



STUDY REPORT

Needs assessment of sustainable livelihoods responding to climate changes in Vietnam

The case of Thai Nguyen

Ha Noi, June 2010

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1. SUMMARY

This project was conducted in Thai Nguyen province. The research site, Vo Nhai, is a poor mountainous district of Thai Nguyen province. Local farmers' main livelihoods on agricultural production, which accounts for 38.3% of the GDP in 2009. Recently, many extreme weather events have been reported as having damaged the livelihoods of the local people. In 2008 and 2009, many roads were damaged, many houses were destroyed, agricultural fields and crops, and animal were lost (Vo Nhai People Committee, 2008 and 2009)¹. However, there is lack of adequate research concerning how poor farmers can adapt to these weather changes, and what they need for sustainable livelihoods.

This research has been conducted in order to develop recommendations for intervention activities that can be carried out by development assistance organizations such as SRD. Improvement of sustainable livelihoods in this area, which is a key in alleviating poverty, remains challenging, especially in the context of climate change which is exacerbating many of the problems that poor people already face. Thus, an understanding of how livelihoods are conducted and sustained, how resources especially land are mobilized to earn an income and meet their basic needs is a crucial step in attaining a true sustainable development to these areas.

This study is designed with the overall objective of forming a comprehensive picture of the problems and needs of local people in maintaining sustainable livelihoods in the face of climate change, and recommending how their livelihoods can be improved in a short term and sustained in the long term by developing adaptation responses to climate change.

The research was divided into four themes which are closely interlinked: water, land, market assessment and climate change. A report was produced for each of the four themes, and this synthesis report for Thai Nguyen province brings those findings together. As a whole, this report highlights the new approach of combining climate change adaptation and sustainable livelihoods in reducing the poverty and vulnerabilities of poor people in rural areas who are highly dependent on nature.

¹ Vo Nhai People Committee. 2008 – 2009. Storm and Flooding Prevention Report. Vo Nhai: Office of the People Committee.

2. INTRODUCTION

2.1 State of problems and background

In Vietnam, climate change is not only a problem heard on public media like TV, radio, newspapers, it is also a problem which people are facing in their daily lives. According to Chaudhry and Ruyschaert (2007)² climate change is a very real threat to Viet Nam's continued socio-economic development. Increasingly erratic and variable rainfall, higher temperatures, more intense extreme weather events like typhoons, droughts and heavy rainfall causing floods, and rising sea levels will all have significant impacts across sectors, regions, and income groups, and particularly on livelihood security of the poorest rural people.

In Vietnam, the adverse effects of climate change are already evident, with impacts affecting many of the natural resources on which the livelihoods of many poor people are based. Climate change impacts include: sea level rise; increasing frequency and intensity of floods, drought, typhoons and storm surges, water supply problems and heat waves; as well as changing distribution and risk from vector-borne diseases. Such consequences directly affected the lives of millions of farmers who are living in climate change risk-prone areas and lack the resources, technology, and infrastructure to deal with erratic weather conditions.

The adverse impacts of climate change are suffered most immediately by the rural poor, because of their high dependence on natural resources, and their limited capacity to adapt to a changing climate. Climate change is believed to have many adverse impacts on the livelihoods of farmers who live mainly on natural resources. According to the sustainable livelihood framework developed by Carney (1998)³, livelihoods of rural dwellers are influenced by shocks, trends and seasons. Since climate change can increase the frequency and intensity of extreme weather events, and generates unpredictable weather trends and seasons, it creates shocks, which exacerbate the already vulnerable livelihoods of farmers.

Farm and livestock productions are important livelihood source of income of households living in the upland area of Vietnam. It plays a primordial role in developing the socio-economic aspect of the people by reducing poverty as well as protecting the environment (FAP, 2003; Otte *et al*, 2005). The poorest of the poor are often located in remote areas and the degree of poverty limits their accessibility to be involved in a wider range of economic activities. Agricultural product markets are encountering varieties of difficulties for the poor people in the upland areas. In addition to such difficulties are capital shortages, frequent diseases, poor extension services, rough terrain, difficult transportation, and fluctuated price, etc which hinders economic development (Jamieson., *et al*. 1998). Moreover, the market in mountainous areas has not developed; thus, products can only reach customers after going through several middle actors (Thao., *et al*, 2008). To enhance its marketing channels, mentioned issues must be thoroughly taken into consideration and solved.

² Peter Chaudhry and Greet Ruyschaert. 2007. Human Development Report 2007/2008: Climate Change and Human Development in Viet Nam. UNDP.

³ Carney, D. Sustainable Rural Livelihoods: What Contribution Can We Make? Nottingham: Department for International Development, Russell Press Ltd., 1998.

However, the full extent of potential impacts on agricultural production and the livelihoods of the poor, and how best to help poor people adapt, are not yet well known in Viet Nam beyond a small community of experts and development workers; some concerned state management agencies, and some local areas (which have benefited from climate change related projects). Research is needed on the most effective long-term adaptation measures and strategies to ensure human well-being and poverty reduction.

Thai Nguyen province is in the mountainous midland region of northeastern Vietnam, surrounded by Bac Kan province in the North, Tuyen Quang and Vinh Phuc province in the West, Lang Son and Bac Giang province in the East, and Hanoi in the South. Vo Nhai district is located in northern of Thai Nguyen province where climate temperature is colder than others place in the province. It is favorable for developing agriculture and forestry but has a high poverty rate due to a number of reasons including limited arable land, lack of access to markets and marketing information, weak infrastructure, and discrimination against ethnic minorities.

The research site, Vo Nhai, is a poor mountainous district of Thai Nguyen province. Local farmers mainly live on agricultural production, which accounts for 38,3% of the GDP in 2009 (Vo Nhai People Committee, 2009)⁴. Recently, many extreme weather events have been reported as having damaged the livelihoods of the local people. For example, in 2008 and 2009, many roads were damaged, many houses were destroyed, agricultural fields and crops, and animal were lost (Vo Nhai People Committee, 2008 and 2009)⁵.

An analysis of how livelihoods are conducted and sustained is required, in order to be able to understand how climate change is impacting on the poor and what is needed to help build their resilience. This analysis must include key issues about access to land, markets, water resources and sanitation. Combining climate change adaptation and sustainable livelihoods is a new approach to reducing vulnerabilities and poverty.

Vo Nhai District of Thai Nguyen Province is among poorest districts of poor provinces in the Northern Mountainous Region Improvement of sustainable livelihoods is considered an important issue for development policies in the agricultural sector in the province in order to achieve poverty alleviation.

2.2 Aim and objectives

This study is designed with the overall aim of forming a comprehensive picture of the problems and needs of local people in maintaining sustainable livelihoods in the face of climate change, and recommending how their livelihoods can be improved in short term and sustained in the long term by developing adaptation responses to climate change in Hoa Binh.

Specifically, the research was divided into four themes which, as explained above, are closely interlinked: water, land, markets and climate change. A report was produced for each of the four themes, and this synthesis report for Hoa Binh province brings those findings together.

⁴ Vo Nhai People Committee. 2009. Socioeconomic Report 2009. Vo Nhai: Office of the People Committee.

⁵ Vo Nhai People Committee. 2008 – 2009. Storm and Flooding Prevention Report. Vo Nhai: Office of the People Committee.

The key objectives of the study are:

- 1. Identifying past, current and likely future:** livelihoods activities of the local communities; land access and management arrangements; irrigation systems, access to clean water and sanitation; market opportunities of agricultural and forest products; and climate change impacts on the area.
- 2. Assessing the awareness and existing capacity of local people on:** climate change and adaptation; land access and management; irrigation and clean water and sanitation systems; value chain channels for local products.
- 3. Evaluating the efforts and interest of government authorities in addressing:** climate change and adaptation; land access and management; irrigation and clean water and sanitation systems; value chain channels for local products.
- 4. Identifying constraints, challenges, and potential solutions for:** coping with the adverse impact of climate change; improving irrigation, access to clean water resources and sanitation; enhancing value chain awareness and market opportunities; and improving land issues access and management issues confronting poor people in these communes.
- 5. Deriving recommendations** that can form a basis for future development intervention activities to promote sustainable livelihoods that can cope with climate change, and take into account challenges related to land, water and access to markets.

