



## **STUDY REPORT**

**Needs assessment of sustainable livelihoods responding to climate changes in  
Vietnam**

**The case of Yen Bai province**

**Ha Noi, June 2010**

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## ***SUMMARY***

This needs assessment study aims to evaluate what is needed by poor rural populations in Yen Bai province to enable them to develop sustainable livelihoods that can cope with the impacts of climate change. This study in Yen Bai is one of a series of projects in four different provinces in mountainous Northern Vietnam, the other three being: Hoa Binh, Thai Nguyen and Quang Ninh. The purpose of these studies is to: identify the risks that climate change poses to the rural poor; understand the role of natural resources (in particular land and water) and markets in supporting their livelihoods and reducing their vulnerability; and specifically recommend adaptation actions that can help increase the resilience and sustainability of poor people's livelihoods in the face of climate change.

### **1. INTRODUCTION**

#### ***1.1 State of problems and background***

Climate change is a serious risk to poverty reduction and threatens to undermine decades of development efforts. Its adverse impacts will be most striking in developing nations because of their geographical and climatic conditions, their high dependence on natural resources, and their limited resources and capacity to adapt to a changing climate.

In Vietnam's upland areas, although people's livelihoods have improved in the last decades, communities still suffer entrenched poverty and food shortages. The Northern Mountainous Region is ranked the poorest area of the country, where over 30% of its inhabitants are classified as poor according to per capita income. Cash income from agricultural products remains important to the livelihoods of the rural people.

In Vietnam, the adverse effects of climate change are already evident. The most commonly discussed consequence of climate change is sea level rise, impacts of which include loss of crops and arable land to salt-water intrusion and storm surges. However, vulnerability to climate change impacts in Vietnam is by no means restricted to the coastal regions. Indeed this study is a response to the fact that many climate change adaptation interventions in Vietnam are focusing on the coastal areas, and there is limited understanding of, and support to address, the impacts of climate change on poor communities in Vietnam's extensive rural mountainous areas.

Predicted impacts of climate change in the Northern mountainous areas include an increase in the frequency and intensity of drought, cyclones, typhoons and other extreme weather events. Climate change is also expected to have serious impacts on biodiversity, with some species unable to adapt to the changing climate, while other species, including pests and disease vectors, may spread more widely.

The impacts of climate change and natural disasters on livelihoods, are expected to be more severe in the rural areas of a developing country like Vietnam due to high levels of poverty, poor quality of infrastructure, limited access to technologies and a high dependence on natural resources. All these factors increase the vulnerability of rural communities and undermine their ability to sustain their livelihoods.

Opportunities to generate sustainable livelihoods are limited in rural areas, in particular in the mountains. There is a direct relationship between poverty and vulnerability to external threats. The livelihoods and well-being of the rural poor are heavily dependent on natural resources, so they are particularly vulnerable to environmental degradation and the impacts of climate change.

This study recognises that poor farmers in Vietnam's mountainous areas are already struggling to cope with issues like lack of entitlement to land, limited access to irrigation, clean water and sanitation, and a low ability to market the agricultural products they produce. Each of these problems stands to be exacerbated by climate change, making even harder for these farmers to improve their livelihoods. But, if efforts to address climate change adequately take into account these interlinked issues, and farmers are supported to improve their access to land, water and markets, their livelihoods will be more resilient to climate change. Any strategy to reduce rural poverty will be more effective if it tackles climate change.

#### **Four interlinked issues**

**1) Climate change** is one of a number of factors influencing the ability of the rural poor to develop sustainable livelihoods. In particular, this study recognises the close relationship between climate change and three other interlinked issues that impact on poverty: water availability, access to land and access to markets.

**2) Irrigation, clean water and sanitation** are crucial factors in ensuring the food security, health and ability to generate income for poor rural communities. Availability of clean water is particularly threatened by the impacts of climate change, including rising temperatures, droughts, and natural disasters that can damage infrastructure and sanitation systems. Besides the health impacts of these problems, if local people are obliged to travel far to access clean water, it reduces their capacity to undertake other livelihoods activities, and can even cause conflicts.

**3) Land** is an important natural resource and a crucial capital asset in agriculture in Vietnam. Although the natural land of Vietnam is large, the land that can be used for agricultural practices is limited. Not only per-capita agricultural land area in highly populated river deltas is low but it is also limited in mountainous regions. Especially due to the booms of industrialisation and urbanisation recently, agricultural land has been increasingly scarce during the last decades. It can also be expected to be further depleted and also degraded in quality in the next decades due to the effects of climate change. The reduction in availability and diminishing quality of agricultural land will certainly affect livelihoods of rural population in the future.

**4) Market development** is a key to raising the living standards of people who live in Vietnam's rural areas, especially uplands, where agricultural activities are predominant. Analysis of agricultural products' value chains is needed in order to better understand the sustainable livelihoods of farmers, other actors in the chain such as collectors, wholesalers, retailers, etc and to identify constraints as well as intervention strategies that can improve farmers' access to markets and market information. There have been many efforts from government and other organisations to assist farmers to get better access to market and market information. However, there is a lack of detailed value chain analysis of potential local products that might empower farmers to get reliable information and stable prices.

Thus, if rural populations are supported to improve their access to water, land and markets, their ability to develop sustainable livelihoods will be strengthened and their vulnerability to climate change will be reduced. Combining climate change adaptation and sustainable livelihoods is a new approach to the reduction of vulnerabilities and poverty.

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

## ***1.2 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.

The key objectives of the study are:

- **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.
- **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.
- **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.
- **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.
- **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.

## **2. 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.

### **3. MAIN STUDY FINDINGS**

#### **3.1 *An introduction of selected study site***

##### **3.1.1 *Yen Bai province***

Yen Bai is one of the poor provinces in the Northern Mountainous Region of Vietnam, 178 km away from Ha Noi. The population is 750,000 including 30 ethnic groups. The educational level of the province's residents is uneven and still very low in remote areas. Living standard of the people on average is low and transport conditions are difficult. Land resources are fragmented and many locations are isolated. Many communes in Yen Bai qualify for support from the Government's Poverty Reduction Program 135.

