research Question 3

How is access and endowments to natural resources influencing vulnerability?

The natural resource management practices are highly influenced by to what extend the various households are endowed with land and to which degree access to this land is secured. Property rights are based on the government's „Land Allocation Program' in which rural households are granted renewable land-use rights certificates called „Red Books'. These certificates provide rights to use land for annual crops for 20 years and rights to use forest land and land for perennial crops for 50 years. In this way the certificates are important to secure a household's land rights and reduce social vulnerability. The following table shows the distribution of Red Books for acacia plantations divided by thon.

	Red Book Certificate Status			
	No	**Yes**	**Waiting**	**Total**
Thon 1	0	5	4	**9**
Thon 2	1	5	2	**8**[16]
Thon 3	0	7	2	**9**
Thon 4	3	0	6	**9**
Total	**4**	**17**	**14**	**35**

Table 6.1: Red Book certificate status for forest land

[16] One household in thon 2 does not have an acacia plantation

Regardless of the presence of the Red Book the households have formal or informal ownership of a diverse amount of land and households average land area per thon is spread out like this.

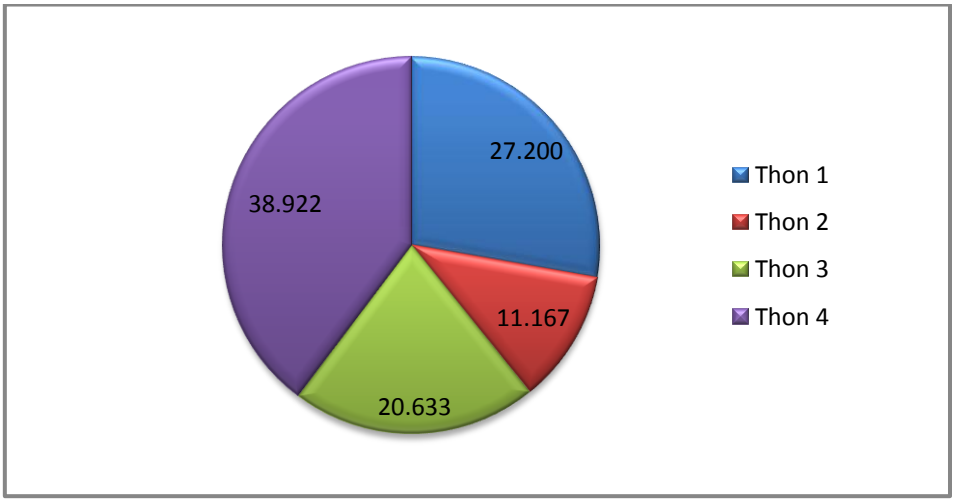


Figure 6.5: Household average land area by thon in m^2

Access to financial capital by taken out loans is also decisive for the social vulnerability and 60 % of the respondents have obtained one or more loans usually from the Social Policy Bank[17] or the Women's Union[18]. The purpose of taken out loans varies greatly as the following figure illustrates.

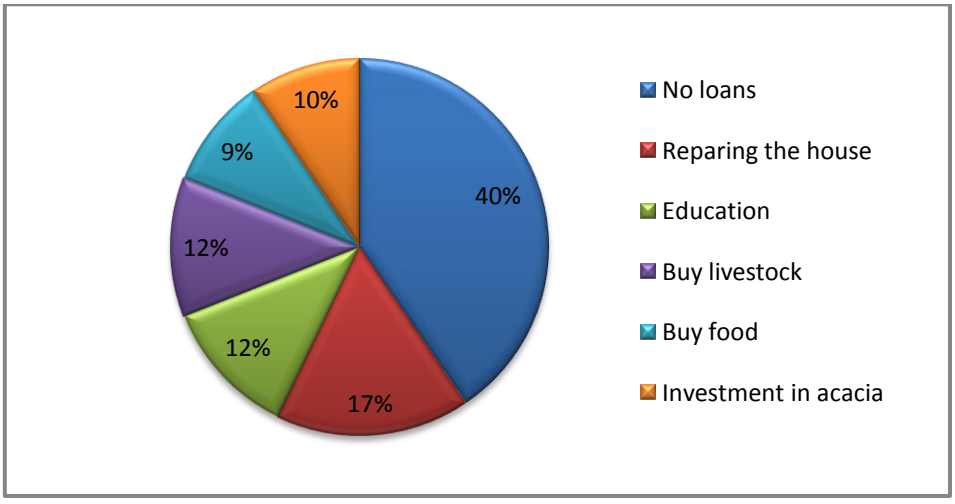


Figure 6.6: Purpose of taken up loans

[17] The Social Policy Bank is a government financial institution that provides financing programs for the poor and small businesses and was established in October 2002 (business.gov.vn)
[18] Vietnam Women's Union (VWU) was founded in 1930 and has a total membership of above 13 million women (hoilhpn.org.vn)

Research Question 4

How is the level of vulnerability affecting adaptation to climate change?

Poverty and diversification of income sources play an important role in the level of social vulnerability. Nevertheless, apart from the official income categorisation done by the government, the level of poverty for each household is for several reasons more complex to investigate and the exact amount of income is thus difficult to assess. According to the household survey the variation in annual income per household is enormous ranging from approximately 2 m. to 187 m. VND[19] and with an annual average income of 33 m. VND. This income is derived from several different sources as showed in the figure below.

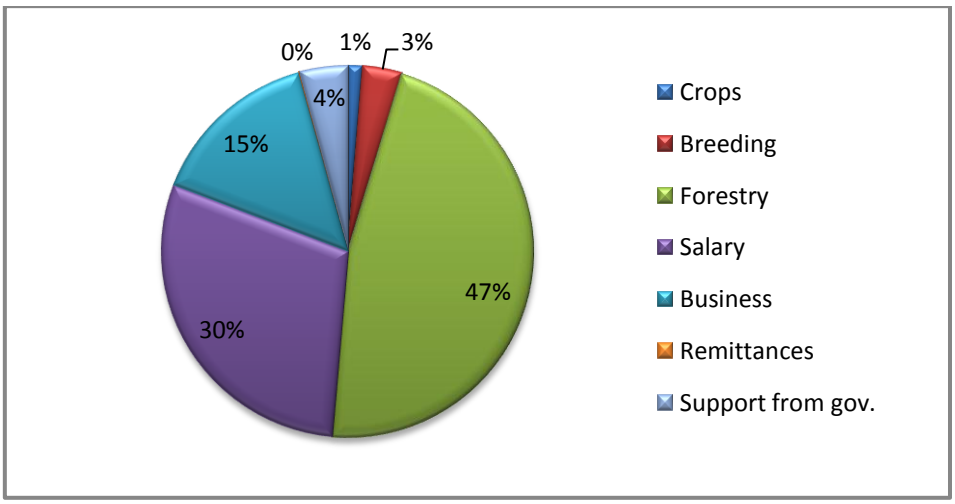


Figure 6.7: Income sources

The business category covers mainly transportation of acacia trees and income generated from small shops, restaurants or cafés while salary is almost exclusively from the cutting and managing of other people's acacia trees and work in Chu Lai industrial zone.

Complementing the amount of income with number of material assets makes it possible to obtain a more comprehensive picture of the economic situation of the households. The material assets are shown in the figure below.

[19] 1 USD equals 19,244 VND (oanda.com)

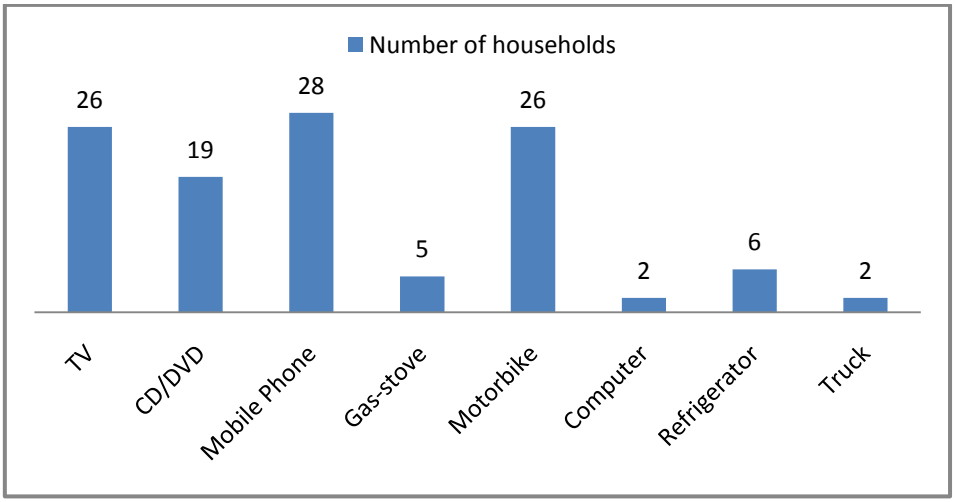


Figure 6.8: Material assets

The challenge of generating sufficient income to sustain and improve the present livelihood is by far the greatest obstacle for the households. With the option of giving priority 1, 2 and 3 to future obstacles based on a list containing 11 factors, capital insufficiency had a great number of priority one. The figure below is developed by giving all priority 1 three points, priority 2 two points and priority 3 one point.

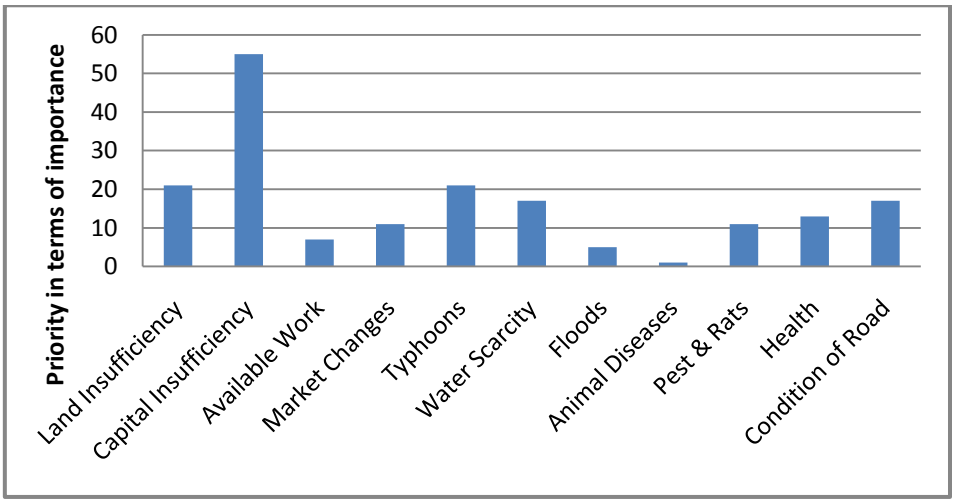


Figure 6.9: Main obstacles in the future

Chapter 7: Physical Vulnerability and Climate Change

Vietnam is because of its geographical location physically vulnerable to natural hazards (see map in appendix D) and has consequently a long history of coping with climate extremes such as typhoons and floods. But more extreme and unpredictable weather conditions are today on the rise as a result of climate change and increased interannual climate variability (Chaudhry & Ruysschaert 2007; ISPONRE 2009; Adger 1999). Climate change is here defined as: *"any change in climate over time, whether due to natural variability or as a result of human activity"* (IPCC 2007 B, p. 5) and persists for an extended period of time, typically decades or longer. On the other hand climate variability is short term founded and refers to: *"the variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events"* (IPCC 2007 B, p. 5). However, with the aim of indentifying physical vulnerability, it is unnecessary to separate long term climate change and short term climate variability into two separate processes (CARE 2009; Thomas & Twyman 2005).

Several recent studies have agreed that Vietnam will be one of the most physically vulnerable countries to climate change in the world (ADB 2009; Dasgupta et al. 2007; ISPONRE 2009; Oxfam 2008; Phan et al. 2010). Gradual changes like sea-level rise and increasing temperatures and more weather extremes such as heavier rainfall, droughts and more intense typhoons are all impacts that will have potentially devastating consequences for the country's people and economy (IPCC 2007; ISPONRE 2009; Shaw 2006). Climate change is indeed evident in the form of increasing temperatures, as in the period between 1951 and 2000 Vietnam's annual average temperatures increased by 0.7 C. In addition, annual average temperatures in the four decades from 1961 to 2000 were recorded as higher than the annual average of the three previous decades from 1931 to 1960 (MONRE 2007). However, due to the length and diverse topography of the country, significant regional climate variations exist. As a result, a contextually based examination of the environmental conditions and impacts of climate change is necessary to understand the characteristics of the physical vulnerability in Tam Thanh (Adger 1999; Chaudhry & Ruysschaert 2007).

The greater region of this investigation is the province of Quang Nam. This province is characterised by a tropical and monsoon climate and suffers from water shortages and saltwater

intrusion during the dry season (February-July) and flooding and typhoons in the rainy season (August-January) (Son et al. 2009; Chaudhry and Ruysschaert 2007). The adverse impacts from extreme weather events and climate variability are highly determined by the geographical characteristics, even in a small area such as that of Tam Thanh commune. The location of the plots, land-use, level of slope, and the condition of the soil are all important factors determining the physical vulnerability of the different households. Because of this, each specific part of Tam Thanh commune is to a large extent affected by certain natural hazards and not by others. Nonetheless, three main natural hazards are in general impacting all parts of the commune: floods (heavy rainfall), water scarcity and typhoons.

Floods

The annual average rainfall in recent decades in Danang[20] has according to weather data from the Institute of Meteorology, Hydrology and Environment developed like the following table shows.

	Decade						
	1930s	1940s	1950s	1960s	1970s	1980s	1990s
Rainfall	1,919	2,223	1,970	2,095	2,019	1,962	2,434

Table 7.1: Annual average rainfall (in mm) in recent decades in Danang (Source: ISPONRE 2009)

What becomes evident from the table is the rather stable amount of annual rainfall yet with a relatively high record in the 1990s. This stable tendency is in line with several studies that highlight that the total amount of rainfall is not actually changing, but rather the intensity and variability increases with less rain in July and August and more in September, October and November (Son et al. 2009; Chaudhry & Ruysschaert 2007).

Focusing on the more recent data of the geographical area closer to Tam Thanh, the official records for annual rainfall in the town of Tam Ký[21] in the years from 2000 to 2008 also indicates that the amount of rain has been relatively stable but with annual variability as the years of 2000, 2005,

[20] Danang weather station (4 MASL; 16°03'01" north and 108°12'53" east) located 75 km north-west of Tam Thanh commune is the closest weather station where it has been possible to find rainfall data several decades back in time

[21] Tam Ký (10 MASL; 15°33'53" north and 108°27′10" east) is the capital of Quang Nam Province and is located 13 km north-east from the centre of Tam Thanh

2007 and 2008 received a relatively high amount (see figure 7.1 below)[22]. However according to the household survey the average amount of annual rainfall has decreased but the rain has become more intense. This is often leading to soil erosion and landslides in the hilly areas, as well as bank erosion because of changes in the water flow resulting in a reduction of the area of suitable agricultural land. These natural phenomena are moreover threatening vulnerable houses and for that reason people are in some cases forced to leave their homes to move to safer areas less likely to suffer from landslides and bank erosion.

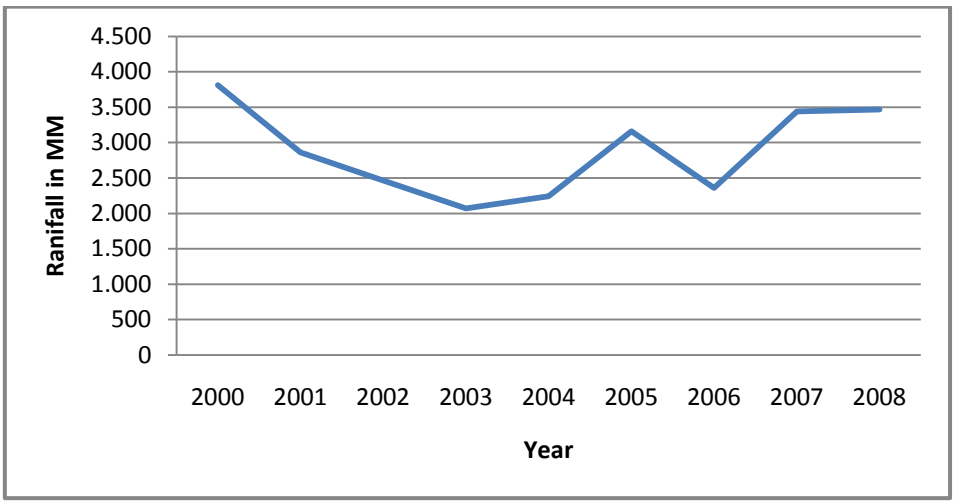


Figure 7.1: Yearly rainfall 2000-2008 in Tam Ký (Source: Quang Nam Statistical Yearbook 2002, 2004 & 2008

The vast majority of the annual rain (83 %) is falling in the months of August to January and in this period of the year floods occur. Especially October and November receive large amounts of rainfall mainly caused by typhoons from the South China Sea leading to flooding especially in the small valleys where water from the mountains is accumulated (Son et al. 2009; ISPONRE 2009).

[22] This variability may to some extent be influenced by El Niño which is characterised by variations in the temperature of the surface of the tropical eastern Pacific Ocean which results in reduced rainfall in Vietnam. The recent El Niño years was 2009-2010, 2006-2007 and 2002-2003 (IPCC 2007 B)

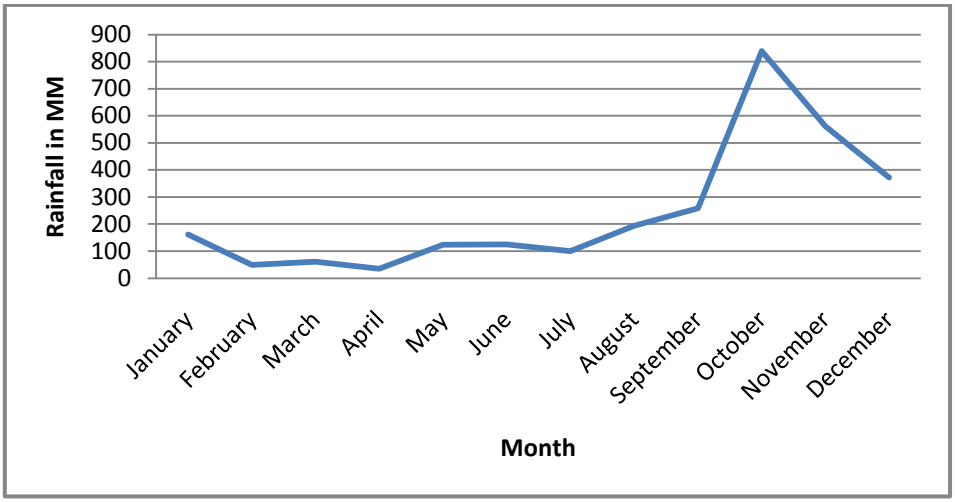


Figure 7.2: Yearly rainfall 2000-2008 in Tam Ký (Source: Quang Nam Statistical Yearbook 2002, 2004 & 2008

Rice production in these valleys is very vulnerable as heavy rain in August/September may coincide with the final period of the summer season, forcing people to harvest the rice before it is full-grown. Also rice plots close to Phu Ninh reservoir experience flooding during the rainy season when the water level in the reservoir increases as a result of the closing of the lock to control the water flow in the Tam Ký River. As a consequence the households with plots just next to Phu Ninh in thon 3 only have the winter-spring season resulting in reduced environmental entitlements. In this way flooding directly creates land scarcity because people need to find more suitable land to be able to generate a sufficient amount of rice.

There has been prolonged periods of water scarcity the last ten years and more severe floods, combined with the peak season having changed from autumn to early winter (Chaudhry & Ruysschaert 2007). This has resulted in a suggestion from district authorities already in the year of 2000 to reduce the three rice seasons down to two. From that year onwards the output from the short summer season in the months of April and May was dramatically decreased and the season was completely abandoned in 2005. Now there are two seasons from late December to late April (winter-spring) and late May to late September (summer-autumn) and no rice production in the months of October and November to avoid the impacts from heavy rain and flooding.

Apart from affecting the rice production in some parts of Tam Thanh and to some extent damaging young flood-sensitive acacia trees less than one year old, flooding also have severe impacts on the physical capital in vast areas of the commune. The only concrete roads are the main road stretching

through the commune from east to west and two short roads connecting the rubber farm and parts of thon 1 to the main road. Due to this fact there is a decreased mobility of the population who live in areas exclusively with dirt roads. During the rainy season, these dirt roads are very difficult to use and transportation time increases significantly.

In spite of these obvious adverse impacts from heavy rainfall, only 5 % of the households consider floods as being an important external factor influencing their livelihoods. Instead, the typhoons that coincides with heavy rainfall is regarded as having a dramatic impact on the people of Tam Thanh.