3. METHODOLOGY

The methodological approach chosen as the basis for this needs assessment study was participatory rural appraisal (PRA), because this approach allows the target stakeholders – poor farmers – to have an active role in identifying and explaining the challenges they face, their strengths and opportunities, and what they most need to support them to address climate change and build more sustainable livelihoods. It is also intended to encourage these stakeholders to feel ownership of the findings of the assessment and therefore be more likely to support and collaborate to implement the resulting projects.

Study sites

Three of the poorest communes in one of the poorer districts in Thai Nguyen province: Lien Minh, Dan Tien, and Lau Thuong communes, in Vo Nhai district.

Target groups

The key stakeholders whose needs were being assessed are local poor people. A range of groups were targeted, including farmers, the landless and those in situations particular vulnerable to natural disasters, and ensuring a representative range of ethnic minorities, ages and genders.

Other important stakeholders were local government officials, from the commune, district and provincial level, in particular from relevant departments such as the Department of Environment and Rural Development and Disaster Management teams. Representatives from mass social organisations such as Womens' Associations and Veterans' Unions were also targeted.

Selection of tools

Besides initial desk study and in-depth interviews, a wide range of PRA tools were used, including focus group discussions, observation and transect walks, calendar and timeline activities, ranking exercises, case studies in target locations, and SWOT analysis.

A feedback workshop was held following the visits to all three of the communes, at which stakeholders were invited to comment on the accuracy of the findings, how appropriate they considered the proposed recommendations, and any obstacles and opportunities they saw in implementing them. The purpose was to ensure the outputs of the needs assessment are as relevant and useful as possible, and to encourage the beneficiaries to feel a sense of ownership over the success of future projects.

Data analysis and interpretation

Since the methodological approach was PRA, qualitative analysis is a core method in analyzing data collected. However, ranking exercises, calendars and timelines generated some quantitative data, which allows for quantitative comparisons between communes and between districts.

Secondary data, in the form of reports provided by government departments, provided a combination of quantitative and qualitative information, and an important part of the analysis is to compare the information gathered from stakeholders with the information contained in secondary documents.

4. MAIN FINDINGS OF THE STUDY

4.1 Introduction of selected study sites

Thai Nguyen province

Thai Nguyen province is a midland province in the northern region of Vietnam with favorable condition for developing agriculture and forestry. With a total land area of 3,563 km² and a population of 1.2 million people, Thai Nguyen's GDP was approximately 16,488,000 VND in 2009, of which, the agricultural and forest production sectors accounted for about 23%.

Vo Nhai district

Vo Nhai is one of the poorest districts in Thai Nguyen province. 66% of the population of Vo Nhai belong to one of the following ethnic minorities: Tay (29.9%), Nung (14.5%), Dao (12.6%), and H'mong, Cao Lan, San Chi, and Hoa (8.7%). The population is scattered quite evenly across the district. The population of Vo Nhai was 63,000 in 2009, 66% of whom are engaged in the labour force. The majority of the district's labour force live in rural areas, which accounts for about 53 percent of the total labor force.

Although in 2009, the GDP growth rate of the district was 12.6%, which is higher than that of Thai Nguyen Province as a whole, and shows good development potential, the poverty incidence of the district was 25.2%⁶, nearly double the district's average⁷. The main incomes from agricultural production of Vo Nhai District are from rice, maize, ground nut, tea, tobacco, and forestry.

Selected Communes: Lien Minh, Dan Tien and Lau Thuong

Among the selected communes in Vo Nhai district, Lien Minh and Dan Tien are the most disadvantaged, according to the Government's Program 135. Lien Minh has the highest poverty incidence of the three (35.3%)⁸ followed by Dan Tien Commune (29.4%)⁹, both suffering a higher poverty rate than the average of Vo Nhai. Four out of Lien Minh's nine hamlets do not have access to electricity, and the access road to Lien Minh is poor.

Although Lau Thuong might appear the most disadvantaged as it has the smallest area of agricultural land and a big population, it has been assessed as having achieved its Program 135 Phase 1 targets and its poverty rate is below the district average. This commune has better transport system compared with the two other communes. It is located on a main road linking Vo Nhai to other provinces.

In the past years, a few interventions have been made in these communes to improve irrigation, water supply, and sanitation, mainly funded by the Government through Programs 134 and 135, but these interventions were minor in comparison with the needs. International donors have also provided some assistance in cow and sow breeding and afforestation.

⁶ Report on of Socio-economic Situation in 2009 and Direction for 2010, Vo Nhai DPC, 2009.

⁷ Supplementary Report on Main Target Socio-economic Achievements in 2009, dated 26/1/2010, Thai Nguyen PPC

⁸ Report on Socio-economic Achievements in 2009 and Direction for 2010, Lien Minh CPC, dated 1/2010

⁹ Report on Socio-economic Achievements in 2009 and Direction for 2010, Dan Tien CPC, dated 1/2010

4.2 Current situation of land and livelihoods

4.2.1 Land management

In general the land use patterns in the communes have not changed much. In Dan Tien commune, a relatively small area of agricultural land has been transformed to other land use purposes such as roads, public construction, and residential areas.

Land Use Planning and Procedures

Land use patterns are assessed in annual surveys that analyse any land use changes. The surveys verify whether land use by any individual households, the private sector or other organizations are violating the land law. The results of the survey form the basis for land use planning and management in the future.

The planning procedure was found to be quite good, with problems and solutions discussed and approved by members of the local people's assembly. However, plans tend to be over-ambitious, with a big gap between land use planning and actual implementation. For example, in Lau Thuong, according to the 2004 land use plan, 67.68 hectares of agricultural land were to be converted to residential areas and public infrastructure such as roads, local government offices and market places by 2010. In reality, by 1 January 2010, only 2.64 hectares of agricultural land had been converted.

Land Use Rights and Markets

Land use rights of farmers in relation to rice paddy areas and other agricultural land are officially determined in land-use right certificates, known as 'Red Books'. Red Books for rice paddy land were issued to individual households between 1993 and 2006. In a red book, only the household head is named, which means officially that men rather than women have land use rights. Although forest land has been assigned to individual farmers, red books have not been issued yet.

30 to 40 households who exchanged their land use rights have been registered in recent years in Lien Minh commune. Beside formal exchanges, local people also exchange land use rights without registering with the government. These informal exchanges are actually violating the Land Law, but the local governments do not have adequate information or power to prevent it.

Problems Relating to Land Use Management

The weak capacity of the Government to implement land use plans means local farmers pay little attention to them, let alone are they able to engage in land use planning processes. The local government does not have enough power or information to control black market exchanges. Many local people say they want more information about land use planning, and the opportunity to participate in the planning process.

Delays in issuing user rights certificates for forest land is inhibiting local farmers from investing in planting trees, which has a negative impact on their livelihoods and the environment. In Lien Minh commune, local people are particularly concerned about a conflict between several households over rights to forest land. This problem has arisen due to delays in issuing land use right certificates.

In Dan Tien commune, there have been negative effects of distributing land to individual households. Although it increases individual income, it creates difficulties such as pesticide control because pests spread from untreated fields to treated fields. There are also conflicts over rights to forest land. Several local households illegally bought forest land from workers of a state-owned forest enterprise located on the commune border. The commune and the enterprise have tried to find solutions for this problem, but it has not been resolved yet.

Local people themselves are converting their land for new purpose not dictated in the official plan. The problem is very serious in Lau Thuong commune, where farmers with rice paddy fields next to roads have converted their fields to residential land, in violation of the Land Law. Due to lenient penalty mechanisms and weak enforcement capacity, the local government is unable to prevent the problem, which means that available rice paddy area is continuously being reduced.