##### **3.1.2 *Van Yen district***

Van Yen is a Northern mountainous district of Yen Bai province, 40 km from the province centre. It has very diverse terrain, with low valleys locked between steep mountains. The economic growth of Van Yen district is relatively high reaching 12.5% in 2009, which indicates good development potential for future years, albeit from a low base. Agriculture is the dominant economic sector (43.5%), with the industrial and construction sector 27% and service sector 29.5%. This ratio is not even among the communes though; the three relatively remote, mountainous communes in this study have a heavily agriculture-based economy compared to the district as a whole.

##### **3.1.3 *Characteristics of selected communes***

**Tan Hop** is located in the middle of Van Yen district. It is one of the poor communes in Van Yen district with 269 poor households at the end of 2008 accounting for 31.6% which is higher than the district average poverty rate. Residents include 3 ethnic groups: Dao, Tay and Kinh, of which Dao and Tay together account for 64.8%.

**Dai Son** is classified as 'extremely disadvantaged' and thus qualifies for support under Program 135. The poverty rate is high: 46.8% at the end of 2009. 306 households are poor, that is 1,369 people. 70 more households are classified as peri-poor. The 2,872 residents of the commune belong to 4 ethnic groups: Dao (73.5%), Tay, H'mong and Kinh.

**Mo Vang** is located the furthest south of Van Yen district. 308 households are classified as poor, that is 46% of the population, a very high rate of poverty. Mo Vang is also supported by Program 135. The geographical conditions of the commune are fragmented and roads are in very poor condition making transport difficult especially in the rainy season. The Dao ethnic group accounts for 70% of the commune population, with other ethnic minorities including H'mong, Kinh, Tay and Thai. The education levels are very low with the number of illiterate is relatively higher than other communes.

### 3.2 Current situation of livelihoods and land issues in local areas

#### 3.2.1 Main livelihoods

The table below shows the most important agricultural products for local people's livelihoods, as ranked by farmers themselves. For all three communes, the top two products are rice (predominantly for farmers' own consumption and fundamental to ensuring food security) and cinnamon (an important cash crop to gain income). Buffaloes, cattle and pigs are also important, and mainly used for farmers' own consumption, and of course draft power.

**Table 1: Matrix of livelihood ranking of the study communes by local residents**

Rank	Tan Hop commune	Dai Son Commune	Mo Vang Commune
1	Rice	Cinnamon	Rice
2	Cinnamon, Acacia	Rice	Cinnamon
3	Pigs	Pigs	Buffaloes
4	Buffaloes and cows	Buffaloes	Cassava
5	Cassava	Poultry	Maize
6	Poultry		Goats
7			Pigs and poultry

*Source: Information collected from the fieldwork surveys*

#### 3.2.2 Land use, land management in local areas

In all the three study communes, land resource in general is scarce. Although the communes' natural areas are often large, the land that can be useful for agricultural and forestry production is not large. The current land resources of these communes are presented in Table 2.

**Table 2: Population and land resources in the study communes in 2009**

Population and land	Tan Hop	Dai Son	Mo Vang
Population (persons)	4,018	2,872	3,767
No. of households	920	652	736
Total area (ha)	6,181	8,136.2	9,963.9
Agricultural production land (ha)	512.9	256.6	764.2
Production forest (ha)	4,399.6	3,433.9	4,681.1
Protection forest (ha)	857.3	129	1,359

*Source: Summarised from Van Yen statistical yearbooks and from the commune leaders' information.*

Dai Son has the smallest amount of agricultural land, as a proportion of its total area and in real terms. Agricultural production land as a proportion of the total commune area is the largest in Tan Hop, but Mo Vang has the largest area of agricultural land, both in total and per capita. Mo Vang therefore seems to have more potential for agricultural development, even though the road conditions to the commune are difficult. However, agricultural land scarcity is present in all three communes to some extent. The areas of protected forest are still large in Tan Hop and Mo Vang, but careful analysis should be undertaken before attempting to extend productive land available by transferring this to production forest land.

Land use has not fluctuated much during the last decades, except due to some transport infrastructure projects. Tan Hop commune is supposed to lose around 52 ha for "through Asia" road, and most of this

will be taken from agricultural land. Plot size of agricultural production land is relatively small, with an average of only about 240 m<sup>2</sup>/piece. The corresponding figure in Mo Vang commune is even smaller, with some fields only 70-80 m<sup>2</sup>/piece.

Land use management in the three study commune is relatively good. However, commune leaders also confessed that there is an issue of forest land certificates. In Tan Hop commune for example, there are still 1,247 certificates for forest land under consideration and subject to be refined and checked. Even for residential land, 53 households still have not completed their tax duties and thus have not been provided with the “red books”. The situation is similar in Dai Son and Mo Vang. This delay has resulted in a few land disputes due to unclear borders of forest land between different households, but all are solved at the commune level. The land rights market is almost non-existent, with only a few households leasing their agricultural land.

The reduction of land fertility is also of great concern to local people. This issue is worst in Dai Son. The leaders of Tan Hop commune have raised awareness about soil fertility to households, resulting in people using more sustainable cultivation techniques.

Land is clearly vital for the livelihood of local residents in all three study communes, with agricultural and forest production the dominant livelihoods in these areas. In places where the soil is degraded, livelihoods are substantially affected. In Dai Son for example, reduced soil quality seems to be resulting in reduced cinnamon output.

People in all three study commune are fully aware of value of land in terms of its vital role in agricultural production and for their livelihoods. All the focus groups agreed that new land cannot come from nowhere; rather the purpose of land can be changed and only within natural limits. The poorest people especially emphasized that it is very difficult for them to change to different livelihoods. Therefore, discussions turned to how to increase productivity. However, their awareness about *how* to improve land quality is limited. Many are not particularly motivated to apply land protection methods, because they do not think the issue is pressing, although Mo Vang commune authorities have undertaken some good awareness raising in relation to sustainable agriculture recently.

### **3.3 Market assessment**

In each of the three communes, villagers in focus groups were asked to rank their main agricultural products in terms of: availability of appropriate land; favourable weather conditions; profitability; feasibility of growing/rearing; tradability; risk of diseases; suitability for small-scale household production; low capital input; opportunities for increasing production; and impacts on the environment. Cinnamon, rice, buffalo and pigs were common to all three of the communes, with cinnamon showing the most potential for generating income if farmers have the initial capital to invest, and the capacity to access the markets and gain a good price for it. The market assessment research team therefore focused on the potential of the cinnamon value chain to assist farmers to improve their livelihoods in each of the three communes.