Typhoons

In the months of August to November typhoons regularly hit the commune. The period of typhoon landfalls has been more difficult to predict as it has gradually shifted from August/September to October/November from the 1950s to the 1990s (Chaudhry & Ruysschaert 2007; MONRE 2007; ISPONRE 2009), acting as a contributing factor for the change of the start of the winter-spring rice season from late November to late December as mentioned above. Moreover, typhoons have increased both in intensity (see table below) and impact (Phan et al. 2010; Son et al. 2009; MONRE 2007) and are by far the most disastrous type of natural hazards affecting the commune. An important aspect of typhoons is the little possibility of reducing the physical vulnerability towards this weather phenomenon unlike the impacts from water scarcity and floods. These facts are emphasised as 89 % of the households mentioned typhoons as being the single most important external factor impacting their livelihoods the last ten years (see figure 6.1); a response that to some extent probably is influenced by the strong typhoon that hit the area six months prior to the fieldwork.

	Level of typhoon						
Year	**7**	**8**	**9**	**10**	**11**	**12**	**13**
2003	2	1	1	0	0	0	0
2004	1	0	0	0	1	0	0
2005	0	2	1	1	0	2	0
2006	0	1	0	0	0	1	2
2007	0	1	0	0	0	3	0

Table 7.2: Intensity and frequency of typhoons in Quang Nam 2003-2007 (Source: Son et al.: 2010)

In September 2009 the area experienced the worst typhoon in many years when typhoon No. 9 (named Ketsana) from the South China Sea made landfall in Quang Nam province and brought with it severe natural and economic consequences to the area. The biggest impacts from strong typhoons like Ketsana are the destruction of trees especially acacia, whereas less intense but more frequent typhoons still result in heavy rainfall but considerable less damage to the trees. One strong typhoon can destroy an entire acacia plantation regardless of the age of the trees and consequently big parts of acacia collapsed or broke when Ketsana swept across the commune. Moreover, a vast number of houses were damaged, roofs blew away and also large numbers of rubber trees broke. All these impacts were still very obvious in the period of our fieldwork in February-April 2010 and a vast number of collapsed acacia tress were visible in the plantations waiting to be sold, collected and then transported to the wood-processing factories in Chu Lai industrial zone.

Collapsed acacia trees after Ketsana hit Tam Thanh commune

The empirical data points predominately to the fact that the direction of the wind and topographical characteristics determine which trees collapse, despite a few respondents being confident that all areas in the commune are hit the same. As the wind typically comes from the east/north-east, it is naturally the trees facing the northern and eastern side of the mountains that are the most vulnerable resulting in some plantations in these areas to lose around 80 % of the trees during the typhoon Ketsana. On the other hand, trees located in valleys and on the western and southern side of the mountains are less exposed to the wind. Consequently, the physical vulnerability towards typhoons is very different within the commune, nevertheless all the four villages seem to be impacted roughly the same.

Water Scarcity

During the dry season many areas in Tam Thanh commune suffer from lack of water. Also, because of changing rainfall patterns in some periods of the rainy season, water scarcity is occasionally a problem. In general the water amount reaches the highest level in November-December and the

lowest in May-June and in this latter mentioned period large parts of the commune suffers from insufficiency of water despite the presence of the two big reservoirs, Thai Xuan and Phu Ninh, as they are primarily used to provide water for Tam Ký City and Chu Lai industrial zone (Son et al. 2009; Quang Nam Statistical Yearbook 2002, 2004 & 2008). Because of low physical capital (in this case pumps) and the absence of legal access rights, several rice plots in thon 3 lack water despite the fact that the fields are located just next to Phu Ninh reservoir. As a result of this thon 3 has a double exposure to climate variability in the form of severe impacts on the rice production from both water scarcity and floods leading to a very low yield in several cases.

Nonetheless, the adverse impact from water insufficiency on the production of rice is also a problem for the other parts of the commune. 33 % of the interviewed households consider water scarcity as being an important external factor influencing their livelihood strategies and especially the rice production. For many respondents, lack of water is seen as the main obstacle to achieve a sufficient yield of rice and even under normal weather conditions the fields suffer from water scarcity in both rice seasons. Moreover, the periods of low levels of available water are becoming more intensive and last longer because of the growing variation in rainfall and may also be due to increasing evaporation triggered by rising temperatures (Phan et al. 2010; Chaudhry & Ruysschaert 2007).

This absence of rain also results in problems concerning the planting of acacia during the period of spring. At the time of the fieldwork, many farmers were complaining about the lack of sufficient rainfall which forced them to wait to plant the small acacia trees, even though the months of March-April normally is the time of planting acacia. For the people with acacia plantations highly affected by the typhoon Ketsana in September 2009 and consequently in great need of planting new trees, the absence of rain acts as yet another climatic impact affecting the acacia plantations at different times during the year.

Future Climate Scenarios

In the future the frequency and intensity of the above mentioned natural hazards are very likely to increase further as a consequence of climate change (Phan et al. 2010; Chaudhry and Ruysschaert 2007; Oxfam 2008). Projections for increasing temperatures in the central part of Vietnam compared to 1998 levels is a 1.1 C increase in 2050 and 1.5 C in 2070 (ISPONRE 2009). Annual

rainfall will increase in total, but patterns will change significantly resulting in more rain in the rainy season and less rain in the dry season. For instance, according to projections from the Danang weather station using an average emission scenario (A1B scenario), already in the period of 2011 to 2020 rainfall will drop 16.3 % in summer time and 35.1 % in winter in comparison to averages from 1971 to 2000, meanwhile the months of spring and autumn will experience a 13.2 % and 49.1 % increase respectively (Phan et al. 2010). Along with the more extreme weather the intensity and frequency of typhoons are also expected to increase considerable (MONRE 2007; Phan et al. 2010; Chaudhry & Ruysschaert 2007).

Summary

The commune of Tam Thanh is highly physically vulnerable to typhoons and water scarcity and to a lesser degree floods. Impacts from typhoons are especially the collapse of acacia and rubber trees and the damaging of houses. Changing weather patterns have resulted in more heavy rainfall as well as prolonged periods of water scarcity which influence the crop calendars by reducing the rice season from three to two per year within the past decade and furthermore impacting the planting and harvesting of acacia trees. In this way the process of obtaining environmental entitlements is constrained by natural hazards and change in rainfall patterns. Moreover water scarcity results in a low yield from rice while heavy rainfall reduces the general mobility and transportation of acacia.
Climate change impacts has emerged in Tam Thanh in the form of increased intensity and frequency of typhoons and changing rainfall patterns, leading to a more unevenly distributed amount of annual rainfall with prolonged periods of floods and water scarcity as an outcome. In addition, projections forebode that natural hazards are set to become more intense and frequent as a consequence of increasing temperatures. Hence, natural hazards and changing weather patterns already have a significant impact on the natural resource management practices, and this tendency will increase as a consequence of climate change.

Chapter 8: Natural Resource Management Practices

A high dependency on natural resources which, to some degree, are physically vulnerable towards natural hazards and climate change makes the management practices of these resources highly relevant. Thus, this chapter examines the natural resource management practices and the relation to vulnerability with the aim of indentifying differences of social vulnerability within the population. Because the environmental conditions which influence the management practices are not only determined by the climate, but also shaped by historical management practices. This chapter concludes with a brief discussion on how agricultural activities have impacted the natural resource base in the past.

Historical Management Practices

During the Vietnam War (1955-1975) the district of Nui Thanh was strongly affected by combats and violence and was therefore partly abandoned until people began to return to the area from 1975 onwards (Interview with Vice President of the commune). In that period, big areas of natural forest in Tam Thanh were cleared and subsistence agriculture started along with tea production managed by Duc Phu Company (a state-owned company), which covered an area of 980 ha. During the 1980s, this area was partly transformed into pineapple production but abruptly halted in the beginning of the 1990s because the biggest purchaser of pineapple, The Soviet Union, collapsed. From there on, the Quang Nam Rubber Group, which then took over the land of Duc Phu Company, started planting rubber trees and from 2009-2010 this included acacia (Interview with Quang Nam Rubber Group). The people in the commune also grew pineapples during the 1980s together with cultivation of tea and cassava but shifted almost all cultivation, apart from paddy rice, to acacia in the period of 2003-2005. Today, rice and acacia, which take up the wetlands and primarily the lower parts of the upland respectively, are the two main natural resource management practices of the population, whereas rubber plantations are owned by the state but managed by the farmers in the area. Moreover, cassava is intercropped on the acacia fields on a considerable scale, whereas other crops such as pineapple and beans only are cultivated to a small degree.

Acacia

The cultivation of acacia trees has significantly increased since the beginning of the new millennium and thereby dramatically transformed the geographical landscape of the commune. Today, acacia production is by far the most important income source from natural resources, and nearly every household (35 out of the total respondents) have an acacia plantation varying in area from 0.02 to 14 ha. The plantations are mainly located on the lower part of the hillsides, spread out in the entire commune and are typically 1-4 km away from the household. Each household has between one and 12 plots of acacia with an average of little more than three plots, in many cases located a few kilometres away from each other. Almost every farmer plants all their trees in the same year and for that reason income from sales is only generated every 4th to 7th year depending on acacia type or when farmers choose to harvest[23]. Both planting and cutting usually take place during the first part of the dry season to avoid impacts from floods and typhoons.

There exist in general two different types of acacia in the commune: A. Auriculaeformis with small leaves and A. Mangium with big leaves. The former is used for producing woodchips mainly used for paper production and is by far the most common type in the commune for several reasons. In general, it grows faster than the A. Mangium and can be harvested after only 5-6 years, resulting in a shorter period for the people to wait for a significant part of their total income. Furthermore, this shorter turnover also reduces the risk posed by typhoons, ultimately leading to a safer investment. Moreover, the A. Auriculaeformis can be planted closer to each other, thereby increasing the yield even more. Most importantly, the smaller leaved acacia are very easy to sell to the wood-processing factories nearby in Chu Lai industrial zone, and for that reason the commune authorities has strongly recommended people to plant the tress (Interview with commune).

Acacia Auriculaeformis 2 to 3 years old

[23] Several instances of farmers selling their acacia already after four years for a lower price before they are full grown have been observed

The A. Mangium is a bigger type of acacia and is primarily used for furniture. It is harvested after approximately seven years and more space between each tree is required for them to grow optimally. Consequently, the investment is both more long-term and more at risk towards typhoons. For that reason, only a small portion of the population, with relatively strong financial capital, invest in the production of big leaved acacia (FAO.org; Acacia-world.net).

Several cases of a third type of acacia have been observed in thon 4 and thon 1. This tree is a hybrid between A. Auriculaeformis and A. Mangium and was introduced to the farmers through the governmental reforestation initiatives, Program 327 and Five Million Hectare Reforestation Project (5MHRP). The bulk of the plantations of this hybrid has been established in the south and central provinces of the country but is however less common in Quang Nam (Bueren 2004). It possesses several important features that makes it very interesting and profitable for future planting in the commune. Apart from growing significantly faster than the two other types (can be harvested after 4 years), the capability in soil improvement is also enhanced. Furthermore, its volume is bigger and the pulping efficiency is higher, ultimately resulting in better paper quality. Lastly, the root system is deeper and therefore, the tree is less vulnerable to collapse during strong winds (Bueren 2004; Acacia-world.net). This type of acacia works as an excellent example of how a changed natural resource management practice, in the form of shifting to a more short-term investment, can reduce physical vulnerability, especially towards typhoons, and in this way facilitate the process of adapting to climate change.

The introduction of acacia in Tam Thanh started very slowly in the mid-1980s, where only a few number of people gradually began to plant the trees. At that time no wood-processing factories existed in the district, and for that reason the market was unsecure, making it difficult to sell the acacia. Approximately eight years ago, the first wood-processing factory was built in the Chu Lai industrial zone and a new market for acacia began to take form. This fact, along with strong encouragement from the government to start acacia production as well as excessive agricultural extension support and the construction of the main road are the key reasons for this significant land-use change that has taken place in the commune. Strong government influence has been demonstrated through the national forest rehabilitation process and the implementation of Program 327, which lasted from 1993 until 1998, and its successor the 5MHRP[24] from 1998-2010 (Jong et

[24] Also referred to as Decision 661 projects (Jong et al. 2006)

al. 2006). Program 327 introduced the trees to a few farmers in the mid-1990s and, with the continued support from the 5MHRP, an intensified process of acacia production unfolded, ultimately leading to a production boom in 2004-5. As part of these governmental initiatives, free seeds and fertilisers were provided to the farmers, as well as guidance on how to plant and manage the trees. In return, the government required a share of the income from the sale usually set to 30 % (Jong et al. 2006).

With buyers in the form of the wood-processing factories, a stable market was also created, resulting in increased confidence that acacia was a relatively secure investment that could generate more income compared to former agricultural cultivations. This fact is illustrated from figure 6.3, which shows that 31 % state the reason for changing to acacia was to be able to generate more income.

During the last five years the production of acacia has exploded in Quang Nam, which may lead to falling prices as supply exceeds demand. Price fluctuations on acacia have also been expressed as being of major concern by many respondents. In a similar vein, several experts state that the year in which the households chose to shift to acacia may play a role in their future success as acacia producers (Interview with FINNIDA and CARE Denmark). When prices decrease, it is often the most established actors that consolidate and endure, while the people new in the business suffer. In Tam Thanh, it has become obvious that the people with a relatively high level of education (see figure below), strong financial capital and access to relevant information changed to acacia before the people with limited resources, less educational attainment and with limited or no safety-net.

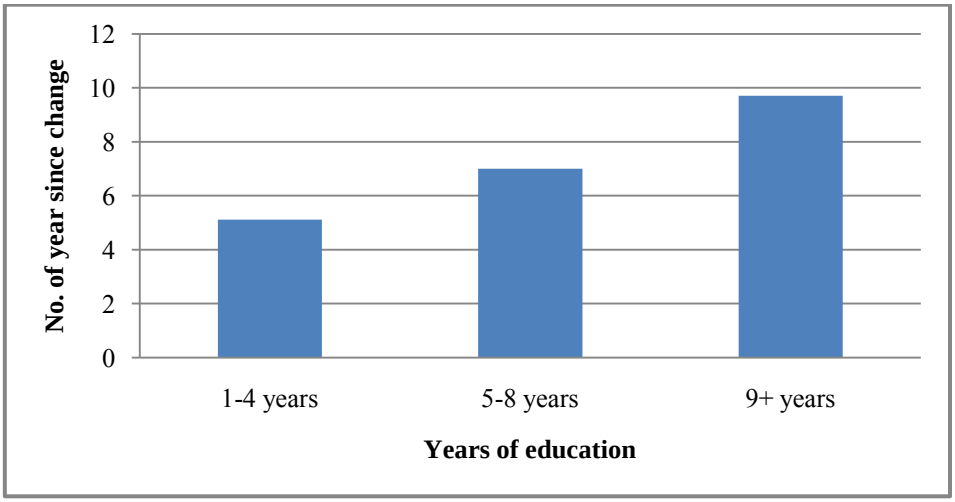


Figure 8.1: Level of education and land-use change

Within the last year, the price of acacia has in reality been falling a lot mainly due to Ketsana and the global economic crisis. However, much evidence points to the fact that this price drop is only temporary and that future demand for acacia in Vietnam will increase sharply (wrm.org.uy; thanhniennews.com; glgroup.com). Thus, the importance of an early change to acacia seems limited. Moreover, no connection between income-level and the year in which a switch to acacia was made has been found.

Another reason for the change to acacia is the strong influence people in the same geographical area have on each other. When one household alters its natural resource management practices, the households nearby tend to follow and the shift to acacia was here no exception (Interview with FINNIDA and WWF Vietnam). The fact that 18 % of respondents pointed to other people's change in land-use as an influencing factor in their own shift to acacia production demonstrates this very notion (see figure 6.3). This domino effect started in the beginning of the new millennium and accelerated between 2004 and 2005, as mentioned above. Moreover, when almost all households changed land-use the market for other agricultural products diminished and as a consequence the shift to acacia further intensified.

The introduction of acacia has significantly changed the livelihoods in Tam Thanh over the last five years. Before, the majority of the population primarily cultivated cassava, tea and pineapple, all more labour-intensive compared to acacia production. In contrast, after the acacia tree is planted, it requires almost no maintenance except from the cutting of branches and clearing of small redundant trees after one year, in order for the remaining trees to grow faster. In addition, no pesticides need to be applied, and only a few households use fertilisers, all together resulting in a very low labour requirement until the time of harvest. If the tree is harvested after five years, it even produces seeds itself, therefore, no planting of new trees is then necessary. Apart from being less labour-intensive, the acacia tree is also able to grow in relatively poor quality land and only the people with the most marginalised fields need to apply fertilisers. Many households complained about the condition of their land and the lack of nutrients; for that reason, acacia is a very suitable crop, as it possesses the important environmental service of enriching the soil. Another crucial environmental service of the acacia is the control of erosion and several households also expressed a considerable decrease in the frequency and intensity of this problem on their plots with acacia trees (FAO.org).

Acacia production has generally improved the economic situation in Tam Thanh. Income from sales and the casual work that is generated from planting, managing and especially harvesting the trees have contributed significantly to the economy of the households and allowed more time to a diversification of income sources. The level of social vulnerability has in this way been reduced. Nonetheless, considerable differences exist in profits received per ton of acacia due to the age of the harvested trees. There are also differences in the amount of expenses used on harvesting determined by the area of the plantation and the distance to the main road. Hence, the environmental entitlements derived from acacia production are not equally distributed among the population in Tam Thanh. Due to this and the general income differences within the commune, natural hazards such as typhoons impact farmers differently. Where middle income households endowed with a great amount of acacia are highly impacted in absolute economic terms poorer households, often with a smaller plot for acacia cultivation, suffer more as their losses are relatively higher. Apart from living in what is often weakly constructed houses, poorer households are also more dependent on income from acacia and therefore more socially vulnerable whereas wealthier farmers with larger plantations consequently are at risk of economic losses that are potentially much higher.

Despite the relatively even physical vulnerability towards typhoons, it then becomes clear that the level of social vulnerability differentiates between the households. It seems impossible to significantly reduce acacia's high level of physical vulnerability towards typhoons that will only grow in intensity and frequency as a result of climate change. However, altered management practices such as the adoption of the hybrid tree and cyclical annual planting for shorter rotation intervals can to some extent mitigate against this vulnerability.

Paddy Rice

Almost all households in Tam Thanh produce rice, and the households that do not have a rice field are households categorised as middle income. Households keep their rice fields until they have a secure and sufficient income to buy their rice which underlines the importance of rice as a subsistence crop. There are very few people that sell their production of rice on the market, but most people exchange some of their rice production for vegetables and meat so that the production of rice fulfil the daily food consumption of the household. In that respect, rice production plays a crucial role as far as the social vulnerability of the farmers in Tam Thanh is concerned. Production

of rice works as a safety net, enabling households to cope with external pressures and shocks such as price fluctuations experienced with the production of cash crops like acacia.

Paddy rice in a valley

The measurement of a rice field is one *sao*, the equivalent of 500 m^2, with an average of 4 *sao* of paddy rice per household in Tam Thanh[25]. The past years have shown a reduction in the number of seasons for rice cultivation. Earlier, rice was planted three times a year, whereas now it is only two. This was a consequence of a suggestion made by the district authorities in 2000 to avoid the rainy season, which according to the district authorities results in higher yields as the crops are not impacted by severe rainfalls. Furthermore, the strategy also reduces the investment load. While harvests have dropped from three to two times a year, provincial annual yield have increased from 296,976 tons of rice in 1993 to 380,528 tons today, which represents an increase from 2.5 tons to 4.6 tons of rice per ha (Quang Nam Statistical Yearbook 2002 and 2008). This incredible development has, among other reasons, been accomplished by new technology, the development of new varieties and a transfer of management authority to the household unit (Schroll 2010; Folving 2007). It is a significant achievement in the production of rice, which is also felt in Tam Thanh.

Nevertheless, the production of rice is still exposed to many setbacks. The production is highly concentrated in the valleys, typically situated close to rivers, and many farmers express concern that parts of their fields are consumed every year by the river in the rainy season. Bank erosion is therefore a considerable problem for the cultivation of rice, as the area for production is reduced. Pests, diseases and particularly rats are other major problems for households producing rice. Moreover, the farmers find themselves in despair, as they cannot find the means to control the rats. Pests have been increasing since the introduction of chemical fertilisers, which unfortunately attract more pests. This year is the first year that the farmers experience significant problems with disease, and they claim that it is the increased amount of sun that is causing it. Pests and diseases can to some extent be controlled by the use of pesticides which has significantly increased in the past decade. The claim that more sun exposure is the cause of the increase in disease is not verified,

[25] There is no upland rice in Tam Thanh commune

however, water scarcity increases pest and disease infestation, which also correlates with the scarcity of water that many farmers experience (ADB 2009). Water scarcity is a major problem for most households producing rice, and only 20 % are not lacking water as they have access to one of the four reservoirs located in thon 1 and 2 (Interview with Vice President of the commune).