4.2.2 Livelihoods in the Three Survey Communes

Local people's main livelihoods are from agricultural production. Each livelihood source plays a specific role: rice production insures food security; tea and tobacco production is the main source of cash income in these communities; acacia is a good medium term investment activity; corn production provides feed for pigs; pig raising is an important income generation activity; and buffalo and cattle production is also a means of medium term investment.

Table 1: Most important products in the selected communes identified in ranking exercise

Rank	Lien Minh	Dan Tien	Lau Thuong
1	Tea	Maize	Acacia
2	Paddy rice	Paddy rice	Tobacco
3	Cassava	Acacia	Paddy rice

Lien Minh

In Lien Minh commune, tea was ranked as the most important agricultural product in terms of its contribution to household income. It is the main cash crop of the local farmers. On average, a typical farmer with 5 sao (1 sao = 360 m²) of tea earns 15 million VND per year. However, as a cash crop, income from tea production varies significantly according to the market demand.

Paddy rice was ranked the second most important product in terms of its contribution to livelihoods. Rice is mainly used for food; of the total rice production, 80%-90% is self consumed. All local farmers have rice paddy fields and they often use purebred varieties. Although the productivity of these varieties is not high – about 150 kg/sao – they prefer purebred to hybrid varieties because the purebred rice varieties do not require as much fertilizer, and they also prefer the taste.

Acacia production is a new, potential income source. Almost 100% of farmer households have been assigned forest land for 6-7 years, in which they can plant acacia. For one hectare of cultivated acacia forest, a farmer obtains 35-40 million VND every 5-6 years.

Making use of home-produced corn and cassava, pig raising is a popular cash income source of the local farmers. However, because of serious diseases, many local households have stopped raising pigs. Buffalo and cattle production is not only an asset accumulation source but it also provides draught power for agriculture and transport. However, this livelihood activity has been decreasing due to a lack of grazing areas. The number has reduced from more than 2000 head of buffalo/cattle in 2005 to 1200 in 2010.

Dan Tien

Another major source of income comes from agricultural products such as maize, rice and livestock, with maize ranked the most important by local farmers. Most households in Dan Tien grow maize for commercial purposes, because it generates more profit than other products.

Rice and pig production are also important livelihood sources for local farmers in Dan Tien commune. Corn crops and buffalo/cattle production are additional income sources for farmer households. Around 60% of the corn output is used for pig production; the rest is sold for cash. Money gained from selling corn is mostly used for buying feed for pig production. Buffalo/cattle production is a method of asset accumulation. The total buffalo/cattle herd population is around 1500 head. However, this livelihood activity is not developing much because of lack of grazing areas.

60% of local households have been assigned productive forest land, and 40% of households have planted acacia trees. Acacia planting is suitable for the farmers' conditions: it requires low investment of around 1 million VND per hectare; and it grows fast, with acacia trees ready for logging after 5-6 years. Furthermore selling acacia wood is very easy.

Lau Thuong

In Lau Thuong commune, tobacco is the most planted crop. During the winter-spring crop-growing period, instead of growing rice, the local farmers plant tobacco in their rice fields. Yet, although it currently plays an important role in contributing to household income, it may not be a profitable agricultural product in the long term due to the uncertainty of the market. Tobacco growers face risks due to price fluctuation, and many farmers have made a loss and become debtors.

Tea production is a relatively new crop of the local people, with 30% of farmer households now having land devoted to tea planting. At the moment, income from tea production is still limited since local people have only been cultivating it for a few years. Acacia planting is another income source for almost 50% of the total farmer households. For the households who have forest land, acacia production is a means of asset accumulation. They obtain around 40 million VND per hectare every 6-7 years.

Rice production also plays important role in farmers' livelihoods in Lau Thuong commune, especially for household food security. Over 80% of rice grown serves home consumption. In this commune, on average a farmer has 5 sao of rice paddy fields, with productivity of 150 kg/per sao.

Pig production used to be an important cash income source for local farmers in Lau Thuong. However, in recent years, pig production has faced the risk of many diseases, exacerbated by farmers limited knowledge of preventive measures, such as vaccinations and hygienic breeding facilities.

4.2.3 Livelihood Assets and Opportunities

The study finds that the following assets increase farmers' ability to generate sustainable livelihoods:

- **Access to agricultural land:** In all three communes, those who have more agricultural land (or 'natural capital') have more opportunities to improve their livelihoods.
- **Access to the market:** This is also a very important factor that influences local farmers' livelihoods. People living far from the central buildings and infrastructure of their commune face poor road conditions, so their access to the market is more difficult. As a result, they are relatively poorer.
- **Access to human capital:** The more strong, healthy, skilled people a household has, and the fewer dependents who are unable to work due to age, disability or ill-health, the better off a household is likely to be. People with better economic analysis abilities are better able to plan, and negotiate with buyers. The research suggested that better-off households tend to be more open-minded to new production techniques, while poorer households are less willing to adopt new approaches. However, this may be due both to a lack of information and training, and the fact that a lack of assets can

discourage risk-taking investment choices. Thus, poverty may be both a cause and a symptom of reluctance to adopt new techniques.

4.2.4 Livelihood Constraints and Limitations

Lack of resources:

- Local farmers lack post-harvest processing facilities for tea which would add value to their product: their tea must be sold shortly after harvesting or it will lose value.
- They lack storage facilities for rice and other products, which would give them the flexibility to store it and wait until they can get the best price for it.
- Irrigation systems are limited and degraded (as will be discussed later).
- Farmers cannot afford to protect their pigs against disease by paying for vaccinations.

Lack of knowledge about production techniques (According to farmers, this is not simply due to a lack of training courses but also they have difficulties in applying what they learn from courses). For example:

- They apply too much pesticide: often 4-5 times per crop for rice; and as much as twice a month during harvesting months for tea. This is because they do not know when, how much and what kind of pesticides will have on the best pest control outcomes.
- They do not have adequate techniques of selecting, reserving and storing their rice seeds for the next crops. They have not participated in any training course which teaches the farmers rice production techniques like IPM or SRI¹⁰.
- People's awareness of pesticide risks to their health is poor. They do not apply labour safety standards. For instance, they do not wear safety equipment when applying pesticides, and pesticide packets are thrown into water sources.

Unpredictable weather and natural disasters (this will be discussed in more detail in the section on climate change). For example:

- Due to poor irrigation systems, crops in these localities are reliant on rain water. In winter, due to a lack of rain, there are no crops. Even in spring-summer, a considerable percentage of rice paddy fields are not irrigated, which means the local farmers only have two crops per year.
- Pig production used to play an important role in livelihoods of local farmers in Vo Nhai, but it has been constrained by serious diseases like leptospirosis and cholera. These diseases not only influence pig production but also reduces pig prices.

Lack of control over markets:

- In relation to tea and tobacco cash crops, the prices fluctuate a lot (e.g. from 30,000 VND/kg to 70,000 VND/kg for tea). It was reported that many farmers producing tobacco have now become debtors, due to prices falling far more quickly than expected.
- Prices are controlled by middlemen, and farmers have limited ability to negotiate.

¹⁰ IPM (integrated pest management) is a well known agricultural technique, while SRI (system of rice intensification) is a set of effective, eco-friendly rice farming practices proven to increase crop productivity, while at the same time reducing inputs such as seed, water, fertilizer and pesticides.

4.2.5 Farmers' stated needs in terms of livelihoods improvement

When asked to express what they thought they need in order to improve the sustainability of their livelihoods, local farmers focused above all on enhancing their **knowledge and production techniques** in relation to their main agricultural production activities e.g.:

- pesticide management for rice and tea e.g. integrated pest management (IPM)
- innovative methods of rice cultivation such as SRI
- techniques for selecting, reserving and storing seeds.
- technical assistance regarding sapling cultivation, particularly for new varieties of tea
- post-harvesting technologies to improve tea quality and increase tea prices
- knowledge and techniques related to disease prevention and control in pigs

They propose that training courses on these subjects will work best if combined with a demonstration model. The contents of courses should be tailored to the existing conditions of local farmers, and offer them the chance to 'learn by doing'. It was recommended that courses be organized through local social associations such as farmer unions and women's associations.