The study recognised the ability of different households to improve their livelihoods through marketing their agricultural products depends not only on their access to markets, but also on their ability to access other production resources. Households were divided into comparatively well-off, average and particularly disadvantaged, and each of these categories was assessed in terms of their access to transport, labour, land, financial capital, social capital (relationships) and external support. The poorest households generally own less than one hectare of land, rely on human strength or sometimes motorbikes to transport their products, have more dependents who do not contribute significant labour, and find it difficult to access loans. Whereas the better off households may have enough land to be able to lease land to others, or run a small shop, they are able to hire labour, they are likely to have an ox cart or a truck, and they have access to loans.

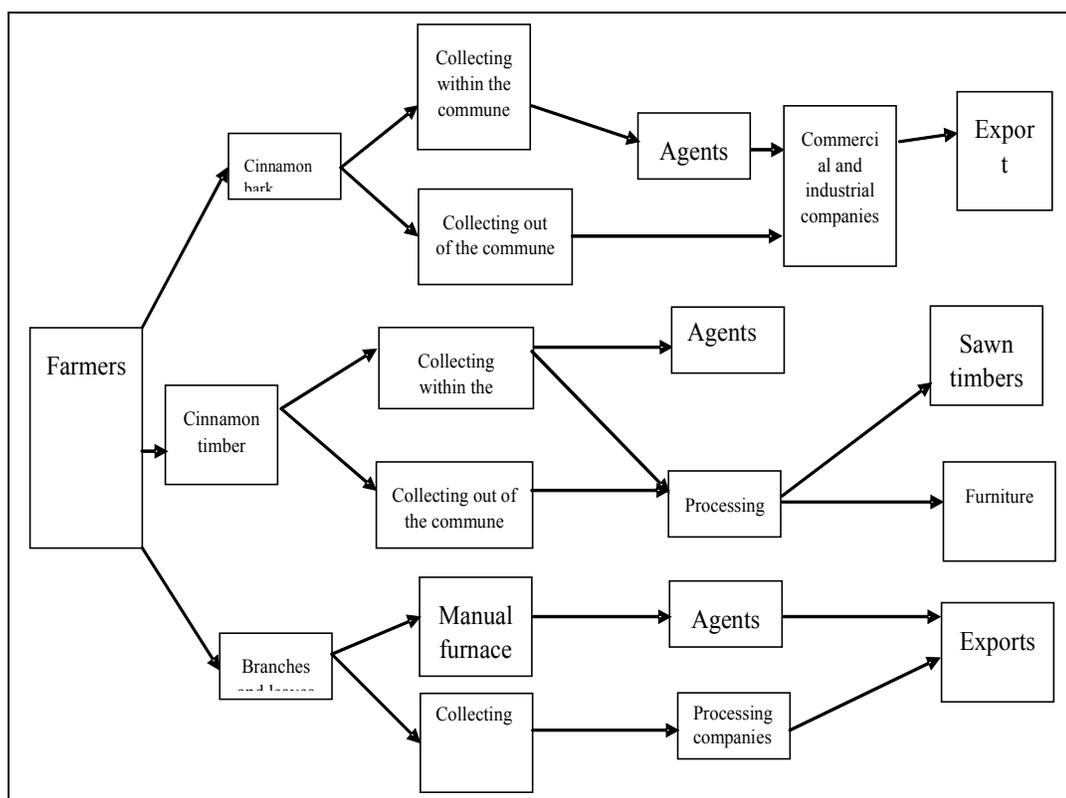
### **3.3.1 Cinnamon value chain**

Cinnamon is a crop of which farmers can use or sell almost all parts, from the bark, to the timber, to branches and leaves. Cinnamon bark is the main product (accounting for 70 % of the total harvested value), but the wood after cutting off the bark, and the leaves and branches also generate 25% and 5%, respectively, of the total income from cinnamon crop.

The value chain of cinnamon starts with cinnamon growing farmers. Farmers cultivate saplings themselves but these only provide 50% of the input they need, so they have to buy the rest from private businesses, as well as fertilizers. Cinnamon is a long-term crop with a business cycle of up to 15 years. Initially, cinnamon trees are grown with thick density of 3,500 – 5,000 plants/ha, then as the trees grow, they are pruned down gradually; and by the 15th year there are about 1,000 trees left per ha. In the first 3 years as cinnamon trees are still small, farmers can intercrop maize and other short-term plants (such as rice and beans) which generate extra incomes for the households. After five years, cinnamon trees can be pruned and generate incomes, and the crop ends in the 15th year to start a new cycle.

80% of the cinnamon bark is sold to buyers in the commune, and 20% to non-commune buyers. Such buyers then resell the bark to commercial companies. Wood of tree-trunks is also bought by agents to transport to carpenter shops and wood processing facilities to make timber or furniture. Cinnamon branches and leaves are also bought to extract oil. These are transported either to local manual oil extracting furnaces, or a big commercial company that uses industrial methods and then exports the oil to China.

**Figure 3: Marketing channels of cinnamon**



*Source: Drawing collated from information collected in three communes*

Within this long and complex value chain, the research team focused on the role of the growers and their relationship with immediate buyers, in order to examine how to improve growers' capacity to negotiate a fair price.

Cinnamon is harvested twice a year. The longer cinnamon grows the more products it produces, but poor households are often in need of cash so they have to harvest early. Farmers are experienced in splitting the bark correctly, and semi-processing cinnamon in various ways (rolling, cutting into small pieces, and smoothing the cover, etc.) but it is still difficult for them to dry cinnamon on rainy days. Besides, the transportation of cinnamon timbers, difficulties of transporting branches and leaves include distance, hilly roads, unfavorable traffic, and high transportation costs. On average, the net income from 1 ha of cinnamon is about VND 31.5 million per year. Compared to other crops in the same area of hilly land, the income from cinnamon is by far the highest.

