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Potential to integrate high-value native tree species into the upland farming systems of Hoa Binh Province, Vietnam

By

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Declaration of Originality

Herein, I declare that this thesis reports the original work of the author, except as otherwise stated. I have not previously presented the work contained in this thesis to any tertiary institution.

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Abstract

This study examines the potential for integrating high-value native-tree species into the farming systems of upland households in Hoa Binh Province, North Vietnam. The fieldwork undertaken during March to June 2005 involved Participatory Rural Appraisal survey methods in four villages representing the range of physical and social environments of upland farming systems in Hoa Binh Province. Local literature was used to further characterise the physical, socio-economic, policy and institutional environment of reforestation of the upland region.

Currently, farmers of Muong ethnicity widely plant acacia and bamboo woodlots without incentives, while poorer Tay farmers do not plant trees without incentives. Acacia and bamboo are favoured because they represent a relatively low investment and they are fast growing. It is also possible to grow annual crops and graze livestock under their canopies in early stages of woodlot growth. The general knowledge of native species, their silviculture and markets is variable, and there is little planting without incentives.

There are five models of tree planting that farmers practise without incentives: single-species plantings of acacia or bamboos, traditional agroforestry of swidden cultivation with *Melia azedarach*, traditional multi-layered home gardens, mixed plantings of acacia with bamboos, and a few farmers experimenting with mixed plantings of native high-value wood tree species between acacia and bamboos. Thus there are adequate indigenous conceptual models for integrating native trees into farming systems.

The best physical opportunity for planting native trees within upland farming systems is likely to be in the land formally classed as 'unused sloping lands' but is actually used for swidden cultivation. Mixed woodlots or agroforestry configurations may be possible here. The next opportunities are inter-planting native tree species in homegardens, and the protection and production forest areas over which farmers have been given tenure. The main farming system constraints on planting native trees concern their biophysical ability to be integrated with existing plantations or with grazing and swidden cultivation as they are currently practiced. Farmer's time is also a limitation and so tree planting must have a clear economic return. Net Present Value analysis of native tree woodlots versus acacia and bamboo indicates that they are currently not an economically rational choice. However, they may be more acceptable in mixtures with acacia/bamboo or in agroforestry systems.

There is a generally supportive physical, institutional and economic environment for upland farmers to plant trees. Farmers are being given title to land and forests and there is strong economic growth. There are also programs to encourage farmers to establish 'material forests' of acacia and bamboo for the pulp industry, Programs to encourage native-tree planting rely strongly on incentives but are not supported by clear market signals or channels, or information about native-tree silviculture.

Several recommendations are made to further the integration of high-value native trees into these upland farming systems. These include: introduce 'agroforestry' as a landuse planning category; broaden community-based forest management to include mixed-species woodlot and agroforest establishment; engage community institutions to foster a culture of commercial plantings of native trees; develop appropriate extension packages for both farmers and commune officials; introduce credit arrangements that acknowledge the long pay-back times of tree planting; develop a clear market channel for farm-grown native trees to the export furniture industry; and research to better understand the silviculture of native trees grown in mixture with acacia and bamboo.

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Glossary of Acronyms

'Doi Moi'	*Innovation*
5MHRP	*Five Million Hectares Reforestation Program*
ACIAR	*Australian Centre for International Agricultural Research*
AFS	*Agroforestry System*
ASB	*Alternatives to slash and burn systems*
CARES	*Centre for Agricultural Research and Ecological Studies*
CBFM	*Community Based Forest Management*
DARD	*Department of Agricultural and Rural Development*
FAO	*Food and Agriculture Organization*
FDI	*Foreign Direct Investment*
FS	*Farming Systems*
FSA	*Farming Systems Approach*
GDP	*Gross Domestic Products*
HB-PC	*Hoa Binh People's Committee*
ICRAF	*World Agroforestry Centre*
IFM	*Indigenous fallow management*
JICA	*Japan International Cooperation Agency*
MAI	*Mean annual increment*
MARD	*Ministry of Agricultural and Rural Development*
MDF	*Medium Density Fibreboard*
MOLISA	*Ministry of Labors, Invalids and Social Affairs*
MSTE	*Ministry of Science, Technology and Environment*
NTFP	*Non-Timber Forest Product*
ODA	*Official Development Aid*
PAM	*World Food Program*
PRA	*Participatory Rapid Appraisal*
SFEs	*State Forest Enterprises*
SIDA	*The Swedish International Development Cooperation Agency*
VAC	*The mixture model of garden, fish pond, and livestock*
VACB	*Vietnam Agroforestry Capacity-Building Project*
VAT	*Value Added Tax*
VGov	*Vietnamese Government*
VND	*Vietnamese Dong – the Vietnamese monetary unit*
WB	*World Bank*
WTO	*World Trade Organization*
SAM	*Mountain Agrarian Systems Programme*
RENFODA	*Regeneration of natural forest on degraded areas*

Chapter 1
Introduction

1.1 Prologue

Vietnam is a country in a period of great economic and social development. Such development is placing strong demands on its forests and upland land use. The long term sustainability of upland land use requires good planning based on a balanced application of ecological and social sciences. This study adds to this knowledge base by a focussed study of how the interface between agriculture and forestry can be better managed in a specific region. This introductory chapter provides the background and context of the study, the essential research aim and questions and an outline of the thesis structure.

1.2 Background to the study

Under the reform era of *Doi moi* (which means 'innovation') established in 1986, a current priority for the national development of Vietnam is the development of upland rural residential areas and forestry. Vietnam's upland regions occupy about 75% of the total land area with a population of about 25 million people, about 30% of the national population. A special character of the uplands is the social and cultural diversity with more than 50 ethnic minority groups estimated at 10 million people sharing the region (Chu Huu Quy, 2002). The main economy of Vietnam's uplands is subsistence or semi-subsistence agriculture. The resource degradation caused by this activity is unrelenting and affects the sustainable development of the region and the country as a whole. The uplands are still under-developed in regard to infrastructure and socio-economic organisation. While Vietnam has achieved great results in terms of poverty alleviation and anti-hunger programs - in period from 1993 to 2004 , the poverty rate was remarkably reduced from 58.1% to 24.4% of the population - this situation has by no means stabilised (VietnamNet, 2005).

Before 1986, all forestry management in Vietnam was undertaken by the State. Four

hundred and thirteen State Forest Enterprises managed about 7.8 million hectares of forestland consisted 6 million hectares of natural forests. The major activity of the State Forest Enterprises was exploitation; sustainable forest management was not yet on the agenda. Since 1986, *Doi moi* has reformed forest management by transferring a large area of State forestland to private and community-based ownership and management. This meant forestry management based purely on exploitation changed to forestry development based on reforestation and improved the socio-economic improvement of the upland communities (Vu Huu Tuynh, 2001).

Doi moi also introduced changes to agriculture in Vietnam including upland farming systems. The old Agricultural Cooperatives ended in 1988 with Resolution 10 of the Government. Households became an independent economic unit with the right of active cultivation on their paddy land. The Government launched a series of policies including Land Law (issued in 1993, and modified and supplemented in 1998), Resolution 02/1994/ND-CP, Resolution 01/1995/ND-CP, and Resolution 163/1999/ND-CP, that conferred to households the right to land including forestland, and also gave upland people the opportunity to earn income from the management of forests. These Resolutions were especially important for the households in the upland regions (Vietnamese Government, 1999).

Under the overall strategy to combine the forestry development with upland rural development, there are two important approaches: reforestation including high-value timber species, and Community-Based Forestry Management (CBFM). Regarding reforestation activities, the main program launched by the Government is the Five Million Hectare Reforestation Programme (5MHRP) which is being carried out over the period of 1998 to 2010. The objective of this program is to reforest 43% of total area of Vietnam with 5 million hectares of new forests (MARD, 2001). This programme has had a strong impact on the lives of the upland residents.

Forestry development needs to be aware of the upland communities and farmers. In recent years, the approach of CBFM has been applied widely. Communities and households play key roles in the CBFM approach to forestry development. However, the upland communities and households still suffer from poverty and hunger. The physical conditions for development are also extremely harsh which negatively affects the reforestation progress.

The highest value trees are usually native timber tree species. They usually grow slowly and have a long payback period, but are very appropriate to the natural conditions. Particularly, they are trees of high value timber production. Native tree plantations play an extremely important role in long-term Vietnamese forestry development strategy, meeting the whole national demand.

Like Vietnamese Government programs, several non-Vietnamese government programs also focus on the development of forestry. In particular, the Australian Centre for International Agricultural Research (ACIAR) has carried out research into mixed species plantation of high value trees for timber production in Vietnam since 2002. The aim of this project is to develop silvicultural techniques and to enhance the planting of native trees. However, the adoption of planting high value trees by communities and farmers is still poorly understood.

Plantations of high value wood tree species are necessary for sustainable forestry development of Vietnam. The important question is how to encourage households to take part in forestry management, including the special planting of native tree species. The ACIAR project needs to research not only into silviculture but also on adaptation of these techniques to the conditions of the upland households. Thus, the study of "**The potential to integrate native species into the farming systems of Hoa Binh Province**" is being carried out to deal with the problem of adoption of the plantation system by farmers based on the participatory approach.

1.3. Rationale and context of this study

The main rational of the research is an adaptation to the ACIAR project that seeks potential of mixed planting of high-value timber tree species into the farming systems adopted by the upland communities and farmers without incentive.

The ACIAR project (FST/2000/003) called "Mixed species plantation of high value trees for timber production and enhanced community services in Vietnam and Australia" carried out from 2002 to 2005 focuses on two major research aspects:

- Socio-economic benefits for farmers related to planting high value trees
- Mixed species plantation of high value trees, concentrating on silviculture

The project leader Associate Professor David Lamb (University of Queensland)

acknowledges that there is a gap in this project which can decrease its value. The gap concerns better knowledge to influence the adoption of mixed-species plantations by communities and farmers. The ACIAR project has been carried out in the uplands of Vietnam, and has been designed to benefit the people of the area with four main objectives showed in Box 1.1.

Box 1.1: Research objectives of the ACIAR project (FST/2000/003)

Objective 1: To evaluate the socio-economic circumstances currently influencing farmers tree planting activities, the financial performance of new forestry systems based on native species and mixtures, the way in which these systems will be integrated with other land-use activities and the financial and livelihood benefits arising from reforestation

Objective 2: to assess the performance of a range high value tree species in existing plantations for suitability for wider use in reforestation and in mixed species plantations

Objective 3: to assess competitive relationships in older plantations to identify species suitable for inclusion in mixed species plantings

Objective 4: to assess the performance of high value trees and determine whether these grow best in mixed species plantations or in monocultures

(Lamb, 2001)

According to these objectives, the research is undertaken as basic research concentrating on silvicultural techniques. Within this study, experimental models of mixed plantations of high value wood tree species were built based on the household forestland areas in Phu Tho Province by researchers with outside support.

However, in upland communities forestry activity is intimately related with agricultural activity. Upland households do not practise forestry activity separately to other farming activities and off-farm activities of the households. New forestry activity cannot be imposed on a farming system if it is not a naturally attractive modification of the existing farming systems. The ACIAR project required deeper understanding of upland farming systems and the physical, socio-economic and institutional constraints on adopting new forestry systems. This rationale leads to the essential question underlying this study: '*What potential is there for integrating high-value native trees into the farming systems of upland households in Hoa Binh Province?*'

1.4. Research aim, objectives and questions

The main aim of this research is to understand the potential and constraints of the integrating high-value native tree species into the upland farming systems in Hoa Binh

Province of Vietnam.

To achieve the main aim of this research, the following six key questions need to be answered.

1. *What physical and time constraints present barriers to farmers planting trees?*
2. *Do upland farmers plant trees and why, or why not, do they engage in this activity?*
3. *Of those farmers that plant trees, why do they plant some species and not others?*
4. *In what configuration do farmers integrate trees in their farming systems?*
5. *How does the physical, socioeconomic, institutional, and policy environment support the planting of integrated mixed species into farming systems of Hoa Binh Province?*
6. *Based on the understanding of these systems, what interventions will further the integration of high-value native trees?*

To answer these questions the study is framed around the specific objectives shown in Table 1.1.

Table 1.1: Specific objectives of the research in Hoa Binh Province

Specific objectives
• Analysis of the upland farming systems
• Socio-economic description of villages in province
• Characterisation of local knowledge and attitudes to tree growing
• Analysis of markets for forest products
• Analysis of physical, institutional and policy environment for planting tree species

1.5. Outline of the thesis

The thesis contains 7 chapters. After this introduction Chapter 2 presents a history of the development of forestry and upland farming systems since the *Doi moi* Era of Vietnam. It also covers the background literature on farming systems research on which the study's method is based. Chapter 3 outlines the research framework and study site selection. This chapter also describes the Participatory Rural Appraisal

(PRA) survey methods with the key tools practised. Additionally, in this chapter the basic analysis of the study site selection is described. Chapter 4 presents the detailed description and analysis of upland farming systems in Hoa Binh Province as a result of the PRA study. Chapter 5 presents an analysis of the physical, socio-economic, policy and institutional environment of reforestation in upland regions. This analysis is based on Vietnamese government and similar institutional literature. On the basis of the preceding two chapters Chapter 6 discusses the potential of integrating high-value native species into the upland farming systems of Hoa Binh Province. In conclusion Chapter 7 summarises the study by reviewing the essential answers to the six research questions. Answers to the sixth question are in effect recommendations to further the integration of native species into the upland farming systems of Hoa Binh Province.

Chapter 2
The Upland Farming Systems and Forestry Development in the '*Doi moi*' Era of Vietnam

Introduction

This chapter has three sections presented in a sequence to provide 1) background knowledge of the historical and institutional context of forestry development in Vietnam, then 2) the farming systems methodology used in this study, and finally 3) current issues and institutions in upland and forestry development. It is necessary to follow this sequence because section 3 needs to be understood with the language introduced in section 2.

In brief, Section 1 describes Vietnamese history since the establishment of the Democracy Republic of Vietnam in 1945 up to the present day. It specifically examines the changes of the government policies concerning the development of agriculture, forestry, and especially agroforestry by following a history time line that concentrates on the *Doi moi* period. As this study is firmly based in a 'systems approach' Section 2 reviews the essential literature describing farming systems and how they can be studied with particular reference to upland farming systems of Vietnam and *Agroforestry systems*. Section 3 then returns to current issues in upland forestry development in Vietnam.

2.1. Vietnam and the period of 'Doi moi'

It is both interesting and necessary to understand the last 60 years of Vietnam's history to appreciate the current status of agriculture and forestry development. A snapshot of Vietnam's that current status is provided in Figure 2.1 and Table 2.1 which provide the key characteristics of the physical and socio-economic environment.

Figure 2.1 Location of Vietnam in Asia region
Source: www.(GraphicMaps.com)

Table 2.1 Major characteristics of Vietnam

ENVIRONMENT/GEOGRAPHY	ECONOMY/SOCIETY
Geography	**Economy**
Area: approximately 332,000 km2	GDP: $44.6 billion (2004)
Land boundaries:	GDP growth rate: 7.7 % (2004)
Total: 4,510 km	GDP-composition by sector (2004):
Border countries: China (1,306 km), Cambodia (1,137 km), Laos (2,067 km)	*Agriculture*: 21.8%
Coastline: 3,260 km	*Industry*: 40.1%
Maritime claims:	*Service*: 38.2%
Continental shelf: 200 m or edge of continental shelf	Inflation rate of consumer price index: 9.5% (2004)
Exclusive economic zone: 200 nm	*Unemployment rate of labor force working in urban areas*:
Territorial sea: 12 nm	5.8% (2003)
Climate	Exports of goods and services/GDP: 66.4% (2004)
Tropical in south; tropical monsoon in north with hot, rainy season (mid-May to mid-September) and warm dry season (mid-October to mid-March)	Industrial production growth rate: 16% (2004 at 1994 price)
Terrain: Mekong River Delta in the south (area approximate 59,000 km2); the Red River Delta in the north (area approx. 17,000 km2); and mountains in the central and west.	*Agricultural production growth rate: 4.2% (2004 at 1994 price)*
Elevation extreme:	Agricultural products: rice, rubber, corn, sugarcane, coconuts, soybeans, coffee, cashews, and aquatic products.
Lowest point: 0 m at sea level	Exports: total value $26.5 billion (fob, 2004)
Highest point: Phan Xi Phang 3,000 m	Imports: total value $31.9 billion (fob, 2004)
Mineral resources: Oil, natural gas, coal, iron, zinc, bauxite	Gross Domestic Investment/GDP: 35.6%(2004)
Environment	Gross national saving/GDP: 32.2% (2004)
Forest: 12.3 million ha (2004)	**Society**
Forest cover: 37.3%	*Population: 82.2 million (2004)*
Protected areas	Population growth rate: 1.2% (2004)
Protected areas: National Parks (957,330 ha); Natural protected areas (1,369,058 ha); Landscape protected areas (215,287 ha)	Labor force: 41.6 million (2004)
Number of protected areas: 27 National Parks, 60 Nature Reserves, 39 Landscape Protected Areas	Birth rate: 19.0 births/1,000 population
Surface Water quality	Death rate: 5.8/1,000 population (2002)
Good: Northwest, Central Highland	Infant mortality: 26 deaths/1,000 population (2002)
Moderate: North Central Coast, South Central Coast, Northeast Region	Access to safe water (percentage of population): 56 (2002)
Poor: Northeast of Mekong, Mekong River Delta, Red River Delta	Access to sanitation latrines (percent of population): 44 (2002)
Groundwater quality	Life expectancy at birth: 69 years (2002)
Good: Northwest, Central Highland	Literacy (percentage of population of age 15+): 94
Moderate: Northeast, North Central Coast, South	National Capital: Hanoi
Central Coast	Administrative divisions: 64 provinces
Poor: Red River Delta, Northeast of Mekong, Mekong	Independence: 1945
River Delta	

Source: World Bank, 2005

As similar snapshot of the 60 years of Vietnam's history, from 1945 up to the present, is provided in the time line given in figure 2.2.