Farmers also indicate that their livelihoods would benefit from better access to **micro-credit**. Without credit, they do not have enough financial assets to apply the techniques they learn. They suggest a loan of between 5 million VND and 10 million VND per household. With that kind of loan they can apply advanced techniques to rice and tea production as well as pig and buffalo/cattle raising.

Furthermore, they believe that a better understanding of **household accounting** would allow them to make better decisions regarding their livelihoods. It will help them to avoid the risks associated with newer cash crops like tobacco and tea which, unlike food crops that are consumed by the growers themselves, require a strong knowledge of how best to invest, plan and access the market.

Local people would also like more **information about land use planning and management**, combined with the opportunity to be involved in land use planning procedures. Having more information and knowledge of these, they will be able to adapt their livelihood strategies more appropriately.

4.3 Accessing the markets for Thai Nguyen's agricultural products

The value chain research team analysed the commodity chain for three agricultural products,:

Tea (in Lien Minh)

Maize (in Dan Tien)

Acacia (in Lau Thuong)

Although the research necessarily looked at the entire value chain (producer – collector – wholesaler – processing firms – retailer – consumer) this report focuses on the producers, because they are the poor farmers whose ability to generate sustainable livelihoods depends on their status within this value chain.

This report finds many commonalities between each of these three products' value chains in terms of the farmers' role and ability to get a fair price.

4.3.1 Role of farmers in the value chain

Farmers are the first actor in the value chain, and arguably the most important, because they produce the product. And yet they invariably receive the lowest net profit for the highest labour. This section explores why.

Nearly 70% of tea growers in Lien Minh own mechanical dryer, so they are able to process it to a certain extent before selling it other buyers. They then either transport their product to Lien Minh market themselves, or they wait for collectors to come and buy it from them. They rely on motorcycles so during the rainy season, they cannot transport their product to the market, because the road to the market crosses a stream which floods during heavy rains. Local people are finding that heavy rains and floods have been occurring more frequently in recent years, affected their livelihoods.

Most maize growers in Dan Tien rely on local collectors and collectors from outside commune to come and pick up their products from their house, while around 30% take their maize to the Dan Tien market themselves. Most of these small-scale maize growers could not afford the high transportation costs of delivering their produce to the collectors. However, residents of Lan Vai are forced to bring their maize to the market themselves because trucks and motorcycle cannot access the village.

A major cost for acacia growers in Lau Thuong is also involved in moving their products to the local collectors or assembling it near a main road. However collectors bear the brunt of transport costs because they have to pay high transport fees in transporting the product to the buyers.

Collectors either live in the commune or come from outside. They travel around to individual growers' homes to collect the raw product. Most collectors pay in cash right away since tea growers need to finance their basic needs and buy inputs for the next cropping season, but sometimes collectors take the product on credit and pay after 2-3 weeks if they have established relationships with the tea growers. Collectors may classify the product's quality (as with tea) but they generally cannot afford to store the product for long, so they resell it quickly.

Collectors then sell the pre-processed product on to wholesalers and traders, or target markets such as retailers, feed millers, and processing agents. Local collectors and wholesalers play a key role in negotiating price of maize and tea products in the study sites.

4.3.2 Farmers' power to negotiate a fair price

Very few of the interviewed farmers in Lien Minh believe that the price they get for their tea matches the prevailing market price. Those who are able to get that fair price have access to reliable and timely price information. However, the majority of the farmers consider that the collectors and traders have the power to set the price at the market level.

In Dan Tien, a problem for farmers' negotiating ability is that there is no competition between local collectors from outside commune and wholesalers, so wholesalers and local collectors can control the price of agricultural products. Because maize growers badly need cash for their daily needs and investment for the next season, maize growers have very limited negotiating power to get a better price.

In Dan Tien commune, local collectors often sell seeds, fertilizers, and pesticides to growers as well as buying maize from them. Some growers say the cash they received from selling maize is just enough to pay for the inputs they bought from local collector few months previously. Growers are often obliged to

sell maize at beginning of harvest season because they need cash and they do not have storage facilities, but then, one or two months later, local farmers have to buy maize at a higher price to feed their livestock.

According to acacia collectors in Lau Thuong commune, marketing acacia is quite easy because of high demand and high financial support from local government. Growers in this commune have been supported with seedlings and financial assistance. If growers want to sell acacia, they have to get permission from Agricultural Department of Vo Nhai district. The majority of acacia are sold direct to wholesalers because local collectors do not have trucks, though local collectors help wholesalers to collect it. Acacia growers report that they have not faced problems in agreeing prices.

4.3.3 Strengths, Weaknesses, Opportunities and Threats

The Strengths, Weaknesses, Opportunities and Threats (SWOT) for local people involved in growing and marketing each of these different products is summarised in tables 2, 3 and 4 below.

Table 2. SWOT analysis for farmers marketing their tea in Lien Minh commune

<p>Strengths (S)</p> <ul style="list-style-type: none"> • Plenty of labour • Local people have much experience in tea producing for long time • Favorable land and weathers in producing tea • Lien Minh’s tea is known as a good quality product in Thai Nguyen province. 	<p>Weaknesses (W)</p> <ul style="list-style-type: none"> • No trade mark or brand for Lien Minh’s tea • Lack of market accessibility and marketing information on prices and quality requirements • Price is controlled by collectors • Poor infrastructure (road, irrigation) • Lack of water for cultivating tea (depending on rain-water) • Lack of storage techniques • Poor processing techniques • Absence of high quality tea varieties • Transactions without written contracts (verbal contract only)
<p>Opportunities (O)</p> <ul style="list-style-type: none"> • Huge market demand (both in domestic and exporting) • Supports from local government in producing and distributing of tea product • Trade mark of Lien Minh tea will be implemented in near future 	<p>Threats (T)</p> <ul style="list-style-type: none"> • Increase in material and inputs prices • Tea price is fluctuating • Pests and diseases occur more frequently in tea production • Increased competition from other locations (Tan Cuong district) and other countries (India, China) • Increase of requirements on food safety

Table 3. SWOT analysis for farmers marketing maize in Dan Tien commune

<p>Strengths (S)</p> <ul style="list-style-type: none"> • Convenience in transportation (close to main road, truck can access to the commune) • Plenty of labors • Some local collector often come and pick maize up at farmer's house (reduce transport costs for growers) 	<p>Weaknesses (W)</p> <ul style="list-style-type: none"> • The absence of trading groups or famer's associations to collect maize • Lack of market information on prices • Lack of storage techniques, high incident of pests and diseases, high storage losses • High post-harvest losses
<p>Opportunities (O)</p> <ul style="list-style-type: none"> • High demand of feeds for animal husbandry • Supporting from government and NGOs in improving roads and irrigation systems • Improving market information (more trader come to the commune) 	<p>Threats (T)</p> <ul style="list-style-type: none"> • High in input costs (seeds, fertilizer, pesticide) • High in transportation costs (fuel, transports fees) • Collectors are controlling maize's price • Drought and Floods often occur frequently (unpredictable)

Table 4. SWOT analysis for farmers marketing acacia in Lau Thuong commune

<p>Strengths (S)</p> <ul style="list-style-type: none"> • Close to main road, convenience in transporting products • Policy support from government on developing acacia product • Acacia can easily grow in any type of land • Forestland is allocated to each household. Therefore, acacia's growers find it easy to manage their land. 	<p>Weaknesses (W)</p> <ul style="list-style-type: none"> • Labor intensive in cultivating acacia • High transaction costs • Uncertain agreement because of buying and selling practices without written contract (verbal contract only) • Difficulties in transporting acacia from forest to the assemble place • Lack of capital
<p>Opportunities (O)</p> <ul style="list-style-type: none"> • Support from local government on planting (financial supports) • High demand in domestic markets (paper processing) • High demand in exports markets 	<p>Threats (T)</p> <ul style="list-style-type: none"> • High transport costs (fuel, toll fees, freight...) • Acacia's prices are often set up and controlled by buyers • Land is going to be exhausted in recent years that causes to low productivity of acacia