The farmers receive guidance from the agricultural extension service under Nui Thanh District. The agricultural extension service provides a folder every year containing guidelines on when and what to plant, how to maintain the field and instructions regarding the use of fertiliser and pesticides (see appendix C). Furthermore classes are held where people are taught new techniques and how to cope with weather and diseases. The guidance is, according to the district, based on the experiences and lessons learnt on the characteristics of the crop and on weather forecasts. The researchers at provincial level continuously study rice and try to find more drought resistance species. The district provides the farmers with seeds; the poor get them for free and others have to buy them though at lower prices than at the market. Generally, the farmers do not know what kind of seeds they receive but follow the guidance on when and how to plant the seeds. This implies that there is a top-down process in terms of agricultural adaptation to shifting circumstances such as weather and the spread of diseases. The agricultural extension service is therefore the institution that is instrumental to this hierarchical process.

As such, the farmers depend on the agricultural extension service, and it is therefore worth noting that a well functioning and professional extension service can play a positive role in reducing physical vulnerability by developing higher yielding rice varieties, such as those that are more drought resistant. This is relevant because the production of paddy rice influences social vulnerability for poor people as they have few other livelihood alternatives. Furthermore, the few alternatives that are available are not entirely risk free, as the example of acacia production shows; a cash crop liable to price fluctuations and industrial production decisions in Vietnam.

Other Management Practices

Cassava

Cassava is one of the most important crops for poor rural people around the world as it is highly tolerant to changing climate and soil conditions and because it can be left in the ground, ready for harvest, for a considerable amount of time until needed (Silvestre 1989). Cassava has also played a

Cassava intercropped with young acacia trees

significant role in Tam Thanh, but in the later years cassava has been changed for acacia because of the low income cassava provides. In addition, acacia trees more efficiently reduce surface water flow and thereby mitigate against erosion and is hence better for the soil quality (Adger et al. 2005). A new type of cassava has been introduced that makes it possible to intercrop with acacia the first year, whereas the earlier type of cassava grew too big to allow enough sun to penetrate for the young acacia trees and thereby killing them.

Today cassava is widely intercropped on the acacia fields in the first year and is mainly used for forage for livestock or is sold and transported to Nui Thanh where it is sent to factories that produce glutamate. In such way cassava provides an extra set of entitlements from the acacia fields. Cassava is no longer an important crop in Tam Thanh, but because of the possibility of intercropping many people still cultivate it as an extra support to sustain their daily lives.

Rubber

Rubber is widely grown in Tam Thanh commune but all belongs to the state-owned Quang Nam Rubber Group and the company is therefore the only producer of rubber in Tam Thanh. Yet it has a high influence on the households in the commune, as many work for the company collecting rubber. In total, 350 people are employed for the Rubber Group and the company is in fact planning to expand in the coming years.

Rubber trees after Ketsana ready for tapping

Hence more people can be expected to be employed by the Rubber Group in the future. The 350 employees have obtained long-term contracts, managing and collecting the rubber for the company. Rubber can be collected ten months a year, while for two months the trees have to regenerate, and it is therefore a stable income for the contract-holders. Furthermore, it lessens the impacts from

stresses and shocks that may be experienced with respect to their alternative income sources in this way reducing social vulnerability. Few have expressed desire to start producing rubber themselves, as it is expensive to start up and because it takes eight years before the collection of rubber can begin. So even though the profit is more lucrative, most are reluctant to initiate personal rubber production. Rubber production, like acacia, was hit hard by Ketsana and many trees broke underlining the risks of such a capital-intensive and long-term investment. The aftermath of Ketsana precipitated in the introduction of a new technique for the production of rubber, where the trees are cut down to four meters after 3 years, to avoid collapse during typhoons..

Livestock

55 % of the interviewed households have a pig, cow or buffalo. For most people livestock in the form of buffalos are essential for their livelihood, as they are used to plough the rice fields. It is, however, only 17 % who own a buffalo (see figure 6.2), presumably because the cost of buying and having a buffalo are quite high as it eats one cubic meter of straw per day[26]. The farmers that do not own a buffalo have to hire them from others in the commune and the cost is around 300,000 VND for a buffalo per planting or harvest of a *sao* (Schroll 2010). More farmers have pigs (22 %) and cows (30 %), generally for the purpose of selling them later, while the excrements are used as fertilisers for the fields. However, experiences in recent years have shown considerable problems with diseases, resulting in the loss of livestock. In spite of this fact, 12 % of the respondents have taken loans with the purpose of buying livestock (see figure 6.6). Furthermore, a large proportion of the households that name capital insufficiency as the major obstacle to generate income in the future explain that they would use additional sources of money to invest in livestock. A significant proportion of the households consider livestock as an alternative source of income. It is mainly poor households that possess and consider investing in livestock, and it is therefore a livelihood strategy closely related to poor farmers in Tam Thanh. This livelihood strategy reduces social vulnerability as it is a way to diversify.

Impact on Natural Resources

The general development in Vietnam has led to an increased environmental degradation (WWF 2005 A). One consequence of this has been the drop in forest cover from 40 % in the 1960s to 26 %

[26] Straws from a rice field of two and a half sao can feed a buffalo for 3-4 months (Schroll 2010)

in 1997. The loss in forest cover eventually leads to soil degradation and exacerbates flooding due to an increased variability in water flow (Adger et al. 2005). This is also the case in Tam Thanh where the natural forest cover has almost been completely cleared during the 1970s and 1980s. Today, the farmers are complaining about soil degradation and bank erosion that results in reduced agricultural output. Though the farmers view bank erosion as a result of changed weather patterns, causing less but more intense rainfalls, part of the explanation lies with the natural resource management practices that unfortunately exacerbate erosion, as crop cultivation on the slopes usually do not reduce water flow to the same extent as natural forest previously was able to do. Another example is the straightening of rivers that has increased the velocity of water flow, also exacerbating erosion (WWF 2005 A). Also the construction of Phu Ninh reservoir has had great influence on the natural resources in Tam Thanh through the dramatic changes in water level.

The change to acacia trees, however, has helped reducing the environmental degradation in the commune, as they are more efficient in reducing water flow than pineapple and tea, which were mainly grown on the slopes before. Furthermore, acacia improves the quality of the soil that otherwise is in a poor condition. Cultivating acacia trees, nonetheless, increase impact from typhoons, since these relatively tall trees are more vulnerable to strong winds than pineapple plants, for instance. Additionally, the perennial circles in which acacia trees are produced increase physical vulnerability to typhoons. Climatic shocks such as typhoons and severe rainfalls are therefore not the only reasons for the increased physical vulnerability that the households in Tam Thanh are exposed to.

Summary

The two main natural resource management practices are paddy rice and acacia cultivation Cassava and breeding of livestock are practiced to a less extent, while rubber is cultivated in large scale by Quang Nam Rubber Group. The production of acacia has increased significantly since the start of the decade, and today it is by far the most important income source. This significant increase in production has been strongly encouraged by the state through different afforestation programmes and by the construction of wood-processing factories in Nui Thanh. The trees are generally planted at the same time and harvested after approximately five years - making the production physically vulnerable to typhoons. Acacia trees, however, have many advantageous characteristics such as erosion-control and a low level of maintenance, allowing the farmers to simultaneously pursue more

casual work. The entitlements obtained from acacia production are not equally distributed, as there are differences in profit received per ton of acacia. Depending on land size and the pre-existing economic situation typhoons have different impact on the households so people with much land experience great economic losses whereas poorer households suffer more due to a higher level of social vulnerability.

Rice cultivation is essential for most households, as it represents a subsistence production and works as a safety net. The production has been reduced from three to two seasons due to more intense rainfalls, nonetheless yields have increased. The cultivation of rice is exposed to many problems such as bank erosion, pests, diseases and rats. Moreover, water scarcity is deteriorating and only 20 % of households do not lack water. The farmers receive guidance from the agricultural extension service that provide knowledge on when and how to plant and furthermore develops and provides new seeds.

The changes in climate that people complain about are exacerbated by the natural resource management practices that lead to environmental degradation, such as soil erosion. The change to acacia trees, however, has helped these problems as acacia reduce erosion and furthermore improve soil quality. Acacia production places farmers at a higher risk, in terms of the impacts from typhoons, as the trees are highly affected by these strong winds.

Chapter 9: Access and Endowments

In the commune of Tam Thanh where agriculture and forestry have an essential role for the livelihood situation, endowments over and access to natural resources are essential factors influencing social vulnerability. Hence this chapter investigates the division of endowments in the commune, the legal land-use rights of these endowments and also examines physical capital and access to financial capital. Furthermore access and endowments will be discussed in relation to natural resource management practices and vulnerability.

The Division of Land

In Tam Thanh the households on average have 2.4 ha of land ranging from 1.1 ha in thon 2 to 3.9 ha in thon 4 (see figure 6.5) and with individual differences ranging from 0.02 to 14 ha, though with the majority possessing between 0.5 and 2 ha. There is, however, a major exception. Quang Nam Rubber Group, an affiliate of the state-owned enterprise Vietnam Rubber Group, is with its 2000 ha all located in thon 4, by far the largest landowner in the commune. Quang Nam Rubber Group took over from Duc Phu Farm that started clearing land in Tam Thanh in 1976 and went into operation that same year. Duc Phu Farm started out as a pineapple and tea plantation for export to the Soviet Union, but after the collapse of the Soviet Union the demand dropped dramatically and Quang Nam Rubber Group took over and changed the production to rubber (Interview with Vice President of the commune and Quang Nam Rubber Group).

Today, the Rubber Group uses 980 ha for the production of rubber and the rest is used by the local people for the production of acacia, but in reality the land belongs to the rubber group (Interview with Quang Nam Rubber Group). As the demand for rubber is increasing, prices for rubber are going up, as for instance companies such as Vinachem, the biggest tube and tire producer in Vietnam, are struggling with shortages of rubber for production (vietnamnet.vn). Therefore, Quang Nam Rubber Group is planning an increase in the production of rubber in Tam Thanh and consequently in an expansion of planted rubber from the 980 ha today to 1200 ha in the year 2015. This expansion entails that some of the local farmers using the land that the Rubber Group has not been using for years will have to give up their land. The Rubber Group takes over the land when people have harvested their acacia trees and the farmer losing land is then given compensation

(Interview with Quang Nam Rubber Group). The compensation has been subject to some dispute between the local farmers and the Rubber Group as the local farmers complain they get too little. The Rubber Group informed that they give 10 - 12 million VND per ha and first priority to the farmers to manage the rubber trees, but the farmers contend that they only get between a few hundred thousand and a few million VND per ha. On that background it is difficult to estimate the actual economic compensation. However, the management of rubber trees that the farmers are offered is a compensating factor. Although the amount is little, it must be considered stable and thereby a reliable income alternative to the acacia production.

The villagers, in the same way as Duc Phu Farm, started clearing the land just after the dramatic end of the Vietnam War, and today the legacy of those few years are still to be seen. The people that first cleared and cultivated a patch of forest has often kept cultivating it and the division of land that happened then is to some extent the cause of the division of land today. The amount that people cleared depended, according to the commune, on the amount of work that people did. Some argue that the ones that did not clear sufficient land were "just lazy", but the ones that did not clear sufficient land explain that they were hindered because of, for instance, bad health or had to look after their children at the time and therefore were not able to clear as much land. Others did not return quickly enough after the war and upon return found that the land was already taken. How the land was divided in the commune is on that behalf a matter of some confusion. Some farmers have even been clearing forest in 1995 and one respondent has been clearing land as late as the new millennium. Despite these stories, most insist that it has not been possible to increase the amount of land. It is furthermore evident that the land cleared in later years primarily happened in thon 4 and seems to be a result of the unused land owned by the Rubber Group. In thon 3 there were restrictions on the clearing of land from 1980 and onwards when Phu Ninh went into operation, and so the forest in this area became protected to avoid siltation of the reservoir. A significant part of the land in thon 3 is comprised of the Phu Ninh Protected Area, resulting in a reduced agricultural area and scarce endowments for the farmers in this thon (FGD 2). Generally in the commune, it seems apparent that few have cleared land in the past two decades, and today there is little natural forest left, apart from a narrow strip located along the western border of the commune (see map 2.2) which is protected by the forest management committee (FGD 2).

Land scarcity is generally expressed as one of the major obstacles for a reduction of social vulnerability (Adger 1999; Leary et al. 2008) and is in Tam Thanh expressed as a serious constraint for generating sufficient income which particularly manifests itself in thon 1 and 2 (see figure 6.5). These are also the smallest thons while simultaneously inhabited by the most people which results in lack of endowments. There is yet a general perception, also from the commune, that there are too many people and not enough land. However, taking into account that the Rubber Group owns 2,000 ha of the 5,400 existing in the commune, it should be acknowledged that the distribution of land is a more reliable reason for land scarcity than the total amount of land. This entails that when the people of Tam Thanh stress scarcity of land as an absolute problem it is more accurate to acknowledge the uneven distribution of endowments as the major obstacle for reducing social vulnerability.

More people move to the commune while few leave resulting in a slight increase in population (FGD 1; Interview with commune). Few sell their land and when people get too old to manage their land, it is usually inherited by their children because few young people migrate to the cities. Therefore it is therefore difficult to buy land. There are, however, cases of land being traded when people have no one to inherit the land or when the people are very poor and need money. There is a general understanding that there is no land for sale. However, it seems to depend very much on the financial capital that the individual villager has access to, as the poorer households do not have the money to buy land at current prices. Individual land rights and trading of land is though a relatively new thing in Vietnam and was first officially recognised with the land law of 1993.

Land Rights and Financial Accessibility

When Vietnam introduced a whole range of reforms with Doi Moi in 1986, it was also the beginning of land reforms (Quy et al. 2003). In 1988, a land law abandoned collective ownership and individual households were granted land-use rights, though the land was still to remain the property of the state and trading with land was not allowed. With the land law of 1993 this changed. The land law granted five rights to the household: the right to transfer, exchange, inherit, rent and mortgage the land (Land Law of Vietnam 1993; Quy et al. 2003). Yet the land was still property of the state, but could now be leased for agricultural purposes through long-term contracts of 20 years

for annual crops and 50 years for perennial crops[27], where these five essential rights were given to the individual holder of a contract, thus making it close to private property. A single landowner is however not allowed to own more than 30 ha and the two largest landowners in Tam Thanh own 13 and 14 ha respectively.
The idea was that these five rights and the creation of a market for land would produce more and larger land transactions and thereby a better allocation of land that ultimately would translate into higher yields. Furthermore, it could be expected that there would be a transfer from less productive to more productive farmers that again would increase the yield. This actually happened and Vietnam went from an importer of rice to being the second largest exporter of rice today (Quy et al. 2003; Castella 2006; Papdemetriou 2000; Christ & Kloss 1998).

When households register their land-use rights they get a land-use certificate popularly known as the Red Book. In Tam Thanh all villagers have a Red Book for their rice fields (annual crops), and most are either waiting for or holding a Red Book for forest land such as the acacia plantations (perennial crops). As seen in table 6.1 there are though great differences within the different thons. None of the households in thon 4 have been registered, though some have had their land measured, but are waiting to receive the Red Book certificate. On the other hand, thon 3 has the highest number of registered households. As thon 4 is the richest thon in the commune and the one where most people from the commune administration live, this is surprising particularly when it is seen in comparison to thon 3 that is the poorest and most isolated thon in the commune. The other two thons are, like thon 3, quite far in the progress of obtaining Red Books for the households. That thon 4 has the lowest number of registered land-use certificates nonetheless has a simple explanation. The Rubber Group is the owner of the land, and although the land has never been used by the company it is not interested in selling the land; on the contrary, the company is actually starting to take it back.

Though the households in thon 4 consequently have a more insecure land tenure, it does not seem to influence their land-use as all interviewed households in the thon have acacia. This is rather surprising, given that insecure land rights usually lead to less productive yields as the incentive to invest is lower (Quy et al. 2003). It could therefore be expected that fewer would invest in perennial crops such as acacia. Waiting for the Red Book is, however, not impacting significantly on the

[27] The long term contracts were reconfirmed with the land law of 2003 (Land law of Vietnam 2003)

security of a person's endowments as the land is socially acknowledged within the commune, and it is a question of time before the people waiting will obtain the Red Book. Moreover, the Quang Nam Rubber Group only takes the land back when people have cut their trees, and they are therefore not in risk of losing their agricultural investment. The Red Book might however still have influenced general natural resource management practices in the commune. The certificates give access to cheap loans in the Social Policy Bank and thereby facilitate access to financial capital that the farmers otherwise might have struggled to obtain, as well as to pay back (Interview with CARE Denmark). This has, as seen in figure 6.6, entailed that a little more than 50 % has taken out a loan. Many have invested in livestock and acacia hoping to increase their production and income.

The more secure endowment situation and easier access to loans have supported the change from pineapple to acacia, with the result that the livelihood of the villagers in Tam Thanh has improved. The change to the more long-term and capital intensive investment that perennial crops are, conversely increase the risk of investment. Ketsana was the perfect storm to prove this. As mentioned earlier, approximately 70 % of the acacia trees in Tam Thanh were damaged during Ketsana and many farmers lost a harvest of trees planted up to four or five years earlier. Therefore, the investment lost was much larger than had it been pineapples, which are an annual crop. So while general social vulnerability might have decreased due to more secure endowments and better access to financial capital, vulnerability towards weather extremes seems to have increased.

Access to Market

The large production of cash-crops has also created a strong dependence on the market, and consequently the market situation is an essential factor influencing the livelihoods of farmers in Tam Thanh (FGD 1 & 4). Volatile market prices is often a significant stress factor for rural people producing cash crops where the dependence on the market makes them vulnerable to market fluctuations to which they have no control (Adger 1999; Thomas & Twyman 2005). This is particularly the case in Tam Thanh where a large percentage of the income depends on one crop, namely acacia. The change to acacia was only made possible because there was a purchaser for the acacia trees, which are the wood-processing factories in the Chu Lai industrial zone that were established in 2003. The local villagers are complaining about the change in prices, as they used to get 700.000 VND per ton and now only receive 550.000 VND per ton on average. However, most

are positive that the prices will increase again, and the general market situation in Vietnam does seem to support the hopes of the locals.

Demand for paper and wood is increasing, and the availability of paper in Vietnam is critical resulting in an increase in the price of paper, which in turn influences the prices for e.g. books and newspapers (thanhniennews.com). In addition, a large proportion of the paper production is used for packaging due to the expanding export market, exemplified by a growth rate in GDP of around 7 % from 2002 to 2009 (cia.gov; Lang 2007). Furthermore, Vietnam is located close to China and Japan, which are the largest importers of Vietnamese wood chips with China outranking Japan as the biggest importer; in 2004, Vietnam was supplying 17 % of China's total import of wood chips (cgiar.org). This inevitably implies that the manufacturing of wood chips competes with the Vietnamese paper industry for the supply of raw materials (cgiar.org). This has caused an increase in the investment in the pulp and paper industry in Vietnam. Among others, the Saigon Export-Import Company has invested US$ 150 million in a 115.000 tonnes-a-year pulp mill in Nui Thanh district (wrm.org.uy). So although the villagers in Tam Thanh are complaining about unstable and falling prices, there seems to be a relative secure demand and access to the market for the production of acacia in the coming years and hence the market is not expected to be a major stress factor for social vulnerability in Tam Thanh.

Quality of Land and Access to Water

The amount of land is not the only factor influencing the endowment situation of a household. There are significant differences in the quality of the land in Tam Thanh caused by various reasons. Hardly any problems with erosion exist in the commune, and many respondents informed that it is only in more mountainous communes with steeper slopes where there are problems with erosion. There are, however, occasions where people have had problems with erosion. When the trees have just been cut and the soil is left bare it is very vulnerable to erosion and landslides and therefore the acacia trees are almost always harvested in the dry season where the risk of erosion is smallest. Generally a connection exists between the slope gradient and the risk of erosion (Folving 2007), but despite the fact that most of the acacia fields are on slopes, there are no significant problems with erosion in relation to the acacia plantations. Besides the slopes, people that have land near a stream

suffer from bank erosion in the rainy season. This is an increasing problem as rainfalls are becoming more intense, thereby increasing the pressure on the streams periodically.

The general soil quality in the commune has been causing some constraints in relation to the natural resource management practices. The farmers from thon 4 are the ones complaining most about the poor soil quality, arguing that it was degraded due to the earlier tea production by Duc Phu Farm. Nevertheless the quality of the soil is not a major obstacle with the current land-use as acacia trees actually improve the soil and can grow in bad soil conditions (FAO.org).

Rice fields at the shore of Phu Ninh during the dry season

One of the factors that has a substantial impact on the quality of the land, but not directly linked to the quality of the soil, is the Phu Ninh reservoir, which however only impacts thon 3. Phu Ninh is supporting Tam Ký with energy and controlling the water flow. This in turn entails that if the area around Tam Ký experiences severe water scarcity, the locks of Phu Ninh will be opened to sustain a steady flow of water to Tam Ký, and thereby the water level in Phu Ninh will drop more dramatically than if it was only due to water scarcity. On the contrary, in times of flooding the locks will be closed to halt the water flow to Tam Ký and thereby the water level will rise even more (Interview with commune). Therefore the farmers in thon 3 living close to the shores of Phu Ninh are struggling with the impacts from the change in water level that is more severe because of the sustained water flow to Tam Ký. As mentioned before the farmers here only have one season of rice because the area is flooded in the rainy season, which has also led to a change of seeds to a faster growing variety. Some households are also complaining about serious water scarcity in the dry season and that they have not been able to harvest in the last four years. This situation affects the transformation of environmental entitlements as the agricultural output derived from endowments is significantly reduced. In addition, before Phu Ninh only served as a reservoir for Tam Tuh and Tam Xuan communes, whereas now it also provides water for the much larger city of Tam Ký, which means that the water level goes even further down in the dry periods. According to the local farmers, this exacerbates the

situation for the farmers. The commune supports this claim and argues that the water scarcity that the commune experience is indeed exacerbated because water from the Phu Ninh reservoir is not used to support the farmers but Tam Ký.