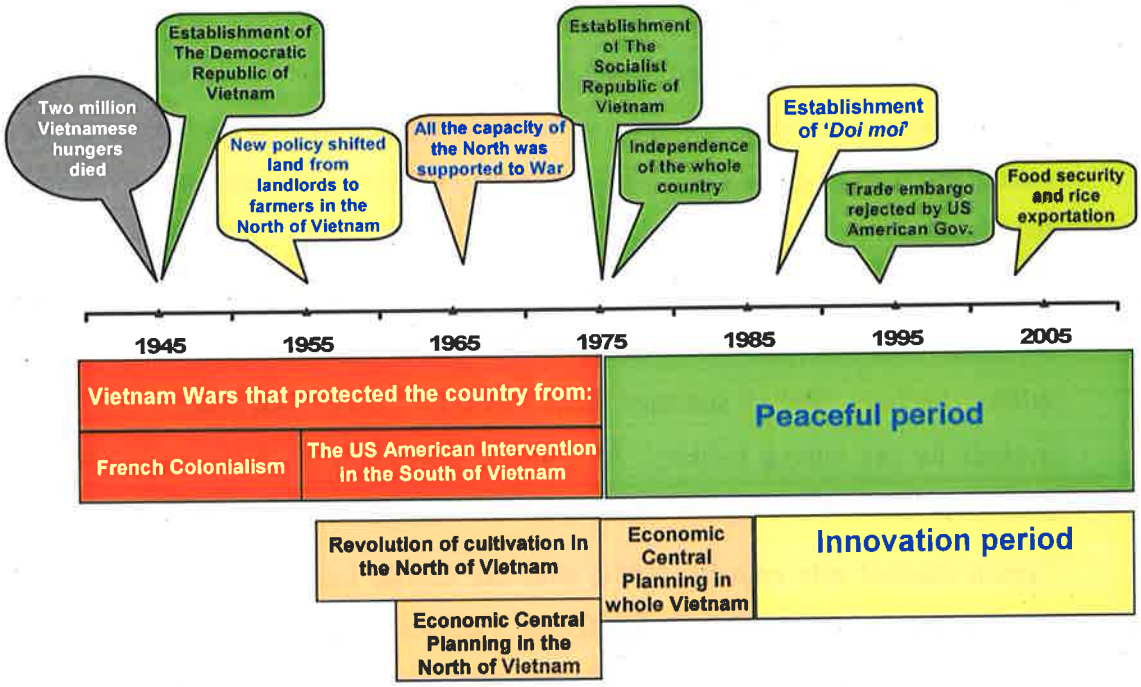

Figure 2.2 Brief history time line of Vietnam over the period 1945-2005

In this time line are two sub-periods, which are the period of the Vietnam Wars (pre 1975), and the period of peace (post 1975 up to the present). This history has been constructed from the personal knowledge of the author. Based on the changes of policy and legislation on economic development, however, the period 1945 - 2005 of Vietnam falls into four main stages leading to the present era of *Doi Moi*:

The 1945 – 1954 stage

The Vietnamese people had suffered the exploitation by three regime levels including Vietnamese feudal system, French colony, and Japanese empire. Vietnam was a colony of France prior to World War 2 until it was occupied by the Japanese. In 1945, a very special year, the Democratic Republic of Vietnam was established by President Ho Chi Minh at the time when the Vietnamese were suffering serious starvation due to the policy of Japanese empire. The Vietnamese people lacked food in the time the French colony but even more extreme conditions were imposed by the Japanese who did not allow farmers to grow rice but had them grow jute. Consequently, two million people died of starvation in this year. A few months after the new independent government of

Vietnam was established in September 1945 the French colonists returned to rule Vietnam.

Land at that time was managed under both Vietnamese feudal and French colonial systems. The peasant farmers themselves owned no land for cultivation. The new Vietnamese Government retreated to work in the northern mountainous areas, but overall the economy was still dependent on the French and as such peasant life was still hard.

During this period Vietnam's mineral resources were heavily exploited. Forest resources were still rich with forest cover was 43% of the total land in Vietnam with 14 million hectares (stored statistics from MARD). Timber was mainly cut down to provide for the mining industry. Agricultural development was focussed on lowland cash crops or material crops for industry such as rubber.

French colonial rule ended in 1954, after the famous battle at Dien Bien Phu to be followed by an even more cruel time for the Vietnamese people.

The 1955 – 1975 stage

During this period Vietnam was embroiled in war. From an international perspective, this was a civil war with the South heavily supported by the United States of America and its allies. From a Vietnamese perspective this was an invasion of the whole of the country by the USA. Whatever perspective is taken, it is clear that during this time the North Vietnamese Government was actively building socialism by collective agricultural and forestry production

The economic development of North Vietnam since the early 1960s was geared towards 'Economic Central Planning' such that all production fields were managed collectively as state farm enterprises. Manufacturing, state forestry enterprises and fishery enterprises were also run under collectivisation management. All the economic capacity and activities of the North aimed to support the attainment of independence of the whole at Vietnam.

This stage is considered as the period of revolution in agriculture. At first, land was shifted to farmers from the feudal system in 1954 - 1955 with the policy of "*Nguoi cay co ruong*" which means, "*Farmers have land to cultivate*". Crop yields, particularly food crops, dramatically increased due to the development of irrigation, cropping

systems, new varieties, and fertilization systems. Most lands in the Red River Delta were shifted from one crop to two crops per year. The rice varieties of long growth duration with 6 months per crop were replaced by shorter duration varieties (about three to four months per annual crop).

In the uplands, the government began to implement the campaign of 'Setting the new economic areas, sedentary cultivation and houses'. As this program was operating from a low base, any improvement of conditions was a great improvement. It facilitated the settlement of the peasantry mostly from upland areas where the government was operating. However, this campaign when continued after the American War through out the period of 1976 – 1985 tended to run down. The government had a much larger country to run and the people settled in the uplands were increasingly from the lowlands. They had little knowledge of upland farming and caused much land degradation.

The achievement of agricultural and the collectivisation economy of the North was the basis of the Victory gained. After about one hundred years of French colonial rule and 20 year-war against the US American backed Southern Government, Vietnam turned to the peaceful period while it was contenting the extremely serious consequences of wars.

The 1975 – 1985 stage

After Victory in April 30th 1975, the 'peaceful period' began with the government having to contend with the serious consequences of the war as well as the long period of colonial rule that preceded the war. Due to this history Vietnam was entered this period as one of the more economically backward countries of Southeast Asian. The efforts to improve the country by collectivisation were hampered by old management policy and limited capacity of managers. The actual state of the natural resources that were being managed was also severely impaired.

Vietnam's forest cover was radically reduced through damage by warfare. According to the statistics recorded in 1976 of MARD, the forest area was 11.2 million hectares, and the forest cover was only 33.8%. These forests were highly exploitatively managed within the system of State Forest Enterprises. The major activity of the State Forest Enterprises was exploitation with about 2.5 – 3 million m^3 of commercial wood, 12 million Ster fuel wood, and hundreds of millions of bamboo stems collected every year.

In this era, agriculture was managed by the State Cooperatives. In the uplands, some 1.8 million hectares of forestland were utilised for agriculture (Vu Huu Tuynh, 2001).

Forest area and cover reduced rapidly in this period due to the exploitation and shifting cultivation. This trend was continuous up to early 1990s. In 1990, the remaining forest area was about 9.2 million hectares with the coverage of 27.8% of total land area (Dang Kim Son, 2004). The forest area was reduced strongly in the Northern mountainous regions, especially in the Northwest region. As a consequence of forest over exploitation, about 11 million hectares were left as bare hill lands.

Towards the end of this 10 year period Vietnam realised that its program of collectivisation was not yield sufficient socioeconomic improvements. This marked the time for the Vietnamese Government to launch the *Doi moi*' reform program.

The 1986 to present stage

This *Doi moi* or 'innovation era' was formally begun with Resolution No 10 dated April 5th 1988. The program aims to shift the economy from state central planning to that of with self-sufficiency achieved through the market economy. *Doi moi* has been very successful in kick-starting the economic growth of Vietnam. It involved re-establishing diplomatic relationships with the USA which led to the lifting of trade embargoes on 1993-4. Since then, Vietnam has widely established diplomatic relationship with 167 countries and trade relationship with many nations in the world (Ministry of Foreign Affairs, 2006). Vietnam fully integrates with the global economy in late 2006 by becoming a party to the World Trade Organisation (WTO).

The 'Doi moi' of Vietnam

'*Doi moi*' operates across all sectors of government activity to improve legislation and policy, institutions of management, and economic structure and performance. The legislation and policy system is at the base of this innovation but within the limitation of the study this section only focuses on several key changes and their improvement regarding to agricultural systems.

In agriculture, the reform was started with the Resolution 10 in 1988. To confirm and make the reform process smooth, the National Assembly passed the first Land Law of Vietnam on December 29th 1987, and it was allowed to implement by the Instruction No

60-HDBT dated April 14th 1988. It was fully issued in 1993 in the 1993-Land Law. The Land Law had been improved continuously to adapt to the new environment through the revisions in 1998, 2003 and 2005. Since 1988, the economic structure has changed from one to five economic units: economic state, collective, non-state, individual, and household. It is extremely important to the household to become an economic unit. So, two aspects, which include the household economic unit, and 1993-Land Law that accorded the land tenure rights of household, are the precondition for the current achievements of the Vietnamese economy, especially in agriculture.

The most significant achievement of Vietnam is that the nation has essentially solved the problem of food security. The increased rice production has moved Vietnam from a rice-importing to a rice-exporting country. Before '*Doi moi*', Vietnamese people regularly suffered famine. Since the innovation began, the rice yields have risen dramatically. The first year that rice was exported was in 1989 with 1.4 million tons, and Vietnam exports annually approximately 4 million tons of rice that makes it the second highest rice exporter in the world (especially exported 5.16 million tons in 2005). In the period from 1986 to 2003, the growth rate of agriculture, forestry and fishery rose in average 5.6% per year, and 3.6% GDP per year. Further more, the improvement is not only in rice production, but also in rubber, corn, sugarcane, coconuts, soybeans, coffee, cashews, and aquatic products. Currently, several of Vietnam's agricultural exports are significant components of world trade share; e.g. Robusta coffee contributes to 40%, black pepper 14.3%, rice 12%, and cashews 9.5% of world trade (Cao Duc Phat, 2006). The great achievement of Vietnam's agriculture creates a sustainable base to allow the political and socio-economic stability.

In terms of forestry and upland development, due to the consequence of deforestation in the previous periods with about 11 million hectares of deforested land, the Government has had to launch new and priority programs of reforestation in the upland development areas in the reform era. The particular policies and national objective programs include the Law of Forest Protection and Development issued in 1992; the '327 Program' from 1992 to 1997 to green the bare hill lands; the '135 Program' of hunger alleviation and poverty reduction, and the current 5 Million Hectares Reforestation Program (5MHRP) from 1998 to 2010. Forestry management is shifted from management based on State Forest Enterprises to Community Based Forestry Management (CBFM). In the

innovation period, forest area increased to 12.1 million hectares with the coverage of 36.1%, and the deforested land area reduced from 11 million hectares in the early 1990s to 6.8 million hectares in 2003 (MARD, 2004). The increase in forest area and coverage grows continuously each year. However, the quality of the forest is very low in comparison with the period before 1976.

Generally, although Vietnam was ranked 144th in development out of the global nations, it is one at the fastest growing economies in the world. Within the innovation era, the level of institutional control and policy has been improved that did so starting from an extremely low base (Dollar, 2002). The main achievements in 20 years of '*Doi moi*' are the increase and stability of the economic growth rate of about 7% (particularly in the period of 2001 – 2005 the average in growth was 7.5%), dealing with food security, social and political stability, and general safety. Now, Vietnam has been ranked 102nd out of the countries in the world in terms of development. By 2020, industrialization and modernization to shift the socio-economy from agricultural to industry country are the major objectives of Vietnam (Vietnamese National Communist Party Board IX, 2006).

2.2. Upland farming systems

This review now shifts to layout an understanding of upland farming systems in Vietnam within the new environment of '*Doi moi*'. To accomplish this, it is necessary to present an explanation of what is meant by 'farming systems'. It does this by a brief explanation of some of the main concepts. In section 3 these concepts are expanded to do describe the upland farming systems of Vietnam.

2.2.1 Definition of Farming Systems Approach (FSA)

A system is created from elements and their actions and relationships. Naturally, systems fall into three families: natural systems, social systems, and artificial systems. Thus, to fully understand any objects or phenomenon ones needs to study them in their environment or their systems. Regarding farming systems, there are many concepts which have been developed since 1956 by Boulding and others (McConnell and Dillon, 1997). Early concepts of farming systems were defined by the different approaches taken whether they natural, social, or artificial systems, or a mixture of these systems. Due to the varied ways used to define farming systems, the term 'Farming systems

approach' (FSA) has been markedly used since the 1970s. The FSA considers an analytical framework, and it has contributed to a paradigm change in rural development thinking. However, farming systems can be classified into two main groups under this approach (Dixon et al., 2001).

- Available natural resource base, including water, land, grazing areas and forests; climate, of which altitude is one important determinant; landscape including slope, farm size, tenure and organization; and
- Dominant pattern of farm activities and households livelihoods, including field crops, livestock, trees, aquaculture, hunting and gathering, processing, and off-farm activities; and taking into account the main technologies used, which determine the intensity of production and integration of crops, livestock and other activities.

Dixon et al. (FAO 2001, p11)

Since the FSA was developed in the 1970s, it has been largely been applied to studying farming systems in the context of rural development. FSA has been developed to be appropriate to different fields such as for technology development (Norman et al., 1995), integrate with marketing systems approaches (MSA) (Fleming and Hardaker, 1993), and for soil conservation, etc. In the recent years, the FSA approach has been applied to concentrate on the farm household, resource allocation and conservation, and particular sustainable livelihoods. As presented in Table 2.2, the FSA is applied focussing on the more specific characteristics in 2000s. By the system level, the District/zones/catchments or sectors have been paid less attention in application of the FSA. The livelihoods, functions, stakeholders, and others are widely approached with FSA in the recent years.

While many modifications of FSA approach has been developed to provide conceptual and analytical framework to study agriculture in developing countries, one of the most important has been that of Participatory Rural Appraisal (PRA).

PRA describes a growing "family of methods that enable local people to share, enhance, and analyse their knowledge of life and conditions, to plan and to act" (Chambers, 1994). PRA is a very appropriate to method to study the potential of planting trees within communities because it focuses on key social information regarding resource use. Moreover, PRA survey methods allow the researcher to collect data in a relatively short-term period. So it is also a very efficient mode of research.

PRA has been used widely since 1990s within different fields: activist participatory research, agro-ecosystem analysis, applied anthropology, field research on farming

systems, and rapid rural appraisal. In each field, many researchers were successful in applying PRA to their work with local people (Chambers, 1994). Many programs of the World Bank, Ford Foundation, FAO, and UNDP usually use PRA tools to carry out the development activities not only in Vietnam but also in other developing countries around the world. Currently, PRA survey methods are emerging, growing and spreading with many more tools (Chambers, 1994). Within the PRA methods, the most common tools used are local literature search, key interviews, landscape transects, focus discussion groups, and household interviews.

With respect to the current study, the FSA approach is the base of the study into the potential of planting tree species into the upland farming systems of Hoa Binh Province. The PRA tools used as the methods to carry out the research is specifically presented in Chapter 3.

Table 2.2 Application of the Farming Systems Approach

Characteristics		1970s	1980s	1990s	2000s
System level	Farm				
	Household				
	Groups/communities				
	District/zones/catchments or sector				
Livelihood focus	Crops				
	Crop-livestock				
	Multiple household livelihoods				
Functional focus	Research				
	Research and extension				
	Research, extension and support services				
	Multiple-sectoral, including infrastructure				
Stakeholder focus	Public				
	Public and civil society				
	Public, civil society and private				
Other foci	Gender				
	Household food security				
	Productivity and resource management				

Note: Darker squares indicate greater focus on the element in that period

Source: Dixon et al. (FAO 2001, p10)

2.2.2 Upland household farming systems

Based on the definition of FSA above, this section presents a way of understanding of how farming systems involve households and communities. The operation of the

family's farming systems is revised to approach the upland household farming system in Vietnam.

Household and community level of farming systems

As shown in Table 2.2, the current trend of farming systems focuses on the household and community levels because the households and communities are considered a component of farming systems.