4.4 Irrigation systems, clean water and sanitation

4.4.1 Irrigation

In general, irrigation structures managed by communes have deteriorated. Actual capacities of reservoirs and weirs have reduced dramatically in comparison with their designed capacities. Many pumping stations have been broken. Temporary weirs are working unstably and farmers have to rebuild them after each flood. Communes have received water fee subsidies from the government since 2008. Maintenance by communes is poor as they lack funds and technical knowledge or assistance. Many cultivated areas lack water during the Winter-Spring seasons. Change of cropping patterns is advisable to areas where accessing

water for irrigation is difficult, in Cay Hong and La Duong Hamlets of Lau Thuong Commune. Farmers are passive and do not participate in maintenance and protection of irrigation systems. There are conflicts over water use.

The main types of irrigation structures in Vo Nhai District are reservoirs, weirs, pumping stations, and canals:

- Except the Quan Che Reservoir, other reservoirs in the studied communes are small, and are currently operating at around half of their actual capacities in the summer-autumn seasons.
- Pumping stations in the studied communes are small, and all have been broken. They were constructed in 1990s. Construction of pumping stations in these communes needs to be carefully considered, because they have a high running and maintenance cost, partly due to the high cost of diesel.
- Weirs in the studied communes were built in 1980s and 1990s. Almost all of the weirs are unable to irrigate their intended area in winter-spring seasons. Some are leaking and others do not have sufficient water resources. Farmers have constructed temporary weirs and for these, the situation is worse: they leak and are unstable. Farmers have to rebuild them after each flood.
- Most of the canals in the studied communes are earth canals. Only a few canal sections are lined with concrete or stone masonry. Consequently, water leakage is common. The communes have received a subsidy for water fees since 2008. It only covers a fraction of the operation and maintenance costs. If major repairs are needed, communes request budget from district or provincial levels. Hence, in all studied communes, canals have deteriorated. Vo Nhai District has 18 irrigation teams of which 9 were assessed to be performing poorly¹¹.

A large part of cultivated areas in the communes lack water during the winter-spring seasons. Some farmers are taking groundwater for irrigation, however, this is costly and reduces groundwater levels in the area and may cause adverse environmental impacts. Some farmers have hired mobile pumps to take water from ponds and streams to irrigate their farms at the cost of VND 30,000/sao¹². For each rice crop, farmers can only afford to irrigate twice, so yield is low and production unstable.

Stories from farmers themselves:

In the past, Cay Hong Hamlet of Lau Thuong Commune was irrigated by Cay Hong Reservoir and some natural water resources. According to Mr. Tran Van Si, in recent years, due to the changes of climate, rainfall has reduced. Human activities, such as deforestation, may have added more stress to the situation. Consequently, water resources have reduced or dried up completely. Part of Cay Hong Hamlet is not irrigated in the dry season, although it is located near Cay Hong Reservoir, which was recently upgraded and rehabilitated. Some households have to extract groundwater to irrigate their farms.

Mr. Nong Van Hoa of La Duong Hamlet of Lau Thuong Commune said that La Duong Hamlet does not have any irrigation scheme. His family has to hire mobile diesel pumps to lift water from stream to intermediate ponds and then from these ponds to farms.

The additional costs of fuel and pump hiring add to the already high input costs of agricultural production, making lives of local farmers more and more difficult.

¹¹ Report on Agroforestry Production in 2009 and Agroforestry Production Plan for 2010, Vo Nhai DPC, dated 26/4/2010

¹² 1 sao = 360 m²

Awareness of people about participation in maintenance and protection of irrigation systems is poor. In Lien Minh Commune, some people are exploiting gold illegally and they dig up not only farms but also some canals, such as the canal taking water from Dong Giao Weir.

4.4.2 Access to clean water for domestic use

Households in Lien Minh and Dan Tien Communes mainly use water supplied by central water supply systems and hand-dug-wells. Households in Lau Thuong Commune mainly rely on their own hand-dug-wells but other sources include water from neighbours, relatives, or water sellers. Not many households use drilled-wells. Even households that have access to the water supply system in La Duong and Cay Hong Hamlets have to buy water for daily cooking and drinking due to fears about water quality. People are not aware about saving water and participating in maintenance of water supply systems. Maintenance is poor because the fee for community management of the systems is not even enough to pay for operation, let alone maintenance.

Central water supply systems were constructed by the Government for 70-120 households and through private funding for groups of 10-20 households. Small scale water supply systems (for 3-5 households) have been constructed by households themselves.

Water is initially filtered before being delivered to common water containers where water is distributed to households through soft plastic or rubber pipes. Households who do not have access to water supply systems have to collect water from up hills or in the mountains. Individual households do not use any further water filtration or treatment methods.

Table 5. Main types of water supply used by households in studied communes¹³

No.	Studied commune	Percentage of households (%)					
		Central supply system	Own hand-dug-well	Drilled-well	Own rainwater containers	Collection from rivers and streams	Other sources
1.	Lien Minh	32.7	60.6	4.5	1.2	0.3	1
2.	Dan Tien	47.7	27.2	5.0	0.2	3.6	16
3.	Lau Thuong	13.7	42.9	7.4	0.2	8.1	28

As can be seen from Table 5, only a small portion of households in Lau Thuong are supplied with water from central water supply systems. Most of the central water supply systems were built in the past 5 years. Each household contributed VND 300,000 - 400,000 initial capital for construction. Households have to pay the management board monthly VND 1,500 for each cubic meter they have used. Approximately 50% of the central water supply systems are working unstably and some are not functioning at all.

Even some households that have access to a water supply system (e.g. in La Duong and Cay Hong villages) have to buy water for daily cooking and drinking at the cost of VND 2,000/20 litres. People in selected hamlets in the target communes are not in the habit of storing rainwater for later use. A small proportion of households in Lau Thuong and Dan Tien Commune use water from rivers and streams.

¹³ Survey Report on the Implementation of Monitoring and Evaluation Indicators on Rural Clean Water and Sanitation in Vo Nhai District, Vo Nhai DPC, dated 28/9/2009

According to Vo Nhai DPC, the percentage of households using clean water in 2009 was 60.4%¹⁴. The percentages of households using clean water in Lien Minh, Dan Tien, and Lau Thuong Commune were 78%, 70%, and 80%, respectively. The study team suspected that these figures were a bit optimistic.

In general, physical water quality of water supply systems, hand-dug-wells, and drilled-wells appeared relatively good, except water quality in La Duong and Cay Hong Hamlets of Lau Thuong Commune where groundwater has a yellow colour and smells of iron. It is out of the scope of this study to test the chemical and biological quality of water in the studied communes. No notable waterborne disease were reported. Water quality is unknown by local people and households do not know which sources of water are good and which are contaminated.

There are conflicts in water use because people at the head of a system take water away from the people at the tail of the system, such as in Che Hamlet. Consequently, households in hamlets downstream of the systems do not have sufficient water.

4.4.3 Sanitation

Field observation showed that general sanitation conditions in the project area are sound. The percentage of households using hygienic latrines in Vo Nhai District was 31.9%¹⁵. The main type of latrines used in the studied communes was pit latrines; these are used by approximately 63% of households. This is a hole dug nearby their houses with a super-structure surrounded by bamboo screens or plastic covers. When holes are full, latrines are shifted to other places around their houses. Double-vault-pit latrines are used by approximately 19% of households. Single-vault-pit latrines are used by approximately 17% of households in Lien Minh Commune. Other types of latrine, such as water closet or pour-flush latrines are not commonly used.