Besides Phu Ninh there is another big reservoir in the eastern side of the commune bordering Tam Hiép commune supporting the industrial zone of Chu Lai though with little influence on Tam Thanh. In addition, there are four smaller reservoirs and 40 ponds. The four smaller reservoirs are all located in thon 1 and 2 and can only serve 20 % of the production of paddy rice in the commune where as the rest depends on precipitation. This is because the 40 ponds that are spread around the commune are very small and are destroyed every time there is a flooding so they have to be rebuilt every year. Water is redirected to them before the dry season in order to support irrigation during this period. However, this is not sufficient in itself and therefore 80 % of the paddy rice in Tam Thanh is rain-fed (Interview with Vice President of the commune). The 20 % that are sustained by the four small reservoirs have major benefits in comparison to the rest of the households in the commune. After the construction of the four reservoirs, all within the last ten years, the production of rice has increased, and the lives of the farmers with fields supported by the reservoirs have improved. This is also clear for the majority of the farmers in thon 2 that do not experience water scarcity as they receive water all year round. Consequently access to water is decisive for the production of paddy rice and is one of the reasons for the differences in environmental entitlements and social vulnerability within the commune.

Pests and rats are another problem for the rice production. Particularly rats pose a severe problem, as they eat the grains and pesticides seem to be of no use in the battle against these rodents. Only in thon 3 was it proclaimed that rats and water scarcity were the greatest obstacles in the process of obtaining environmental entitlements; if only they had sufficient water and rats were not a problem, agriculture itself would be enough to sustain their livelihoods without income from casual work.

The Physical Access Situation

The commune is well connected to Highway 1 by an asphalt road built from 2003 to 2005 financed by Quang Nam Rubber Group. Nonetheless, access varies widely within the commune as the asphalt road stretches just 11 km therefore only reaching limited parts of the commune; the rest is

A truck transporting acacia on its way from thon 3 in the dry season

connected by dirt roads. This implies that the opinions expressed about the impacts from limited access vary enormously.

As the asphalt road penetrates both thon 1, 2 and 4 these thons have in general a stable and secure connection independent of the weather. Parts of these thons are however only connected by dirt roads. Thon 3, on the contrary, is located far from the asphalt road and is therefore dependent on a dirt road for access to markets, work, health care and schools, etc. The difference between the road leading to thon 3 and the dirt roads connecting people to the asphalt road in the other thons is the length of and pressure on the road. The road to and from thon 3 is the sole connection for a large amount of people and products and thereby creating heavy traffic. This has caused the road to be in very bad condition to the extent that the thon is almost inaccessible in the rainy season in which the road turns to knee-high mud. People complain that it takes half a day to walk the around 6 km to the asphalt road in that period. Hence, access to school and healthcare, aside from the ability to maintain casual labour during that period, is considerably hampered. The poor accessibility to the main road is therefore seen by the people in thon 3 as the most considerable obstacle to the improvement of their livelihood situation, and thereby contributing to their social vulnerability.

The small roads also induce complications during the rainy season when the farmers face difficulties reaching their fields and forests. The access to the acacia plantations is essential for the transportation of heavy timber and the closer the plantations are located to the main road the easier it is to sell them and the less is the cost of transporting the timber. Yet the trucks are able to reach the most inaccessible plantations as long as there is some kind of dirt road, although the price of transporting the wood is higher. In this way a clear correlation between access and social vulnerability exists.

Summary

The major problems regarding access and endowments in Tam Thanh are the scarcity of land and access to the main road from the most isolated parts in the commune. Land scarcity, however, is not a result of an absolute shortage of land, but caused by the uneven distribution where Quang Nam Rubber Group owns 37 % of the total area in the commune. Furthermore, there is no more land to clear and trading of land is minimal as most land stays in the family and is inherited by the younger generation, with no signs that the younger generation has started to migrate to the cities on a larger scale.

Demand for wood to pulp and paper has increased which has led to the construction of the various wood-processing factories in Chu Lai creating a stable market for acacia. The accessibility differs within the commune as some parts are very isolated. Especially thon 3 is suffering during the rainy season as its 6 km of dirt road is the only connection to the main road. Moreover, many farmers particularly in thon 3 struggle with pests and rats in their rice fields, and the thon is moreover affected by the Phu Ninh reservoir which necessitates that a large area is under protection and water level changes dramatically. Also water scarcity for the production of rice is a significant problem, not only in thon 3 but for the majority of households in the commune that lacks sufficient irrigation systems.

Increased financial and physical capital and more secure land rights have reduced social vulnerability, although differences in access, location and quality of endowments exist. This entails that households with equal endowments do not obtain the same amount of environmental entitlements.

Chapter 10: Vulnerability and Adaptation

The past three chapters have identified the level of vulnerability in Tam Thanh. This chapter focuses on how vulnerability affects adaptation. Initially, the geographical and socioeconomic differences will be discussed and related to collective vulnerability as it has influence on adaptation. Then the focus will turn to the individual household level and look at the aspect of diversification, resource dependency and poverty. Finally, adaptation to climate change will be examined.

Inequality and Institutional Influence

The land-use of the households in Tam Thanh is generally very similar. There are however differences in the natural resource management practices; differences determined by the inequality in access, endowments and livelihood capitals that the individual farmer holds. Inequality within the commune is affecting collective vulnerability and an increase in inequality over time will increase collective vulnerability to climate change (Adger 1999). This is because inequality constrains the options of poor households when faced with external shocks. The relationship between inequality and collective vulnerability is, however, not always unidirectional. There exist exceptional cases where wealthier farmers provide and maintain common services such as irrigation and water management. Services that in a poor community of absolute equality might not exist as no one could afford them (Adger 1999).

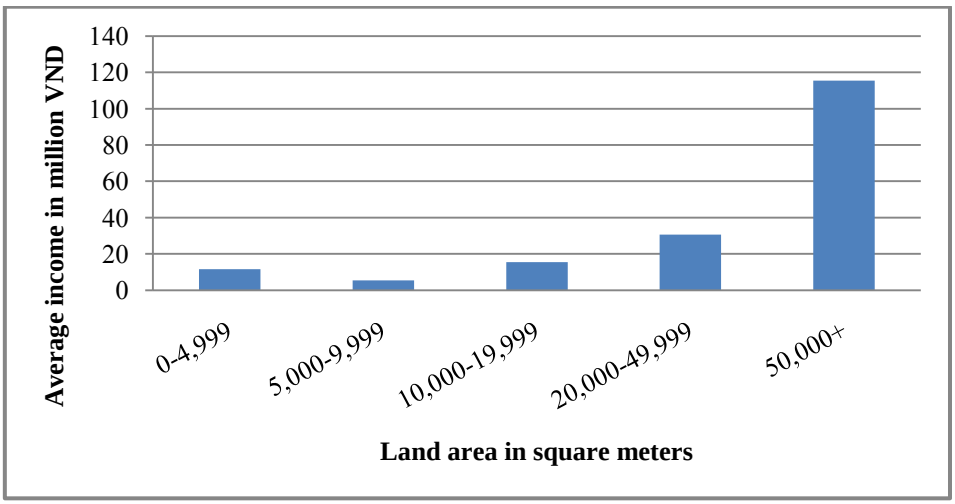


Figure 10.1: Land area and income.

Land is essential for individual households because natural resource management is the predominant source of income. There is a clear correlation between land size and income, where people with most land have the highest income (figure 10.1). Hence it is the households with most land that experience the highest economic losses when typhoons hit the area. Households with large amounts of land are most exposed to typhoons and are thereby the most physically vulnerable, but in general also the least socially vulnerable as they have the highest incomes and thereby can withstand these temporary economic losses.

There is generally enough land and water in the commune. The problem is the unequal distribution of it, which means that some people do not have sufficient access to water or land and consequently lack endowments in many cases. This situation perpetuates social vulnerability. The differences in access and endowments between the socio-economic groups are exacerbated by geographical location. Thon 3 lacks water, land and sufficient infrastructure and is also the poorest thon in the commune and hence this is where the most socially vulnerable households are found. Thon 4 is the richest thon and in addition has good infrastructure and a high number of people employed with the management of rubber contributing to an extra income source. Thon 1 and 2 are the thons with the smallest land seize per household but contain the four water reservoirs located in the commune and in this way better physical capital to serve their agricultural production. The construction of the main road running through the commune has contributed to general economic growth in Tam Thanh (Interview with commune). However, infrastructure remains insufficient in absolute terms, which reinforces existing inequalities in the commune. It is the poorest areas that lack infrastructure the most, which constitutes a major constraint of access for these areas and in turn strengthens the geographical differences of social vulnerability. This inequality in infrastructure is worst in the rainy season and is aggravated by the changes in climate experienced in the commune.

The construction of asphalt roads in the commune has been financed by Quang Nam Rubber Group (Interview with commune and Quang Nam Rubber Group), the largest and richest landowner in Tam Thanh. This implicates that the small asphalt road leading to the rubber plantation in thon 4 has been built where it is most useful for the Rubber Group and not where it is most needed for the people in the commune. Consequently, the positive contribution provided by the Rubber Group through the financing of roads has at the same time increased the inequalities of the physical access in the commune exacerbated by changing weather patterns. The construction of the road is an

excellent example of how inequality, in the form of a rich landowner, provides improved infrastructure that would otherwise not have been built in a situation with absolute equality. The main road has definitely improved access to Tam Thanh but it has also deepened inequality within the commune.

Furthermore, Quang Nam Rubber Group produces rubber that would otherwise not have been produced without the group's intensive capital investment. The rubber production provides an alternative source of income for people hired to manage the rubber. At the same time, however, it amplifies the difference in the endowment situation in the commune because the Rubber Group has started to take over land that the company has not been using for years. As such, this rich and large landowner provides an alternative income source, which enable some households with diversification options but at the same time takes land from households in thon 4 which increases inequality of endowments.

Institutional practices have a high influence on the enabling and constraining factors of development affecting inequalities in Tam Thanh. The central role of the state in the provision of collective security in the past has changed and today the state has a more marked-based policy (Chaudhry & Ruysschaert 2007). Current policies in the agricultural sector focus on industrialising and intensifying agricultural production, on increasing investments for irrigation and extension services and on promoting agro-forestry (WWF 2005 A). In Quang Nam this is illustrated by the strong influence that the agricultural extension service has and by the change to acacia production seen in recent years. The change to acacia has reduced social vulnerability by increasing overall income and by releasing household capacity to focus on other income earning opportunities.

The change to acacia and the construction of the asphalt road to the commune have strengthened the integration of Tam Thanh commune with the lowland communes in the district. This might eventually lead to a higher diversification as more people go to Nui Thanh and Chu Lai to buy and sell agricultural products, and may also apply for jobs there in the periods where demand for agricultural work is low.

Diversification and Resource Dependency

There exists a potential high level of individual vulnerability in communes such as Tam Thanh where income generated from natural resources contributes significantly to the economy of the households (Thomas & Twyman 2005; Adger 1999; Adger 2005). Livelihood strategies in such cases are likely to be very climate sensitive and physically vulnerable towards natural hazards such as typhoons, water scarcity and floods. However, diversification of income sources may play an important factor in reducing social vulnerability. Access to multiple types of resources and income earning opportunities increase people's resilience to climate events and other external shocks such as price fluctuations or crop diseases that results in the disruption of particular sources of income (Chaudhry & Ruysschaert 2007; Thomas & Twyman 2005).

As previously mentioned income from acacia production is by far the most important source of income among households in Tam Thanh. But the tree production has also enabled the population to engage in other income activities because the production of acacia is significantly less time consuming compared to earlier natural resource management practices in the commune. Consequently, in addition to acacia production, casual work and business also contributes considerably to the economy (see figure 6.7*).* Yet, both these activities are linked to some extent to the production of acacia in the form of planting, managing, cutting and transporting the trees. Furthermore, the management of rubber contributes as an income source in thon 4. Additional income from this kind of activities is a diversification within forestry and climate sensitive natural resources. For that reason, as income sources, they remain vulnerable to natural hazards (Baumann 2002; Adger 1999; Thomas & Twyman 2005). Diversification beyond acacia especially, and natural resources in general, are however less common in the commune. Nonetheless several respondents receive income from activities less dependent or totally non-dependent on the environment such as breeding, industrial work, service (restaurants and cafés) or support from the government. This type of diversification is undertaken in particular by the wealthier households that receive a significant proportion of their income from non-forestry and non-agricultural activities. They are in that sense less socially vulnerable to natural hazards compared to poor households that tend to diversify within climate sensitive natural resources. That said, several poorer households diversify through the investment in livestock but due to a recently high loss of especially pigs and cows because of various diseases this investment seems rather unsecure.

The major shift to acacia production has so far brought substantial income improvements for the vast majority of the population but has also increased physical vulnerability towards typhoons. As numerous households lost 70-80 % of their acacia trees after typhoon Ketsana hit the commune in September 2009 access to other sources of income are necessary in order to cope with such natural hazards. The importance of diversification is illustrated by the fact that 75 % of the households generate income from two or more activities, however, primarily from climate dependent sources. Despite a diversification that remain within the realm of natural resources, households nevertheless indicate a level of responsiveness towards external stress that may be important in the process of adapting to climate change (Thomas & Twyman 2005).

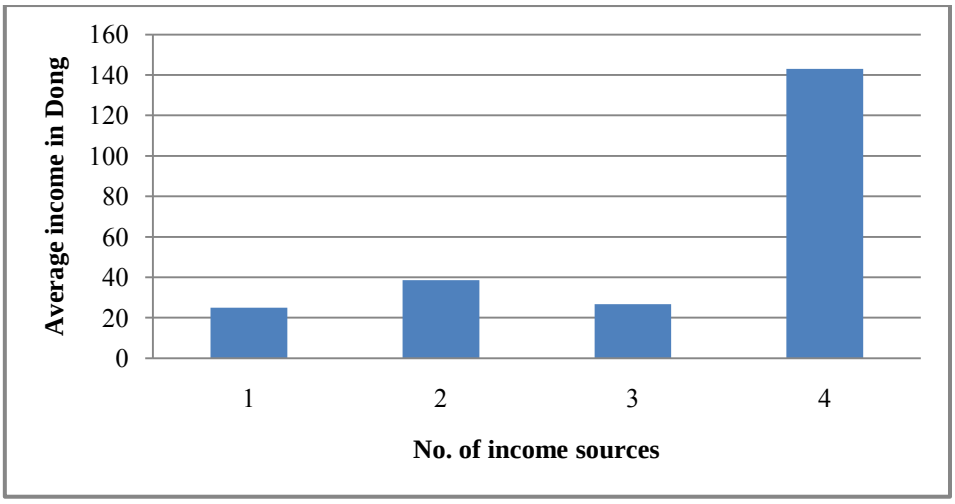


Figure 10.2: Diversification and income (only one respondent had four income sources)

As figure 10.2 shows there exists no direct link between the number of income sources and the total income although households with only one source of income are almost exclusively categorised as poor. Moreover what is evident is a spatial tendency of more climate dependent income sources in the remote thon 3 compared to the three other thons. In contrast, especially thon 2 has a high level of diversification beyond activities reliant on the environment mainly due to the presence of the market, the commune headquarter, public institutions and the various cafés and restaurants. Income from forestry in thon 2 also contributes less to the economy of households than in the other tons, possibly due to the obvious scarcity of endowments in the form of agricultural land as it is the most populated and at the same time smallest village in the commune.

The geographical correlation between the distance to the main road or the urban area east of Tam Thanh and the reliance on climate dependent income sources is an important factor determining the

variation in the level of social vulnerability. Diversification options for households living far from the main road and urban areas are generally limited to diversifying within the use of natural resources. On the other hand, households with better access to a high level of infrastructure and closer location to industrial jobs have enhanced possibilities in generating non-climate dependent income. In this regard the population in thon 3 and other remote areas with low physical capital in the commune are more socially vulnerable when natural hazards occur.

Apart from the geographical variation in the level of social vulnerability, there is an evident link between natural resource management practices and the type of natural hazard that impact households the most. Figure 6.9 shows that typhoons and water scarcity are seen as the main natural hazards that will impact livelihoods in the future but they will impact unevenly among the population. It is predominately the wealthier households that are often endowed with the largest acacia plantations (see figure 10.1) which regard typhoons as the most serious obstacle to their livelihood, whereas the poorer households fear water scarcity the most. While typhoons impact farmers with large acacia plantations economically, water scarcity affects poor households highly dependent on rice for own consumption, not in an economic sense but in their ability to generate a secure amount of sufficient food. Despite the fact that poorer households receive a relatively higher proportion of their income from acacia compared to wealthier households, food security is ascribed paramount importance.

Poverty

Poverty is an important aspect of individual vulnerability primarily because of its direct association with access to resources (Adger 1999). As discussed in the previous chapter, lack of endowments in the form of land scarcity is regarded a significant problem by numerous respondents because an increased amount of land can generate more income. Figure 6.9 shows that households consider typhoons and land insufficiency equally important obstacles for their future livelihoods and it is almost exclusively poor households that state land insufficiency as significant. In addition several respondents regarded sufficient land for forestry and agricultural activities as the best option for improving their economic situation because of the lack of profitable alternative income sources in the area. Access to land is consequently of major importance in reducing the level of social vulnerability especially for the part of the population that live in marginalised and remote parts of

the commune. This argument is supported by the fact that the majority of the respondents that state land insufficiency as an obstacle in the future, live in thon 3. The Phu Ninh reservoir and its protected area in this thon significantly influence access to land, while the location of the village and limited infrastructure reduces the possibility of diversifying outside the use of natural resources.

The importance of poverty in the livelihood strategies is also illustrated in figure 6.9 where capital insufficiency by far is ascribed the highest priority. Financial capital can reduce the level of social vulnerability in case of disruption of an essential income source, e.g. from acacia production, as a result of a natural hazard or other external factors (Adger 1999; Adger et al. 2005). Another type of safety net for the households is investment in livestock, which can be sold in times of stress. In fact the vast majority of respondents that stated capital insufficiency as the main obstacle for the future would use more money on livestock investment. This could be seen as a deliberate diversification away from climate dependent income sources.

Adaptation to Climate Change

The above mentioned factors at the community and household level strongly influence the varied level of social vulnerability of the population in Tam Thanh. These factors, shaped by prevailing economic and institutional contexts, agriculture and forestry policies and natural resource management practices, are all dynamic and constantly in a state of flux (Chaudhry & Ruysschaert 2007; O'Brien et al. 2004). The same counts for the environmental and biophysical conditions that impact the physical vulnerability and today are experiencing more frequent and intense natural hazards as a result of climate change. This dynamic dimension of vulnerability is critical to this investigation's interpretation of the term where social vulnerability is a state that exists within a society before impacts from climate change occur. Hence, in order for a process of adapting to climate change to take place, it is necessary to address the above mentioned factors that currently challenge the progress in reducing the level of social vulnerability (Schipper 2007).

The population of Tam Thanh has a long history of adapting to environmental and political change as recently illustrated with the major shift to acacia production. This significant land-use change was strongly encouraged by government policies and the construction of wood-processing factories in the district and has had great implications for people's income situation and physical

vulnerability. In this way the elements of social vulnerability that are determined by natural resource management practices are to a large degree a function of external factors beyond the control of the individual households in the commune. Moreover, institutions and government policies also influence other crucial elements of social vulnerability such as inequality, access to resources and the level of infrastructure.

In Tam Thanh, our research shows that an important reason for a relatively high level of social vulnerability of certain groups of the population is the lack of endowments in the form of land to increase acacia and rice production. A more equal distribution of land rights within the commune would reduce the level of social vulnerability of the people that at present suffer from rice shortage or inadequate income from acacia production due to land scarcity. Furthermore, impacts of climate change such as more frequent and intense typhoons and changing rainfall patterns increase the pressure on the land and consequently reinforce the importance of an equal land distribution.

A more structural and technical-based solution to this insufficiency in the output from acacia and rice productions would be to raise crop productivity, introduce short duration and drought resistant seeds and promote an enhanced irrigation system. More drought resistant rice seeds that also grow faster have already been introduced to the farmers by government and supported through training and agricultural extension services. However, water scarcity remains an important obstacle for rice production. Access to water is unequally distributed among the people in the commune. Construction of irrigation systems and smaller reservoirs to ensure a safe and stable water supply during the dry season would reduce both the social and physical vulnerability of especially the poorer households that are most dependent on food from the rice production. With regard to the production of acacia, a shift to the hybrid tree would result in a higher productivity and also reduce social and physical vulnerability.