Poor households often get prepayment from buyers. Even though there are no written commitments between sellers and buyers, their confidence is based on long relationships within the same commune. It is easy for them to agree on the classification. People can refer information about product prices from previous sellers or from buyers, then decide the most favorable selling volume, price, and time. Since sellers and product suppliers are out-numbered, farmers usually accept prices offered by buyers. There is a gap of buying prices in the beginning time and the ending time of a harvest, depending on the supply

and orders from export companies. For example, in the latest harvesting season, price for cinnamon bark was VND 12,000/kg, whereas the number was VND 15,000/kg. In recent years, requirements for cinnamon bark products have been diversified, therefore, buyers also carry out semi-processing to satisfy order requests. Commune buyers then resell products to agents and get commission of 4-5 percent of the buying price.

After splitting the bark of the tree, cinnamon tree-trunks are sold for manufacturing into timbers or family furniture. The prices of wood depends on the tree's circumference. The bigger the tree is, the higher is the price being offered. Farmers often sell 50 percent of cinnamon wood to buyers in the commune who own carpenter workshops, the rest is sold to non-commune buyers. Similarly, buying prices also depend on sizes of the timbers and transportation distance. Comparing to buying prices of cinnamon bark, the prices for cinnamon wood are rather stable and tend to increase thanks to increasing demand for wooden products. High transportation costs, equivalent to 10 – 15 percent of the buying prices. On average, 1 ha of cinnamon provides 40m<sup>3</sup> of wood, generating about VND 20 million for farmers.

Prices for branches and leaves are VND 500/kg on the harvesting field, VND 1000/kg if brought to processing facilities. About 50 percent of branches and leaves are sold to 35 manual oil extracting furnaces in the commune, the rest are sold at Thanh Dat Company for oil extracting. It is noteworthy that there is significant different in capital investment and effectiveness of manual and industrial oil extracting furnaces. Manual furnaces require not much investment, and the oil extracted is 0.2 – 0.3 percent only. On the contrary, Thanh Dat company invested 2 production chains with total investment of VND 17.7 billion (about USD 1 million) with capacity of extracting oil from 15,000 tons of branches and leaves supplied by 18 cinnamon cultivating communes in the region, the rate of extracted oil is noticeably high, approximately 100 percent, four times as high as the rate of manual method. Buying price of raw branches and leaves right at the gate of the company is also VND 1,000/kg. Extracted oil is exported, mostly to China, the cif price at Mong Cai, Quang Ninh border gate is VND 300,000/kg.

### **3.3.2 *Summary on major difficulties and challenges in the three studies communes***

#### **Cinnamon production:**

- Unqualified saplings, in both qualitative and quantitative terms (currently, there are just 90 qualified trees for seeding in the whole district, of which Dai Son commune has 30 trees, Xuân Tâm has 30 trees, and Viên Sơn has 30 trees)
- Cinnamon cultivation consumes a lot of labour for growing trees, caring, pruning, and harvesting.
- Cinnamons grow slowly because they are grown multiple times in the same land without proper cultivating methods
- Many new kinds of damaging worms and diseases are currently existing and there is no effective prevention and treatment found yet.
- Unfavorable weather changes to cinnamon, particularly in the infant phase of the crop (many saplings fail to survive)

- Lack of capital for basic fertilizers (farmers in Mo Vang cultivate without any fertilizers), lack of labourers for growing tree.
- Eroded land, and unfavourable conditions for visiting the fields.

#### **Cinnamon consumption:**

- - Unstable buying price for cinnamon
- - Lack of information regarding products, consumption markets, and specific measures for brand name building and marketing.
- – High transportation costs due to difficult traffic conditions (particularly to the transportation of cinnamon tree-trunks, branches, and leaves)

### ***3.4 Irrigation systems, clean water and sanitation***

#### ***3.4.1 Irrigation systems***

The Tan Hop commune has 14 irrigation schemes, of which 5 schemes are in good condition, 9 schemes need to be improved. Irrigation management unit of Tan Hop commune has 3 persons: Their duties are to manage, instruct, monitor the schemes. The commune entered into contracts with the people for their direct operation, calculating 13 working shifts/1ha/year. Almost system of rolling weirs was constructed. Transport is convenient, materials are available.

The Dai Son commune has 42 small irrigational schemes. To collect auto running irrigation water by rolling weir blocked across the stream, most of these dams have not been constructed, the people used soil to fill across the stream, and are usually broken in flooding time. Almost irrigation canals are constructed by concrete, size of the canal section is usually 0.25x0.3 m. Irrigation management unit of Dai Son commune has 3 persons: Their duties are to manage, instruct, monitor the schemes.

The Mo Vang commune has 9 small irrigational schemes. To collect auto running irrigation water by rolling weir blocked across the stream, most of these dams have not been constructed, the people used soil to fill across the stream, and are usually broken in flooding time. Almost irrigation canals are constructed by concrete, size of the canal section is usually 0.25x0.3 m. Irrigation management unit of Mo Vang commune has 3 persons: Their duties are to manage, instruct, and monitor the schemes. Of food plants cultivated by the people, rice plant is staple, concentrated by the people to provide food to human and livestock breeding. Of the project's issues, the people always put first priority on irrigation scheme to stabilize food, enhance life in the condition of current climate change.

Through the current situation of irrigation schemes of the three project's communes, we realize that average wet rice cultivation area of around 220m<sup>2</sup>/capita is a few, together with small, scattered, incomplete irrigation schemes, leading to low rice output. In order to cultivate rice with high efficiency, sufficient irrigation water is needed.

Therefore, the people's comments are very urgent, wishing organizations, donors to invest in construction of some irrigation scheme items in the communes to help the people go out of poverty. With small scheme scope, construction investment of the items requires little cost but brings about high economic efficiency, which shall clearly change economic life of the people in the project area.

Report by Yen Bai Provincial Sanitation and Clean Water Center shows that, with target to 2010, 80% of rural population can access to sanitary domestic water; 80% of rural households have toilets and sanitary breeding facilities, invested by capital sources from ADB, 134, 135, credit, NGO and capital contributed by the people. However, that target has not yet been obtained. Due to the climate change, water sources are increasingly exhausted, many constructed auto running water supply schemes do not supply sufficient water to the people at present. Long drought, high forest fire danger cause the loss of aquatic life, directly affecting central water supply systems. Additionally, torrential rain pollutes, severely damages the constructed water supply schemes. After big torrential rains, flooding in the residential areas pollutes water sources, materials brought by the torrential rain such as trees, rubbish, animal dead bodies, etc. cause environmental pollution, directly affecting the people's health (Concretely, flood occurring in rainy season in 2008, caused damage to around 35% of the people in the three project's communes).