People are not aware about general sanitation. Observation showed that packages of pesticides and herbicides, other waste, and dead animals are thrown into rivers and streams. Domestic waste is buried in holes around houses or dumped in the open. Wastewater generated from domestic use is released freely and filtrated into ground naturally. Cattle are bred in cages. Households collect waste to fertilise their farms. There are still some people who graze cattle near streams.

4.5 Climate change

4.5.1 Local people's awareness

100% of local staff of all agencies at provincial, district and communal level and 70% of local people who were interviewees said that they have heard of climate change in the mass media. However, when asked, most do not thoroughly understand the manifestations, causes and impacts of climate change.

According to the Institute of Strategy and Policy on Natural Resources and Environment (2009), climate change in the Northeast area in general and Thai Nguyen in particular is typically characterized by a cold winter with less sunlight and more rain and frost and a hot summer with little wind, intensive tropical cyclones, and more precipitation. The rainy season almost coincides with the hot season. The rainy season

¹⁴ Survey Report on the Implementation of Monitoring and Evaluation Indicators on Rural Clean Water and Sanitation in Vo Nhai District, Vo Nhai DPC, dated 28/9/2009

¹⁵ Survey Report on the Implementation of Monitoring and Evaluation Indicators on Rural Clean Water and Sanitation in Vo Nhai District, Vo Nhai DPC, dated 28/9/2009

normally starts in April or May, then peaks in July and August and finishes in September or October. (See Table 2)

4.5.2 Recorded changes in the local climate

According to data from Bac Quang station (in Ha Giang Province) by the Center of Meteorology and Hydrology, from 1961 to 2007, the average temperature of the Northeast region in general and Thai Nguyen province in particular has increased about 0.016°C every calendar year. According to the climate change scenario developed by the Ministry of Natural Resources and Environment in 2009, by 2100 the average temperature will have increased 1.7°C to 3.2°C compared to that of the period 1980-1999. (Table 3)

In the province, districts and communes studied, the leaders and local people involved in the interview also said that in recent years, summer is longer, winter is shorter; quite a few days in summer have seen the temperature of over 36°C.

According to the Institute of Strategy and Policy on Natural Resources and Environment (2009), the rainy season is also varying from year to year, with the rainy season beginning earlier (in March) and ending later (in November); the peak month also varies, falling in June some years.

The Ministry of Natural Resources and Environment’s scenario of climate change and sea level rise for Vietnam (2009), rainfall in the dry season is expected to decrease, while rainfall in the rainy season and the total rainfall of the whole year may increase. (Table 4)

The change in both rainfall and rainy season was acknowledged through group discussions with local people and interviews with commune leaders. They realize that recently the rainy season has come later and ended earlier than before; and that there has also been unusual rain.

4.5.3 Observed climate change phenomenon and patterns

Local people in the communes as well as leaders at all levels report clearly seeing the recent extreme phenomena such as storms, flash-floods etc. Table 6 below indicates the opinions of local people in the three communes in the research about the extreme phenomena which they have seen the change in frequency, intensity and impacts on their lives.

Table 6. Unusual phenomena linked to climate change compared with 7-20 years ago

<i>Phenomenon</i>	<i>Intensity</i>
Storm, whirlwinds	Come earlier, increase in quantity
Hail	Come earlier, increase in frequency with smaller stones
Heavy rain	Occur unusually and dangerously due to thunder and lightning
Rainstorm	More extreme, more sudden
Heat wave	Increase in level and length
Damaging cold weather	Increase in intensity
Thunder and Lightning	Increase in frequency, sometimes happen even in the absence of rain
Hoarfrost	Does not occur, happened before
Pipe floods, flash-floods	More strong, more sudden
Drought	Come earlier, in both winter and summer, increase in length
Scarce water source	Water was never scarce and polluted before and had better quality
Erosion, landslide	Increase in frequency and scope
Pests in crops	Many new diseases, more pests, increase in need for spraying pesticides
Diseases in animals	Appear all year round, many new diseases, including mass death

<i>Phenomenon</i>	<i>Intensity</i>
Diseases in humans	Many new diseases, increase in the number of people infected

Source: Group discussion in 3 communes of Lien Minh, Dan Tien, Lau Thuong

According to local people in the three communes, river floods, flash-floods, rainstorms, storms, thunder, lightning and heavy rain happen more suddenly and over a shorter amount of time than before. In particular, storms appear one month earlier; thunder and lightning used to occur in July and August 5-10 years ago, but now thunder and lightning happens whenever it rains. More notably, pests in plants and animal diseases are increasingly happening, many new diseases have never been seen before, pesticides are becoming ineffective. There have been cases when many diseases happened at the same time, or overlapped each other. Droughts and water scarcity have become more and more serious, not following the usual patterns as in the past, often begin earlier and last for a longer period of time. Usually, in March, there is enough water for people to do farm work; however, in March this year, work could not be done because there was no water. Even at the time of this assessment which was at the end of April, the rain still had not come, causing water shortage for farmers.

Extreme cold and damaging cold do not happen frequently; however, when they do happen, they cause serious impacts. “Over 30 years there has never been such a cold wave like that in 2008 which killed many animals and plants, causing great loss for farmers”, said the Chairman of Dan Tien Commune.

Calendar and timeline exercises with farmers’ focus groups also indicated that peak times for these phenomena are changing, for example the rainy season comes earlier, and droughts sometimes come twice a years instead of just once.

Table 7. Extreme phenomena considered the most serious problems by local people

<i>Ranking</i>	<i>Lien Minh Commune</i>	<i>Dan Tien Commune</i>	<i>Lau Thuong Commune</i>
1	Scarce water sources	Plant pests	Drought
2	Polluted water sources	Drought	Diseases on human
3	Plant pests	Storms, whirlwind	Scarce water sources
4	Drought	Diseases on animals	Diseases on animals
5	Flash-flood	Flooding	Plant pests

Source: Group discussion at 3 communes Lien Minh, Dan Tien and Lau Thuong

4.5.4 Impacts on livelihoods

Through consultation with leaders and local people, combined with observations in the field, the research group found that climate change is already clearly generating impacts on economic and social development, natural resources, and the lives of local people.

Droughts and water scarcity are the most serious issues for farmers in these three communes. In the dry season, many streams and ponds dry up and the water level of wells reduces markedly. Droughts lead to poor plant development, withering, late harvest, higher investment for production, lower quality products, and more labour is required to irrigate crops, as well as to collect water for daily use. In Lien Minh, food crops are being replaced by industrial trees and forest trees to respond to water shortages. In Dan Tien, sugarcane has gradually been replaced by maize.

Unusual, heavy rain and hail is getting worse. These incidents damage crops, cause soil to be washed away and eroded, and reduce soil fertility. Reports on natural disasters in all three communes over the past

4 years describe severe damage, especially from flash floods washing away rice, maize and vegetables and causing soil erosion that is difficult to rehabilitate.

Changing temperatures and unpredictable weather affects the growth and development rate of plants, meaning that planting and harvesting times have to change, productivity is reduced in some cases, while some previously rare pests and diseases flourish in the altered conditions. Extreme cold, though it happens rarely, severely affects farming, killing premature plants, damaging crops and killing livestock.

Pests on crops, including rice and tea, have increased recently. One of the contributing factors is changing in weather. In Lien Minh, an estimated 20 ha of rice was infected by rice blast in 2005, and the Commune authorities blamed changes in weather, with droughts at the beginning of the season and lots of rain in the middle, making conditions just right for pests and diseases to develop. As a consequence, farmers use pesticides in higher doses, and with higher frequency.

Diseases in poultry and livestock are increasing, including leptospirosis and diarrhoea in pigs, paralysis and diarrhoea in chickens, respiratory failure and hatch-mouth in cows and buffaloes, and some mass deaths. In poultry, unfamiliar symptoms indicate new diseases, making diagnosis difficult. This affects livelihoods by reducing productivity, and requiring a higher input of resources for treatment.