These concrete recommendations are positive technical-based solutions. They focus on solving problems directly linked to climate change while at the same time also reduce social vulnerability on a wider basis. The latter because they simultaneously and independently from changing weather patterns, increase and stabilise income from existing natural resource management practices. Such structural measures would, as seen, first and foremost address some of the causes of social vulnerability regardless of the presence of climate change. But as they also reduce the level of

physical vulnerability, the process of adapting to climate change is also facilitated, which leads to a mitigation of the adverse impacts from more frequent and intense natural hazards.

Another important cause of social vulnerability is the absence of alternative income sources beyond the use of natural resources. Despite the fact that the shift to acacia production has allowed farmers to use more time on other income activities, non-climate dependent income sources are relatively rare in the commune mainly because of lack of such alternatives in the area. Tam Thanh is located relatively close to the urban area in Nui Thanh and to the industrialisation that takes place in this district and in the province of Quang Nam in general. The opportunities for income diversification are therefore unquestionably increasing. Also, further infrastructure development in remote areas of Tam Thanh would contribute to better access to alternative income sources beyond the use of natural resources, and also improve the general mobility, not least during the rainy season.

Non-structural measures that ensure equal distribution of land rights and diversification of livelihoods reduce the level of social vulnerability and thereby strengthen the ability to respond to external shocks, which ultimately increase the capacity to adapt to climate change. In effect, the response to immediate changing political and environmental conditions is facilitated and constrained by the same dynamic factors that enable climate change adaptation (Adger et al. 2005). Addressing the causes of social vulnerability towards these immediate challenges allows adaptation to uncertainty, which has been increasingly indentified as a distinguishing characteristic of climate change (O'Brien 2004; Chaudhry & Ruysschaert 2007; ISPONRE 2009; Adger 1999).

Chapter 11: Conclusion

This study has analysed the relation between natural resource management practices and vulnerability in the process of adapting to climate change in the rural commune of Tam Thanh in mid-Central Vietnam.

In order to analyse this relation the concept of vulnerability has been examined resulting in a division of the concept into physical and social vulnerability. Social vulnerability is a pre-existing state of inability to cope and adapt to external stress such a climate change and is unevenly distributed within a population. A clear connection between social vulnerability and adaptation has been established. That is, a reduction of social vulnerability is a precondition for enhancing the process of adapting to climate change. Based on a household survey, the different levels of social vulnerability in Tam Thanh have been analysed through the Environmental Entitlements Framework and the Sustainable Livelihood Approach. The following conclusions are drawn on these theoretical and methodological approaches.

The most significant evidence of climate change in Tam Thanh is more frequent and intense typhoons, increased intensity in rainfalls despite unchanged total annual precipitation and in relation here to, increased water scarcity and floods. These changing weather phenomena affect the natural resource management practices in different ways, which primarily concerns the production of paddy rice and acacia trees. A significant land-use change to the production of acacia has taken place within the last five years, and today all households in the commune independent of income categories produce acacia. This recent change was primarily motivated by government policies, the possibility of generating more income and due to the less labour-intensive nature of acacia production. Furthermore, acacia trees improve the soil quality from an otherwise often degraded state. Consequently, this change in natural resource management practice carries significant benefits with it. However, acacia trees also entail that households are more physically and socially vulnerable to typhoons compared to the earlier production of pineapple and tea. This is not only because the trees protrude higher into the air, therefore with a higher risk of collapse, but also because acacia production demands a higher investment and are grown in five-year perennial circles.

The richest households are endowed with the largest areas of acacia trees and hence have a concomitant risk of high economic losses as a result of typhoons. In contrast, the poorer households with smaller acacia plantations suffer not as much in absolute economic terms, but lose essential profit from their most important source of income. Nonetheless, because of a high dependency on rice production, this part of the population regards water scarcity as a more severe natural hazard than the impact of typhoons. Lack of water in the commune strongly influences the output from rice production, therefore the poorer households often fail to obtain a sufficient level of food security. In this way natural resource management practices and the amount of endowments affect the level of social vulnerability and are decisive for how climate change impacts the population.

There is a considerable problem regarding the unequal distribution of land in the commune. Lack of arable land is one of the major obstacles to generate income, and the general impression of the households is that the commune suffers from an absolute land scarcity. However, the state-owned Quang Nam Rubber Group owns more than 1/3 of the land in the commune and hence the cause of this perceived land scarcity is obviously the unequal distribution of land. This concentration of endowments constrains the available options for how the poor can adapt to climate change, as they have fewer coping strategies in times of stress. Another constraining factor is the great differences in physical accessibility. The areas in the outskirts of the commune are very isolated as they are only accessible by dirt roads. This low level of physical capital significantly impacts social vulnerability as households in these parts of the commune face serious difficulties in their mobility and access, especially during the rainy season. Therefore, the possibilities for diversifying income are constrained considerably for these households.

Yet diversification plays a decisive role for a reduction of social vulnerability since it is very unlikely that external stress factors will impact upon all income sources simultaneously. The households in the commune have demonstrated their adaptive capacity and ability to diversify with the comprehensive land-use change to acacia. It is, however, primarily the richest people that have attained income sources outside the area of natural resource management practices. Alternative income sources beyond climate sensitive natural resources are lacking in the commune and the majority of the households diversify within the field of acacia production. As such, diversification as a response to climate change has its limitations.

Government policies have a strong influence on the natural resource management practices. For example, such policies have influenced rice production through the agricultural extension service, which provides the households with for instance drought resistant seeds and distributes information for farmers about when and how to plant. These are technical solutions, of which some are especially focused on reducing physical vulnerability to climate change instead of reducing social vulnerability at the more general level. However, some technical solutions such as water reservoirs or the construction of asphalt roads first and foremost focus on reducing existing social vulnerability on a wider basis. But due to the fact that they also address physical vulnerability, these technical solutions encapsulate both aspects of vulnerability in the process of adapting to climate change. Nevertheless technical solutions are often a quick fix, solving obvious infrastructural problems, while the most socially vulnerable are often the last to receive the benefits. If the underlying causes and contexts of vulnerability are not taken into account the structures that maintain social vulnerability in the commune will persist.

The most socially vulnerable households are those that have the least endowments and are most geographically isolated. These are also the households that gain the least environmental entitlements for their endowments comparatively and furthermore face the most difficulties obtaining alternative income sources beyond the field of natural resource management practices. All factors which are decisive for social vulnerability. The large differences in endowments, access to natural resources and environmental entitlements that exist in the socio-economic and geographic units in Tam Thanh put constraints to the natural resource management practices for the most socially vulnerable. These differences are reinforced by the impacts of climate change. An approach that addresses some of these underlying causes will facilitate a process of adaptation to climate change that reaches the most vulnerable households in a community.

References

Books, Articles and Reports

Abramovitz, J. N. (2001): *Unnatural Disasters.* Worldwatch Paper 158. Worldwatch Institute, Washington.

Abramovitz, J. N. et al. (2001): *Adapting to Climate Change: Natural Resource Management and Vulnerability Reduction.* Background Paper to the Task Force on Climate Change, Adaptation and Vulnerable Communities

ADB – Asian Development Bank (2009): *The Economics of Climate Change in Southeast Asia: A Regional Review.* ADB. Mandaluyong City, Philippines

Adger, W. N. (1999): *Social Vulnerability to Climate Change and Extremes in Coastal Vietnam.* World Development, Vol. 27, No. 2, p. 249-269

Adger, W. N. & Kelly, P. M. (1999): *Social Vulnerability to Climate Change and the Architecture of Entitlements.* Mitigation and Adaptation Strategies for Global Change 4, p. 253-266

Adger, W. N. et al. (editors) (2005): *Living with Environmental Change: Social Vulnerability, adaptation and resilience in Vietnam.* Routledge, London

Adger, W. N. et al. (2003): *Adaptation to climate change in the developing world.* Progress in Development Studies, 3, p. 179-195

Adger, W. N. et al. (2005): *Successful adaptation to climate change across scales.* Global Environmental Change 15, p. 77-86

Adger, W. N. (2006): *Vulnerability.* Tyndall Centre for Climate Research, Norwich

Baumann, P. (2002): *Improving access to natural resources for the rural poor - A critical analysis of central concepts and emerging trends from a sustainable livelihood perspective.* Food and Agriculture Organisation of the United Nations

Brooks, N. (2003): *Vulnerability, risk and adaptation: A conceptual framework.* Tyndall Centre for Climate Change Research, Working Paper 38

Bryman, A. (2004): *Social Research Methods.* Oxford University Press, New York

Bueren, M. V. (2004): *Acacia hybrids in Vietnam.* Impact Assessment Series Report No. 27, Australian Centre for International Agricultural Research, Canberra

CARE (2009): *Climate Vulnerability and Capacity Analysis Handbook*

CARE (2004): *Civil Action for Socio-economic Inclusion in Natural Resource Management, Phase 2 (CASI).* Program document, January 2004 – December 2009, Care International in Vietnam and Care Denmark

Castella, J-C et al. (2006): *Impacts of forestland allocation on land use in a mountainous province of Vietnam.* Land Use Policy 23 (2006), p. 147-160

Chaudhry, P. & Ruysschaert, G. (2007): *Climate Change and Human Development in Viet Nam.* Human Development Report 2007/2008, UNDP

Christ, H. & Kloss, D. (1998): *Land Use Planning & Land Allocation in Vietnam with particular reference to improvement of its process in the Social Forestry Development Project Song Da.* Hanoi, GTZ Consultancy Report 16

Cutter et al. (2003): *Social vulnerability to environmental hazards.* Social Science Quarterly 84, p. 242-261

Dasgupta, S et al. (2007): *The Impact of Sea Level Rise on Developing Countries. A Comparative Analysis.* World Bank Policy Research Working Paper 4136, February 2007

DFID (1999): *Sustainable Livelihoods Guidance Sheets.* Department for International Development, London

Ellis, F. (1998): *Household strategies and rural livelihood diversification.* Journal of Development Studies, 35: 1, p. 1-38

Folke, C et al. (2002): *Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations.* Report 2002: 1. Swedish Environmental Advisory Council, Stockholm

Folving, R. (2007): *Farming system changes among ethnic minorities in the Vietnamese uplands.* University of Copenhagen

Ghai, D. & Vivian, J. (editors) (1992): *Grassroots Environmental Action: People's Participation in Sustainable Development.* Routledge for UNRISD, London

Ghai, D. (Editor) (1994): *Development and Environment: Sustaining people and Nature (special issue).* Development and Change 25 (1)

Holmberg, J. K. et al. (1993): *Facing the Future: Beyond the Earth Summit.* IIED/Earthscan, London

IPCC (2001): *Climate Change 2001, Working Group II: Impacts, Adaptation and Vulnerability.* Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom

IPCC (2007 A): *Climate Change 2007, Working Group II: Impacts, Adaptation and Vulnerability.* Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom

IPCC (2007 B): *Climate Change 2007, Working Group I: The Physical Science Basis, Summary for Policymakers.* Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom

ISPONRE - Institute of Strategy and Policy on Natural Resources and Environment (2009): *Viet Nam Assessment Report on Climate Change (VARCC).* ISPONRE, Hanoi

Jones, R. & Boer, R. (2003): "*Assessing current climate risks*" in Adaptation Policy Framework: A Guide for Policies to Facilitate Adaptation to Climate Change. UNDP

Jong, W. D. et al. (2006): *Forest Rehabilitation in Vietnam – Histories, realities and future.* Center for International Forestry Research, Jakarta, Indonesia

Kelly, P. M. & Adger W. N. (2000): *Theory and Practice in Assessing Vulnerability to Climate Change and Facilitating Adaptation.* Climate Change 47, p. 325-352

Land Law of Vietnam (1993): Ministry of Planning and Investment, Hanoi

Land Law of Vietnam (2003): Ministry of Planning and Investment, Hanoi

Lang, C. (2007): *Vietnam: What's happening in the pulp and paper sector?* World Rainforest Movement, Issue 115

Leach, M. et al. (1999): *Environmental Entitlements: Dynamics and Institutions in Community-Based Natural Resource Management.* World Development Vol. 27, No 2, p. 225-247

Leary, N. et al. (2008): *Climate Change and Adaptation.* Earthscan, London

McGrew, J. C. & Monroe, C. B. (2000): *An introduction to statistical problem solving in geography.* McGraw-Hill Higher Education.

Mearns, R. (1996): *Environmental entitlements: pastoral natural resource management in Mongolia.* Cahiers des Sciences Humaines 32 (1) 96, p. 105-131

Mearns, R. et al (1997): *The institutional dynamics of community-based natural resource management: an entitlement approach.* Paper funded by UK Economic and Social Research Council's Global Environmental Change Programme, Phase IV

MONRE (2007): *National Target Program to Respond to Climate Change.* MONRE, Hanoi

O'Brien et al. (2004): *What's in a word? Conflicting interpretations of vulnerability in climate change research.* CICERO Working Paper 2004: 4

Oxfam, 2008: *Vietnam – Climate Change, Adaptation and Poor People.* Oxfam in Vietnam and Oxfam International

Papademetriou, K. M. et al. (2000): *Bridging the rice yield gap in the Asia-Pacific region.* FAO, Rap publication: 2000/16

Phan, V. T. et al. (2010): *Study on Development of Detailed Climate Change Scenarios for Mid-Central Vietnam.* Report on Sub-project 3, Project P1-08 VIE, Hanoi

Pimbert, M. & Pretty, J. (1995): *Parks, people and professionals: Putting participation into protected area management.* UNRISD Discussion Paper No. 57, UNRISD, Geneva

Quang Nam Statistical Office (2003): *Quang Nam Statistical Yearbook 2002.* Statistical Publishing House

Quang Nam Statistical Office (2005): *Quang Nam Statistical Yearbook 2004.* Statistical Publishing House

Quang Nam Statistical Office (2009): *Quang Nam Statistical Yearbook 2008.* Statistical Publishing House

Quy, T. D. & Lakshimi, I (2003): *Land rights and economic development: Evidence from Viet Nam.* World Bank Policy Research Working Paper No. 3120

Schipper, E. L. F. & Burton, I. (editors) (2009): *The Earthscan Reader on Adaptation to Climate Change.* Earthscan, London

Schipper, E. L. F. (2007): *Climate Change Adaptation and Development: Exploring the Linkages.* Tyndall Centre for Climate Change Research, Working Paper No. 107

Schroll, H. (2010): *Draft paper on: Climate change and development responses in agriculture in the province of Quang Nam, Mid Vietnam.* Roskilde University

Scoones, I. (1998): *Sustainable Rural Livelihoods: A Framework for Analysis.* IDS Working Paper 72

Shaw, R (2006): *Community-based climate change in Vietnam: inter-linkages of environment, disaster, and human security.* Multiple Dimension of Global Environmental Change. TERI publication, p. 521-547

Silvestre, P. (1989): *Cassava.* The Tropical Agriculturist. Macmillan Publishers, London and Basingstoke

Son, L. D. Et al. (2009): *Climate Change Adaptation Survey – Quang Nam Province, Central Region, Vietnam.* East Meets West Foundation

Tomas, D.S.G & Twyman, C. (2005): *Equity and justice in climate change adaptation amongst natural-resource-dependent societies.* Global Environmental Change 15, p. 115-124

Tompkins, E. L. & Adger, W. N. (2003): *Building resilience to climate change through adaptive management of natural resources.* Tyndall Centre for Climate Change Research, Working Paper No. 27

Tompkins, E. L. & Adger, W. N. (2004): *Does Adaptive Management of Natural Resources Enhance Resilience to Climate Change?* Ecology and Society (2): 10

WCED - World Commission on Environment and Development (1987): *Our Common Future.* Report of the World Commission on Environment and Development. Oxford University Press, Oxford

WWF - World Wide Fund for Nature (2005 A): *Agricultural Development in Quang Nam Province, Vietnam: Assessing Policy Impacts.* WWF-Macroeconomics Program Office, Washington

WWF - World Wide Fund for Nature (2005 B): *Community Forest Management and Protection in Quang Nam Province, Vietnam.* WWF MOSAIC Project, Management of Strategic Area for Integrated Conservation

Websites

Acacia-world (17-06-2010):
www.acacia-world.net/html/vietnam.html

Business Portal (22-09-2010):
www.business.gov.vn/asmed.aspx?id=64&LangType=1033

CGIAR - Consultative Group on International Agricultural Research (16-06-2010):
www.cifor.cgiar.org/publications/pdf_files/research/governance/foresttrade/Brussels/Attachment44-Roda-Rathi-BrusselsWshop051205-1355-1435.pdf

DMI (22-09-2010):
www.dmi.dk/dmi/index/verden/verdensvejr.htm?country=Vietnam

Ecoenvi.org (12-01-2010):
www.ecoenvi.org/

FAO – Food and Agriculture Organization of the United Nations (16-06-2010):
ftp://ftp.fao.org/docrep/fao/005/AC775E/ac775e03.pdf

General statistics office of Vietnam (10-05-2010):
www.gso.gov.vn/default_en.aspx?tabid=483&idmid=4&ItemID=1837

Gerson Lehrman Group (16-06-2010):
www.glgroup.com/News/Vietnam-Paper-Industry--flying-under-the-radar-8647.html

Oanda (25-09-2010):
www.oanda.com/currency/converter/

Thanh Nien News (16-06-2010):
www.thanhniennews.com/2008/Pages/20086171045110393 88.aspx

UN (22-09-2010):
www.un.org/milleniumgoals

Vietnam.net.vn (03-06-2010):
http://english.vietnamnet.vn/biz/201001/Vietnams-rubber-group-boosts-overseas-investment-891618/

The World Fact book (16-06-2010):
www.cia.gov/library/publications/the-world-factbook/geos/vm.html

Women's Union (22-09-2010):
http://hoilhpn.org.vn/?Lang=EN

World Rainforest Movement (16-06-2010):
www.wrm.org.uy/bulletin/115/Vietnam.html

Division of the Thesis

Only because of official requirements we have felt obliged to account for the author of the different chapters. This is of course an impossible task and the division of chapters has no connection to the reality in which this thesis has been produced. We, the authors, have produced all of the chapters in close collaboration.

Jointly produced	**Tobias**	**Anton**
Chapter 1	Chapter 2	Chapter 4
Chapter 5	Chapter 3	Chapter 6
Chapter 11	Chapter 7	Chapter 9
	Chapter 8	Chapter 10

Total number of keystrokes including spaces: 207,950

Keystrokes per nominal page: 2,400

Total number of keystrokes in this thesis: 207,950/2,400 = 87 pages

Appendix

Table of Contents

A - Household Template and Focus Group Discussions

A1: Household Template

HOUSEHOLD INTERVIEWGUIDE

For Master Thesis at Roskilde University

Tobias von Platen & Anton Mikkel Thorsen

Date of interview.....

Interviewer.....

Coordinates (UTM, WGS84)**:** E: N:

A. Introduction and household information

A1. Tên người trả lời **(Name of respondent)**: .....

Tên chủ hộ **(Name of head of household)**: ...……

A2. Sex of respondent: 1. Nam **(M)**

2. Nữ **(F)**

A3. Sex of Head of Household[28]: 1. Nam **(M)**

2. Nữ **(F)**

A4. Địa chỉ: **(Address)**

- Thôn/bản **(Hamlet/Village)** ….....
- Xã **(Commune)**…….....