### **3.4.2 Clean water condition**

In Tan Hop commune, the commune has 2 clean water schemes including Phao canal supplies water to 54 households in villages 12, 13 and 14 (176 households are not supplied). Mang canal supplies water to 380 households in villages 3,4,5,6,7 and 8. The schemes constructed in 2002 is broken and its repair is planned. Remaining 384 households take domestic water by wells or underground water. Sanitary schemes at surveyed households is temporary schemes.

In Dai Son commune, need for domestic clean water is very necessary and urgent. There is one clean water schemes constructed in village 3, supplying 60 households, the rest dig wells or take water from underground sources. Toilets of the People's Committee, schools, markets and households are unsanitary. Substantial epidemics: Cholera, diarrhea, measles and female diseases.

Mo Vang commune's need for domestic clean water is very necessary and urgent. There are 2 clean water schemes constructed in villages Gian Dau 1 and Gian Dau 2 with 134 programme's capital, the rest take water from springs. Toilets of the People's Committee, schools, markets and households are unsanitary. Substantial epidemics: Cholera, diarrhea and female diseases.

HHs in Tan Hop Communes mainly used water supplied from hand-dug-wells and central water supply systems. Depth of hand-dug-wells is usually 10 – 15 m. For Tan Hop commune, domestic water supply source is mainly by exploiting underground water, digging or drilling wells for households living in low terrain, and households living in high terrain, which is impossible for well digging, must ask for water from the low terrain households and are always in shortage of water in dry season from November to March of the following year. In order to settle this issue, it is necessary to get support from organizations for construction investment in wells, electrical pump and pipeline to the households, but management and operation shall be costly and complex, inappropriate with current condition of the people.

Households in Dai Son commune use domestic water mainly from stream, underground water and hand-dug-wells, they live in a scattered way, finding high streams to supply water to them is almost nothing. Quality of hand-dug-wells in this area is poor because of having thin coal beds at the depth of about 5-7m.

Households in Mo Vang commune mainly take water from stream, using bamboo tree or plastic pipe for water irrigation or get water from stream to keep in vases, basins, etc. These streams are usually influenced by cattle, human or torrential rains, causing dirty water. In order to overcome this, it is important to get interventions of the State or large-scaled investment organizations to construct central water supply systems.

Currently, domestic water supply sources for the people are exhausted and polluted due to uncontrolled exploitation and use with various objectives. Not being managed by governmental levels, freely exploitation by the people lead to the fact that needs to use domestic water are very urgent. But, in order to build central domestic water supply systems for the project's communes, it requires big investment capital because households live in a scattered way, in different terrains, supply source is far from residential area. It is easy for schemes to be damaged and there is no cost for repair.

### **3.4.3 Sanitation**

Visual inspection shows that sanitary condition in the project area is polluted. Rate of households using sanitary toilets in the three communes is below 30% (households with moderately good economic life build sanitary schemes, poor households usually have temporary schemes or nothing). Main materials for toilets in studied communes are temporary timber, covered by nylon without roof, or without toilets, making a mess in an utter disorder. There are toilets at schools, markets but they are not standard, stools are let out to the ground, without septic tank and washing water, very dirty, used by few people.

Breeding facilities are not standard, near dwelling houses, animal droppings are let out right on the ground, without manholes, causing nearby environmental pollution. Because the people are still poor, weak in awareness, they almost do not pay attention to sanitation of breeding facilities, toilets. It is crucial to deeply and widespread campaign, educate, propagandize the people to change their thoughts about not using toilets. In kitchen and well areas, there are no pipes and discharge work for domestic water. Households let out washing water in a random way. Main sanitation issues in studied communes are summarised in Table 5.

### **3.5 Climate change**

Participants almost all recognised the term 'climate change' from sources such as television, and when the phrase was explained in terms of changes in temperature, weather patterns, increases in extreme weather events, with indirect impacts including changes to biodiversity such as different types and frequency of pests and diseases, the participants in focus groups felt very confident in listing the climate change-related symptoms that they were aware of. However, changes were largely discussed in terms of general trends

and specific remembered events, with more limited data gathered from interviews and group discussions regarding quantifiable changes in frequency and severity.

### 3.5.1 Climate change phenomenon and patterns

**Table 1: Symptoms of climate change ranked by participants according to how severely they affect farmers' livelihoods**

	<b>Tan Hop</b>	<b>Dai Son</b>	<b>Mo Vang</b>
<b>1</b>	Diseases in animals	Disease in crops and trees	Diseases in crops and trees
<b>2</b>	Diseases in crops and trees	Flash floods	Diseases in animals
<b>3</b>	Unusually heavy rain	Heavy rain	Flash floods
<b>4</b>	Droughts	Drought	Land slides
<b>5</b>	Human ill-health	High temperatures	Drought
<b>6</b>	Flooding and water-logging	Strong winds	Human ill-health
<b>7</b>	Higher temperature	Human ill-health	Soil erosion
<b>8</b>	Flash floods	Diseases in animals	Flooding and water-logging
<b>9</b>	Land slides	Lack of distinction between seasons	Hail and heavy rain
<b>10</b>	Thunderstorms	Whirlwinds	Whirlwinds
<b>11</b>	Sudden darkness during daytime	Hail	Storms
<b>12</b>	Shorter winter		High temperatures
<b>13</b>	Harmful cold weather		
<b>14</b>	Whirlwinds		

Source: Group discussion

#### **More detailed description of the nature of these changes according to focus group participants:**

**Flash floods** have become much more severe now compared to the past, even though the rivers are generally lower. In Mo Vang they only used to happen once every 2 or 3 years, with a particularly bad one remembered in 1993. However now they happen every year. In Dai Son, the worst flash flood remembered happened in 2008, and in Mo Vang the worst ones were 2005 and 2007, with 7 sao of rice fields (belonging to 10 households) being damaged. Where floods used to bring just water, they now bring mud and rocks, which is blamed on stone and iron mines in Dai Son.

**Landslides** have got much more severe and more frequent since 1997. This is blamed partly on deforestation. The worst remembered landslide in Mo Vang was in 2008, in which cinnamon hills were damaged, as well as rice fields. More than 10 households were affected.