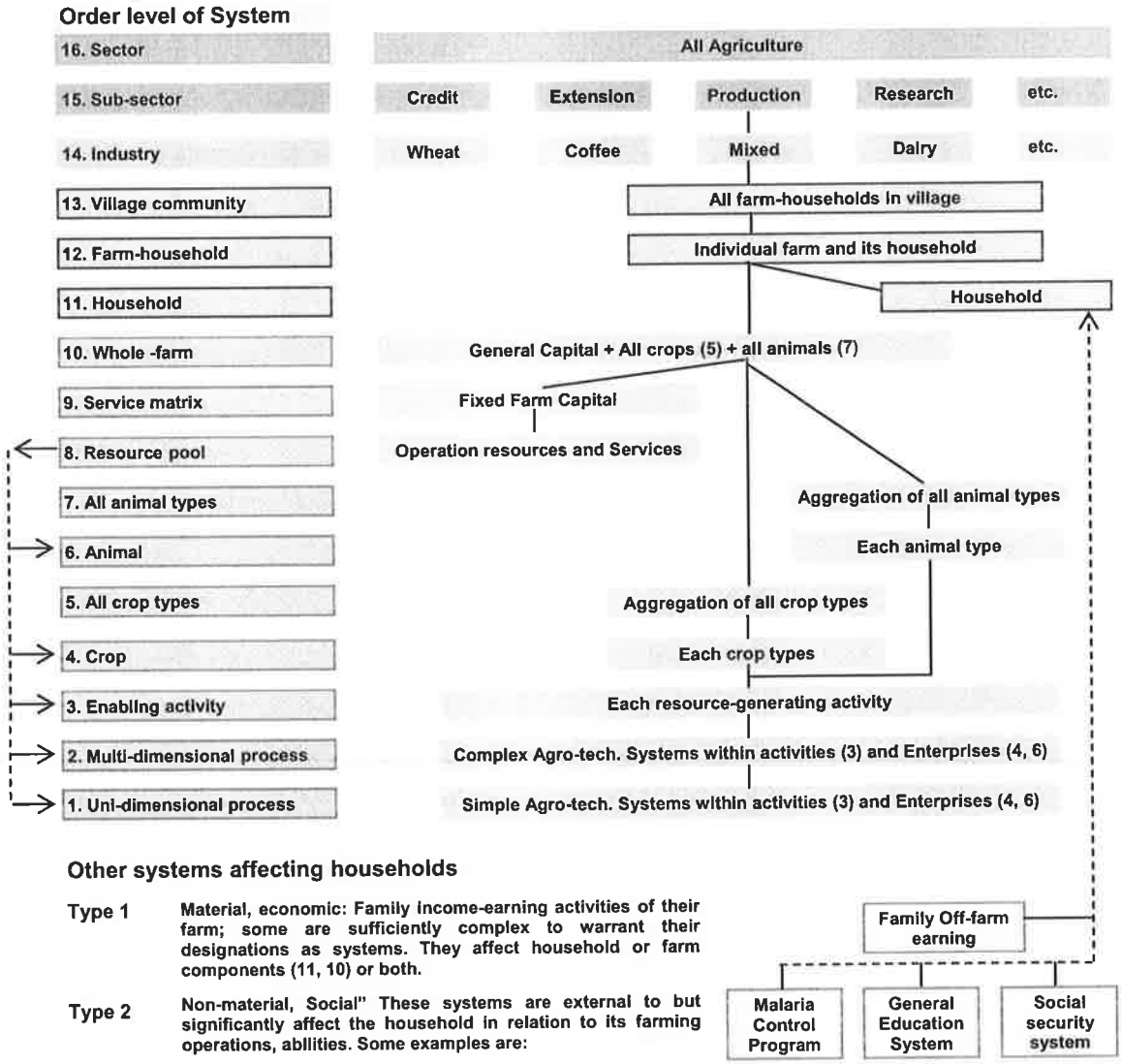

Figure 2.2 The Hierarchy of Agricultural Systems

Source: McConnell and Dillon, 1997

With Asian farming systems, the natural farm-level systems are divided into 12 order levels based on farm management (Figure 2.2). The village-level farming systems may

replace household farming systems. Farm-household systems consist of two sub-systems, which are the whole-farm system and its associated household system. However, a farm-household system includes ten structural elements or components: (1) Boundary; (2) Household; (3) Operating plan; (4) Production-enabling resources; (5) Final product-generating enterprises; (6) Resource-generating activities; (7) Agro-technical processes; (8) Whole farm service matrix; (9) Structural coefficients; and (10) Time dimension (McConnell and Dillon, 1997). Ten structural elements can be examined within a systems approach in farm management in Asian farming systems.

Upland farming systems in Northern Vietnam

The upland farm-household systems in Northern Vietnam can be considered using a similar farming systems approach. An upland farm-household system can be divided into three major subsystems: the household, the farm, and the off-farm employment. The farm elements includes swidden fields, wet rice fields, home gardens, forest gardens, fish ponds, and livestock (Tran Duc Vien, 2003). Alternatively, these systems have also been analysed using on the approach of income source analysis: paddy rice, upland farming (sloping land), home garden, fishing pond, grazing, forestry management, and off-farm incomes (Donovan et al., 1997, Rambo, 1998). Another alternative used by the Vietnam - Sweden Mountain Rural Development Programme (MADP) described the farming system using five elements: flat land, sloping land cultivation, home gardens, forestry, and livestock (Bui The Hung, 2001).

Across all of these alternatives of describing upland farming systems one can usually include four interrelated elements (or subsystems): flat land farming systems, sloping land farming systems, grazing farming systems, and forestry systems. These four components characterize the various upland households. The success of the relationships between the different farming systems in each household depends on the decision-making ability of the individual farmer.

In Vietnam's uplands, programs of forestry development have not always treated upland households as farming systems that could include plantations. So this way of thinking has led to conflicts between forest plantations and agricultural cultivation (Tran Duc Vien, 2005). The actual activities of the upland households are very difficult to separate. These activities mix together in the daily work of the households, which include agricultural and forestry activities, and off-farm work. Thus, the activities interact and

can also conflict with one another having an impact on the success of farming, and the success of high value tree plantations of the upland households. So to understand upland forestry it is necessary to approach the upland households/communities as farming systems. Based on this understanding, this study approaches the upland farming systems as the upland farm-household-forest systems.

2.2.3 Agroforestry systems

In the upland areas, farming systems not only include crop cultivation and livestock rearing but also off-farm activities and, importantly, the management of trees. Thus many upland farming systems are characteristically traditional agroforestry systems.

The concept of agroforestry systems fits well within the definitions for Farming Systems given earlier, agroforestry systems have naturally existed on the Earth for a long period of time, particularly in tropical regions. The concept of agroforestry as a field of study emerged to develop and widen the practice of these systems due to their advantages in terms of sustainable development.

Agroforestry combines agriculture and forestry technologies to create more integrated, diverse, productive, profitable, healthy and sustainable landuse systems (NAC., 2006). Agroforestry practices meet the demands of people regarding economic, environmental and social needs that are raised to be the great alternatives to unsustainable shifting cultivation or 'Slash and burn systems' in the tropics in recent years. To be called agroforestry, a land-use practice must satisfy all the following criteria:

- **Intentional:** Combinations of trees, crops and/or animals are intentionally designed and managed as a whole unit, rather than as individual elements that may occur in close proximity but are controlled separately.
- **Intensive:** Agroforestry practices are intensively managed to maintain their productive and protective functions; these practices often involve annual operations such as cultivation and fertilization.
- **Interactive:** Agroforestry management seeks to actively manipulate the biological and physical interactions between the tree, crop and animal components. The goal is to enhance the production of more than one harvestable component at a time, while also providing conservation benefits such as non-point source water pollution control or wildlife habitat.
- **Integrated:** The tree, crop and/or animal components are structurally and functionally combined into a single, integrated management unit. Integration may be horizontal or vertical, and above or below ground. Such integration utilizes more of the productive capacity of the land and helps balance economic production with resource conservation.

NAC (http://www.unl.edu/nac/agroforestry.html)

Agroforestry systems are very diverse across the world; their structure and functions reflect the environment and people that implement them. The major agroforestry

systems are characterised as 14 types: improved fallow; taungya (a common agroforestry in Myanmar which combined stand of wood and agricultural species during early stages of establishing plantation); alley cropping; multi-layer tree garden; multipurpose tree on croplands; plantation crop combinations; trees in soil conservation and reclamation; home gardens; shelterbelts and windbreaks, live hedges; fuelwood production; trees on rangeland or pastures; protein banks; plantation crops with pastures and animals; apiculture with trees; and aquaforestry (Nuberg, 2006).

Like in many tropical countries, agroforestry has existed in Vietnam for a long time. About 10 general types of systems have been documented (Tran Duc Vien, 2005). A particularly Vietnamese form of traditional agroforestry which is widely practised is the 'Garden – Fish pond – Livestock' or *VAC (vuon-ao-chuong)* system. Other traditional forms of agroforestry are: the forest – garden – fish pond – livestock systems (an upland version of *VAC*); bush fallow shifting cultivation system; integrated forest and terrace system; composite swidden system; forest–cash crops–paddy rice system; traditional home garden; perennial tree garden; and fruit gardens.

Research into agroforestry since the 1970s, mostly conducted by international projects, have refined these systems as well as innovating new systems such as: alley cropping; green fence/boundary planting; windbreaks and shelterbelts; and taungya. These innovative systems are practised in the upland household farming systems level. They have been developed to enhance the productivity of the farming system. It is recognised that trade-offs between productivity and biodiversity have been made in developing these new systems (Tran Duc Vien, 2005).

Current agroforestry research in Vietnam is being undertaken by the Vietnam Agroforestry Capacity-Building Project (VACB) which is supported by SIDA via ICRAF. The project has the following components:: Information dissemination, training in agroforestry and alternatives to slash and burn systems (ASB); Policy development for sustainable upland systems; indigenous fallow management (IFM); conserving farming on sloping lands; tree domestication and germplasm dissemination; and modelling of complex agro-ecosystems (Le Quoc Doanh, 2003). The particular study of agroforestry product markets is, however, is still missing (Tran Duc Vien, 2005).

Developing agroforestry for upland farming systems is considered a priority activity in Vietnam. Agroforestry has been taught at The Forestry University of Vietnam in Ha Tay

Province since 1994 and the university has an Agroforestry Department established in 2000. It is believed that agroforestry offers opportunities for upland households to meet both the current demands and long-term demands. It can deal with the conflicts between agriculture and forestry in the uplands. In addition, it can contribute to meeting the whole country's demands on forestry development,. Notwithstanding this optimistic vision, it is important that the agroforestry systems developed are appropriate to regional physical and socioeconomic conditions.

2.3. Forestry and upland development

This section reviews the current environment of forestry and upland development in Vietnam that relates the potential to integrate tree species into the upland farming systems. Concerns of high value tree plantings, community-based forestry management approach, and issues of the upland households are the basis of this review.

2.3.1 Plantations of high-value tree species

Worldwide, there have been several research projects studying plantations of high-value trees for sustainable forest management. Some research was carried out into this in Queensland, Australia (Lamb, 1998). Trial high-value trees, such as *Acacia melanoxylon, Araucaria cunninghamii, Argyrodendron trifoliolatum, Castanospermum australe, Cedrela odorata, Cryptocarya erythroxylon, Dysoxylum fraserianum, Dysoxylum mollissimum, Elaeocarpus grandis, Flindersia brayleyana, Flindersia schottiana, Gmelina leichhardtii, Grevillea robusta, Khaya nyasica, Rhodosphaera rhodanthema, and Toona ciliata,* were planted in the farm woodlots and mixed with pastures. It is valuable that the research might show the potential of combining plantation of high value trees and grazing. Although this research has only achieved the first results of silviculture, it could help farmers shift from monoculture to multi-culture for sustainable development. The research into high-value trees in terms of the sustainable use and management by rural communities was also studied in the Umzimvubu District of South Africa. The indigenous tree species of local forests were unsustainably exploited by the foresters. So, the study was undertaken to find the ecological basis for appropriate harvest. It was also noted that households far removed from the forests also participated in planting native trees in the community forests actively (Obiri et al., 2002).

In Vietnam, the plantation of native tree species is extremely necessary for sustainable forestry development. For this purpose, several research projects have been initiated to plant native trees in different areas, for example the study of the Vietnam Forestry University, and the ACIAR Project.

The Vietnam Forestry University has undertaken research into reforestation with native trees. In the trial, ten native tree species including *Cinnamomum iners, Canarium album, Bassia pasquieri, Chuckrasia tabularis, Erythrophloeum fordii, Peltophorum tonkinensis, Castanopsis chinensis, Bischofia trifoliatai, Aphanamixis grandifolia, and Podocarpus wallichianus,* have been planted in the Cat Ba National Park, and 165 native tree species have been planted in the trial forest of the University. This research is still being carried out. It mainly focuses on silviculture and does not look at the impact of the techniques with have for farmers (Pham Xuan Hoan, 2002). With respect to planting native trees in the context of CBFM, the paper reported that the farmers of the Phuc Sen commune planted the native tree called 'Mắc rạc' *(Delavaya tosocarpar)* in the Limestone Mountains of Cao Bang Province (Tran Huu Vien, 2004). Also, cinnamon *(Cinnamomum illicioides)* was widely developed in the Van Chan District of Yen Bai Province. In Yen Bai, Cinnamon relates closely to the traditional shifting rotation. It is considered as a pioneer species improving the fallow period. Cinnamon is planted as a monoculture or mixed plantation with natural reforest species (Pham Xuan Hoan, 2003). A study of Da Bac Tay composite swidden system of the North-western uplands described the planting at candlenut and *Melia azedrach* into the swidden fields (Rambo, 1998). The activities of planting these native trees were considered in improving the fallow of the shifting cultivation system. The studies, undertaken under the CBFM, are really important and valuable to the development of forestry.

The Project of 'Regeneration of natural forest on degraded areas' has been carried out in Hoa Binh since 2003 with the ODA budget supported by JICA-Japan. This project has been managed by the Forestry Bureau – MARD. The project focuses on the reforestation of the natural forest with added planting native tree species, and development of silviculture techniques. Several models of mixed planting *Erythrophleum fordii* and bamboo are trial in Tan Lac District (Hoa Binh Forestry Development Department, 2003).

The study project of the Forestry University of Vietnam into 'Trial of reforestation on the semi-wet land in Hoa Binh Reservoir area' has been carried out since 2000. The project has built experiment models with mixed plantings of *Melaleuca leucadendra* and native tree species which are *Hura crepitans, Dracontomelum duperreanum, Cacia siamea, Saraca dives Pierre, Engelhardtia tonkinensis, Bischolia javanica*, and Vay nuoc (*sp.*). The early assessment of the growth of these tree species was very good (Le Sy Viet and Pham Van Dien, 2003).

The ACIAR project within which the current study is placed, has been carried out to develop mixed plantations of high-value wood tree species. Several experiments of the study have been designed in the uplands of Phu Tho Province aiming at the growth of three native tree species, which were mix-planted together with *Eucalyptus europhylla.* By the early assessment of three tree species including *Canarium album, Chuckraria tabularis, and Michelia mediocris*, the growth of individual members of these trees was good. In particular, *Michelia mediocris* was considerably the fastest growth tree species (Nguyen Thi Yen et al., 2003).

All the above research in Vietnam has focussed on silviculture. There has been little attention paid to participatory design and adoption of forestry and agroforestry systems. The adoption of native species into farming systems that has occurred has done so largely in response to incentives provided by projects from outside the community. The next real challenge is to design agroforestry systems which include high-value native trees that will be adopted without incentives. This research will also include consider the social and institutional context in which new systems can be best adopted.

2.3.2 The approach of Community Based Forestry Management (CBFM)

Community-Based Forestry Management (CBFM) is one such approach to enhance adoption of new forestry systems. It is an approach that has been adopted by Vietnam since the early 1990s. CBFM is not only viewed as forest management but also management of associated natural resources such as land, water, fauna and flora. Several programs carried out in Vietnam have applied CBFM successfully, such as the Sweden International Agency, 1993 (SIDA); the Social Forestry Development Program, 1993 (SFDP); the Vietnam – Sweden Mountain Rural Development Program, 1996

(MARD). The most recent initiative is the Five Million Hectare Reforestation Program (5MHRP) which began in 1998.

There are two existing forestland ownerships in Vietnam: state forestry (company forestry belongs to state forestry), and household forestry. State forestry has been found to be rather inefficient so there has been a shift to Household forestry. The aim of this policy is to reduce conflicts between local people and State Enterprises and encourage local investments in forestry management (Sikor, 1998). Unfortunately, the allocation of household forestlands (including forests) is so slow and this affects the overall forestry development process (Bui Quoc Toan et. al., 2004).

Apart from the whole national forest, large areas of forest exist in the mountainous communities, and many of them still have no ownership. This means that these forest areas are customarily 'owned' by the local communities, even though they have no Land Use Certificates or 'Red Books' (Bui Quoc Toan et al., 2004). Fortunately, the Vietnamese Government revised the Land Law in 2005 and is now forming a policy to formally allocate these forests to the communities. This new policy to allocate of remaining natural secondary forest to communities is first being rolled out in the Province of Son La.

Thus, both households and communities, together and as separate entities, will play key roles in the development of sustainable forestry in Vietnam.

2.3.3 Critical issues of the upland households

Socio-economic issues of the uplands

Development is constrained in the uplands naturally by the topography with the steep slopes, high mountains and deep streams. On top of this there are critical socio-economic issues that remain problematic. Briefly, the issues are: high rate of poverty; low levels of education; limited infrastructure, availability of credit, marketing channels; limited application of new farming technologies; and limited forest product processing.

These issues affect households in their decision-making ability and participation in planting high-value trees. Poverty and hunger are the most serious issues that can strongly affect community forestry development and the decision-making ability of

farmers. Although the Vietnamese Government has applied several active policies and strategies to erase hunger and reduce poverty, the rate of poverty and hunger in 2002 was still 29% and 10%, respectively. Within this numbers, 90% of the poor live in rural areas. The Northern uplands had the highest poverty rate, accounting on 44% of the whole country. Poverty in Vietnam is widespread among the low and unstable income households (Bui Dzung The, 2004). To complicate the issue, the Ministry of Labour, War Invalids and Social Affairs (MOLISA) changed the way that it assesses poverty levels in 2005. This has had the effect of apparently increasing the number of poor households and it is difficult to compare published estimates of poverty before and after 2005. Nevertheless, there is serious concern that many households are not keeping up with the general economic fortune of the nation (Vietnamese National Communist Party Board IX, 2006).

The short-term period income of the upland households

The short-term period income is the main current demand of the Vietnamese upland households that arises from their recent livelihood performance. A recent study of development trends in the northern mountainous region of Vietnam showed that many households still suffer poverty and food insecurity (Donovan et al., 1997). Farmers were asked for what they expected economic development to bring; 70% of them replied 'livelihood improvement', and within this, food security is the highest priority. The upland households find it extremely difficult to secure food by themselves because of their limited paddy land (Donovan et al., 1997). Food security in this environment means growing enough rice to feed the family from one harvest to the next (SAM, 2003). In Yen Bai Province, many households still only produce at subsistence level. The average net value of production is about Aus$800 per household per year. The household income is mainly derived from farm activities (cropping, perennial trees, livestock, aquaculture, and forestry), and off-farm activities (handicraft, pensions, the provision of services, and wages and casual labour) which constitutes 40% of the net value of production (Marsh et al., 2004). The income generation of households in Bac Kan Province consists of small-scale agriculture and the strictly regulated exploitation of forest resources. Farmers have difficultly in accessing important off-farm income sources (Alther et al., 2002). Farmers make all efforts to find ways of providing themselves with cash (personal note). The success of upland households in establishing

food security and short-term period incomes can lead to the success of the long-term period incomes, and these may enhance farmers planting high value trees.