A5. Loại hộ gia đình phân theo mức sống (do cán bộ địa phương cung cấp). **(Household Living Standards provided by local administration)**

1. Giàu/Khá giả **(Rich)**
2. Trung bình **(Middle)**
3. Nghèo **(Poor)**

[28] As female headed households are vulnerable than male headed households it's important to know the sex of head of household

A6. Tự đánh giá mức sống của Hộ gia đình (so với các HGĐ trong cộng đồng). **(Household living standards, compared with others in the same village. Household evaluates themselves)**

1. Giàu/Khá giả **(Rich)**
2. Trung bình **(Middle)**
3. Nghèo **(Poor)**
4. Không biết/Không trả lời **(Don't know/No answer)**

Codes for question A7

A7.1 Quan hệ với người trả lời	**A7.4. Tình trạng hôn nhân**	**A7.5. Trình độ học vấn**	**A7.6 Nghề nghiệp chính/phụ**
Chủ hộ (Head of household)	1. Chưa có vợ/chồng (Single)	1. Chưa bao giờ đi học (Illiterate)	1. Công nghiệp, TT CN (Industry/home craft)
1. Vợ/chồng (spouse)	2. Có vợ/chồng (Married)	2. Tiểu học primary	2. Buôn bán/Dịch vụ/du lịch(Trade/service/tourism)
2. Con đẻ (children)	3. Goá (widow/-er)	3. Trung học CS secondary	3. Cán bộ/viên chức NN (Officials)
3. Con nuôi (Adopted children)	4. Ly thân (separated)	4. Trung học PT High	4. Bộ đội/công an (Military/policy)
4. Con dâu/rể (Children in law)	5. Ly hôn (Divorced)	5. Cao đẳng/đại học College/university	5. Nông nghiệp – Lâm nghiệp – Ngư nghiệp (Agriculture-Forestry-Fishery)
5. Cháu (Grandchildren)	6. Không thích hợp (<18 tuổi) (N/A under 18)	6. Thạc sĩ/tiến sĩ (Master/doctor)	6. Học sinh/sinh viên (Pupil/student)
6. Cha/mẹ đẻ (Parents)		7. Không thích hợp (<6 tuổi) N/A under 6	7. Hưu trí/già yếu không làm việc (retired)/
7. Cha mẹ nuôi (Adopted parents)			8. Lao động làm thuê tự do (Casual labour)
8. Cha/mẹ vợ/chồng (Parents in law)			9. Thất nghiệp/không có việc làm (Unemployed)
9. Họ hàng (Relatives)			10. Không thích hợp (=<15 tuổi) (N/A under 15)
10. Khác (Other)			

A7. Một số thông tin chủ yếu về các thành viên này trong hộ gia đình: **(Some basic information about the members in the household)**

TT	Quan hệ với chủ hộ	Giới tính 1.Nam 2. Nữ	Năm sinh (dương lịch)	Tình trạng hôn nhân	TĐ học vấn	Nghề nghiệp chính (12 tháng qua)	Dân tộc
No.	Relations with Head of household	Sex	Year of birth	Civil status	Education	Main occupation during last 12 months	Ethnicity
	A7.1	**A7.2**	**A7.3**	**A7.4**	**A7.5**	**A7.6**	**A7.7**
1							
2							
3							
4							
5							
6							
7							
8							
9							

A8. Ông/bà hiện đang tham gia vào tổ chức nào dưới đây không? **(Which of the following organizations do you join?)**

1. Đảng **(Com.Party Union)**
2. Chính quyền **(Local authorities)**
3. Mặt trận Tổ quốc **(VFF)**[29]
4. Hội Nông dân **(Peasant's association)**
5. Hội Phụ nữ **(Women association)**
6. Hội cựu chiến binh **(Veteran assoc.)**
7. Đoàn TNCSHCM **(Com.Youth)**
8. Dòng họ **(Family-clan)**
9. Hội người cao tuổi **(Elderly assoc.)**
10. Hội đồng môn **(Classmate's assoc.)**
11. Hội đồng niên **(Age group assoc.)**
12. Khác **(Othes)**

A9. Ông/bà có thường xuyên tham gia các hoạt động/sinh hoạt của các cơ quan/tổ chức đó không? **(How often do you participate in meetings of these organisations?)**

[29] Vietnamese Fatherland Front

1. Thường xuyên **(Always)**
2. Thỉnh thoảng **(Occassionally)**
3. Không bao giờ **(Never)**
4. Không biết/Không trả lời **(Don't know/No answer)**

A10. Ông/bà hoặc tổ chức mà ông/bà tham gia có sự ảnh hưởng nào đến quyết định của xã không? (Xây dựng đường, cầu và hồ chứa nước, bảo vệ bờ, hỗ trợ thiên tai và bảo vệ rừng) **(Do you or the organizations you are member of have an influence on the commune decisions? (Constructions of road, bridge and water reservoirs, bank protection, disaster assistance and protection of forest))**

.....

.....

.....

A11. Nếu có, theo cách nào? **(If yes, in which way?)**

.....

.....

.....

B. Agriculture B1.Land-use information and agricultural production

№	Field type, location of field (upland/lowland) and distance to field from home in time.	Number of pieces of land	Area (m^2)	Area of land registered in the Red Book	№ of harvest	Quantity of harvest (kg)	Quantity for sale (kg)	Income from sale (dong)	Production increase or decrease the last 10 years	B1.1 For what reason	Land-use change within the last 10 years (which year?)	B2.1 For what reason (Drought, flooding, typhoon, landslide, price change, illness, pests, government policy etc)
	Total											
1												
2												
3												
4												
5												

B2. Ông bà có trồng các loại cây khác trong cùng một mảnh ruộng không? (luân canh – rotational cultivation – shift of crops) **(Do you grow different crops on the same field?)**

.....

.....

.....

B3. Ông/bà bán những sản phẩm nông nghiệp ở đâu? **(Where do you sell your agricultural products?)**

.....

.....

.....

B4. Ngoài để ăn và để bán, ông/bà có sử dụng sản phẩm nông nghiệp vào mục đích gì khác không? **(Do you use your agricultural products for other than sale or food?)**

.....

.....

.....

B5. Nếu có thì là gì? **(If yes, what?)**

.....

.....

.....

B6. Đất nông nghiệp của ông/bà đã tăng hay giảm trong vòng 10 năm trở lại đây? **(Have your area of agricultural land increased or decreased the last 10 years?)**

.....

B7. Tại sao? **(Why?)**

.....

.....

.....

B8. Ông/bà có mảnh đất không được đăng ký trong Sổ Đỏ như thế nào? **(How did you obtain the land not registered in the Red Book?)**

.....

.....

.....

B9. Với mảnh đất không được đăng ký sử dụng như vậy nó có ảnh hưởng đến việc sử dụng đất của ông/bà không? **(How does it affect your use of the land that you do not have official ownership?)**

.....

.....

.....

B10. Ông/bà có sử dụng mảnh đất nào ngoài đất của mình hay không? (Trồng cấy, chăn thả, gỗ rừng, thu hoạch khác trong rừng ngoài gỗ, …) **(Do you use any other land a part from your own? (Crops, grazing, NTFP, timber etc.))**

.....

.....

.....

B11. Nếu có, có sự thay đổi nào trong việc tiếp cận và sử dụng của những mảnh đất này trong 10 năm qua? **(If yes, have there been any changes in your access to and use of this land the last 10 years?)**

.....

.....

.....

B12. Ai là chủ của những mảnh đất và có thỏa thuận gì? **(Who is the owner of the land and what is the agreement?)**

.....

.....

.....

B13. Ông/bà sử dụng chúng vào mục đích gì (bán, gia đình)? **(What do you use it for (sale, own use)?)**

.....

.....

.....

B14. Ông/bà có được trả tiền để trông nom mảnh rừng công nào không? **(Are you paid to take care of any commune forest apart from your own?)**

.....

.....

.....

B15. Nhà ông/bà nuôi những con gì? **(What kind and number of livestock do you have?)**

.....

.....

.....

B16. Ông/bà có thay đổi gì trong sản xuất nông nghiệp trong vòng 10 năm trở lại không (Kỹ thuật, tưới tiêu, phân hóa học, thuốc trừ sâu, sử dụng lao động, sử dụng máy móc)? **(Have you changed your agricultural practices the last 10 years (Techniques, irrigation, fertilizer, pesticides, labour use, use of machinery)?)**

.....

.....

.....

B17. Tại sao? **(Why?)**

.....

.....

.....

B18. Ông/bà lấy giống cây, phân bón và thuốc trừ sâu ở đâu? **(Where do you get your seeds, fertilizer and pesticides from?)**

.....

.....

.....

B19. Ông/bà có nhận được bất cứ sự trợ giúp nào từ dịch vụ mở rộng nông nghiệp không? **(Do you receive any assistance from agricultural extension services?)**

.....

.....

.....

B20. Nếu có, là những gì? **(If yes, which?)**

.....

.....

.....

B21. Có dịch vụ hỗ trợ nông nghiệp nào cung cấp những hướng dẫn vào thời gian trồng cấy và giống cây trồng không? **(Does the agricultural extension service provide guidance on when and what to plant?)**

.....

.....

.....

B22. Ông/bà có nhận thấy đất bị sạt lở ít hơn sau khi mà trồng cây keo không? **(Have you experienced less erosion after you started planting acacia trees?)**

.....

.....

.....

B23. Trong 10 năm trở lại đây, cuộc sống của ông/bà phụ thuộc ít đi hay nhiều hơn vào nông nghiệp? **(During the last 10 years, have you become more or less dependent on agriculture?)**

.....

.....

.....

C. Thiên tai và biến đổi khí hậu (Natural disasters and climate change)

C1. Sự kiện nào trong 10 năm gần đây ảnh hưởng nhiều nhất tới ông bà (Mỗi cột chon 03 sự kiện và đánh số theo mức độ quan trọng nhất) **(Which major events during the last 10 years have affected you most? Make brief statements)**

Sự kiện **(Events)**	**Trình bày ngắn gọn** **(Brief statements)**
Chính sách của chính phủ (Government policy)	
Thay đổi thị trường (Market changes)	
Giống cây trồng mới hoặc kỹ thuật mới (New crops or new techniques)	
Mưa quá mức (excessive raining)	
Nhiệt độ tăng cao (increasing temperatures)	
Bão lụt (lũ) (typhoons, flooding)	
Sạt lở đất (landslide)	
Hạn hán (drought)	
Bệnh tật ở người (diseases in the family)	
Dịch bệnh cây trồng, vật nuôi (pests)	
Khác (Other)	

C2. Ông bà đã làm gì để giảm nhẹ thiệt hại, mất mát do tai biến tự nhiên hay hoặc là do biến đổi khí hậu và thay đổi điều kiện môi trường gây ra. **(Have you taken any measures to reduce losses from natural disasters or changing climatic and environmental conditions?)**

.....

.....

.....

C3. Có những thay đổi nào trong các hình thái khí hậu? Nếu có, nó ảnh hưởng đến cuộc sống ra sao? **(Is there a general change in weather patterns? If yes how is it affecting you?)**

.....

.....

.....

D. Vốn tài chính/sự đa dạng của thu nhập (Financial capital/diversification of income)

D1. Thu nhập năm 2009 (**Household income in 2009 year)**

Các nguồn thu (Sources of income)	**Số tiền thu nhập (Tổng sản lượng quy thành tiền) Total income (counting by cash)**	**% so với tổng thu nhập của hộ gia đình Percentage of total income**	**Nhiều hơn Increase the last 10 years**	**Ít hơn Decrease the last 10 years**
1. Trồng trọt (Crops)				
2. Chăn nuôi (Breeding)				
3. Khai thác lâm sản (Forestry)				
5. Lương/tiền công (Salary)				
6. Buôn bán/kinh doanh/dịch vụ (Business/Service/Tourism)				
7. Lãi từ tiền gửi tiết kiệm/đầu tư sản xuất/kinh doanh (Savings/Investment…)				
8. Từ quà tặng, tiền của người thân gửi biếu (Remittances from relatives)				
9. Hỗ trợ (từ nhà nước/tổ chức/cá nhân) Other (Supports from individual, NGO, social welfair…)				
Tổng thu: (Total)				

D2. Trong khoảng 10 năm trở lại đây, mức sống của Hộ gia đình ông/bà biến đổi như thế nào? **(Have you increased or decreased your income and household living standards during the last 10 years?)**

1. Tăng lên nhiều **(Increased much)**
2. Tăng lên ít **(Increased little)**
3. Như cũ **(As before)**
4. Giảm đi ít **(Decreased little)**
5. Giảm đi nhiều **(Decreased much)**
6. Không biết /không trả lời **(N/A)**

D3. Hiện nay trong hộ gia đình có các loại tiện nghi chủ yếu nào? **(Equipment and furniture)**

1. TV màu **(Colour TV)**
2. Đầu CD/VDC **(CD)**
3. Máy giặt **(Washing mach.)**
4. Điện thoại **(Telephone)**
5. Bếp ga **(Gas-stove)**
1. Xe máy **(Motobike)**
2. Máy vi tính **(Computer)**
3. Bình tắm nóng lạnh **(Heat)**
4. Tủ lạnh **(Fridge)**
5. Điều hoà **(Air condition)**

11. Ô tô **(Car)**
12. Khác ghi rõ **(Other)**

D4. Vốn sản xuất kinh doanh của gia đình **(Origin of the household investment capital)**

	Tổng số tiền (Quantity in total)-1000đ	Lãi suất (interest rate) (%/month)
1. Vốn từ ngân hàng chính sách xã hội:(Loan from social pol. bank)		
2. Vốn vay ngân hàng thương mại: (Loan from commercial bank)		
3. Vốn từ quỹ tín dụng (Loan from credit fund)		
4. Vốn vay đoàn thể (Loan from union fund)		
5. Vốn vay tự do (cộng đồng, hụi, họ.) (Loan from community)		
6. Vốn từ các dự án (Loan from development project)		
7. Vốn tự có (From saving)		
8. Khác (Others)		
Tổng thu: (Total)		

D5. Mục đích vay **(Purpose of borrowing)**:

1. Đầu tư sản xuất kinh doanh **(Investment in productions/Business)**
2. Xây dựng – sửa chữa nhà cửa **(Bulding/Fixing house)**
3. Mua sắm máy móc trang thiết bị **(Getting equipment)**
4. Mua sắm tài sản gia đình **(Getting furniture)**
5. Chi tiêu hàng ngày **(Daily family consumption)**
6. Ốm đau, chữa bệnh **(Health)**
7. Chi phí học hành **(Education)**
8. Khác **(Others)**

D6. So với 10 năm trước đây khoản vay nợ của ông/ bà tăng hay giảm **(Has your debt increased or decreased during last 10 years?)**

.....

D7. Trong những vấn đề sau, điều gì gây cản trở chính trong cộng đồng ông/bà để kiếm tiền gia tăng thu nhập? **(For the coming years, what do you consider being the main obstacles to generate income in your household?)**

STT (Number)	**Những cản trở chính (main obstacles)**	**Xếp loại theo mức độ quan trọng (Priorities in terms of importance)**
1.	Thiếu đất sản xuất (Land insufficient)	
2.	Thiếu nước (Water insufficient)	
3.	Thiếu vốn (Capital insufficient)	
4.	Thiếu lao động (Employment insufficient)	
5.	Sức khỏe, bệnh tật (Diseases)	
6.	Chính sách (Policy)	
7.	Trượt lở (Landslide)	
8.	Bão (Storms)	
9.	Sạt lở (Erosion)	
10.	Chất lượng đất (Land Quality)	
11.	Hạn hán (Drought)	
12.	Lũ lụt (Flood)	
13.	Nhiệt độ (Temperature)	
14.	Vấn đề thị trường (Market)	
15.	Dịch sâu bênh (Pests)	
16.	Nguyên nhân khác (Ghi rõ)-Others (Identify)	

D8. Giải thích lý do cho sự xếp hạng trên? **(Explain the reasons for your ranking?)**

.....

.....

Respondent's signature *Interviewer's signature*

Chữ ký người trả lời Chữ ký người phỏng vấn

Comments

A2 - Focus Group Discussions

A2.1: Focus Group Discussion No. 1:

Thon 1, Tam Thanh, 11th of March 2010

Participants:

- Mr. Troung. Born in 1948. Farmer. Classified as middle
- Mr. Loung. Born in 1968. Farmer. Classified as middle
- Mr. Luu. Born in 1966. Teacher. Classified as middle
- Mr. Luu. Born in 1970. Farmer. Classified as middle
- Mr. Ngo. Born in 1962. Farmer and village headman. Classified as middle

- 95 % of the population in Thon 1 is doing rice production and forestry
- The rice production is not stable
- If they had enough land or the prices for the products were high enough they wouldn't find casual jobs. There is no way to increase the land, only if people move out others can get more, but not many young people move out of the commune
- It is also difficult to find work outside the commune
- If they have fields far away they have to carry the product out on their shoulders, here they help each other without getting paid
- The climate affects them with water scarcity, even in normal dry seasons there is a lack of water for the rice but flooding and typhoons are not a problem
- 6 sunny months and 6 rainy months
- There is not a lot of rain in the area but many typhoons which is common in central Vietnam
- One typhoon can destroy an entire plantation of acacia trees
- Prices are not staple and one never knows if you need to use more money to buy food or get a low price for your agricultural products
- The condition of the road is a major problem
- Irrigation systems is very important for everything
- Land scarcity means that the people have to do casual labour to generate sufficient income

- Salary is unstable and this influences the income from casual work
- Not enough labour available in the commune so the people have to go outside of the commune to find work
- If the acacia fields are close to the main road it is easier to sell them and one can earn more because there is no need to hire people to help carrying the trees to the truck
- If they are far away they carry them on their shoulders they usually help each other on their fields without demanding any payment
- The first year they have to take care of the trees two times the second and third only one the fourth and fifth none and the sixth they cut them, every time they take care of them they spend around ten days per ha
- A 1 year old acacia tree is very vulnerable to droughts and floods but after that only a typhoon can make it collapse, the typhoon hits all trees no matter age
- The wind and topographical characteristics determine which trees that will collapse it are typically the trees on the east side that are vulnerable as the wind typically comes from the sea; this means that the people that have land on that side are more vulnerable to typhoons. Tam Than suffered more from Ketsana than Tam Son because Tam Than is located on the eastern side of the hills that divide the two communes. The people that have land on the western hill sides are however not yet better of as the roads are not as good on that side and because the land is not well managed so people tend to have land on both sides of the hills
- If they have extra rice they sometimes change it for fertilizer and therefore the price on rice is also important to them
- Drought is the main problem for rice and even during normal conditions both two seasons they suffer from water shortage, the flooding and typhoon are not a problem for the rice
- There are two rice seasons: 1. Winter-spring, Jan. to May/June. 2. Sum.-fall, June to Oct.
- There has always been two rice seasons
- The most important constraints for economic development are the bad climate, lack of irrigation, bad road conditions and lack of available jobs in the commune
- Another is land scarcity and could be solved if the number of the people in the commune could be reduced as there is no more land to cultivate
- If they had enough land or the prices were high enough they wouldn't look for casual jobs it's also difficult to find jobs outside the commune
- There is a 0,9 % increase in the population of the commune

- Improvements of the roads and irrigation system (for rice) are the most important factors the commune should focus on to help the people in forestry production
- The only way to obtain more land is if someone moves out of the commune as there are no extra land at the moment but its only very few young people that leaves for other places

The average income is 300.000-400.000 dong/month

Vulnerability Matrix

Disturbing factors / Income sources	Climate	Infrastructure	Land	Price
Forest	3	3	3	3
Crops	3	2	2	3
Casual labour	1	1	2	2

A2.2: Focus Group Discussion No. 2:

Thon 3, Tam Thanh, 13th of March 2010

Participants:

- Mr. Cuc. Born in 1964. Farmer. Classified as poor
- Ms. Vi. Born in 1965. Farmer. Classified as poor
- Ms. Khanh. Born in 1987. Farmer. Classified as poor
- Mr. Hoang. Born in 1932. Farmer. Classified as poor

- Rice is rain fed in this village
- People living close to Phu Ninh suffer from floods
- The condition of the road is a big problem during the rainy season
- The foundation of Phu Ninh affected the people in the area a lot and took land from them and the possibility of increasing their land to that side and on the other side there is the rubber farm and the natural forest where the forest management board no longer will let them cut the trees
- Land scarcity – nowhere to get new land
- In 1970-80 people could freely go to the forest and clear it and do agriculture. This is not possible anymore
- Phu Ninh leads to land scarcity
- More casual labour if it rains sufficient because the rice production increase and more people call for labour
- Bad road conditions affects the transportation of trees
- Sometimes it is difficult to get to their rice fields
- If there are no rats and sufficient water they don't need to do casual work
- More rain leads to higher yield and more casual work because then people need more help to harvest
- Rats eat the small trees just after they are planted
- Bad road affects the access to their rice fields

- Don’t use water from Phu Ninh because they are too poor to invest in pumps
- Flooding from mountains during rainy season
- Phu Ninh is closed during heavy rain and this affects the village with flooding and when its dry Phu Ninh opens and affects them negative because the reservoir has to regulate water for downstream users
- Investment in better road is the most important thing in this thon

Vulnerability Matrix

Disturbing factors / Income sources	Phu Ninh affect land	Rats damage crops	Condition of the road	Water scarcity
Rice	1	3	2	3
Trees	1	2	3	2
Casual work	1	1	2	3

A2.3: Focus Group Discussion No. 3:

Thon 2, Tam Thanh, 17th of March 2010

Participants:

- Mr. Son. Born in 1954. Farmer. Classified as nearly poor
- Ms. Phung. Born in 1954. Farmer. Classified as poor
- Ms. Hoa. Born in 1954. Farmer. Classified as nearly poor
- Mr. Gran. Born in 1956. Farmer and village headman. Classified as middle

- Agriculture is very unstable
- Acacia cannot be used to generate much income but it is better than Cassava
- Acacia needs at least 3 years before it can be harvested
- Most people's work is to help with the acacia and some go to industrial zones (Chu Lai or Saigon)
- 1 working month = 360 kg rice (1000 m2) / 1 working day = 60.000 dong / 1 month = 1.8 mill.
- In this commune they use the smallest size for rice fields equalling 500 m2 pr field
- Natural disaster is the main obstacle in the village. Affects the other disturbing factors (transport, diseases in crops and changes in prices)
- Climate affects all of them, if there is a storm it will affect prices if it is raining it will affect the road
- Less natural disaster generate more casual work – less storms more days of work
- Acacia price is more stable than the price of cassava and easier to sell
- After Ketsana the price of acacia decreased a lot but is normally pretty stable
- 12 storms every year at level 12 – it was two out of twelve storms that pushed over some trees
- Too much available labourers compared to the numbers of jobs in the commune
- Most casual labour is helping each other with the acacia trees, but some work for Chu Lei
- The small roads to their forest are in bad condition. During the rainy season they can't access their forest