**Droughts** have become much more severe over the past 10-13 years. Where the drought season used to be almost over by the end of January in Tan Hop, it now usually lasts through February and March. In Dai Son, the worst remembered drought period was 2007-2009.

**Unusually heavy rain** has become much worse over the past 10 years (Dai Son). The worst remembered heavy rain was in 2008. Rain storms are shorter now but much heavier, leading to worse flash flooding.

**Flooding and water-logging** happens every year and lasts for a few days, but has got much worse since 1990. In Mo Vang, the worst remembered floods in the past were in 1968 and 1972. Recently there was a very bad one in 2005.

**Soil erosion and poor soil fertility** has got much worse since 1990, also blamed partly on deforestation.

**Higher temperatures** have been noted over the past 10 years, with 2010 the worst so far. 5 years ago, in Dai Son, participants reported that the temperature never went above 34-35°C in the height of summer; now it reaches 38-39°C.

**Shorter winters and an increasing lack of distinction between seasons** was reported in all focus groups. Winter is warmer, with the temperature similar to autumn and fewer very cold days. There used to be hoar frosts in winter, but now there are none. In Dai Son, there are reports of more unpredictable temperatures, with cold days in summer and hot days in winter (e.g. February 2010).

**Storms, including thunder storms,** are reported to have got much worse since 1997 with the worst remembered one in Mo Vang in 2008.

**Hail storms** have got significantly worse and now occur at last once a year. The worst remembered hail storm in Dai Son was in 2008 lasting 15-20 minutes with hail stones the size of one's thumb. The worst remembered hail storm in Mo Vang was in 2007 and lasted 30 minutes. The worst hailstorms cause sudden very unusual darkness during the daytime.

**Strong winds** have got worse in Dai Son over the past 5 years, with the strongest winds remembered in 2006.

**Whirlwinds** used to be very rare with residents of Mo Vang remembering just two serious ones in 1975 and 1986. They are still not highly frequent but in past 2-3 years almost all big storms have included whirlwinds

**Pests and diseases in crops and trees** have got much worse over the past 5-10 years, in particular in rice, cinnamon and cassava. In Mo Vang the worst year remembered for pests in crops and trees was 2007.

**Diseases in animals** have got much worse over the past 10 years. Bouts occur 2 or 3 times a year. Affected animals include: pigs (lepto and cholera); chickens (fowl cholera and an unknown disease reported in Dai Son that kills chickens suddenly); cows and buffaloes.

**Human ill-health** is reported to have got much worse over the past 5 years. The major occurrences are in summer, and includes malaria, diarrhea, colds, measles, and mumps. In Tan Hop there are reports of dizziness getting worse in 2010, and eye disease patients suffering for long periods. In Dai Son there used to be no malaria or cancer, but now there are many cancer cases, with a 20-30%). Khe Rang village, on the other hand, has been nick-named 'appendicitis village'.

### 3.5.2 *Impacts on livelihoods*

When participants were asked about how each of the climate change-related symptoms that they had identified impacts on their livelihoods, their answers included less quantifiable data but more detail about the longer-term impacts on their livelihoods.

Table 2: Description of how each of these climate change symptoms affects participants' livelihoods, according to farmers

Symptom of climate change	Impact on livelihoods
<b>Flash floods</b>	<ul style="list-style-type: none"> <li>- Death of people</li> <li>- Death of animals</li> <li>- Damage to crops (2008's flood in Dai Son caused the loss of 10% of rice fields) and cinnamon trees</li> </ul>

	<ul style="list-style-type: none"> <li>- Damage to houses and property</li> <li>- Flash floods now bring deposits of mud, stones and rocks which creates worse and longer-term damage than just water. The result is high labour costs to rehabilitate the land for agriculture, and in many cases the land is no longer usable.</li> <li>- People need to be evacuated</li> </ul>
<b>Landslides</b>	<ul style="list-style-type: none"> <li>- Loss of crops and trees</li> <li>- Loss of arable land</li> <li>- Cost of labour to rehabilitate arable land</li> <li>- Damage to infrastructure, limiting access to market and reducing income</li> <li>- People need to be evacuated</li> </ul>
<b>Droughts</b>	<ul style="list-style-type: none"> <li>- Most crops rely on rain water and so these crops' productivity will be reduced or entire harvests lost (e.g. in Mo Vang's 1997 drought, it was not possible to transplant rice seedlings to the fields in time due to the lack of water).</li> <li>- Lack of water for daily use, including drinking, cooking and cleaning</li> <li>- More resources are required to pump water to fields and farmers sometimes have the opportunity to rent pump equipment from the government, but this is a cost, and is not possible for people in highlands</li> <li>- People need to dig wells: this has an impact on income and health, since they are expensive, and can be polluted with iron</li> <li>- People spend a lot of time and labour collecting water that they could otherwise have dedicated to other tasks including farming and education</li> <li>- Even wells run out of water sometimes, and then families need to share wells: a number of people reported conflicts between families over water resources which undermines the important resource of human and social capital</li> </ul>
<b>Unusually heavy rain</b>	<ul style="list-style-type: none"> <li>- Damage to, and loss of, crops including vegetables, rice, cassava and corn</li> <li>- Flash floods and landslides</li> </ul>
<b>Flooding and waterlogging</b>	<ul style="list-style-type: none"> <li>- Houses are not usually affected as they are on high land, but rice fields can be.</li> <li>- Not as damaging as flash flooding</li> <li>- A storm in 2008 caused the biggest flood for 40 years in Tan Hop.</li> <li>- The secondary school is the most vulnerable building to flooding in Mo Vang because it is on lower land. It floods every year for a few days and then the ground floor is covered in mud and silt that needs to be removed. At this time, resident teachers go and seek shelter in the community. In 2005 the ground floor was flooded to the ceiling.</li> </ul>
<b>Soil erosion and poor soil fertility</b>	<ul style="list-style-type: none"> <li>- Reduced productivity</li> <li>- Less food, and reduced income</li> <li>- Increased need for, and cost of, fertilizers</li> </ul>
<b>Higher temperatures</b>	<ul style="list-style-type: none"> <li>- Can get more power cuts because using more fans, so they spend more on electricity, and have to reduce electricity use for other purposes</li> <li>- Trees including cinnamon and fruit trees can die due to heat.</li> <li>- Rice productivity is reduced.</li> <li>- People have to start work earlier, and get more tired from outdoor labour.</li> <li>- People are affected more with malaria and respiratory disease, as well as colds and headaches. Especially affects people with high blood pressure.</li> </ul>
<b>Shorter winters and less distinction between seasons</b>	<ul style="list-style-type: none"> <li>- This is not reported have a serious impact on crops or animals</li> </ul>
<b>Storms including thunder storms</b>	<ul style="list-style-type: none"> <li>- Do not seriously affect productivity, except that when they bring sudden darkness in the daytime, parents have to go and collect their children from school and cannot work</li> </ul>