Impacts on human health: The majority of participants believe that unusual climate, extreme heat and cold, floods and water shortages (the latter which can exacerbate problems of contaminated water) are contributing to an increase in illnesses such as flu and headaches, as well as unusual diseases.

Pollution was raised as a challenge that is linked to drought and lower crop productivity, because access to clean water becomes more difficult and water resources become more toxic especially in the dry season. Furthermore, farmers are attempting to address pests and poor crop productivity by increasing their use of fertilizers and pesticides, causing long-term damage to the environment, crop productivity and of course, human health. Climate change too, combined with overuse of pesticides, contributes to a reduction in biodiversity.

Evidently, climate change is causing or exacerbating problems in almost every aspect of people's livelihoods. In terms of its impacts on production, infrastructure, health, natural resources and the environment, climate change is exacerbating many difficulties and challenges faced by the poor such as increasing food insecurity, making it difficult to rehabilitate the household economy, pushing households deeper into debt, and forcing poorer households to migrate to other areas.

4.5.5 Responses to climate change

Although people in Thai Nguyen province and Vo Nhai district in general, and in the three chosen communes in particular, have not formulated detailed strategies to respond to climate change, they have developed adaptation methods based on past experiences and traditional knowledge.

Community experiences in disaster forecast: Currently there has not been any warning system about climate change or measures and weather forecast systems in communes yet. Generally, local farmers have had to rely on newspapers or the province's TV stations and experiences to forecast the weather such as: running ants and low flying dragonflies indicates storms; or hot wind blowing in sunny weather indicates hail.

Experience in prevention of disasters or extreme weather caused by climate change: People are aware of the necessity to prevent and minimize damage before an event happens, rather than just focusing on post-event recovery:

- Reinforcing the house and cutting down big branches to prevent storms;
- Cutting off electricity, preparing food and keeping poultry in pens before a storm comes;
- Not keeping metal equipment in the home and staying at home when heavy rain comes;
- Moving up to the highlands in case of flood;
- Choosing a safe place to build the house;
- Planting trees along the rivers and streams to prevent flood and erosion
- Using rocks and sand bags or planting trees (bamboo) to prevent soil erosion;
- Digging pits and constructing irrigation dams to hold water;
- Enclosing the pens in cold weather and using appropriate roof materials in case of hot weather;
- Vaccinating people and poultry as well as keeping environment clean to prevent any diseases;
- Checking the fields regularly to prevent worms
- Using seeds with high resistance to drought and diseases.

Post-disaster recovery: In most cases of minor damage, households are expected to recover by themselves or with assistance from their neighbours. In case of serious damage, a report will be sent to the commune authority to request subsidies based on the damaged area or number of dead livestock.

Natural disaster prevention: The three communes, as well as the district and province, have established natural disaster prevention departments. Every year, the departments review activities of the previous year and plan for the following year. Post-disaster reports are also prepared. Thanks to these efforts, damage is often mitigated and local people receive subsidies. However, prevention and communication is still weak due to low budget and a shortage of men.

Government plans and strategies: A general plan for responding to climate change has been designed by the Natural Resources and Environment Department and sent to Province People Committee for review. A detailed plan will then be formulated and is expected to be complete by the end of 2010. In the meantime, only a few activities related to climate change have been implemented and these are limited to the provincial level, such as Biodiversity Day, and World Environment Day events.

4.5.6 Combining adaptation with climate change mitigation

The area of natural forest in Vo Nhai used to be very big. However during the 90s, forests were greatly exploited due to market demand for wood. Although some forests have been divided into small parts and managed by many households, watershed forests are still not well managed due to shortages of resources and labour especially in remote areas. Income from managing forest is low so that local people are not interested in taking this responsibility.

Besides building resilience against the impacts of climate change, by protecting soil quality and reducing erosion and water run-off, forest protection and development is very important to mitigate the impacts of climate change by storing carbon.

In Dan Tien and Lau Thuong communes, biogas tanks are quite popular. These are sealed tanks connected to the latrine and livestock pens, which use bacteria to digest and convert the waste into a clean,

odourloess bio-fuel for cooking, while the remaining slurry can be composted to make fertilizer. The positive effects of these tanks include energy saving, reducing costs for the household, and climate change mitigation by reducing methane emissions. However, in Lien Minh commune, only a few households have built biogas tanks because of the high cost.

4.5.7 Strengths, weaknesses, threats and opportunities

Table 8. SWOT analysis of households in adapting to climate change

Strength	Weakness
<ul style="list-style-type: none"> - Experienced - Hard working - Time and labor availability - Mutual support within the community - Forest protection awareness - Awareness of natural disaster 	<ul style="list-style-type: none"> - Lack of understanding of the problems - Lack of training opportunities - Lack of mutual support group - Lack of opportunity to share information - Lack of cultivated land - Production depend on weather - Low budget - Fertilizers are expensive
Opportunities	Threats
<ul style="list-style-type: none"> - Much attention from the Government and donors on this area (Program 135). - Attention on climate change. - Weather forecasts shown on TV - Official documents from government and province address climate change - Meteorological station in Dinh Ca District in Thai Nguyen Province. - Natural disaster mitigation departments exist in many administrative levels - It is easy to access loans from banks - Currently in land using plan period from 2010 to 2015 	<ul style="list-style-type: none"> - Remote areas have poor transport and infrastructure - Limited communication facilities - Lack of detail weather forecasts. - Lack of budget for awareness raising - No separate budget for climate change - No specialized department responding to climate change - Watershed forests are destroyed - Statistical data about natural disaster damage in communes are hard to collect - Polluted water and soil, due to poor waste disposal and overuse of pesticides

Source: Group discussion in three studied communes

4.5.8 Vulnerability of farmers

It was evident from discussions that the impacts of many of these climate-related challenges are exacerbated by other non-climate-related challenges that increase the vulnerability of farmers' livelihoods. The main non weather-related **weaknesses** that farmers identified making them more vulnerable to climate change impacts can be divided into two basic categories:

a) **Lack of resources** e.g. money and labour:

- To invest in wells and irrigation systems
- To clear debris from arable land after flash floods and landslides
- To predict and warn about sudden natural disasters

- To access alternative food sources when they lose their harvest
- To move their home if it is in a vulnerable position
- To buy fertilizers and pesticides
- To care for animals (vaccinations, hygienic cages, vet visits)
- To invest in new methods or equipment that will be better suited to changing conditions

b) **Lack of knowledge and capacity** e.g. about how best:

- To diversify into drought and flood-resistant crop varieties
- To plant on steep hillsides and protect against landslides
- To use pesticides and fertilizers appropriately
- To get the best price for their crops
- To use income to invest in the future without falling into debt
- To prevent and cure diseases in animals
- To prevent and cure human illnesses

At the root of these weaknesses, reducing farmers' ability to adapt their livelihoods to cope with climate change is poverty. A number of interviewees in positions of authority (including a village leader, the head of commune women's union and the Vice Chairman of the Party of a commune) identified a third category, which is also closely linked to poverty and a lack of education:

c) **Lack of 'vision' and future planning** e.g.

- To prepare for long-term changes and sudden disasters (as opposed to the mentality: 'disasters are inevitable')
- To record, store, share and learn from information about changes in weather-patterns
- To invest in new methods, breeds and techniques (including taking risks)
- To apply learning from training courses to apply methods that are different from those they learned from their parents
- To work together as a community to share efforts in order to enjoy mutual benefits, e.g. to support the building of a new irrigation system

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

People living in the three targeted communes in Vo Nhai district of Thai Nguyen province are already poor, and are being prevented from developing sustainable livelihoods due to a number of factors, all of which are linked to climate change. These factors include weak land management and access rights; poor irrigation, clean water and sanitation; and lack of power to access the markets and negotiate a fair price for their products. The consequences of these include low investment, low productivity, diminished crop quality, low income, pressure on limited labour resources, poor health and even conflict over resources.