Summary

Doi Moi is a remarkable turning point to wake up the whole Vietnam's economy after a long time of underdevelopment and famine. Changes in agricultural and forestry policy are an important component of the national innovation policies. This review of the history of agricultural and forestry development and nature of upland farming systems indicates that sustainable forestry development needs to be set firmly in the context of improving upland farming systems. The review has outlined some of the general constraints on upland households in deriving a subsistence livclihood. It discussed the opportunities and difficulties of upland farmers to adapt to tree plantings, particularly plantings of high value tree species. Thus, this chapter has provided an overview of the context of this the study on the potential to integrate mixed-species plantations into the farming systems.

Chapter 3
Research Framework, Methods and Study Site

3.1. Overview

In the previous chapter, it was determined that a farming systems approach was necessary to understand comprehensively the factors influencing the integration of high-value tree species in upland areas. From this theoretical basis, this chapter describes the research framework and methods undertaken in this study. It also provides essential background information about the study site in Hoa Binh Province of Vietnam.

The research involved members of four village communities in Hoa Binh Province in activities and decision-making on incorporating mixed planting of tree species into the farming system. The major method followed was Participatory Rural Appraisal (PRA). The specific tools of PRA that were applied were local literature search, key interviews, landscape transects, focus discussion groups, and household interviews.

3.2. Research framework

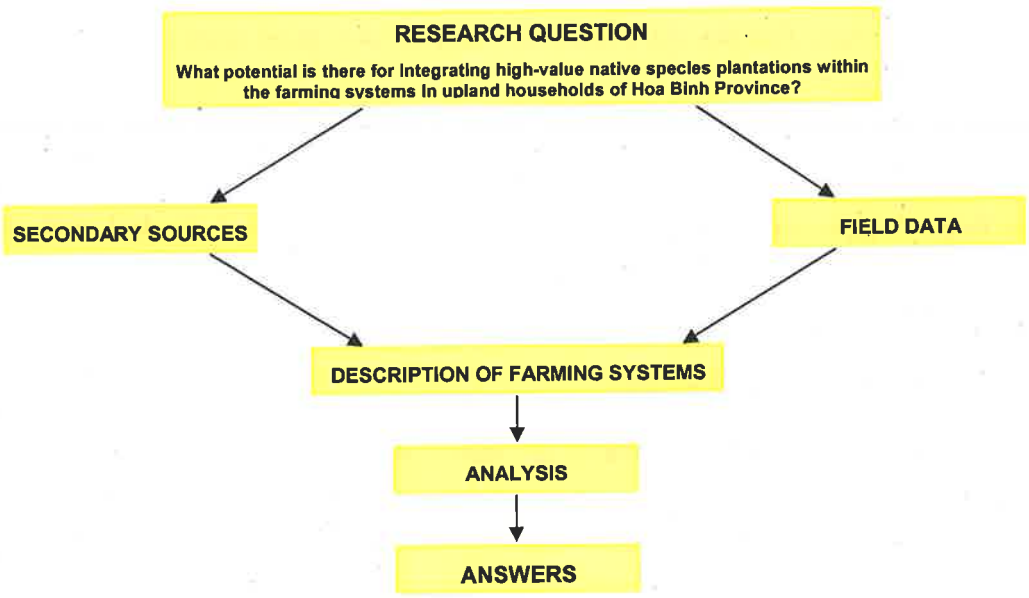

Figure 3.1 Framework of the research in Hoa Binh Province of Vietnam

The overall research framework is illustrated in Figure 3.1. The essential research question can be divided into a series of specific questions that require information from a variety of sources. There are several categories of information: that derived from local Vietnamese (both government and non-government organisations), and that derived from the fieldwork carried out over the period from March to June 2005. This information was used to develop farming system descriptions of the study sites. Basically, the study topic is approached by both ways that are based on the upland communities and households, and outside communities. This information is in turn analysed by Chapter 4 and Chapter 5 to reveal the final research conclusions.

3.2.1. Research question

Topic question: '*What potential is there for integrating high-value native trees into the farming systems of upland households in Hoa Binh Province?*'

- Field data collected from the village fieldwork focus on to answer the following key questions:
    - *What physical and time constraints present barriers to farmers planting trees?*
    - *Do upland farmers plant trees and why, or why not, do they engage in this activity?*
    - *Of those farmers that plant trees, why do they plant some species and not others?*
    - *In what configuration do farmers integrate trees in their farming systems?*
- Regarding to the study, the secondary sources were used to deal with the question: *How does the physical, socioeconomic, institutional, and policy environment support the planting of integrated mixed species into farming systems of Hoa Binh Province?*

The specific questions of the research are shown in Table 3.1 to indicate the topic question and key questions of the study.

Table 3.1 Specific question of the research in Hoa Binh Province

Specific questions
Will farmers participate in long-term reforestation while they currently need short-term income? o Will farmers plant any trees (other than fruit trees) without some incentives? o Given that there is a technically reasonable model what does it take to change behaviour? o What are the current silvicultural skills, market knowledge, attitude, and resources? o What do farmers consider as a 'financially reasonable model'? o What risk do farmers perceive in adopting the model?
What influence do the following reasons have in farmer's decision for planting or not planting trees? o Cost to establish o Land availability and opportunity cost o Land tenure o Planting material availability/cost o Technical information o Lack of knowledge on market prices for timbers o Costs of felling and transporting timber to market o Labour availability / costs o Ethnic differences (e.g. 'cultural trees', dowry crops) o Delayed financial payoff versus cash flow o Already have access to the alternative sources of supply of forest goods o Right to harvest o Proximity to natural forest in good condition
What are the decisions that lead farmers to o plant tree in home-gardens o plant as scattered trees o plant community woodlots o plant in small farm timber plantations o develop other agroforestry options o create other types of landuse / time-use o become involved in off-farm activities (e.g. off farm income)?
What fruit and other trees are farmers planting o What species are they planting? What made them choose these? o What are the age classes of trees planted? Were they all planted at one time or have farmers continued to plant trees at different times? Does this depend on the size of the farm area?
Which models are farmers using? o Non-timber forest products (NTFP) (medicinal and other) under canopy of plantation o Tea and tree o Even-aged versus uneven-aged o Mono versus mixture. If mixtures, why did they choose these rather than monocultures and how was it designed? That is, how did they decide which species to use in the mixture? o Cooperative / Community based forestry management (CBFM). o Bamboo
Will farmers give priority to supporting reforestation of planting high value trees while other activities also need investment?
How can they invest in reforestation while they are still hungry and/or have limited investment sources?
What will encourage farmers to plant high value trees?

3.2.2. Information from the fieldwork

The fieldwork was carried out in Hoa Binh Province from March 14th to June 18th 2005 (Table 3.2). The fieldtrip length undertaken at each village was for approximately 6 days.

Within this study, the participatory approach was combined with consideration to farming in the uplands as farm household systems. The study approaches focussed on the upland village communities and households and their farming systems. The physical and socio-economic environment of Hoa Binh Province was also analysed and integrated into the study by using secondary sources.

The participation regarding to participatory approach applied in this study, was the local participation included participation of the local professional offices, the communities and villagers, in which the participation of village participants is the most important. Secondary literature sources that were available at the local committee offices were the first approach. The data obtained through secondary literature was used as the basic information of the fieldwork, and to analyse the physical and socio-economic environment of planting tree species in Hoa Binh Province. The communities and villagers participated directly in the fieldwork procedures. By the encouragement of the researchers, villagers participated in analysing and providing information of the communities and their households.

Table 3.2 Schedule of the research activities in Hoa Binh Province

Activities	Time			
	Lac Son District		Da Bac District	Luong Son District
	Bap Village	Khuong village	Tat village	Suoi Bu village
Local literature search and key interviews at Provincial People's Committee	14 – 31 March 2005			
Collecting more information and references	19 -20 June 2005			
Local literature search and key interviews at District People's Committee for choosing Villages	10 – 17 April 2005		17 -18 May 2005	19 – 22 May 2005
Doing the fieldworks	18 – 22 April 2005	23 – 30 April 2005	23 – 28 May 2005	30 May – 4 June 2005
Household interview	11 -14 May 2005	8 – 10 May 2005	-	6 – 7 June 2005
Collecting the missing information	15 -16 June 2005		17 – 18 June 2005	13 – 14 June 2005

To approach the research based on the framework and the participation of communities, a research proposal and a flexible schedule was developed to carry out the fieldtrip in Hoa Binh Province of Vietnam. The fieldtrip schedule consisted of two

major aspects: works for focus discussion groups and household interviews. The brief of this section is showed in the Table 3.3. The section of focus discussion groups including the specific subject with the supposed time, PRA tools applied, and persons participated. A questionnaire was developed to carry out the section of household interviews. The questionnaire combined both closed questions and open-ended questions with tables to allow information to be added.

Table 3.3 Brief schedule of the fieldtrips at the villages of Hoa Binh Province

Time	Tasks	PRA tools	Materials	Participants	
				Local participants	Collaborators
Day 1	Introductions Village transects Wealth ranking households Demand analysis	Landscape transects Wealth ranking Scoring and priority analysis	Stationery Maps Camera	9 – 10 persons	3 persons
Day 2	History line Description of landuses Gathering forest products and their uses Season calendar of farming activities	Focus discussion groups History lines Season calendars	Stationery Maps Camera	9 – 10 persons	3 persons
Day 3	Existing tree growing activities Sources and quality of local harvested forest products Season calendar of off-farm activities Attitude and market of forest products	Season calendars Focus discussion groups	Stationery Camera	9 – 10 persons	3 persons
Day 4	Strength and weakness analysis Classification and semi-processing forest products Awareness of forestry policies Conflict of harvest forest products	Focus discussion groups	Stationery Camera	9 – 10 persons	3 persons
Day 5 - 6	Interviewing households	Household interviews	Questionnaire	2 persons	2 persons

3.2.3. Data analysis

The data collected for the research including two types: secondary sources and field data. Data collected from local literature searches were analysed as the basis to undertake the fieldwork. They are also analysed to support the answer of physical, socio-economic, policy and institutional environment. Field data are used to answer the key questions. Both datum sources are combined in the discussion to answer the topic question.

3.3. PRA survey methods

3.3.1. Local literature search

Local literature contains extremely important information for clarifying the research topic and defining the study sites. Visiting Provincial, District and local People's Commune Committees was essential because the agreement of the Committees had to be requested to carry out the study in the local regions. From the committees or their

departments, information from grey sources was collected such as socioeconomic statistics, annual reports, 5-year reports, project reports, maps, and law and policy documents. The information of these documents was the basic for collection study sites and undertaking the fieldtrips at the villages.

3.3.2. Key interviews

Parallel to the local literature search, key interviews also were carried out to add more information for the study, particularly regarding selection of research sites. Interviewees were the elected leaders, heads of Departments and professional officers. Persons who were interviewed were the Chiefs of the Extension, and the Forestry Development Departments of the Province, two officers of the Extension Department, Chiefs of Administration Departments, Chiefs of Land and Agricultural Departments of the Districts, Presidents of the Communes, and land officers of the Districts and communes.

3.3.3. Landscape transects

Two levels of landscape transects activities were practised.

First level – commune landscape transects was practised prior to the villages being chosen. Based on the information collected from grey literature, some communes of the districts were defined to visit. By commune landscape transects, the location of the villages in each commune were identified aimed to defined and choose the villages where could be the research sites.

Second level - village transects was carried out after the villages were chosen. Village participants and researchers together walked over the sensitive points of the villages and discussed aimed to understand and to have an over view of the villages. From the village walking, the current landuses of villages, the issues of farming systems were generally identified. Moreover, information received from the landscape transects was the basic for other activities of the fieldworks including focus discussion groups, and household interviews.

3.3.4. Focus discussion groups

Local participants, including male, female, old, and young villagers who were experienced and able to analyse the activities of the villages were invited to take part in

the focus discussion groups. In each village, nine or ten people participated to practise these tools: Wealth ranking, point ranking, season calendar, and historical line.

Wealth ranking exercises

Participants evaluated and classified the general economic condition of all households of the villages by practising wealth-ranking exercises. This information was not only the basis for household interviews, but also for analysing the relation between groups of households and tree planting.

Practising the wealth ranking exercises undertaken the following steps:

First, full names of householders were collected and wrote into the cards. To save time, this was prepared prior to the day of the exercises.

Second, participants listed all wealthy goods which households owned such as houses, land, animals, tools, furniture etc.

Last, participants sorted or classified the name cards of households by wealth levels. The households with similar wealth levels placed in the same groups.

Scoring/Point ranking exercises

Point ranking exercises were practised to evaluate the tree species, which farmers planted. Based on that, the priority of description trees and the perception of farmers about these trees were analysed.

Both researchers and participants together defined the list of evaluated indicators. Based on this, participants scored each tree species by a score ruler from 0 to 10.

Season calendar exercises

The farming activities and off-farm activities of the communities were analysed by participants who used the tool of season calendar exercises. The detailed timing description of the activities in a year was discussed and drawn into charts. Season calendar exercises were practised to understand the farming systems, crop seasons, and off-farm seasons which villagers worked.

3.3.5. Household interviews

Based on the data conducted from the focussed discussion groups, household interviews were conducted to gather more information, and to enable a cross check of the information collected.

Household interviews carried out in the four study villages were semi-structured interviews. A questionnaire frame was prepared with a complex questionnaire of closed questions (yes/no answers) and open-ended questions (questions with What, Where, When, Why, and How).

The size of interview samples in each village was about 20. The interview households were defined according to the following criteria of household class, gender of householders, and household locations in the villages.

In the interviewing procedure, interviewers visited each chosen household to make the interviews. The interviewers filled in and took note of the answers into the questionnaire frame. Based on the answers of farmers and relating to the research topic, interviewers used open-ended questions to add more information. The leaders of the villages introduced the interviewers to each householder.

3.4. Study site selection

3.4.1. General characteristics of Hoa Binh Province

Hoa Binh is located in the northwest mountainous areas of Vietnam about 80 km from capital Hanoi. The natural and socio-economic conditions are better for development than other provinces in the northwest region. The province is the link between the Red River Delta and the northwest uplands by the national road system, such as Road 6, Ho Chi Minh Road, and Da river waterway. The natural resources, such as land, water, forest and mineral also help to develop the economics of Hoa Binh Province. It consists of 1,896 villages of 214 communes and towns which belong to 11 districts: Da Bac, Mai Chau, Tan Lac, Lac Son, Kim Boi, Luong Son, Ky Son, Cao Phong, Lac Thuy, Yen Thuy and Hoa Binh Town (Bui Van Chuc, 2003).

The total land area of the province is 466,252 ha, with 66,759 ha of agricultural land; 200,173 ha of forestland; 5,807 ha of inhabited land; 33,171 ha of special-use land; and 166,149 ha of unused land (Bui Van Chuc, 2003).

The existing forest area is 200,173 ha, of which 146,470 ha is natural forest; and 53,703 ha of afforested area. The area includes watershed forests, endemic forests, and economic forests. The main trees of economic forests are eucalyptus, wattle, and bamboo species. The forests provide materials for processing bamboo floorboards and bamboo chopsticks, paper mills, bamboo coal, wooden products, and bamboo mats. By 2010, the forests will have to provide more materials for fibre pressboard and chipboard processing companies which are being built (Hoa Binh Provincial People's Committee, 2000).

In recent years, the local Government intends that the agriculture of the province will change from food crops (cereal) to cash crops (fruit trees, industrial trees and some annual crops), especially in the sloping land areas. These crops are grown to provide materials for processing, including tea, sugar cane, pineapple, asparagus, plum and apricot (Hoa Binh Provincial People's Committee, 2000).

The population of the province is 759,555 with 7 ethnic groups: Muong, Kinh, Dao, Thai, Tay, H'mong, and Hoa, in which the Muong accounts for 60%, Kinh for 31%, and the rest 9% (Bui Van Chuc, 2003). The labour force is 440,000 accounting for 57% of the population. The economy grew on average 9,8% per year from1990 to 2000 (Hoa Binh Provincial People's Committee, 2000).

As a special location, Hoa Binh has been the recipient of investments from several programs of the Vietnamese Government and also foreign support. Besides the simple forestry development of the Government Schedule, the Vietnamese Government has also undertaken to conserve the Hoa Binh Reservoir and improve the standard of living in the area (Program 327, DA 747, Poverty Alleviation Project) (Hoa Binh Provincial People's Committee, 2000). Moreover, the projects which have supported building processing companies, have encouraged the development of forestry in Hoa Binh Province. Farmers have also been made aware of and encouraged to undertake forest management. However, planting high value tree species is a concept which has not been easily adopted by the farmers. This will be discussed within the next sections.

3.4.2. Description of study site collection

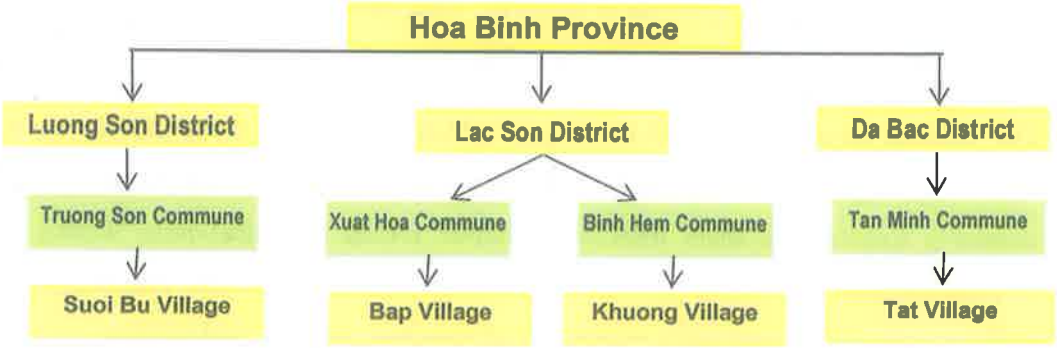

Figure 3.2 Locations of the study sites in Hoa Binh Province

Four communities of three Districts in Hoa Binh Province were chosen to carry out the research showed in Figure 3.2, and their locations are showed in Figure 3.3.