<b>Hail storms</b>	- Loss of crops, with rice hit particularly hard
<b>Strong winds including whirlwinds</b>	- Strong winds do not generally cause too much damage but whirlwinds can be very destructive even though they cover a small area - Big trees are knocked down - Houses can be severely damaged
<b>Diseases in crops and trees</b>	- Lower productivity and loss of crops - Higher investment required - Lack of food - Poor nutrition and hunger
<b>Diseases in animals</b>	- Participants do not know what the new diseases are, do not have information. - People do not have easy access to a vet, and do not want to pay for one, so they treat their animals on their own - Sometimes people eat animals after they have died and don't realize the animals were diseased: bad for health. - Lack of draught power for farming and transport. - People are discouraged from investing because they do not want to take the risk of losing the animal through disease
<b>Human ill-health</b>	- People lose money e.g. for labour, and for cost of medicines - When one person is sick, they are likely to infect others

### 3.5.3 *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

### 3.5.4 *Adaptation approaches*

However, participants did demonstrate some capacity to adapt to climate change challenges. Their approaches mainly consist of their own resourcefulness but are also supported with some external assistance.

**Table 3: Adaptation approaches currently used by farmers, and support available to them**

	<b>Current approaches</b>	<b>Support available</b>
<b>Flash floods</b>	<ul style="list-style-type: none"> <li>• Plant acacia and cinnamon at the top of hills</li> <li>• Avoid burning forest or clearing trees for cultivation</li> <li>• Replant forests</li> <li>• Plant bamboo to prevent land erosion</li> <li>• After flash floods, remove stones and mud deposited on arable land</li> <li>• Mutual support among villagers</li> </ul>	<ul style="list-style-type: none"> <li>• Disaster and Storm Risk Management teams at the village level inform people about expected risks reminding people to prepare tools for emergency response.</li> <li>• Following disasters where harvests are lost, support is sometimes available from the government in terms of money or rice</li> <li>• Support is sometimes available from the government to repair houses</li> </ul>
<b>Landslides</b>	<ul style="list-style-type: none"> <li>• Reinforce bare slopes</li> </ul>	
<b>Whirlwinds</b>	<ul style="list-style-type: none"> <li>• Reinforce houses</li> <li>• Cut down big trees around houses</li> </ul>	
<b>Drought</b>	<ul style="list-style-type: none"> <li>• Dig wells</li> <li>• Pumping water to fields via canals, and build dams and wiers</li> <li>• If there is a lack of water to pump, leaving fields uncultivated</li> <li>• Change crop: from rice to corn, potatoes or beans</li> <li>• Water each plant or tree by hand</li> <li>• Limit use of water for daily use</li> </ul>	<ul style="list-style-type: none"> <li>• Irrigation systems have been built in some fields</li> <li>• A well-digging service is available (Tan Hop)</li> <li>• The commune provides support for pumping, by renting out a water pump to farmers (Tan Hop)</li> </ul>
<b>Unusually heavy rain including hail</b>	<ul style="list-style-type: none"> <li>• Stay home</li> </ul>	

<b>Soil erosion and poor soil fertility</b>	<ul style="list-style-type: none"> <li>• Buy nitrogenous fertilizer</li> <li>• Use green manure</li> </ul>	
<b>Unpredictable high temperatures</b>	<ul style="list-style-type: none"> <li>• Plant trees around houses</li> <li>• Use roofs made of leaves</li> </ul>	
<b>Pests and diseases in crops and trees</b>	<ul style="list-style-type: none"> <li>• Rice: use pesticides preventatively (3-6 times per year) according to the advice of the sellers</li> <li>• Cinnamon: Cut down the trees; use pesticides; or avoid weeding among cinnamon trees.</li> <li>• Acacia: Apply pesticide to each tree individually</li> <li>• Although some farmers have been trained, including in ‘integrated pest management (IPM), many are not applying their learning</li> <li>• Some farmers are successfully using lime as a fertilizer which is environmentally friendly and reduces the incidence of pests</li> </ul>	<ul style="list-style-type: none"> <li>• Sufficient pesticides are available from traders but their effectiveness, especially given poor understanding of how to use them, is uncertain</li> </ul>
<b>Diseases in animals</b>	<ul style="list-style-type: none"> <li>• Use traditional herbal remedies such as banana leaves to cure pigs and chickens affected with diarrhea</li> <li>• Occasional injections (administered by the farmers themselves) but these are often not effective</li> <li>• Keep cages clean and use appropriate cages (though they cost 12 million VND each)</li> </ul>	<ul style="list-style-type: none"> <li>• Sometimes vet comes to treat animals, but usually farmers buy medicine and try to cure sick animals themselves</li> <li>• There is one animal medicine shop in Tan Hop commune</li> </ul>
<b>Human ill-health</b>	<ul style="list-style-type: none"> <li>• Maintain good hygiene, sanitation, and diet if possible</li> <li>• Herbal medicines are used preventatively (e.g. liquorice water) and to treat mild, common sickness</li> <li>• Buy medicine (without prescription)</li> <li>• Go to the doctor or hospital for serious issues (if can afford to)</li> </ul>	<ul style="list-style-type: none"> <li>• There are many indigenous doctors</li> <li>• There are local physicians, nurses and pharmacists.</li> <li>• The district hospital is 6 km away</li> </ul>

These methods are evidence that farmers have an awareness of the impacts of the changing climate and unpredictable and severe weather, and they recognise the need to respond to them. Farmers’ **strengths** that help them adapt include: (i) Local knowledge and experience; (ii) Local organisational structures such as communes and women’s associations that facilitate sharing of information and mutual support in times of need; and (iii) An environment rich in natural resources, in particular forests

Overall, however, the current adaptation methods listed above are not adequate to support sustainable livelihoods in the long-term. Many of them have disadvantages including the fact that they are costly, labour intensive and/or ineffective.