- Only storms affect acacia production. Not drought or floods
- The storms hit every plot of acacia the same
- They always see natural disasters as a collective thing
- This is the first year they have a lot of diseases and even though they use pesticides it comes back
- They have small lakes all over and that is enough to support the rice fields with water
- Cassava is used for livestock and to sell
- Acacia is easier to sell than cassava
- Enough work is the most important lacking factor in the commune, 40 people wants to work and only 20 can
- More sun creates more diseases in the rice
- The main road was built in 2006
- The commune should invest in better roads – most important

Vulnerability Matrix

Disturbing factors / Income sources	Natural disasters	Price changes	Transportation	Diseases on crops
Acacia	2	1	2	0
Cassava	2	0	2	1
Rice	1	0	1	2
Casual work	0	3	0	0

A2.4: Focus Group Discussion No. 4:

Thon 4, Tam Thanh, 19th of March 2010

- Quality of the soil in thon 4 is in worse condition compared to the three other thons
- 2700 ha half of the commune average 2 ha per HH but most belongs to the rubber farm and it is very different between the families
- Most of the area has been planted for 30 years when Duc Phu started so the soil quality is really bad
- The forestry area was investigated first in thon 4 so the trees have been planted for ten years only
- Duc Phu planted tea which made the soil poor so they changed to pineapple
- The rivers close to the forests were protected since 1980 because of Phu Ninh and the program of planting trees was started in 1988 – pilot program of planting forest in 1989, program 327
- The rubber belongs to the farm so they don't know about the techniques
- The fertilizer labour and seeds has increased 1.5 times the price has decreased
- Acacia cannot be planted because it is too dry in this season – normally this season is planting season
- The prices on Acacia has decreased from 750.000 till 550.000 pr. ton because of the financial crises

Vulnerability Matrix

Disturbing factors / Income sources	Soil quality & land scarcity	Weather	Diseases in crops	Price changes
Acacia & Eucalyptus	2	1,5	1,5	2
Rice	1,5	2	1,5	0
Rubber	1,5	2	0	0
Service	0	1	0	0,5
Other crops (Cassava, maize, bean and potatoes)	1	1,5	0,5	0,5

B - Key informant interviews

B1: Interview with IFRC

26th of February 2010, Hanoi

Representatives:

- Mr Dang Van Tao, DM Programme Manager
- Mr Paul van der Lann, Country Representative for the Netherlands Red Cross

- Red Cross has a climate change relief program in Quang Nam and they work from community level and up
- Quang Nam is the worst hit by typhoons
- The farmers have to change the time for planting
- The role of DARD is really strong; they decide when people have to plant
- MARD decides what crops to be planted where
- Farmers no longer have their own seedlings, they will either have to buy them or get them provided
- The Red Cross makes some vulnerability mapping of a community and identifies the major risk and vulnerabilities – for instance that people can't swim or their houses are not strong enough
- There is a connection between poverty and vulnerability
- The strategic environmental assessment is lacking and therefore some communes for instance build a dam that protects the commune but makes the flood move to another commune
- Ethnic minorities are poorer than Kinh but doesn't know why, maybe because they live in the mountains or because they are ethnic
- There is a good typhoon warning in Vietnam
- Deforestation regulations are really bad
- The Red Cross focus mainly on community based approaches
- It can be a problem if there is a dependency on one crop – diversification is good

- Vulnerability is not only about poverty or wealth but also about the ability to change livelihood strategies
- The national target plans that the government implements take a long time before they reach community level
- The NGOs can to some extent influence government policies by doing pilot projects and by publishing different materials
- Even though there is a budget for climate change it has to be allocated right
- There is a climate change debate but it is separate and it should be integrated across all policies

B2: Interview with Spatial Decisions

26th of February 2010, Hanoi

Representatives:

- Mr. Pant, GIS expert
- Mr. Chaudhery, Director of Spatial Decisions

- Transformation from irrigated to rain fed crops results in more vulnerability
- Agricultural extension services are playing an important role for what farmers are growing
- Farmers get both upland and lowland areas for production
- Acacia production is happening because of the government /district want the change
- Hard to plant anything else on the same area as acacia
- Farmers are normally doing both high value (acacia) and low value (rice) production for subsistence

B3: Interview with CARE Denmark

3rd of March 2010, Hanoi

Representatives:

- Fiona Percy, Rural Development Coordinator

- The government has an agricultural extension strategy
- Fruits and cashew nuts are the normal big scale agricultural industries
- Each district has quotas on rice production they need to meet, which normally has a big influence on the type of crop production
- Value chain is implemented by NGO's and INGO's to help farmers meet market demand
- Lack of market approach to production because of the communist system
- Development of lowland areas and quotas are important factors determining extension service strategies and guidelines
- Seeds that are most high yielding are provided by the government
- There exists special certified rice that are sold for higher prices than conventional produced
- Nature of land policy affects land-use
- Land is allocated to the people including production and protected forest
- Acacia is a fast growing tree which normally can be harvested after 5-6 years
- Acacia is normally planted on degraded land
- One need to be relatively wealthy to produce acacia because of the high demand of investment needed
- Government policies stopped shifting cultivation and now the farmers are told where to plant their crops
- The social policy bank is working as social welfare for the poor people and it is these people which get top priority at the bank
- Because of this some middle or high income people pay to be categorized as poor to get the benefit of the poor people such as cheap loans
- Money from the government is distributed randomly to the people on the poor list without any further consideration
- No business plan is needed to get money or cheap loans. No demand based strategy

- Women's Union distribute a big part of the money flow from the social policy bank and also has other separate micro financing programmes
- One has to pay to be a member of the Women's Union
- Farmer's Union is not that visible and strong and has mainly male members
- Money lenders: rich people lend money at high interest rates often when poor people are not able to pay their loans to the social bank
- The lending system is not very effective to get people out of poverty
- People rather save money on a short term period compared to long term which is often to abstract and insecure to people
- Important factors that determine the vulnerability of people: No land, no livestock but chickens and no diversification of income sources
- Poverty and vulnerability is closely linked
- The construction of houses is also an important factor for vulnerability
- The causes for vulnerability are different for every community
- Lack of a effective security system to reduce impacts from natural disasters is a important factor as well
- Protection forest's aim is to regenerate the forest in Vietnam
- Big parts of protected forest is bare land
- The government does not care about mountain areas and the degradation is consequently severe in these areas
- Districts make developments plans every year which leads to land use strategies
- Deforestation leads to big landslides
- Grazing policies are needed in mountain areas
- There exists no support to cattle producers
- Not fair just to blame shifting cultivation for land degradation
- A system of rotation cultivation would be a good idea
- People do not want to protect land they do not own as the lack reason or incentives
- Making contours instead of building terraces which is a extremely labour intensive
- Rice production is sensible to night temperature changes
- People may experience new weather patterns but are not linking these to climate change
- The government's programme for climate science and strategies need to be more practical in order for the farmers to understand

- 5 million hectare reforestation project (ending in 2010): People who have protected forest on their land are paid 100.000 dong/hectare/year to manage the forest. This is a big income for many people and the agreement can last for max. 5 years. The project works and is enforced and the farmers get their compensation
- It is effective because of the top-down system and because people are afraid of breaking the agreement
- Provinces are quite autonomous. They can decide how to interpret laws and make their own strategies
- Rice quotas are not playing an important role in the province's strategies
- Vietnam import wood from America and process the timber and then export it to the West
- Vietnam is both the biggest exporter and importer of cashew nuts
- Wood-production is over in Vietnam

B4: Interview with WWF Vietnam

4th of March 2010, Hanoi

Representatives:

- Trine Glue, Project Coordinator

- Hver provins skal udvikle en adaptation plan
- National Target Programme for klimaændringer response på national plan udviklet af MONRE. Heri er fremtidsscenarier for påvirkning af klimaændringer og disse scenarier danner grundlag for hver provins' adaptation plan.
- Det er meningen at hvert ministerium skal udvikle deres egen klimastrategi
- I Vietnam bliver termen response ofte brugt frem for adaptation
- Provinsen skal lave climate change steering committee
- Der eksisterer både peoples council og peoples committee
- På distriktsniveau er personen der er ansvarlig for miljø og land-use planning med til at udforme adaptation planen
- Et væsentligt spørgsmål er hvordan tilpasning skal forvaltes?
- De fleste strategier er top-styret og central planlagte
- Vietnam har været ret proaktive indenfor climate change response
- Der eksisterer en stærk indflydelse fra hvordan naboen forvalter sin jord
- Agricultural extension officer giver råd til hvordan landmænd skal forvalte deres jord
- NTP er ikke så konkret at det har indflydelse på strategier på distriktsniveau
- MARD har også deres egen klimastrategi

B5: Interview with FINNIDA

4th of March 2010, Hanoi

Representative:

- Jens Rydder, Program Coordinator & Senior Adviser

- Opdelingen af land sker på provins niveau gennem land department - MONRE – forskellige sektorer forskellige planer
- Provins niveau: bestemmer hvilke fabrikker (sukker/træ mv.). Derfor fordeler de jordområder til at være forskellige produktionsområder
- Kommunen bestemmer hvem der har hvilke lodder, men bygger meget på det eksisterende jordopdeling – man kan godt handle med land – derfor en betydelig land koncentration i Mekong deltaet men mindre i bjergene
- Den røde bog er lig med brugsret i 50/70/100 år afhængig af land kategori – man kan sælge de røde bøger på markedsbasis men markedet er meget lille i central highlands
- Man kan ikke lave sit landbrugsland om til en anden land use som f.eks. industri
- Landbrugsland er paddy rice – skov er meget mere flydende
- Der er mange problematikker for tildelingen af skov fx de forskellige kategorier af skov og forskellige institutionelle processer – state forest enterprises sidder på store områder og holder på dem
- Hvilke interesser har bønder i at vedligeholde skov og desuden er skov meget ofte afsides beliggende og utilgængelige – der er meget skov (protection forest) hvor der i virkeligheden bliver dyrket shifting cultivation
- Meget lidt ikke overrislet risproduktion derfor koncentreret i dalende
- Provinsen laver en sukkerrørsfabrik og så dyrker folk sukkerrør fordi de gør hvad der bliver sagt. Folk er meget autoritetstro – det er en kommando økonomi og hvis man ikke følger det er det svært – der er dog en tendens til at flere ikke gør det og så skal man længere væk for at få sukker til fabrikken og så bliver den urentabel
- Det er lettere at følge systemet – der er en basal sikkerhed i systemet fordi de bliver sikret i yderlighederne ved at staten udsteder kreditter i de hårde tider, det er bedre end at være sin egen lykkes smed fordi staten udbyder og opkøber dine produkter det sikrer en basal sikkerhed det kan godt være at de ikke blive rige men det er sikkert

- Man skal have hår på brystet for at sige fra over for systemet. Folk er i højere grad begyndt at sige fra fordi det i højere grad er blevet muligt at få sine såsæd fra ikke statslige organisationer i nogle områder
- Land-use strategierne på provins niveau har stor betydning – på to tre år gik Vietnam fra ikke at være selfsufficient på ris til at være den næst største eksportør på verdensmarkedet
- Det er svært at sige hvornår noget er tvang og hvornår det er frivilligt
- Folk omlægger tit fordi naboen gør det – der er en stor flok mentalitet også mellem provinserne
- For de bønder der omlægger deres produktion sidst er det ofte en dårlig business fordi landet oversvømmer markedet og så falder priserne umiddelbart efter de har omlagt – de bønder der kommer først til mølle når at konsolidere sig, men for dem i anden række er det en dårlig business
- Omlægningen til acacia kan skyldes, at der er blevet oprettet en papirmølle og så bliver folk bedt om at producere acacia – ikke nødvendigvis direkte men kan også skyldes bedre priser – problemet er, at alle provinser opretter papirfabrikker og så falder priserne og så er problemet, at dem der omlægger for sent ikke får noget ud af det og ikke når at opbygge en buffer. Det er typisk de ressourcestærke der omlægger først, de mest sårbare er ofte dem der omlægger for sent da de er mindst ressourcestærke og får mindst ud af det
- De ressourcesvage har ikke midlerne til at tage de rigtige beslutninger fordi de f.eks. mangler informationer – derfor kan det være godt at der er nogle mere ressourcestærke personer der træffer beslutningerne så længe de mennesker er kvalificeret og træffer nogle kloge valg. Det er de bare ikke; det er typisk irrationelle beslutninger der bliver truffet f.eks. at anlægge sukkerfabrikker i samtlige provinser
- Klima bliver overhoved ikke tænkt ind i disse strategier
- Det er en subsidie kultur – folk venter på staten og venter på hvad der bliver sagt
- Eksempel på subsidie kultur: Infrastruktur – budget for drikkevands anlæg – hyrer et surveyfirma der kommer ud i landsbyen der godt kunne tænke sig et drikkevandsanlæg – der kommer teknikere udefra – landsbyboerne skal levere arbejdskraften og bagefter skal de vedligeholde det hvad de hverken har ressourcer eller incitament til fordi de ikke er blevet taget med på råd – det hele er meget top down og hvad der kommer oppe fra siger de ja til – hvis de blev taget mere med på råd ville der være større incitament
- Regeringen har en politik om at støtte fattige generelt

- Det er en stor fordel for fattige fordi de får mange fordele, der er derfor ingen interesse i at ryge lige over på den anden side af fattigdomsgrænsen fordi man så mister sine subsidier – dette betyder at fattigdoms certifikater bliver handlet
- Der vides præcis hvor mange der bliver fattige men certifikaterne går på skift fordi alle skal have subsidier
- Der er mange fattigdomsprogrammer i Vietnam – nogle beslutninger bliver drevet af subsidie hensyn snarer end udviklingshensyn
- Der er sket en decentraliseringsproces i Vietnam til provins niveau hvilket betyder at de provinser der ligger det rigtige sted og har et godt lederskab tordner derud af
- Top-down fungerer på den måde, at systemet er der som en sikkerhed så der er balance mellem top-down og bottom-up
- De vigtige beslutningstagere i Vietnam er provinserne
- Hvis man vil være medlem a Farmers Union er det godt at være medlem af partiet
- Etniske minoriteter er i meget høj grad stigmatiseret ligesom muslimer – det er svært at integrere dem i det vietnamesiske samfund
- Staten styrer udbudssiden og efterspørgselssiden så man har ikke så mange andre muligheder som bonde i Vietnam

B6: Interview with CARE Vietnam

8th of March 2010, Tam Ký

Representatives:

- Egbert Mone, Economic Development Advisor at CARE International

- CARE gets their data from an international typhoon center and as soon as they know where it will strike they take action. The typhoon stroke on the 29th of September and on the third of October they were already distributing emergency goods and had 900.000 $ for Quang Nam
- 52 % of the harvest was lost (all crops) and 100 % in mountainous areas
- The provincial committee for storm and flood control identifies where much of the damage was done
- The Fatherland Front is the one in charge of social affairs, they are most powerful and most directly linked to the party and they coordinate all relief management
- CARE works in 3 communes in Nui Than: Tam Hai, Tam Mitey and Tam Tra. They also work in Quay Son district
- Quang Nam is the province worst hit
- Main income in the mountains is wood logging
- In Tam Tra most of the crops were lost but the yield is also not that high
- People have generally the same crops and depend on producing trees to the paper mill for money
- What they grow on the land is for subsistence and they actually have to buy more rice
- Some have income from family members working in Danang, Hoi An or Chu Lei
- People don't have savings and it is very much a subsistence culture
- People still feel the effects from Ketsana because they lost their last harvest and still haven't got money from the next so they really have to tighten their belts. Some are lucky that they get money from people working outside
- 25 % are female headed HH
- Some receive some state pension
- Fatherland Front does nothing on mitigation only coordinate support. If someone does mitigation it is the Red Cross

- The Vietnamese army is well prepared for mitigation, they moved 300.000 people in 5 hours thanks to the speaker system and they are good at providing water and food
- They always ask for assistance from international NGOs
- The mitigation is mostly about building the homes stronger, against storms there is not much you can do
- CARE works on better financial planning with the HH – through the women union
- They could try to get better flood control of the rivers
- The women's union has one of the better micro finance programs in Vietnam. The women take the loans so they are the ones paying them back
- They create a group of women who will save up money so they can borrow money. There is also micro insurance
- A poor book gives you the advantages. Only provided to Vietnamese people and many are not registered because they don't know about it or are too lazy or other reasons
- If the commune has to reach a target of for instance minimizing poverty by two percent they just choose some and take their books
- The social policy bank doesn't have the loaning aspect of loans and that sometimes ruin the idea of micro finance. The social policy bank doesn't do much to get their money back but most of the people do pay the money back. The bank is good for poor people
- The Agribank is another big player on loans in rural areas and they charge 1.5 %
- Many micro finance schemes
- If you want to loan money from the social policy bank you can't owe money somewhere else or to the bank
- The microfinance loans are in general between 1 and 2 m. the first time and then 3-4 m. and 5-6 m. afterwards
- Agribank loans are different as they are higher and can't be paid back immediately
- There might be government subsidies for acacia production
- There are two types of acacia trees they use for paper production
- There is the Quang Nam Rubber Company
- It is a coincidence that CARE are in Quang Nam and they will pull out in April 2010
- Quang Nam is famous for illegal logging
- In Tam Tra between 50 % and 75 % of forest was affected by Ketsana

- Tam Tra is already vulnerable because of limited resources, the resource base is quite limited
- Many female and elderly HH might suggest a depopulation for the uphill communes
- Central Statistic Office Vietnam – www.gso.gov.vn
- Than Nien News

B7: Interview with Nui Thanh District

3rd of February 2010, Tam Ký

Representatives (for all three interviews):

- Vice-president for agriculture and prevention board
- Vice-president for environmental board
- Staff from agriculture and prevention board

- Coastal/lowland areas are more affected by natural hazards than mountain areas
- Serious erosion in the mountain areas and bank erosion along the rivers
- Climate change part of the reason
- Before it was not so severe but the last 5 years it is getting worse
- Climate change impacts the condition of the natural resources, socioeconomic situation and livelihoods of the communities
- Landslide and erosion reduce area of agricultural land in mountain areas
- Coastal land suffer from increasing sea levels and more intense typhoons
- Difficult to say which areas are most affected by climate change
- The district support all households during Tet[30] (helps produce rice or provide rice to the people)
- The livelihoods in the province depend much on agriculture
- The poor people do not have concrete houses to protect them against typhoons

8th of February 2010, Tam Ký

Natural Disasters and Land use change

- In general it is difficult to say which land is most affected by climate change
- Coastal/lowland areas are more affected by natural hazards than mountainous areas
- Typhoons, landslides, soil erosion and salt water intrusion are the most typical natural disaster

[30] The vietnamese New Year

- Bank erosion also exists because of changes in the water stream
- Partly because of climate change landslides and soil erosion is a major problem in the mountains and therefore the government has a plan to move people to safer areas
- Before landslides/erosion was not so severe but within the last 5 years it is getting worse and results in a reduction of the area suitable for agriculture in mountainous areas
- Climate change impact the natural resource condition, the socio-economic situation and the livelihoods of the community
- Coastal land suffer from increasing sea level and more intense typhoons
- The possibilities of doing agriculture is important when people are moved to new areas
- To prevent economic losses the district suggest (guidelines) farmers only to produce shrimps when there are not typhoons which mean that between 15/9-1/3 there should be no production. Before 2003 farmers did production the hole year without other suggestions from the district
- In 2000 the district also suggested farmers to reduce the rice production season from 3 to 2 per year to protect against typhoons
- 2 season per year can produce higher yields because the crops are not impacted by typhoons and are in addition to that less costly and therefore needs less investment
- At commune level there is control for illegal expansion into forest because less forest causes soil erosion
- Acacia trees are produced here because there is a factory in the district

- **On-farm / non-farm relations**
- The Chu Lai Industrial Pact is from 2003
- Many agricultural areas are transformed into factories/industrial zones
- 1000 hectares of agricultural land = 500 labours
- In the age of 18-40 30 % work in the industrial zone compared to 0 % of the age of 45+
- The district has been transformed from a agricultural area to an industrial area
- Agriculture contributes to 32 % of the district GDP and is expected to drop to 20 % soon

- **Natural Disaster Prevention Measures**
- The disaster prevention board was established at the same time as the district???
- Investment of 15 billion VND in building a safe harbour for 1200 boats

- There are protected forest in the district which means that people are not allowed to cut down trees within this area
- The government has invested in a dike to avoid bank erosion
- Bank erosion is a problem anywhere in the district
- There is a dike along the coast to prevent salt water intrusion
- Support all households during Tet in producing rice
- The poor don't have concrete house to protect themselves against typhoons

- **Poverty Situation**
- Poor people are allowed to have a loan up to 30 m. VND per. person from the social policy bank at a 0,7 % interest rate
- The district organize special training for farmers in breeding and cultivation
- The 5 mountainous commune are provided free seeds or at a low costs prioritized to the poor people
- People are categorized as poor if they have less than 200.000 dong per month
- 3000 families out of a population of 150.000 are categorized as poor

- **Poverty Reduction or Natural Disaster Prevention Measures**
- Investment in constructions to prevent natural disaster is very costly
- The district focus on investment in research and science
- Have to consider the poor but also the rest of the population
- Constructions are very important to prevent natural disaster and not only poverty reduction