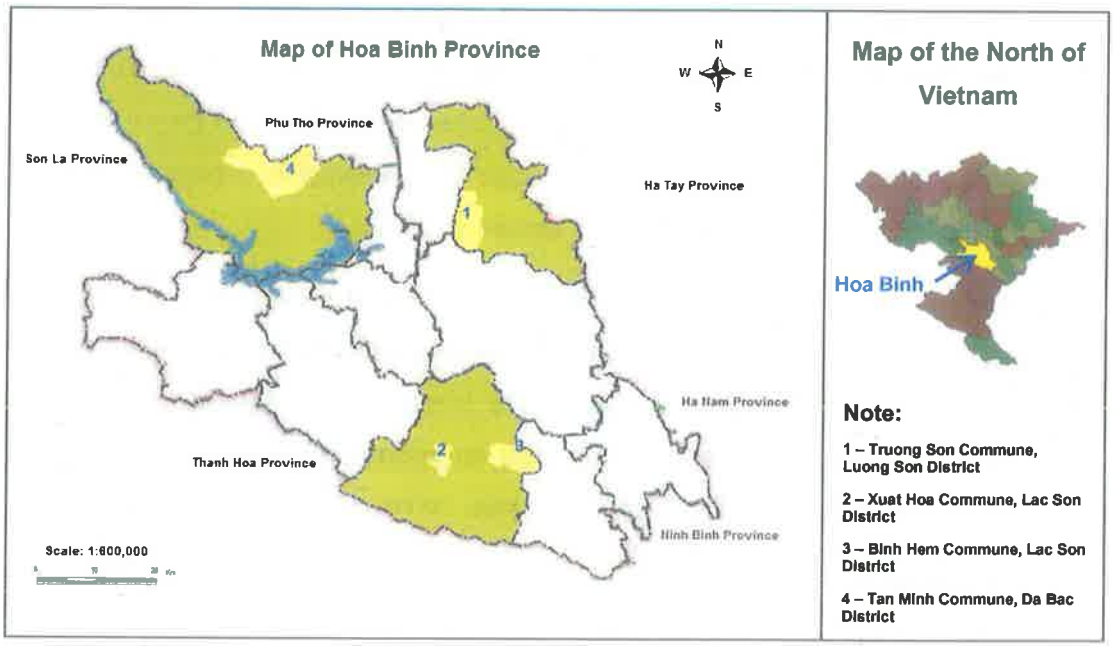

Figure 3.3 Locations of the study sites in Hoa Binh Province

Source: Vietnam Map Bureau

The study sites were chosen based on a series of relevant indicators: geography, climate, ratio of landuse types, socio-economic environment, and topic focussing requirements.

Based on the information collected from the province offices and key interviews, three Districts were chosen to carry out the research: Luong Son, Lac Son, and Da Bac. Table 3.4 shows the indicators with two key aspects which determined the

representation of the study Districts where representative for the geography and climate of Hoa Binh Province. The climates of the three regions are clearly different, especially the rainfalls. Luong Son with the lowest rainfall of 1,665 mm/year represents to the hilly region of the province which borders the provinces of the Hong River Delta. Lac Son has the highest rainfall of 1,958 mm/year, and is presentation of the medium high mountain region of Hoa Binh. Da Bac represents the high mountain region which is affected by Hoa Binh Reservoir. Since the water was stored at Hoa Binh Dam in 1985, rainfall and humidity have increased in the rainy season (Mai Trong Thong et al., 1996). The average rainfall of this region is now 1,833 mm/year. A third factor in the selection of the Districts was the ratio of different landuse types.

Table 3.4 Indicators of chosen Districts of Hoa Binh Province

Indicators		Luong Son District	Lac Son District	Da Bac District
Topography	Co-ordinates	Latitude 20.967 N Longitude 105.317 E	Latitude 20.463 N Longitude 105.465 E	Latitude 20 N Longitude 105 E
	Topography	Hilly	Mountainous	Mountainous
Climate	Mean temperature (^{0}C)	17 - 29	16.6 – 28.6	17 - 29
	Total rainfall (mm/year)	1,665	1,958	1,833
Landuse types (hectares)	Total area	37,469	58,046	82,016
	Agricultural land	8,042	11,374	3,491
	Forestland	8,152	30,037	30,553
	Unsued upland	13,996	12,244	38,168

Sources: Statistics of the Province (Hoa Binh Provincial People's Committee, 2001)

Synthesis statistics of Hydrometeorology Bureau from 1980 to 1999

Within the chosen Districts, four communities were defined using the indicators shown in Table 3.5. The indicators of geography and climate were relatively important, but landuse types, socio-economic status, and topic focusing indicators were much more important. In term of landuse types, forestlands and remaining uplands were categories related closely to the research topic. The sizes, ethnic groups, and class types of communities were needed to be identified that they are able to representative. The four chosen communities are relatively large villages of the Communes. The Muong ethnic groups made up are major people of Hoa Binh, so three of the four communities are made up of Muong residents. However, the Tay ethnic group is also a key group in the uplands, so a village of Tay people was selected. In Hoa Binh Province, Tay people mostly live in Da Bac District, and they characterize different culture and linguistic comparing to the main body of Tay. Therefore, Tay was defined and called Da Bac

Tay Ethnic Minority (Rambo and Tran, 2001). The Kinh ethnic group was not chosen because they live mainly within towns or centres of the districts. According to the information obtained from key interviews, the forestry development of Lac Son District is better than other districts, so two villages chosen in order to focusing on the topic were Bap and Khuong. The Khuong and Tat communities belong to class III, which means that they are located in remote high mountainous areas. Class II communities are non-remote high mountainous areas, included Bap and Suoi Bu (Vietnamese Government, 1998, Vietnamese Government, 1999).

Table 3.5 Indicators of chosen Villages of Hoa Binh Province

Indicators		Suoi Bu Village	Bap Village	Khuong Village	Tat Village
Topography	Regional class*	II	II	III	III
	Altitude (m)	100 - 480	95 - 116	150 - 250	400 - 900
Landuse types (hectares)	Total area	499.0	194.0	537.3	715.1
	Agricultural land	20.4	64.0	83.1	9.2
	Forestland	415.4	123.0	438.7	195.5
	Unused upland	0	0	48.5	458.0
Social-economic	Population	391	989	738	481
	Numbers of households	87	186	145	105
	Main ethnic groups	Muong	Muong	Muong	Tay

Note: * Class II – mountainous region; Class III – high remote mountainous region (VGov, 1999)

Sources: Statistics of the District and Commune People's Committees, 2004

Synthesis statistics of Hydrometeorology Bureau from 1980 to 1999

Chapter 4
Farming Systems and Plantings of the Upland Households and Communities in Hoa Binh Province

This chapter describes the household farming systems of the upland communities in Hoa Binh Province of Vietnam. It is necessary to identify and characterise all the components of the farming system that may affect the farming family's decisions about planting trees. Importantly, one must also articulate the relationships between these components. This understanding is necessary for us to answer the following key questions:

- *What physical and time constraints present barriers to farmers planting trees?*
- *Do upland farmers plant trees and why, or why not, do they engage in this activity?*
- *Of those farmers that plant trees, why do they plant some species and not others?*
- *In what configuration do farmers integrate trees in their farming systems?*

To answer these questions this chapter begins with a detailed picture of the upland farming systems through describing the landscape, the farms' physical and temporal structures, and the nature of farm households. Then, the existing forestry is described to determine the forest management, and planting of the upland households/communities.

4.1. Farming systems

4.1.1. Landscape

As an overview, the landscape of a village-level farming system in Hoa Binh Province is illustrated in Figure 4.1. The landscape of each community looks like a mosaic, and it generally falls into four land use types: paddy rice, home garden, sloping crop cultivation, and forestry. According to the landuse planning at the provincial level, there is no land for sloping crop cultivation. Nevertheless, sloping crop cultivation still exists.

Thus, the existing landscape of the village farming systems is a mosaic picture (see photo in Appendix C2).

By the altitude, the landscape falls in to three levels: (1) Paddy fields in low lying areas; (2) Residents, home gardens, and roads occur immediately above paddy fields; (3) Forests and sloping cultivation areas occupy the higher areas in the landscape. In the landscape, the main road and residents are usually at the centre. Paddy fields are mainly located around the central communities, and along the stream. Protection forests usually lie in the watershed areas near the residential areas and along the main road. Protection forests are usually visible from the central village. Most plantation forestlands and unused sloping lands (the lands used for shifting cultivation) are located far from the residential areas at least 30 minutes walk.

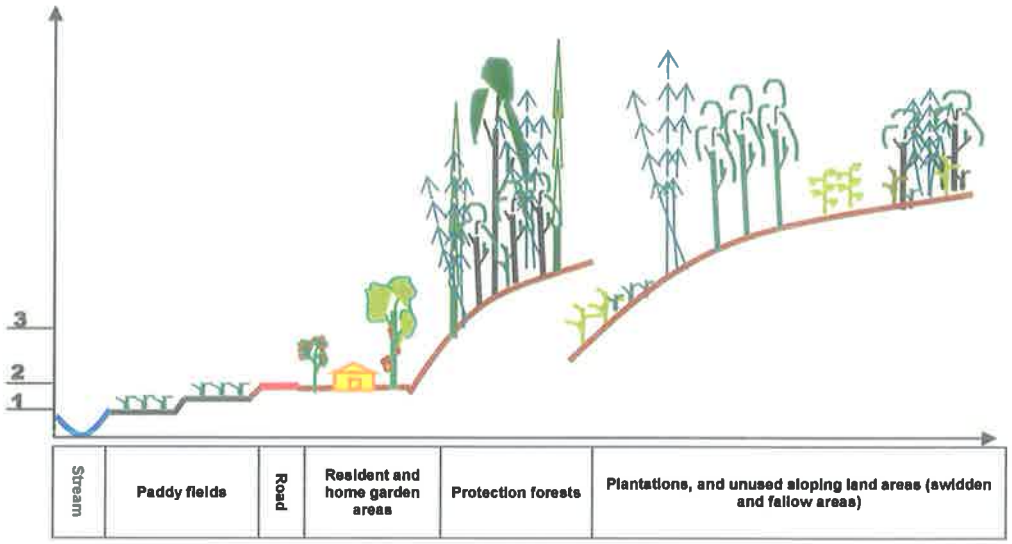

Figure 4.1 Transect diagram of the upland villages in Hoa Binh Province

Sources: This synthesis diagram is based on the results of transect exercises and participatory mapping exercises

The boundaries of the farming systems usually depend on the maturity of landuse planning processes. At the commune level, landuse planning of many communes is not complete. In the study sites, landuse planning and allocation to households of the three communities are basically complete including Bap, Khuong, and Suoi Bu villages. The boundaries and the landuse types these farming systems are clearly defined. In contrast, Tan Minh Commune and some other communes of Da Bac District had not completed landuse planning and allocation at the time of the study. Therefore, the boundaries of

the farming systems in Tat Hamlet are not clear and this can easily cause conflicts between villages, the households, and the landuse types.

The transect diagram (Figure 4.1) is not only a general picture of the upland village, but also indicates the potential places where farmers can increase their plantings. As in Figure 4.1, the lands that are suggested to be available for planting are certainly the unused sloping land areas. This is discussed further in the "landuses' section.

4.1.2. Farm structure

Physical farm structure

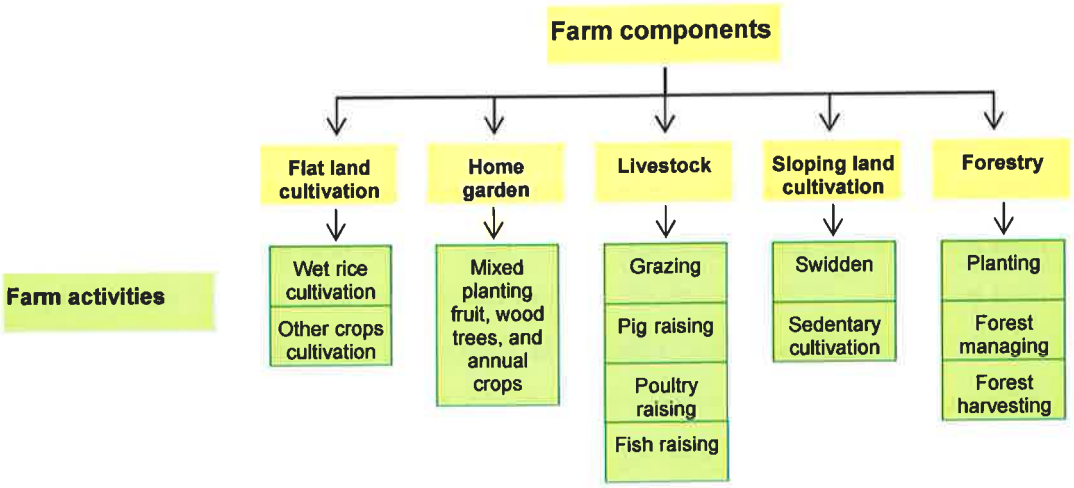

Figure 4.2 Structural features of the upland households in Hoa Binh Province

In Hoa Binh Province, the structure of the farm-household system mainly falls into five components: Flat land cultivation, home garden, livestock, sloping land cultivation, and forestry. Figure 4.2 illustrates the farm activities undertaken on each of these components of the farming systems.

Landuses

Figure 4.2 gives a general picture of landuse in the upland farming systems in Hoa Binh Province. Specific areas of landuse in the four communities under study site are presented in Table 4.1.

Table 4.1 Landuse status of four study sites in Hoa Binh Province

Landuse types	Suoi Bu Village		Bap Village		Khuong Village		Tat Hamlet	
	Hectares	*%*	*Hectares*	*%*	*Hectares*	*%*	*Hectares*	*%*
Total area	449	100	221	100	1075	100	715	100
1. Agricultural land	390	86	188	85	522	49	227	30
1.1 Agricultural area	*23*	*5*	*65*	*29*	*83*	*8*	*30*	*4*
1.2 Forestland area	*367*	*82*	*123*	*56*	*439*	*41*	*198*	*26*
• Natural protection forestland area	315	70	68	31	439	41	196	26
• Production forestland area	52	12	55	25	-	-	2.0	0.3
2. Non agricultural land	3	1	30	14	16	1	4	1
3. Unused land	56	13	3	1	537	50	512	69
3.1 Unused sloping land area	*49*	*11*	*3*	*1*	*537*	*50*	*458*	*62*
3.2 Others (Rivers, streams, and stone mountains)	7	2	-	-	-	-	54	7

Sources: Statistics of the Commune People's Committees of 2004, and notes of the Village Chiefs (2005)

Table 4.1, shows some interesting differences between villages with respect to the proportion of land used for agriculture, forestry and unused sloping lands.

Flat land is considerably most important element in the household farming systems. Farmers prefer to grow food crops, and also cash crops in this land that is relevant to food provision for the households. So, the range of flat land area relates to the positive food production of the households. Unfortunately, flat land areas of most villages are usually fixed and small that means it is difficult to increase this land in the upland villages. The flat land of every village usually occupies some very small proportions. Among the four villages, Khuong is the largest village of 1075 hectares while Bap village is the smallest total land area of 221 hectares, but is the biggest ratio of flat land of 29% of the total. Flat land of Suoi Bu, Khuong, and Tat are 5%, 8%, and 4% of total land area, respectively.

Most forestlands of these villages are natural secondary protection forests. The production forestlands of villages occupy the small areas, of which Bap village is the largest area of 55 hectares, accounting for 25% of total and about ½ forestlands, while other villages account for very small ratios of 0,3%, and 12% of total, respectively Tat Hamlet, and Suoi Bu villages. In contrast, Khuong village does not have production forestland.

The forestland area, especially the plantation area closely relates the unused upland area and swidden area. According to the landuse planning of the committees (Hoa Binh Provincial People's Committee, 2001), the sloping land area uncovered by forest vegetation belongs to the forestland area (protection or/and production forestlands). In fact, excepting Khuong village had the statistic of swidden area others have no swidden

land areas, although swidden cultivation still exists, and colonizes the sloping land area. Both Bap and Suoi Bu villages have very small swidden area or unused land area accounting for 1% and 11% of total, respectively. Differently, Tat and Khuong villages have the extremely large unused land area of 62% and 50% of total, respectively; these land areas are apparently available for tree plantings.

Paddy land

The flat land of the upland communities is mostly used for paddy cultivation. The main paddy fields are usually located at the bottom of the narrow valleys along to the main streams and near the residential areas of the upland villages. Farmers also increase their paddy fields by building more terrace bunds around water sources. However, these fields are small and scattered far from farmer's homes, for instant in Tat Hamlet. Paddy fields are built as narrow terrace bunds. The height of terrace paddy fields is from 50 cm to 150 cm, and the area is small of from 40 to 300 m^2/field (Tran Duc Vien, 2003). All paddy land areas in Hoa Binh are allocated to the households with land ownership certificates, called '*Red Book*' issued by the District authority. The last update of the *Red Book* issued for paddy land of many households here was in 1999.

Wet rice cultivation is popular in the paddy fields. Several other annual crops are also grown in this land: maize, sweet potato, cassava, soybean, groundnut, taro, watermelon, vegetables, and others (Table 4.2).