A fourth factor undermining the ability of the rural poor to break out of the poverty cycle is climate change. The impacts of climate change are exacerbating the impacts of each of the other three factors, all of which are closely inter-related. Increased frequency and severity of natural disasters, such as extreme heavy rain, is responsible for landslides and soil erosion that reduces the availability of arable land. Rising temperatures and longer droughts are reducing the availability of water resources for irrigation, drinking water and sanitation. If farmers are inhibited from investing in new products and diversifying their livelihoods due to inequitable value chains, they will be less able to change to more drought-resistant or pest-resistant products.

Evidently climate change adaptation measures are needed, to ensure that the livelihoods built by the rural poor are sustainable now and in the future. Any intervention activities must take into account the role of the above three factors – land management, water and sanitation and access to markets – in supporting sustainable livelihoods that are resilient to the impacts of climate change. They must also ensure that the benefits do not accrue to one particular group in the community, to the exclusion of others: such as women, the elderly, those with a disability, or a particular ethnic group.

To adapt successfully, the rural poor need not only to learn and apply a new tool or technique; they need to be empowered to continue to adapt to their changing conditions as necessary. Today that might mean building a well, reinforcing the roof, or learning to manage pests more effectively. Tomorrow, it might mean investing in a new crop, moving house to a less vulnerable location, or even finding different employment. All of these adaptation approaches entail costs and risks which are impossible for the poorest of the poor. The best way to achieve long-term resilience is to break out of poverty.

5.2 Intervention activities

Land and livelihoods

- Regarding rice crop, transferring techniques of SRI, IPM, and seed saving to the local farmers is really necessary. This will reduce their pesticide and fertilizer application and simultaneously increase rice productivity.
- Regarding tea production, IPM and sapling cultivation techniques should be transferred to the farmers. This will reduce their production cost by cutting down their pesticide application and simultaneously increase the quality of their tea.

- Regarding pig production, the local farmers' knowledge of disease prevention and prophylactic hygiene should be improved. Furthermore, veterinary services should be better. In each village, there is essential to have one person who takes care of veterinary service, updating disease information, giving advices regarding to disease prevention and treatment to the local farmers. This person should be paid monthly and be offered updated technical training.
- Improve knowledge of household economic accounting as well as knowledge and skills of marketing for the local farmers is essential. This will enhance their position and power in the market, so they have more opportunities to take advantage of their cash crops
- Provide accurate information on land used planning. Bulletin board of the state land regulation should be posted up at commune head quarter and at village houses. In addition, it is practical to introduce land law to the local farmers in village meetings, and to organize annual awareness raising events.
- Micro credit program should be installed. This will support the mentioned above interventions.

Value chains

- Create new markets for Lien Minh tea as well as formulating and encouraging the Lien Minh tea's trademark. Local government should cooperate with Non-Government Organization (NGOs), Ministry of Agriculture and Rural Development (MARD) and Ministry of Industry and Trade (MIT) to advertize Lien Minh tea to the market.
- Co-operation and coordination between tea producers, processors and domestic and foreign research institutions (NGOs, universities, etc) in extent storage time for processed tea and maize. Currently, transactions among actors in value chains of these agricultural products are conducted through verbal agreement (without contracts). Hence, it is so difficult for local people in reducing risks and conflicts. Transactions through contracts should be encouraged to state relationships among actors (producers; buyers and sellers) in the value chains.
- The local authorities must design and assist farmers in the creation of strong growers' association that would address the problems of tea and maize growers. The Department of Agricultural Extension in Vo Nhai district should cooperate with NGOs to implement training course about IPM for local growers.
- The linkages (horizontal and vertical) among actors in marketing chains should be encouraged. The weekly prices obtained from the mass media and news on television should be analyzed to focus on the trends and behavior of price at different market levels. This would properly guide the growers on their cropping schedule and wholesalers on their storage and release of tea stored for sale in the market.
- Due to the high cost and limited supply of high quality maize seeds, and tea variety, growers often utilize seeds from previous cropping season and old variety for their next planting (Trung Du tea variety). This results to a decline in yield and quality of tea and maize. Technology transfer from the agricultural extension workers to the private seed growers must be established to encourage the latter in producing high yielding and disease resistant maize seeds and tea variety.

- Since tea and maize growers and wholesalers incurred much storage losses, the local government should promote the adoption of proper storage technologies/practices. This could be implemented through the training of tea growers and wholesalers with actual field demonstrations using model storage facility. Extension workers who will spearhead the trainings must be retooled on the latest tea storage practices as well as other production and post-harvest technologies.

Irrigation systems, clean water and sanitation

- Repair structures with applicable technology and low cost, giving priority to structures with more beneficiaries, e.g.
 - o Construct a weir and canal system in Nho Hamlet to provide irrigation for 15 ha. Cost estimate: VND 170 mil (Lien Minh)
 - o Construct Dong Hiem weir and canal system to provide irrigation for 15 ha. Cost estimate: VND 240 mil (Lien Minh)
 - o Rehabilitate the Thinh Khanh pumping station using electric pumps to irrigate 8 ha. Cost estimate: VND 206 mil (Dan Tien)
- Provide other resources and equipment such as models of hygienic toilets, water filtration containers, rainwater containers for some poor households, supported by training in how to use and maintain them.
- Provide assistance with changing cropping patterns (in parts of La Duong and Cay Hong Hamlets of Lau Thuong Commune) and testing water quality;
- Run training courses, prepare and disseminate information to raise awareness and build knowledge and skills on:
 - o proper collection, storage and use of rainwater; how to maintain and use hand-dug-wells and drilled wells, and how to protect hydraulic structures
 - o protection of water quality, causes of water pollution, and prevention and detection of common waterborne diseases;
 - o filtration technology e.g. water filtration containers, and how to construct, use and maintain them

Climate change – government engagement

- Assist local authorities to research, develop and implement a plan for responding to climate change, in close consultation with local people;
- Activities responding to climate change should be incorporated into activities of Division of Flood and Storm Control at all levels, and communication activities on climate change should be integrated into other mass media activities of the province, district and commune;
- Take advantage of external support, especially from the state-subsidized Program 135, to upgrade local infrastructure so that it is resilient to climate change;

- Build up a database on climate change at all levels, and support local authorities to form procedures on data collection in connection with climate change at all levels;
- This task can be assigned to Division of Flood and Storm Control under Department of Natural Resources and Environment;
- The issue of climate change should be put into the Planning on land use for the period of 2010-2015. The focus should be on assisting households living in vulnerable areas to move to safe place;
- Valuable local knowledge about the climate should be made use of to conduct research and build up good model to respond to climate change;
- Hold training sessions for Division of Flood and Storm Control, key participants, leaders of interest groups on crucial knowledge and skills in response to climate change, group management, planning, and participatory project monitoring skills.

Climate change – grassroots level

- Provide assistance to local people to form interest groups in connection with sustainable livelihood responding climate change for sharing and learning;
- Provide interest groups with funding sources and valuable knowledge about funding and expenditure management;
- Build up and apply good models on climate change adaptation connected between local and scientific knowledge, for example, plant drought-resistant trees, plant green-band trees to against soil erosion and sustainable reforestation;
- Enhance local people’s awareness of climate change, protection of the environment and water-shed forests. Training courses should initially be provided to a key group who will then be able to transfer the knowledge they have gained to the community. Communicative tools such as posters and billboards should be used. Awareness enhancement can be conducted through cross-project visits, workshops on experience sharing, training sessions, village meetings and local festivals;
- Upgrade places susceptible to flooding, storm and cyclone by providing construction materials, funding to prevent soil erosion of river banks and slopes, consolidating irrigation systems and carrying out reforestation.
- Support testing and conservation of native plant and animal varieties’ drought-resistance and disease-resistance.

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