8th of March 2010, Tam Ký

- Total area of Nui Thanh 533 km^2
- Forestry in Nui Thanh 21.916 ha
- Protection forest 15.554 ha
- Production forest 6.362 ha
- No conservation forest
- Natural forest cover 9.183 ha
- Planted forest 10.433 ha

- There is a management board for the Phu Ninh Reservoir – main office in Tam Ký but also has small offices around the district e.g. one in thon 8 in Tam Trá commune
- Phu Ninh was build from 1975 – 1979 and started working from 1980
- The reasons for the increase of acacia production in the area: acacia take short time to produce, it fits with the condition of the land and climate, it is easy for local people to grow and it can be reproduced because seeds can be taken from the trees. Moreover there is a good market for acacia – three factories were constructed in the district of Nui Thanh (in Tam Hiep (Chu Lai industrial zone), Tam Nghia and Tam Hoa) five years ago and others in the district of Danang and Quang Ngai.
- The shift to acacia came 5-7 years ago
- The acacia was imported from Madagascar in 1975
- Before there were eucalyptus trees in the area but it take longer time to grow them (15-20 years) and the market for the eucalyptus is not very good
- The district is guiding the farmers by giving them a schedule of what to plant and when. The guidance is based on the experience on the characteristics of the crop and then on the weather forecast. They continually study rice every year and they try to find more drought resistant species. The researcher is on provincial level.
- The district provides the farmers with seeds – the poor people get them for free and others have to buy them. It is also possible to buy them from the market but that is sometimes more expensive.
- If a new type of rice is discovered it will be provided for free in some selected areas to try it
- Chu Lai can be divided into two different categories: the open economic zone and the industrial zone. The total area of the open economic zone is 27.045 ha covering 14 communes and 1 town. The area for the industrial zone covers 785 ha.
- Of the 73.692 people working in Nui Thanh 4.416 are working for Chu Lai in Nui Thanh. There is an additionally 716 people from outside the province working in the industrial area in Nui Thanh
- 2750 people are working outside the district
- The factories pre-process the wood and then export the woodchips to other countries

B8: Interview with Quang Nam Rubber Group

18th of March 2010, Rubber Farm Office in Tam Thanh

Representatives:

- Duong Phú Tân, Director of the Rubber Farm
- Mai Vân Pháp, Technician

- 1976: The state-owned company started clearing small forest land in the area
- 1976: In the state-owned area production of tea and pineapple on 980 ha started
- The state owned 2000 ha but only used 980 ha of this area and allowed the local people to use the rest because this area was mainly on high slopes or natural forest
- 2001: The rubber factory started producing rubber on a 260 ha area
- The rubber farm has 980 ha in total today and the 1020 ha is eucalyptus and acacia trees which the local people manage but in reality belongs to the government
- After 8 years rubber trees can start to produce rubber
- 106 official full-time workers; there is a limit for how many people they can give full-time contract
- 246 part-time workers which are almost all local people
- 350 people get salary and are responsible for managing the land and the rubber trees
- Two types of contracts: 1 year for official workers and 3 months for the rest
- Pineapples were exported to the Soviet Union but after 1991 the demand stopped and therefore they changed to rubber production
- Invested in rubber because it generates more money and is too capital intensive for local people to produce
- The rainy season is in October and it is hard to plant rubber in the dry season
- 2001: started planting acacia
- Still planting a few hundred ha of acacia each year and is trying to corporate with the commune to get people to give their land to the factory to be able to produce more acacia
- The big newly-planted area has been obtained from the local people that just harvested acacia and from areas which were destroyed during Ketsana
- 10-12 m. VND pr. ha as compensation for the land
- The farmers who give their land to the factory get first priority to manage the rubber

- The rubber farm expects to have 1200 ha of rubber in 2015
- If it is too rainy the trees will grow slowly and if it is too dry the production of rubber will decrease
- The rubber farm has only land in thon 4
- The main road was built across the commune to Tam Son in 2003-2005 for 24 billion VND and was paid by the Vietnam Rubber Group
- There is a long-term plan to build more concrete roads but it depends on the production of rubber

B9: Interview with Commune Officials in Tam Thanh

4th of February, 10th of February and 22nd of March 2010

Representatives (for all three interviews):

- Vice-president
- Environmental and mapping officer
- Agricultural officer

- Total area of commune: 5393 ha
- Forest area: 1000 ha (belonging to local authorities)
- Rubber factory: 1600 ha
- The rest of the land belongs to local HH
- 4 villages – 1035 HH – 4165 population
- 1338 ha protection forest – protected and natural forest – for acacia trees in the protected area 25 % can be cut to protect the water reservoir
- Acacia trees are very normal in central Vietnam and grows really fast it takes 7 years then they are ready to harvest.
- 80 % of the acacia trees in specific areas were destroyed during the Katsana storm and 70 % on the general basis
- It is difficult to protect the forest because it's a large commune – there is a forest management committee
- Major land use changes during the last 10 years have been change from forested areas to grain crops but after planting cassava land is turned into acacia trees
- The five year rainfall is decreasing and the average yearly rainfall is lower than the previous
- Last year GDP was 2.8 m. pr/y pr/person
- The young men in the commune go to the south for industrial jobs. They don't go to Chu Lai as its new and parts of the community is already settled in HCMC and earn more in the south – this is contributing between 15 – 18 % to the local economy
- There are 273 poor HH out of 1025
- In 2005 63,8 % of the population was poor compared to 25,7 % in 2009

- This reduction of the number of poor is because there has been a provision of new seeds, cheap loans, technical support and establishment of rubber farm in 2001 which has brought a main concrete road and electricity.
- There is an annual training with 5 classes of 1000 farmers and there are officers helping individual HH in agriculture and forestry
- The major disasters are drought and storms – the droughts happen because the big reservoirs (Thai Xuan and Phue Ninh) located in the commune are not used for the rural area in the commune but for Tam Ký and Chu Lai.
- From 2000-2008 there has only been small storms causing small damage. Now it should be rainy season but there is less rain and higher temperatures. The total precipitation is decreasing but the individual rainfalls are more severe and water scarcity is more severe and frequent.
- There are an annual plan to prevent damage from floods
- There are three reservoirs in the commune and small ponds that they build themselves.
- To help people adapt to climate change the best options is to mainly support individual HH – if you build reservoir you can't cover the whole commune and the poor families are spread out over the whole commune so if you support them it is better.
- Prioritize the economic sector and support the economic condition of the people is the best way to prevent big damages from natural hazards
- To calculate the rice production of a field one m2 is cut out and then calculate the production of that and times it by the area of the field - the general area of the field is calculated by looking at it
- Price on acacia decreased in 2009 and transport expenditures increased
- The harvest of rice has been reduced from 3 to 2-3 times a year but in general rice production is increasing because of introduction of new technologies and seeds. The harvest is 3-4 tons per ha per harvest.
- Extension service at HH level gives e.g. financial support

22nd of March 2010, Tam Thanh

- The commune is the lowest administrative unit
- The borders of the thons have never changed

- Names of the thons: Thon 1 – Phuoc Thanh, Thon 2 – Trung Hoa, Thon 3 – Truong Thanh, Thon 4 – Duc Phu
- The thons are there to make it easier to manage, people know about them but they are not formal and the borders are not official, people that live in one thon can grow trees in another thon
- The concept of thons has existed for a thousand years
- They added the south western mountain range to the program 661, the forest under the program is still managed and protected
- The map is not detailed enough to show production/protection forest
- Only a few areas of natural forest on the border of Tam Son but people cleared the forest before 2000
- Tried to protect the forest via pr. 661 and 327
- Have to irrigate the land around the four reservoirs to keep water for the dry season
- There is a population increase in the commune
- People have less land so they have to do more casual work and therefore people have to go other places to work
- Planning for more asphalt roads up to 2015 (21km)
- The division of land happened after the war and depended on the amount of work that people did just after the war, but after that people have bought and sold land
- You can't have more than 30 ha in Vietnam
- Difficult for people to clear forest in the rubber factory's area
- Many people in thon 4 work on the rubber factory and easily get above the poor level

B10: Interview with Vice President of the commune

12th of March 2010, Tam Thanh

- Thon 1,2,4 production forest thon 3 has protection forest
- There is no special use forest in Tam Than
- There is a forest management board in the commune
- Cassava and rice for lowland areas
- They only intercrop with cassava on their acacia fields the first year but in some areas they don't do that as cassava is to low value
- They use it for food for animals and sell the cassava to the factory to make cassava flour
- From 1975 – 1995 there was a tea farm and then it changed to rubber
- In 2000 the farm changed to rubber
- In 2000 the commune decided to change to acacia because there were build to factories in Nui Thanh
- Pineapple prices has gone down
- 10 families producing rubber only ten because of lack of knowledge and investment
- The price of a ton of acacia fell from 700.000 to 550.000 dong because of the economic crisis but they think it will rise again. The big supply of acacia is not a problem
- It was because of the Ketsana storm that the market was overflowed and because it was the end of the year and the factory was reaching its quota for export
- Protection forest equals planted and natural forest
- Protection forest – natural forest and planted forest, its allowed to cut 25 % each year according to the law of the government
- Climate and natural disaster are the biggest problem
- They are living between two big reservoirs, there are four big reservoirs in the commune and that's only enough to serve 20 % of the agriculture the rest depends on precipitation. All the reservoirs are located in thon 1 and 2, there are another 40 ponds but they get destroyed every time there is a flooding and they have to rebuild them every year and they are very small. Before the dry season they redirect water

- The four main reservoirs have been built within the last ten years. After the construction of the reservoirs the production of rice has increased and the life of the farmers has also improved
- Before the flooding and typhoon season people are asked to strengthen their houses and if it is serious people are moved before the flooding, they check for bank erosion and if it is not secure people are moved to safer places
- To mitigate impacts from droughts the commune tell people to collect water or redirect the water stream to have enough water
- There is a local response team that help people after the storm
- They suggest the higher authorities to provide more money, techniques and knowledge
- They are always building and improving the dykes and ponds but because of lack of finance it is not possible

B11: Transect Walk

9th of March 2010, Tam Thanh

Representatives:

- Vice-president of Tam Thanh

- Acacia trees are only used for paper production
- The leaves and branches are burn after harvest and used as fertilizer when planting new trees and sometimes they are used as firewood in households
- It takes 5-8 years before it is ready to be harvest
- All acacia trees rain fed and are pretty drought resistant; only a few trees are lost in the dry season
- Limit area of flat land in the commune
- Lots of rubber plantation near Phu Ninh reservoir
- Rubber trees take normally 8 years before they can provide rubber. After 25 years it is harvest and sold on the market or used to build furniture
- One rubber plant costs 35.000 dong compared to 350 for an acacia tree. Therefore most rubber plantations are managed by state-own companies
- Also rubber trees need much more technical knowledge and maintenance and the people in the commune do not have these kind of resources

C - Agricultural Extension Service Paper

Quang Nam Agriculture Department

Guide to intensively cultivate winter-spring rice 2009 – 2010

Technical Guidance for farmers

Nov. 2009

I. Season and variety for winter-spring rice

1. Rice fields watered by artificial irrigation

Arrange time for winter-spring rice to blossom in period of between 20 March and 05 April 2010. For rice areas irrigated by Phu Ninh irrigation system, time for winter-spring rice to blossom is between 20 – 30 March 2010 in order to have time to repair channels between 2 seasons. The schedule for spreading rice varieties as follows:

- Long-term varieties (120-130 days) include: Xi23, NX30, X21, NP12, NP16, their spreading time is 20 – 30 Dec. 2009 (account for 50-60% of the total area).
- Medium term varieties (110 – 120 days) include hybrid varieties such as Nhi Uu 838, Nghi Huong 2309, TN15, Bio404, TH3-3 and normal varieties: CH5 and CH207. Their spreading time is 1 – 10 Jan. 2010 (25-30% of the total area)
- Short-term varieties (100-105 days) include HT1, VĐ20. The time for spreading seeds is 10 -20 Jan 2010 (15 – 20% of the total area).

Note:

Besides the above varieties, depending on natural conditions of each zone to use more some adaptive rice varieties, but the area for these varieties should be only 10 -15 % of the total rice area of the zones. Don't use varieties too sensitive with weather and diseases.

- Produce new hybrid varieties such as: Quong Huong Uu No 5, Van Huong 7, T-BE1, HYT100 in where these varieties have ever tested with good results.
- Low fields should be transplanted with rice seedlings 5 – 7 days earlier than the time for spreading rice seeds;

- For fields in mountainous areas, time for spreading rice can be 10 days later than the scheduled time to avoid cold weather;
- Fields watered by Phu Ninh irrigation system should be use to produce short and medium-term varieties used for Summer-autumn season.

2. Fields irrigated by natural water

- High-base fields are suitable for growing maize, cassavas or grasses for cows.
- Use rice varieties CH5, CH207 and some others which are able to adaptive to natural condition for low fields, time for spreading rice-seeds from 25 Nov to 10 Dec. so that rice can flower in early March.
- Upland fields: use LC93-1, Lc22-7 and local upland rice varieties.

II. Techniques

- After harvesting Summer-Autumn crop turn up soil by ploughing so that rice stumps, grasses decay in order to reduce diseases and increase fertility of soil.
- It is necessary to provide enough lime especially when flooding bring a lot of alluviums to fields to neutralize poison in soil before working soil for Winter-Spring rice crop.
- Reduce volume of rice-seeds: Use only 1.2 – 1.5 kg of seeds F1 of hybrid rice varieties for about 500 m^2 and 3.0 – 3.5 kg of seeds at final level for normal rice varieties. Encouraging method of spreading rice-seeds to reduce the amount of seeds and to regulate density of rice in fields.
- Increase use of muck, green manure or organic phosphate, micro-organism phosphate
- Process rice seeds by a solution of lime in water or chemical to reject poor rice seeds and to kill germs.
- Dry surface of fields when rice ramify to make soil airy and rice roots grow deeply and promote nutritive so that rice well ramify and do not fall (Be noted that when temperature under 20 ^{0}C should keep water at level 10 cm to stand against cold weather.)
- Based on field base and irrigation condition to use pesticides suitable to remove grass combined with pulling grasses by hands. Don't use pesticides to remove grasses in cold weather.

III. Fertilizer

- Fertilizer quantity: Total amount of fertilizers for 500 km^2/1 season***(Unit: Kg)***

Fertilizer	**Hybrid rice**	**Purebred rice**	
		Long-term	**Short-term**
Muck	400 - 500	350 – 400	350 – 400
Lime	20 - 25	20 -25	20 - 25
Phosphate	25 - 30	15- 20	15- 20
Urea	10 - 11	9 -10	7 - 8
KCl	7 – 8	6 - 7	5 - 6
NPK	7 - 8	6 – 7	5 - 6

- **How to use fertilizer**

Method	**Variety** / **Time**	**Purebred rice**		**Hybrid rice**
		Long-term	**Short-term**	
Basal fertilizing	Before working soil for final time to spread rice seeds	Total amount of Muck and Phosphate + 2 – 3 kg of NPK		
Additional fertilizing	1st time: (12 - 15 days after spreading seeds)	3 – 4 kg Urea + 3 kg Kali	3 – 4 kg Urea + 3 kg Kali	4 – 5 kg Urea + 3 kg Kali
	2nd time: (20 - 25 days after spreading seeds)	2 kg Urea + 4 kg NPK	2 kg Urea + 3 kg NPK	2 kg Urea + 4 kg NPK
	3rd time: (35 - 40 days after spreading seeds)	2 kg urea + 1 kg Kali		2 kg Urea + 2 kg Kali
Earring dressing	- 60 – 70 days after spreading seeds for long-term varieties - 45 – 55 days after spreading seeds for long-term varieties	2 kg urea + 2 - 3 kg Kali	2 kg urea + 2 - 3 kg Kali	2 kg urea + 2 - 3 kg Kali

III. Pestilent insect and disease management

- Frequently take care of fields to timely detect diseases and give suitable treatment. Apply the process "3 reduce and 3 increase" to reduce diseases and increase quality of rice.
- Winter-Spring rice is vulnerable to diseases: Rice blast disease, Brown backed rice plant hopper and white backed rice plant hopper.

In order to prevent against rice blast disease, it is necessary to frequently look after fields to discover the disease especially when rice flowers; we should use prophylactic specific pesticides 5 – 7 days before and after flowering period for varieties which catch this disease (Please follow guidance on package).

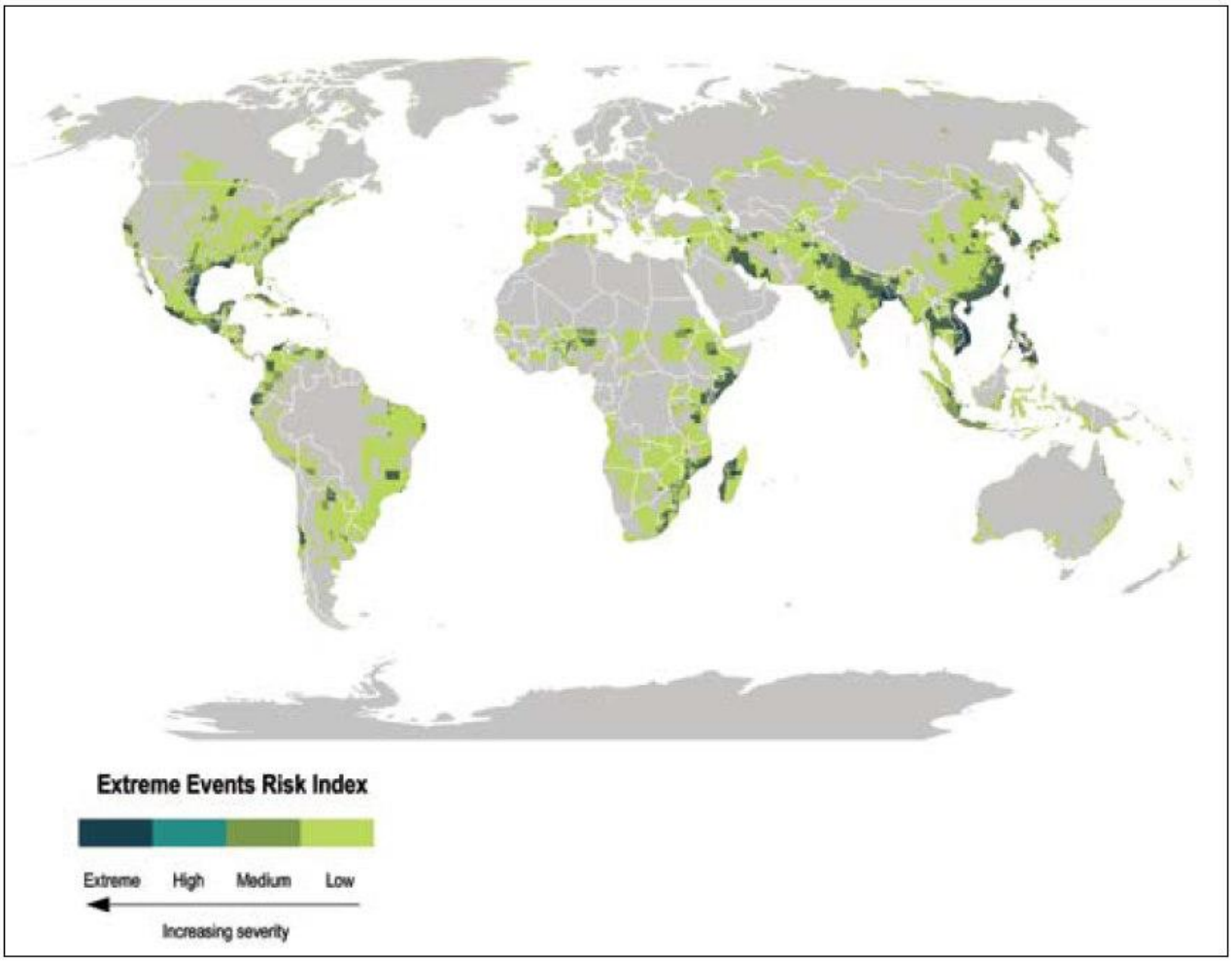
- Brown backed rice plant hopper and white backed rice plant hopper are usually appeared on winter-spring rice. Not only burning rice these insects also transmit rice grassy stunt virus and some other viruses to cause serious disease against rice.

In order to prevent these insects, it is necessary to frequently inspect rice stumps. If density of the insects is about 2 – 3 insects/branch up, need to use pesticides to kill them.

Be noted that don't over-use pesticides if density of the insects is low. Please contact local dedicated staff to get guidance on using pesticides. When use pesticides fields need have water. Spray pesticides carefully into rice stumps and in order of from-large-to-small circle.

D - Physical Vulnerability Index Map

Figure 3 — Physical vulnerability to weather-related disaster and sea level rise*



* "Climate Vulnerability Index" designed and prepared by Maplecroft
Source: Center for Hazards and Risk Research, Center for International Earth Science Information Network, Columbia University , International Bank of Reconstruction/World Bank, United Nations Environment Programme. Global Resource Information Database Geneva.