Table 4.2 Crop systems of the study villages in Hoa Binh Province

Villages	Crop systems			Note
	Spring crop	Autumn crop	Winter crop	
Tat	Wet rice	Wet rice	Fallow	Most paddy fields are grown two rice crops. Farmer have no experience of growing winter crop
Khuong	Wet rice Maize Watermelon	Wet rice	Maize Sweet potato Soybean Fallow	Water supplied for some fields is not enough to grow rice in the spring crop. Therefore, other crops replace rice. Some fields are fallowed in the winter crop
Bap	Wet rice Watermelon Fallow	Wet rice	Maize Sweet potato Vegetables Fallow	Water shortage in the spring crop is the big problem in Bap village. So, many fields cannot cultivate from winter crop to spring crop.
Suoi Bu	Wet rice Maize Soybean/groundnut Taro	Wet rice	Maize Sweet potato Soybean Vegetables	There is much more propitious than other villages

Sources: Results of village transects, observing, and focus discussion groups (2005)

Table 4.2 also shows the crop systems cultivated in the paddy fields of the study villages. The paddy crop systems of Tat Hamlet are very simple such that only wet rice is cultivated. The Da Bac Tay ethnic minority of Tat Hamlet characteristically follow a

composite swidden farming system which is considered as unique. The composite swidden farming system of the Tay people is characterised as being able to adapt to the change of environment in Hoa Binh. The farming system combines wet rice and rotation swidden cultivation (Rambo, 1998). Meanwhile, the Muong people of three other villages also combine flat land crops and swidden cultivation; however, the paddy crops are more diverse and complex than these of Tat Hamlet.

"Landuse coefficient" is the number of annual crops farmers grown per year. The Muong farmers use paddy land with higher landuse coefficient than the Tay farmers. Muong villagers in Suoi Bu, Bap, and Khuong grow three crops per year, while the Tay in Tat Hamlet grows two crops per year. The table also indicates that the major crop grown on the flat land in the villages of Hoa Binh Province is cereal, especially wet rice. In addition, some crops considered as cash crops are maize and watermelon. The other crops are mainly grown for home consumption.

Flat lands of all upland villages are very small, so the households use these lands as a priority for food production and they expect to produce food enough for households' consumption. Apart from rice production, farmers cannot produce a large enough quantity of cash crops for sale with their small land areas.

(See illustrated photos in Appendix C3a)

Home garden

Home gardens belong to the residential land area, because they were issued in the *Red Book* of residential land. Like the paddy land, the residential land *Red Book* of most households was last issued in 1999. Home gardens and resident areas are located in the centre of the villages and the area of this land is very small, accounting for about 850 m^2, 2,700 m^2, 1,100 m^2, and 800 m^2 per household in Suoi Bu, Bap, Khuong and Tat, respectively (Table 4.3).

Home gardens in the study villages are quite complex with a mixture of annual crops, fruit trees and forest tree species. As shown in Table 4.3, the average home garden area of the households in Bap village is the largest, accounting for about 2700 m^2/household. This is interest as the total area of this village is the smallest (only 221 ha) of the four. Furthermore the range of tree species planted in home gardens of Bap village is also much greater than those of other villages. In contrast, Tat home gardens are not only the

smallest, but also the poorest of tree species. The products of home gardens are largely used for home consumption. By the small areas involved and the mixing of many types of crops and trees, home gardens are difficult to produce a large enough quantity of commodities for sale.

Some wood tree species are planted in home gardens for both aesthetic and productive purposes, however they are scattered and relatively few. Farmers also plant wood trees are around the borders of home gardens taking the advantage of small opportunities of space.

(See illustrated photos in Appendix C3b)

Table 4.3 Home garden status of the study village in Hoa Binh Province

Characteristics	Suoi Bu	Bap	Khuong	Tat
Area (m^2/household)	850	2,700	1,100	800
Fruit trees	Jackfruit, mango, pomelo, longan, litchi, plum, banana, persimmon, etc.	Jackfruit, mango, pomelo, longan, litchi, plum, banana, persimmon, etc.	Jackfruit, mango, pomelo, longan, litchi, banana, persimmon, etc.	Jackfruit, mango, pomelo, longan, litchi, plum, banana, persimmon, etc.
Tree species	*Dendrocalamus membranaceus* *Gigantochloa scribneriana* *Chuckrasia tabularis* *Dracontomelum mangiferum* *Canarium album* *Cinnamomum cassia*	*Melia azedarach* *Dendrocalamus membranaceus* *Gigantochloa scribneriana* *Chuckrasia tabularis* *Dracontomelum mangiferum* *Canarium album* *Cinnamomum balancae* *Michelia mediocris* *Acacia sp.*	*Melia azedarach* *Dendrocalamus membranaceus* *Gigantochloa scribneriana* *Chukrasia itabularis* *Canarium album*	*Melia azedarach* *Dendrocalamus membranaceus*
Others	Soybean, vegetables, and herbs	Tea, cassava, maize, vegetables, and herbs	Vegetables, and herbs	Vegetables, and herbs

Sources: Results of village transects, observing, focus discussion groups, and synthesis of household interviews (2005)

Sloping land

Sloping land is the resource of shifting cultivation mainly practised by ethnic minorities in the uplands of Vietnam. There are six ethnic groups living in the uplands of Hoa Binh that still practice swidden cultivation on sloping land that has been allocated as forestlands by the planning processes of the commune, district, and provincial People's Committees (Hoa Binh Provincial People's Committee, 2001). The one other minority ethnic group in Hoa Binh is the Kinh people who mostly live in the central districts and towns.

The official records for land under swidden cultivation were incomplete at the time of study. Only 49 ha of swidden land is record for Khuong Village. From observation it is

clear that the swidden land area of all other villages, and also for Khuong, is recorded as being unused upland area in the statistics of the authorised Committees.

Table 4.4 Status of the swidden cultivation of the study villages in Hoa Binh Province

Villages	Suoi Bu	Bap	Khuong	Tat
Area (hectares)	48.5**	3.0**	48.5* + 537.3**	458.0**
Allocation	*Red Book*	*Red Book*	*Red Book*	Not yet
Crops	Upland rice Maize Cassava	Maize Cassava	Upland rice Maize Cassava Soybean	Upland rice Maize Cassava Canna
Tree species intercropped	-	-	*Melia azedarach*	*Melia azedarach*
Crops/year	1	1	1 – 2	1 – 2
Cultivation types	Sedentary swidden	Sedentary swidden	Sedentary swidden Intercropping soybean and maize	Rotation swidden Intercropping maize and cannas
Fallow period (years)	none	none	0 – 2	3 – 4

** The statistic of swidden land recorded by the Binh Hem Commune People's Committee*

*** The statistics of unuse upland recorded by the Commune People's Committees*

Sources: Statistics of Commune People's Committees of 2004, and notes of the Village Chiefs
Results of village transects, observing, focus discussion groups, and synthesis of household interviews

Table 4.4 shows the major characteristics of swidden cultivation of the households in Hoa Binh study sites. There are some different points between Tay and Muong ethnic minorities in terms of sloping landuse. First, Muong households hold swidden plots by the *Red Book* that was last updated in 1999, while Da Bac Tay households use these sloping land areas without authorisation. In Tat Hamlet, villagers currently own the swidden plots under traditional land ownership. The traditional land ownership of Tay people is the way villagers hold their land by the local rule; i.e. the household, which initiates swidden cultivation on a parcel of land, will 'own' that land over many cycles, including the fallowed field period. Second, Tay groups retain the practice of rotation swidden cultivation with the fallow period of 3-4 years, while Muong groups of the study villages have changed from traditional shifting to sedentary sloping land cultivation.

Further distinctions are that when cultivating sloping land, the Muong people mainly grow cassava, maize, and particularly soybean in Khuong village. Farmers also have to till by hoes and use chemical fertilizer when growing crops. This differs greatly to the traditional shifting cultivation practice by Tay people in Tat Hamlet. In the traditional shifting or Da Bac Tay swidden cultivation, land is prepared by 'slash and burn' with no tillage (Do Dinh Sam, 1994; Tran Duc Vien, 2003). Finally, many Tay households of

Tat Hamlet practise an indigenous agroforestry alternative of intercropping *Melia azedarach* (Bead tree) into the swidden plots as the way to improve the fallow period. In contrast, few of the Muong households plant *Melia azedarach* into the swidden plots.

This practice can be defined as traditional swidden cultivation with the improvement of the fallow period. The technique of this practice is described in Box 4.1.

Box 4.1 Practising Agroforestry form in Tat Hamlet of Hoa Binh Province

Before burning the swidden, the people sow the Melia (*Melia azedarach*) seeds. When the swidden is burnt, the seed are stimulated for an even and vigorous germination. This tree provides many different benefits. Melia leaves are used as a green manure to fertilize rice, especially autumn rice; they also serve as an insecticide. The charcoal made from Melia wood was previously used as gunpowder, so it was a product to sell. The branches of Melia are also used as firewood.

In the weeding period, while one is looking after rice, one is also looking after Melia. A density of 1,000 – 1,500 plants per hectare is believed to be ideal for Melia. Excess Melia is pruned and additional Melia may be planted. After yielding two or three annual crops of rice, the earth loses its fertility and grain cultivation is abandoned. Nevertheless, by this point, the Melia is already tall enough to continue growing. The swidden is left fallow, and normally bamboo (*nua*) also begins to sprout. After 7 – 8 years (some time 10 years), when the Melia trees have grown to a diameter of 20 – 30 cm, both the Melia and bamboo are harvested and sold. The cultivation cycle then begin again. Of course, during the fallow period, people can still obtain some income from this land by harvesting bamboo shoots. Usually, each hectare of fallow swidden can bring to 100 m^3 of wood. Using current price (250,000 VND per m^3) of Melia wood, farmers can earn up to 12 million VND/ha after 8 years. If the field was only used as a rice swidden, the farmers would harvest 2 crops of rice, and 2 crops of cassava. They would gain cash value of 5.5 million VND in total of cultivated period (4 years) and then give fallow for 4 years more before turn back to next cycle.

Tran Duc Vien (2003), p197

Currently, some households still practise this agroforestry option. However, they mostly practise in the swidden fields near their houses because bead-tree fields need protection from free grazing. Several villagers also grow bead-tree at the swidden fields far from home, but the growth and quality of bead-tree is not as good as the bead-tree in near home fields.

The above traditional agroforestry may be an initial basis to promote farmers to plant native tree species. Villagers are practising the intercropping technique to plant tree species supported by the 661 Project. However, many indigenous tree species need cover in their establishment period. So these high value wood species may be mixed into the available bead-tree plots, because the bead-tree will provide the cover for young wood trees.

(See illustrated photos in Appendix C3d)

Forestry

In the upland households of Hoa Binh Province, forestlands are either under protection forests or plantations. As shown in Table 4.1, the forestlands covered by forest

vegetation are very different between the study villages, accounting for 27%, 41%, 56%, and 82% of total area of Tat, Khuong, Bap, and Suoi Bu, respectively. Remarkably, most forests of the villages are the protection forests. Within forestland area, the plantations of three Muong villages are about 50 – 55 hectares per village, accounting for 5%, 25%, and 12% of total land of Khuong, Bap, and Suoi Bu, respectively. Particularly, the plantation area of Tat Hamlet recorded before the guidance of 661 Project was very small of 0.3% of total land area. The small plantation mentions that it seems less important than others activities of the household farming systems in the upland of Hoa Binh.

All forestlands including protection forests and plantations were allocated to the households with the *Red Book* issued in 1999.

Livestock

Households of the study villages raise buffaloes and cattle, pigs, poultry and fish. In Khuong village, some villagers also raise goats. Raising buffaloes and cattle is very important in the upland household farming systems, but there is not land area planned for grazing within the study communities. In Tat Hamlet, grazing buffaloes and cattle is freely in the swidden and forest areas. Therefore, many farmers do not use cattle manure because it is very difficult to collect. In contrast, farmers of Muong villages raise buffaloes and cattle by herding. Usually one member of the household, either an elder or child, takes the responsibility of tending oxen and buffaloes, and goats every day. In this situation, farmers can easily collect cattle manure to make fertilizer. Livestock is raised not only for home consumption, but also for sale. Villagers also raise buffaloes for providing power for plough and harrow.

Grazing, swidden agriculture, and tree planting all occur on the same type of land. This often gives rise to conflicts between these farmers' priorities, especially in Tat Hamlet. It can also lead to conflict between farmers. These conflicts are another barrier to farmers planting trees.

(See photos in Appendix C3c)

4.1.4 Temporal farm structure

The farming temporal structure is analysed through season calendars. Figures 4.3, 4.4, 4.5, and 4.6, describe the specific farm activities over the year across the study villages.

Analysis of the farming season calendars helps us understand the time dimension of the farming activities and distribution of household labour. Analysis of farming season calendars mentions the interrelationships between the farming elements of the households. It also indicates the decision and management of the households on their farming activities. As illustrated in Figure 4.3, 4.4, 4.5, and 4.6, the households have to make the decisions of crops, plants/trees, time, tillage, irrigation, seedling, nursing, growing/transplant, harvest, animals, animal food, diseases, and management. Their decision-making needs to adapt the weather/seasons and their resources including land, labour, and capital. The specific activities of the upland household farming systems are extremely diverse. Those are relevant to the decision making of farmers in terms of tree planting.

Apart from irrigated flatland crops, most other activities mainly occur in the rainy seasons. It means that most labours spent for farming activities concentrate on these times. Crops and farm activities calendars of Muong households are similar, but they differ in terms of the variety of farm activities. Across the activities throughout three farming seasons (Spring, Summer, and Winter), farming activities of Bap village seem are evenly scattered over the seasons, but less farming activities of others exist in the winter season from October to early January that means farmers spend less labours in this season than others.

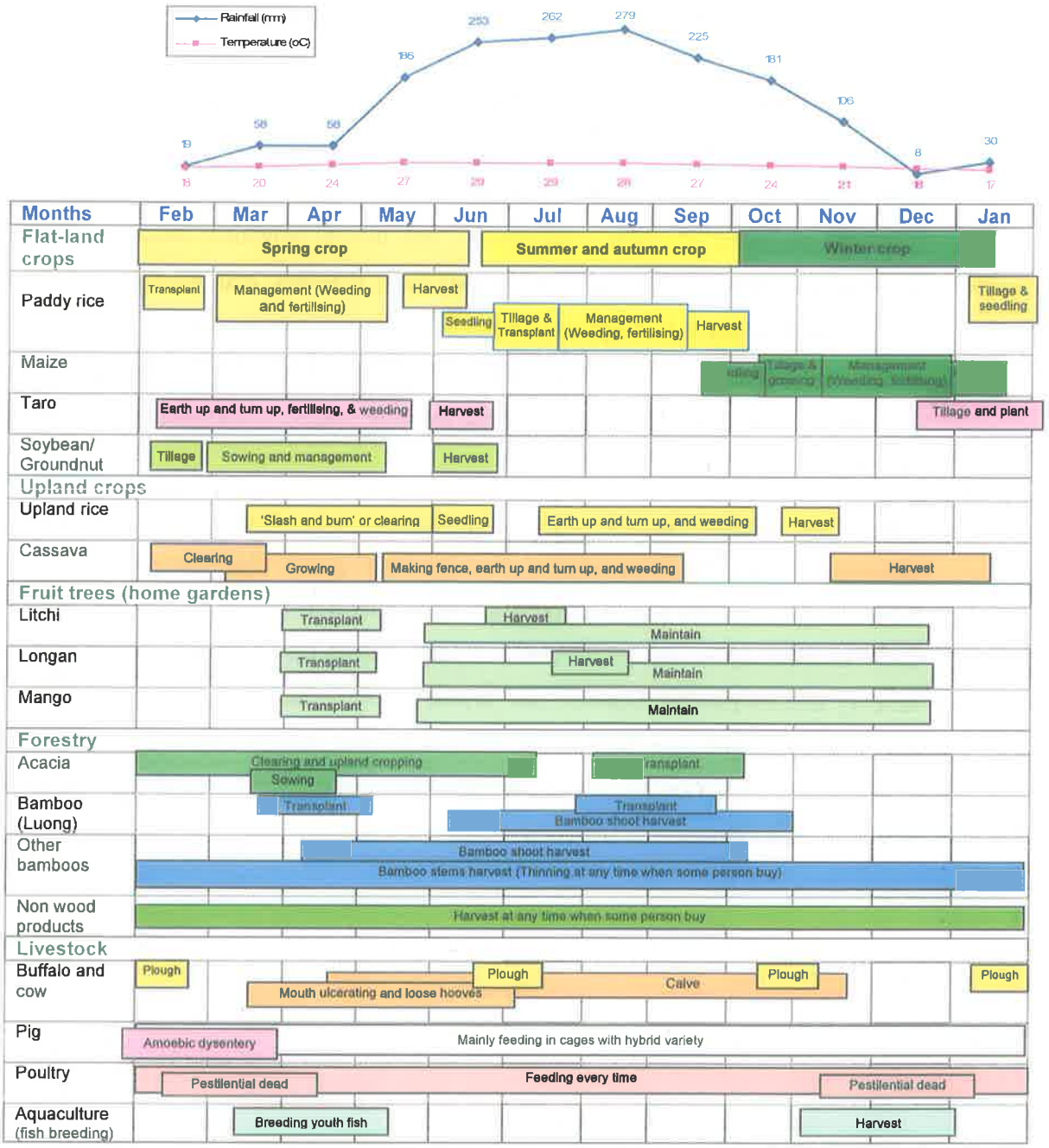

Figure 4.3 Season calendar of the farming activities of Suoi Bu Village in Hoa Binh Province

Source: Results of Village Transect and Focus Group Discussion (2005)