While the above-mentioned strengths and resources form an important foundation on which any interventions to improve adaptive capacity should be built, more is clearly needed to enable farmers to be better cope with the impacts of climate change.

## **4. CONCLUSIONS AND RECOMMENDATIONS**

### **3.6 Conclusions**

This report clearly shows that poor people in the target communes in Yen Bai province face daily challenges in sustaining their livelihoods already, and many of these are being exacerbated by the impacts of climate change. Inherent challenges they already face include poor soil quality and lack of access to land rights; limited irrigation and water supply facilities; and lack of negotiating power to get a good price when marketing their products.

Climate change is undermining the ability of the rural poor to break out of the poverty cycle, in relation to each of these challenges. 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.

Below are suggested a number of intervention activities that can support poor farmers in these communes to develop and maintain sustainable livelihoods in the face of climate change.

### **3.7 Intervention activities**

#### **Land and livelihoods**

- Organizing training courses for technique transfers on sustainable land use cultivation and for increasing awareness of local people on sustainable land use. This activity could be applied in all three communes of Tan Hop, Dai Son and Mo Vang
- Providing training courses in hamlets, where agricultural land is most deteriorated and be most vulnerable in land due to climate change.
- Re-growing forests especially in upstream areas and re-growing new young trees substituting for old and unproductive forests, is really important to prevent soil erosion in all study areas especially in the downstream land. Particularly, Acacia could be grown more in Tan Hop and Mo Vang communes, while cinnamon should be improved in Dai Son.
- Replacing gradually the old and unproductive cinnamon forests in Dai Son but in faster paces so that the crop keeps being the most important livelihood in the commune such as seedlings or consulting about the first right areas to be newly re-grown.

- Grow hedgerow or other similar crops to prevent effectively soil erosion in the study areas in Mo Vang and Tan Hop communes, especially in most affected areas by natural disasters by providing techniques of growing hedgerow and seed costs.
- Conducting training courses on land policies including land law and regulations especially on the rights and duties of people in using agricultural and forest land, not only useful for farmers as the final land users, but also for commune leaders and staffs.
- Providing basic rights and duties of land users for each types of land should be provided as well in the forms of brochures or announcements in each hamlet community houses.

### **Market assessment**

- To support farmers in establishing a cinnamon cultivation system, so as to ensure land protection, prevent erosion, while improving the rate of surviving saplings, and maintain good product quality.
- To support setting up and training of Good Agricultural Practices (GAP) for Van Yen cinnamon to ensure products' quality.
- To support recover and maintain precious Van Yen cinnamon genes. Helping to protect and reserve 90 qualified trees for seeding (given local assessment), selecting the best parent trees to reserve and develop good genes resources.
- To support the establishment of Van Yen cinnamon trademark. Although the origin of Van Yen cinnamon has been certificated, it is still necessary to protect the trademark.
- Support product promotion, by marketing cinnamon products particularly Van Yen variety through participation intrade fairs and other activities.
- To support deeper product processing, and the diversification of cinnamon product designs: regarding cinnamon bark, it is necessary to study proper preservation methods, invest in required semi-processing equipments, e.g.: chopping cinnamon into standard pieces, and smoothing cinnamon covers as required, etc. Regarding cinnamon wood, it is necessary to carry-out deeper manufacturing to make cinnamon-based furniture and goods. There should be support for the transportation of cinnamon branches and leaves to industrial processing factories for higher processing effectiveness. To help factories looking for partners consuming cinnamon oil.
- To support establishing farmer organizations of cinnamon product consumption.
- To support handling tie-up traffic points, particularly in rainy seasons, to reduce transportation costs.
- To support poor household developing intercroops, diversifying income-generating activities so that farmers do not have to harvest cinnamon early.
- To support value-added activities by developing bio-tourism in cinnamon region.

### **Irrigation systems, clean water and sanitation**

- Conducting communication activities to raise awareness of people on natural and water resources protection such as forest plantation, reservation to create sustainable source of water.

- Building capacity for people to understand and assisting them so they are able to construct temporary dams with local materials.
- Piloting some models on local irrigation schemes that sensitive to climate change by applying flood-retained designs
- In parallel with support for infrastructure, it is necessary to conduct communication activities to raise awareness of people about the environment and water resources protection such as forest plantation, reservation to create sustainable sources of water.
- Building capacity for people to understand and assisting them so they are able to construct temporary dams with local materials. Piloting some models of local irrigation systems that are sensitive to climate change by applying flood-resistant designs
- Drawing attention from the government on rationale of large plant for drinking water by further studies and advocacy programmes
- Assisting poor families to build wells and toilets, and undertake communication activities to support behaviour change among households without latrines
- In the meantime, awareness raising on water resource protection should be optimised by communication campaigns. This could be achieved by setting up local regulations on water management among local people and the inter-village community.
- Develop guidelines on designing and managing animal husbandry facilities should be developed and disseminated to people to improve their health condition

### **Climate change**

#### *Facilitate community capacity building projects:*

- Providing training that develops the knowledge, skills and confidence farmers need to adopt new livelihoods approaches that will be more resilient to the impacts of climate change;
- Supporting communities to develop special interest support groups that can share information and support each other to learn about and implement new adaptation techniques;
- Providing training that builds farmers' management skills, including how to record information, learn from experience, plan for the future, invest in new materials, and make the transition to new products or methods.
- Providing training in implementing specific sustainable livelihoods models such as systems of rice intensification (SRI), integrated pest management (IPM) and cultivation on steep hillsides.

#### *Improve information and knowledge development by providing tools and building capacity*

- Collect, record and store information about changes and trends weather, climate and livelihoods;
- Analyse and learn from the information, and be prepared to adapt accordingly;
- Share and distribute information, knowledge and experience.

#### *Pilot sustainable livelihood model projects including supporting farmers*

- Design model projects that apply lessons learned about climate resilient livelihoods;
- Implement those pilot projects;
- Learn from the pilot projects and adapt them accordingly;
- Share the lessons learned from them.