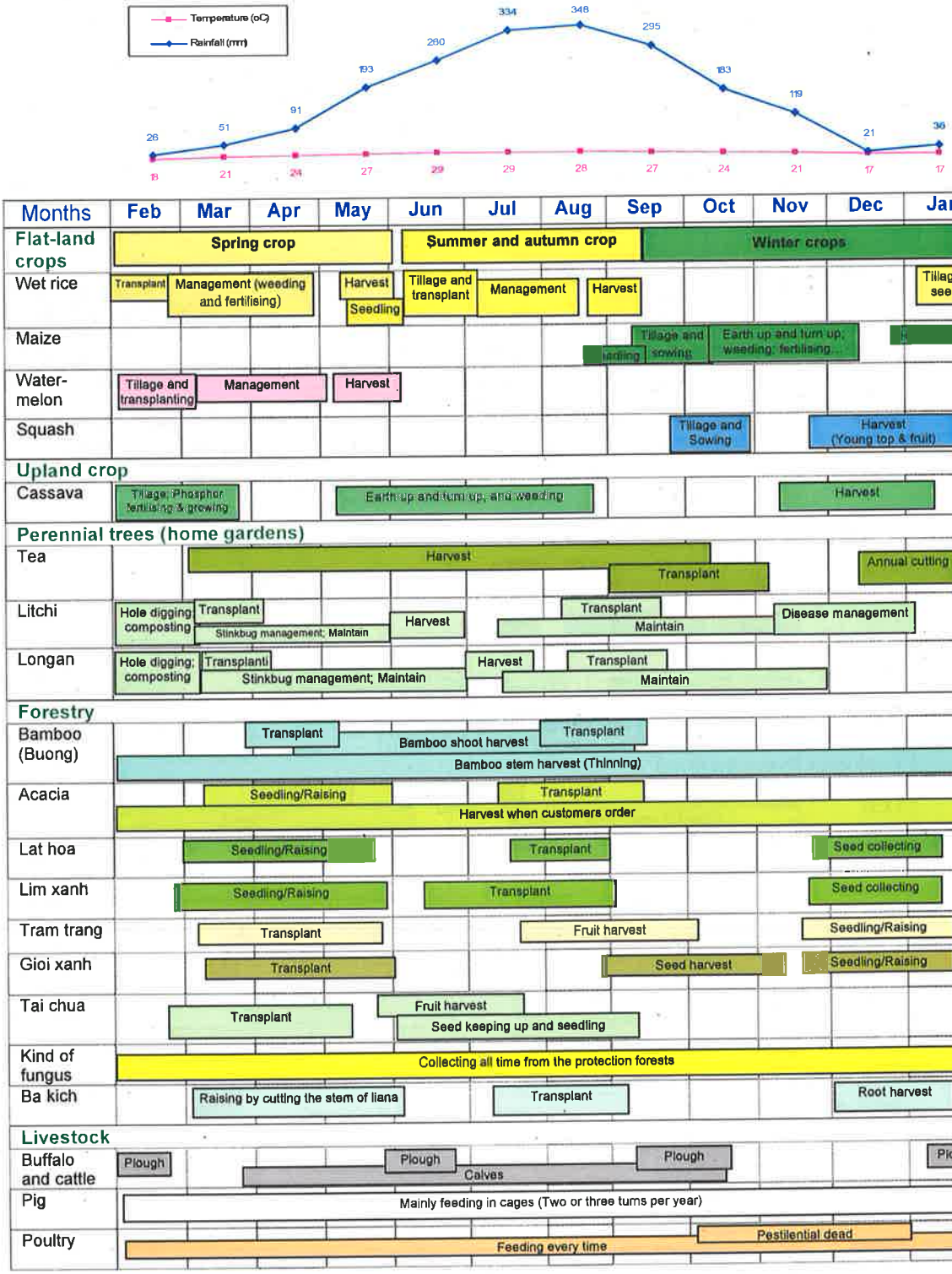

Figure 4.4 Season calendar of the farming activities of Bap Village in Hoa Binh Province

Source: Results of Village Transect and Focus Group Discussion (2005)

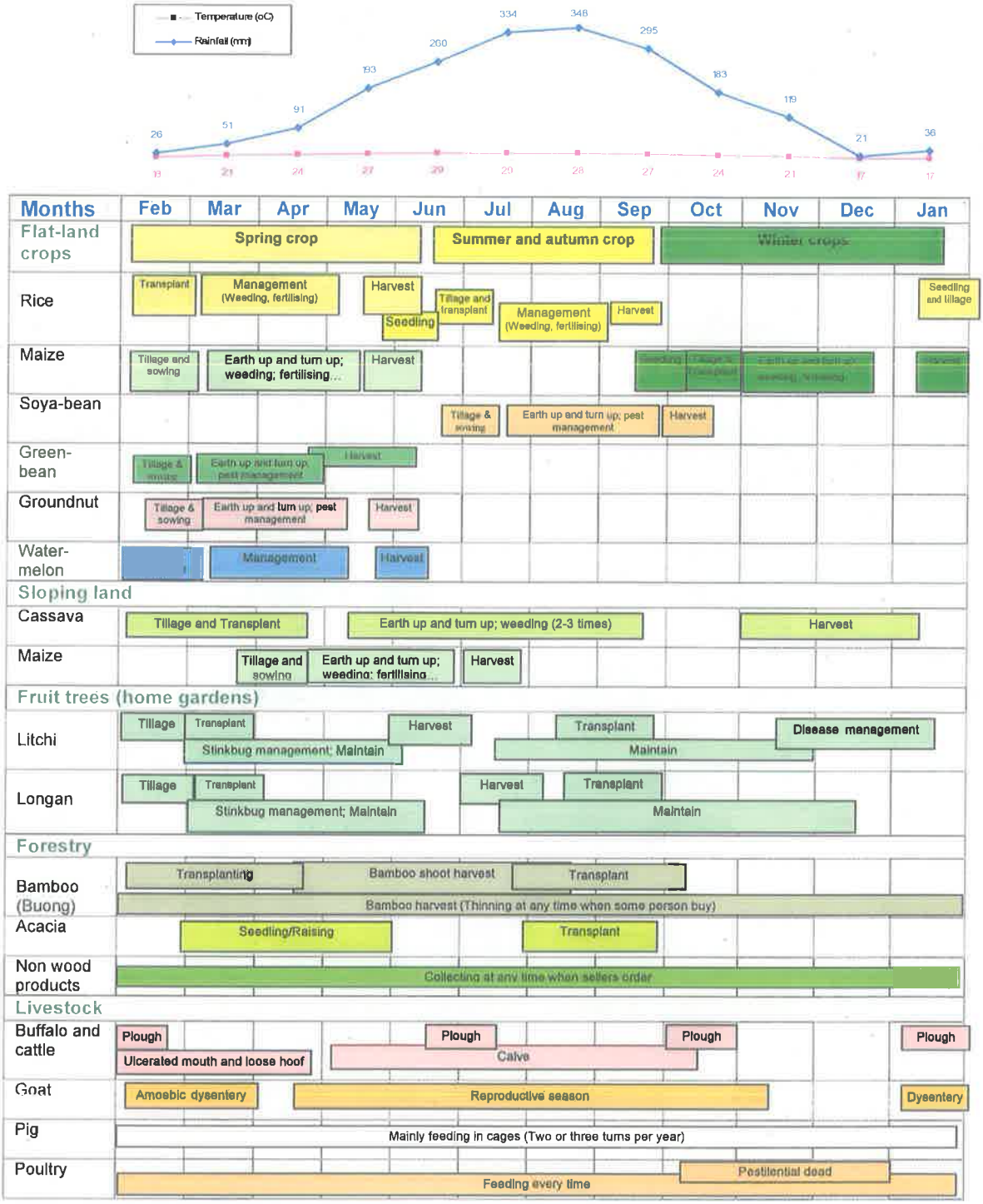

Figure 4.5 Season calendar of the farming activities of Khuong Village in Hoa Binh Province

Source: Results of Village Transect and Focus Group Discussion (2005)

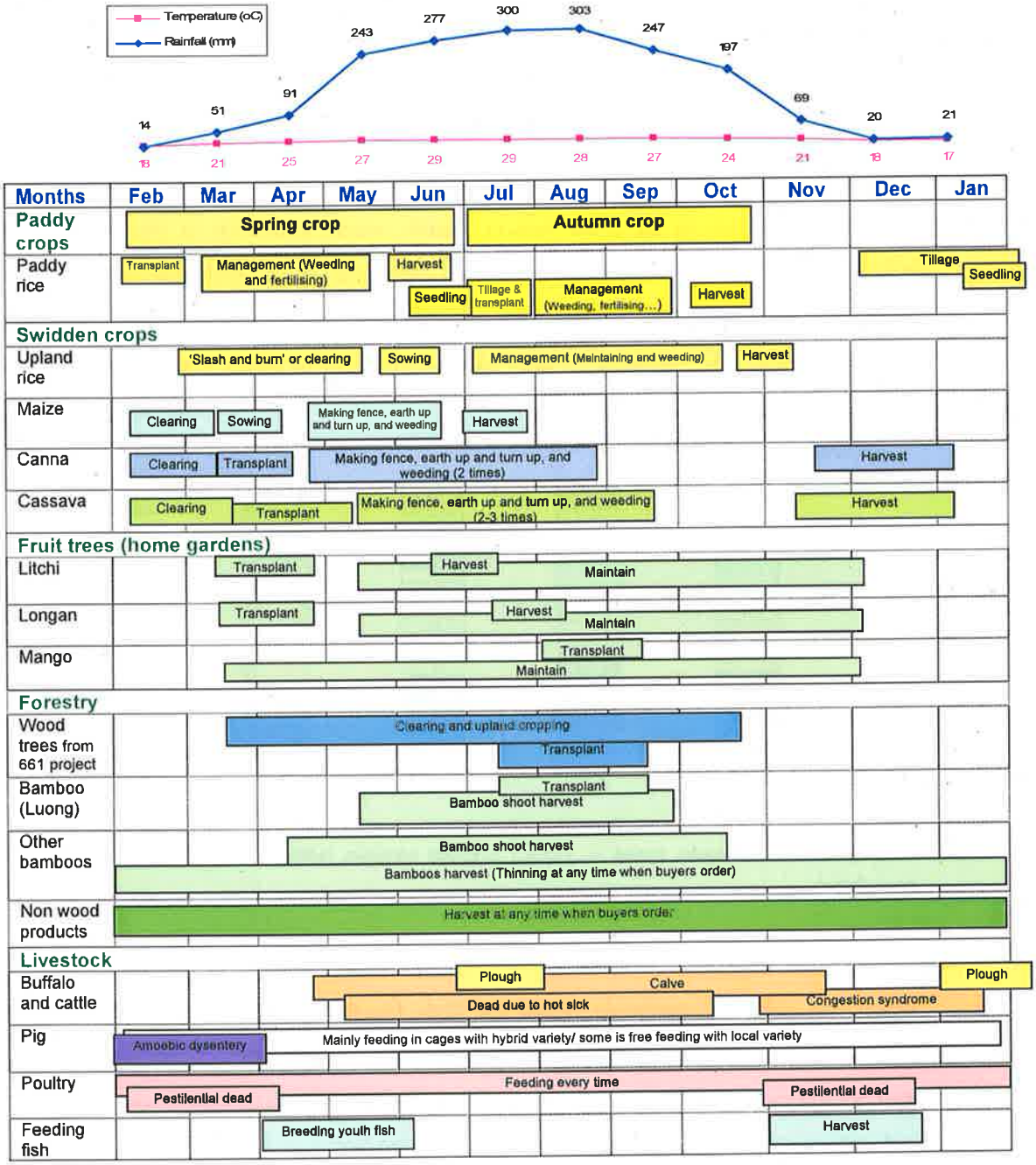

Figure 4.6 Season calendar of the farming activities of Tat Hamlet in Hoa Binh Province

Source: Results of Village transect and Focus group discussion (2005)

Regarding forestry activities, the most diverse forestry activities are in Bap village, while its activities of other villages are simple and similar. In contrast, the seasonal calendar of the Tay farming systems in Tat Hamlet is much different to Muong farming systems. The activities of Tay households are less diverse in flat land cultivation, but more diverse in swidden cultivation than Muong households (see Figures 4.3, 4.4, 4.5, and 4.6).

These figures also present that the farming activities of the upland households come between each other in the same season, month, week, and even in the same day. For example, farmers tend their buffaloes when they work in the swidden fields, or on the way home from swidden farmers collect fuel wood, and NTFPs. So, farming activities may affect each other through farmers' decision making of time dimension.

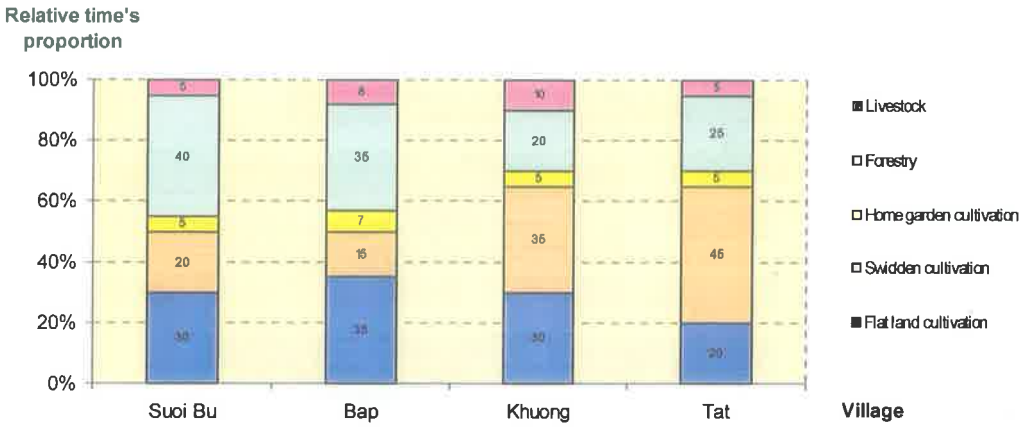

Figure 4.7 Relative time proportion of family's farming components in each of the study villages
Sources: Estimated results based on season calendar analysis, landuse analysis, transect analysis, and observation.

Based on the analyses of seasonal calendars and landuses, the relative time proportion, which the upland households spend for their farming components, is estimated and illustrated in Figure 4.7. Across the villages, most time is spent concentrating on flat land, swidden cultivation, and forestry. Time for home gardens and livestock is similar and occupies the smallest proportion, accounting for 5 – 10% of total, respectively. Time spent for flat land cultivation are the highest in Bap and smallest in Tat, accounting for 35%, and 20% of total, respectively, because farmers of Bap have the largest flat land area, while farmers of Tat do not cultivate winter crops. In particular, time for swidden cultivation that farmers of Khuong and Tat spend is much higher than other farming activities of the villages, accounting for 35%, and 45% of total,

respectively, while households of Suoi bu and Bap use 20% and 15% of total, respectively. In contrast, farmers of Suoi Bu and Bap spent much time for forestry activities, accounting for 40%, and 35% total, respectively, because they widely plant acacia, and bamboo (more analysis is in the below sections). Farmers of Khuong and Tat mostly spend time for protection and harvest, rarely planting; these are 20% and 25% of total, respectively. *(Forestry includes protection, planting, and collecting forest products).*

The above analysis indicates not only the temporal farm structure, but also the existent landuses and relationship of farming components and planting. It mentions that the opportunities of planting in Khuong and Tat are still not explored. The farming systems in Khuong and Bap may develop tending to Suoi Bu and Bap, when farmers shift to use their sloping land from swidden cultivation to planting trees. However, changing the perception of upland farmers is a difficulty that is one of the big challenges of trees plantings, especially plantings of indigenous wood trees.

4.1.3. Farm household

This section describes the household component of the upland farming systems of Hoa Binh Province in terms of: wealth status, needs of the households, off-farm activities of the households. (See photos in Appendices C4 and C5)

Wealth status of households in the study villages

The households of the study villages fall into four wealth classes, ranked A to D by the village participant (Table 4.5). For clarity, the proportions of wealth class within each village are also represented in Figure 4.8.

Figure 4.8 clearly shows that the villages vary greatly in the distribution of wealth as measured by household materials. Whereas in Suoi Bu the four wealth classes are relatively evenly presented, in Tat the majority of households are in the moderately wealthy class. In contrast, poor households are relatively dominant Bap and Khuong villages. However, the ratios of numbers of households in each class vary in the villages.

The households of class A usually have the strongest capacity. The forestlands that these households own are larger and nearer homes than others household classes. Moreover, they have much more experience of cultivation and breeding, higher ability

of accessing the new approaches, and more confidence of investment in farming and off-farm activities than other household groups. In four study communities, the ratio of class A is the highest in Suoi Bu village of 29%, while they are 12%, 23%, and 9% of Bap, Khuong, and Tat, respectively.

The households of class B usually concentrate on the farming activities with good experience, but they are limited confident investment. The household class B of Tat Hamlet is the highest ratio of 52%, while in Suoi Bu, Bap, and Khuong villages they are 19%, 30%, and 21%, respectively.

The capacity of the households in class C and D are very low. The ratios of both household classes occupy about 50% of total households in each village. The households of these classes are limited knowledge, experience, and accessing information. They are in the situation of food shortage. Therefore, all activities of these households concentrate on providing food for home consumption. They spend much time on harvesting forest products, especially in Suoi Bu, Khuong and Tat.

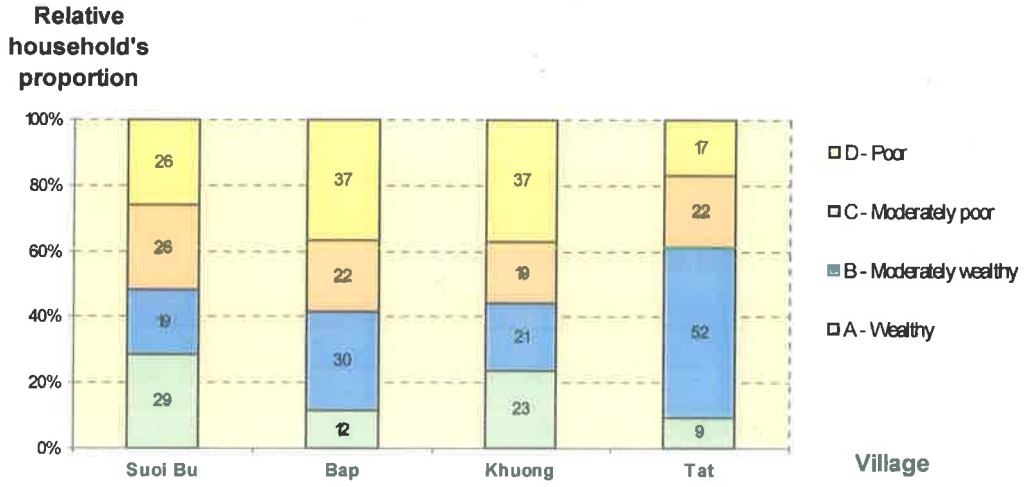

Figure 4.8 Relative household's proportion of wealth classes in each of the study villages
Sources: Results of Participatory Wealth ranking practices (2005)

Table 4.5 Status of the households in the study villages of Hoa Binh Province

Characteristics		Suoi Bu	Bap	Khuong	Tat
Total households		**77**	**186**	**145**	**106**
Households of Class A	*No*	22	22	34	10
	Ratio (%)	29	12	23	9
	Houses	Strong houses	Strong houses	House on stilts style I*	House on stilts style I Strong houses
	Land area	Large plantation areas (more than 4 hectares) Forestlands are near home	Large forestlands	-	-
	Livestock	1 – 4 buffaloes Large fish pond	Most have buffaloes or/and oxen Good experience of breeding	More than 2 buffaloes, 10 goats 5 pigs per year	More than 8 buffaloes or/and cattle
	Home comforts and tools	Motorbike Colour TV High value goods Some have machines: Grill machines, pumps	Motorbike Colour TV and DVD players Some have machines: Grill machines, pumps, small tractors	Motorbike Colour TV Some have machines: Grill machines, pumps	Motorbike Most of the households have colour TV with satellite antenna Some have machines: Grill machine
	Others	Confidently investment in development of household economic High ability of new approach	Having much experience Higher ability to approach the new things Having off-farm activities Confidently in investment	Having much experience Higher ability to approach the new things Confidently in investment	Higher ability to approach the new things Confidently in investment Having good off-farm activities
Households of Class B	*No*	15	55	30	55
	Ratio (%)	19	30	21	52
	Houses	Medium houses	Semi-strong houses	House on stilts style II**	House on stilts style I or style II
	Land area	More than 2 hectares of plantation Forestlands are near home	Large forestlands	-	-
	Livestock	1 – 4 buffaloes	Most have buffaloes or/and oxen	1-2 buffaloes less than 5 pigs/year	7 – 8 buffaloes or/and cattle
	Home comforts and tools	Motorbike Colour TV	Motorbike Colour TV	Motorbike Most have black and white TV	Motorbike Most of the households have colour TV with satellite antenna
	Others	Having much experience Limited investment	Having experience Enough food Unconfidently in investment	Having much experience No in excess	Having much experience Good thinking in economic development
Households of Class C	*No*	20	41	27	23
	Ratio (%)	26	22	19	22
	Houses	Tile roofed houses	House on stilts made with low quality wood or bamboo	House on stilts made with bamboo	Cottage
	Land area	Forestlands are far from home that are difficult to manage	Medium forestlands	-	-
	Livestock	1 – 4 buffaloes	Some having buffalo	0ne buffalo Two pigs/year	Less than 2 buffaloes or/and cattle
	Home comforts	Old motorbike Black and white TV	Black and white TV	Some have black and white TV	Black and white TV
	Others	Major investment is labour	Food shortage Lack of experience	Lack of experience	Limited experience Mainly labour investment
Households of Class D	*No*	20	68	54	18
	Ratio (%)	26	36	37	17
	Houses	Cottages	Cottages	Cottages	Bad cottage
	Land	No forestlands or small area	Small forestland areas	-	-
	Livestock	Most has no buffalo	No buffalo Lack of feeding experience	0 -1 buffalo	0 - 1 buffaloes or cattle
	Home comforts and tools	Some have black and white TV	None	None	Some have black and white TV
	Others	No investment Major activity is forest product harvest	Food shortage Lack of experience Limited capacity	Lack of knowledge Harvesting forest products	Lack of experience Harvesting forest products Limited knowledge

** House on stilts style I made with good wood values more than 20,000,000 VND*

*** House on stilts style II made with wood values from 10,000,000 to 20,000,000 VND*

Sources: Results of Wealth ranking practices (2005)

Within the farming systems, household play roles of farming management, decision, and getting benefits. So, the educational levels of the households' heads mention the ability to make the decision in terms of planting. Figure 4.9 illustrates the educational levels of 76 interviewees in the province. Interestingly, only one of 76 persons who finished high school, while 72 persons are under high school level, and 3 persons finished during high school level. Most interviewees have the educational levels at level 4 to level 7. The figure also indicates the correlation between educational levels and wealth classes, but it is very low of 21% (see detail in Appendix B.2). In overall, it does clearly mention that wealthy class is not higher education than others. Low education levels of the interviewees indicate the limitations on their ability to receive information through written means and in many case their confidence with outside institutions. Low educational levels form a barrier to farmers understanding and holding the land allocation policy of the government.

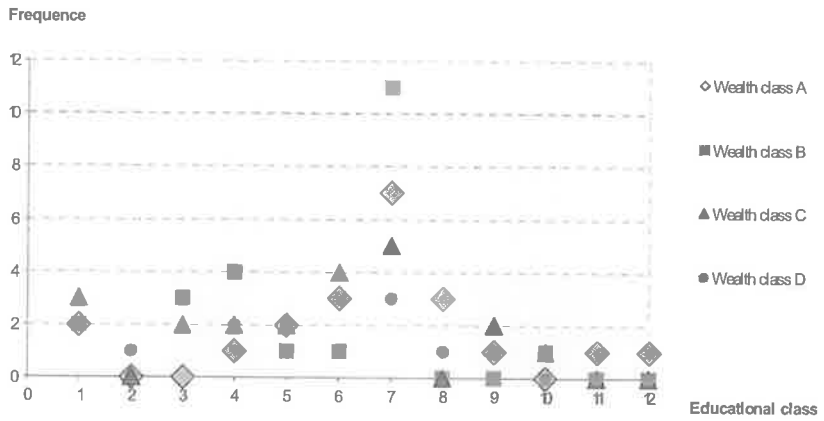

Figure 4.9 Relative individual educational level of each of wealth classes in the study villages in Hoa Binh Province

Sources: Results of Household interviews (2005)

To clearly understand the roles of the households in terms of land management and land ownership, a further correlation is analysed to identify the relationship between educational levels and land ownership. Its detail is illustrated in Figure 4.10. The figure shows that most farmers with any educational levels hold under 4 hectares of forestland. The farmers who have more than 4 hectares of forestland are most at the educational level 4 to level 7. It is possible that farmers with higher educational level may be in the situation to acquire more land for their family. However, this is not the case in this study as the correlation between educational level and land ownership is very low (only 10%).

It also mentions that all farmers have an equal chance to acquire land ensured with land tenure policy.

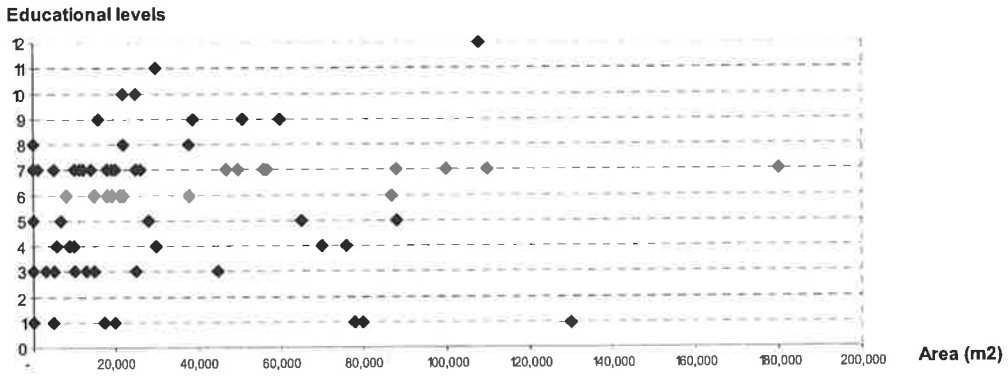

Figure 4.10 Relationship between educational levels and forestland ownership in Hoa Binh Province
Sources: Results of Household interviews (2005)

Needs analysis of households and communities

The needs and priorities of households were analysed across their requirements for paddy land and subsistence crops, water, cash, traction, fuel-wood, electricity and timber. These are presented in Table 4.6.

The needs and priorities of villagers vary across the study communities. However, consistently the two most important priorities are rice and water resource that directly relate the paddy cultivation. This is characteristic of subsistence agriculture where food security is the first thought of farmers. Access to fuelwood is also very important for the the Tay community of Tat Hamlet and to a lesser extent the Muong of Bap village. In the other villages, fuelwood is readily available within the village and so it is not considered a priority. Increasing the access to timber for construction is not apparent priority for any of the communities as new houses are being constructed from concrete rather than timber. Cutting timber for sale from surrounding protection forests is prohibited; however it is still carried out illegally. Much of the timber available in plantation forests is still immature. The low ranking given to the need for timber may be due to the perception that the plantation timber, when it matures, will supply their timber needs.

Notably, farmers in Suoi Bu village identified the need for electricity distribution from the central village to the forest farms. Electricity is seen to be necessary for the

development of forest farm activities in Suoi Bu. This suggests a more developed forestry culture in this community than others.

Table 4.6 Needs of the study communities in Hoa Binh Province

Needs \ Village	Suoi Bu		Bap		Khuong		Tat	
	Necessary*	Priority**	Necessary	Priority	Necessary	Priority	Necessary	Priority
Rice	10	II	10	I	10	I	10	I
Water for drink and irrigation	10	I	10	II	10	II	10	II
Cash	-	-	10	III	10	III	-	-
Traction (animal power)	5	V	-	-	10	IV	-	-
Other foods	10	IV	-	-	7	V	5	IV
Fuel wood	5	VI	8	IV	10	VI	7	III
Electricity line and lanes to forest farms	10	III	-	-	-	-	-	-
Timber	-	-	5	V	-	-	4	V

** The 'Necessary' of each demand was marked from 0 to 10 by the villagers* *** The priority was ranked by the villagers*

'-' Needs are not offered by village participants ***Sources: Results of Focus discussion groups (2005)***

Off-farm activities

Off-farm activities are important for making best use of available household labour and increasing household income. Such off-farm activities are presented in Table 4.7. If some off-farm activities, which use materials from forest products, are developed that may impact the perception of farmers on planting. Across the four villages, the off-farm activities of Bap village are more diverse than other villages. Activities include wine making, textile, hat making, and rattan basket making, which many persons (even children and elders) can work at any time at home. Bap villagers also have more opportunity to access to the outside employment than villagers of other communities. In contrast, Suoi Bu, Khuong, and Tat villages have very simple off-farm activities that cannot use all free labour in the free farming time.

The development of some off-farm activities within the household, particularly those using local traditional techniques or knowledge and local materials, is very important. Such activity not only benefits the household in terms of income, but it also serves many social issues. As in the case of Bap village, many households traditionally work with: 'Ruou can'* wine making, weave brocade textile, hat making, and rattan basket

* Rượu cần, a special wine product of Hoa Binh Province, is made with mixed materials, contained in the jar, and drunk out of a jar through bamboo pipes. "The ingredients of rượu cần include wild leaves, cassava roots and rice which are washed and put above an oven for 20 days or so. Then all the mixed ingredients are wrapped with large banana leaves and left in a corner of the house for a couple of days. As soon as the process of fermentation is completed, the whole brew is put into a jar. It is drunk on several occasions: Tết festival, wedding parties, groundbreaking ceremonies or other festive days. The jar containing the wine is put at a fixed place (in the middle of the house or the yard), so that as many people as possible can drink it. Pipes are put into the jar prior to drinking and a basinful of pure water is placed beside it. A buffalo horn to be used to pour water into the jar is put on a tray nearby. Not everyone is allowed to drink rượu cần. And the order of precedence is strictly observed. But there is no racial discrimination: the Kinh (Việt) may drink with the Thái and Mường. When all the guests are seated, the host pours water from the basin into the jar. At first, he invites the guests to taste the wine from a jar whose wine is bitterer than others. This is meant to remind everyone of the bitterness of life. Then a second jar is brought in which the wine tastes more pungent. In the third jar, the wine is sweetest symbolizing that "your heart can be happy after so much grief". Drinking rượu cần is accompanied by Múa Xoè (a dance of the Thái ethnic minorities) and drum beating. All this is to help the host and guests forget all their daily worries and enjoy to the utmost the pleasure of tasting rượu cần" (LACVIET DICTIONARY, Lacviet Dictionary Software 2002).

making. These activities can take all advantages of the labour sources, and non-timber forest products, which are available at the village.

Table 4.7 Off-farm activities of the study villages in Hoa Binh Province

Off-farm activities		Month: Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Quantification (persons)
Brick making	Suoi Bu													None
	Bap			Hoa Binh								Hoa Binh		40
	Khuong													None
	Tat													None
Brocade textile weaving	Suoi Bu													None
	Bap	About 60 % of total households weave brocade textile at home for use and sale (only female)												60% HHs
	Khuong	Some households weave brocade textile at home for use in the free time (only female)												Some
	Tat													None
Building worker	Suoi Bu													None
	Bap	Working inside the Lac Son District												15
	Khuong													None
	Tat													None
Carpenter	Suoi Bu													None
	Bap	Working outside the village (No workshop in the village)												10
	Khuong	Working outside the village (No workshop in the village)												10
	Tat	Working inside the Hamlet (only one workshop in the Hamlet)												3
Hat making	Suoi Bu													None
	Bap	Working at any time if having order												10
	Khuong													None
	Tat													None
Labour service	Suoi Bu			Outside village								Outside village		-
	Bap													None
	Khuong													None
	Tat													None
Maison coolie	Suoi Bu	Working outside the village												-
	Bap			Everywhere										30
	Khuong		Hanoi					Hanoi						20
	Tat													None
Rattan basket making	Suoi Bu													None
	Bap	Working at any time if having order												50 HHs
	Khuong													None
	Tat													None
Services	Suoi Bu	Serving in the village: plucking rice, grinder, and small trading shops												8
	Bap	Serving in the village: plucking rice, grinder, and small trading shops												12
	Khuong	Serving in the village: grinder, small trading shops												9
	Tat	Serving in the village: grinder, small trading shops, and transportation												11
Wine making	Suoi Bu													None
	Bap	Making wine for use and sale in the Lac Son District												30
	Khuong													None
	Tat													None

Sources: Results of Focus discussion groups, and household interviews (2005)

Some off-farm activities closely relate to farm activities, for example wine making and pig feeding. In Bap village, most households that made wine are usually more involved with raising pigs than others. These households use fermented distiller's grains, a sub-product of wine making, as feed for their pigs.

As shown in Table 4.7, the members of some households working professional off-farm activities, such as building worker, maison coolie, and carpenter, usually spend all their time on these activities. However, while one or two persons of each household work may be in engaged in off-farm work, farming is still identified as the main activity of the household.

From the above analysis it seems that upland households derive most of their cash income from off-farm activities. Agricultural activities mainly supply subsistence needs. These off-farm activities have to fit in around the time dedicated to farming activity. However such off-farm activity can create a capital source from which to invest in tree planting and other farming activities.

4.2. Existence of forestry

The section presents the existing forestry and perception on forestry of the households of the study villages. Two major aspects carried out in the section are forest management and plantations.

4.2.1. Forest management

Forestland status

Based on the information collected from focus group discussions and household interviews, the forestry status of the households is synthesized and shown in Figure 4.11 and Figure 4.12.

Generally, most households of Muong communities including Suoi Bu, Bap and Khuong villages have both protection forest and production forestland. The total forestland area of the interviewed households is the biggest in Suoi Bu village, accounting for about 5.8 hectares per household, while in Bap and Khuong villages the forestland area is about 2 hectares per household. A large area of the household's forestland of all villages is protection forestland. In contrast, Tay households in Tat

Hamlet currently have only protection forest, accounting for about 3 hectares per household (Figure 4.11).

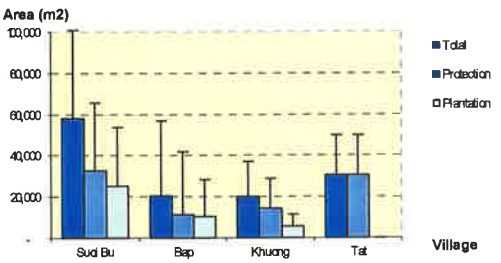

Figure 4.11 Average forestland area of households of all wealth classes in the 4 villages studied in Hoa Binh Province

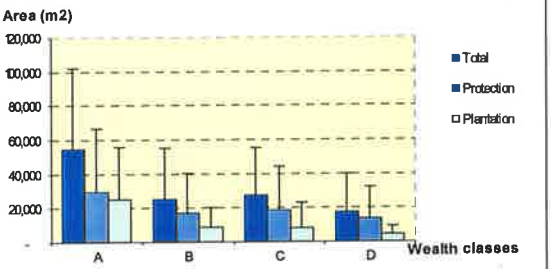

Figure 4.12 Average forestland areas of households of each of the 4 wealth classes across the 4 villages studied in Hoa Binh Province

Note: Error bars represent standard deviation.

Sources: Synthesized results of Household interviews, 2005 (see Appendix B.3.)

Forestland area differs in different household classes. The forestland area is much different between class A and D. While the households of class A own the largest area of about 5 hectares per household, the households of class D have about 1.6 hectares. The households of classes B and C have the equivalent forestland area, accounting for about 2.5 hectares (Figure 4.12).

Figures 4.11 and 4.12 also show that the deviation of the forestland area farmers hold is broad. Some farmers own a large area of up to 10 hectares, but some others do not have. Wealthy households seem having larger forestland area than others, but the correlation is not strong enough to prove that. The correlation between wealth classes and forestland area is 31% (see Appendix B.3).

The difference of having forestland of the household classes partly relates to the chance of the households on forestry development, especially on planting. Forestland's proportion of the households is presented in Figures 4.13 and 4.14.

As illustrated in Figure 4.13, households of Suoi Bu village have more planting opportunities than Bap and Khuong villages, because of the plantation forestland area farmers have. It accounts for more than 40% of total forestland of the households in Suoi Bu and Bap, while it is about 25% in Khuong villager. In particular, Tay households in Tat Hamlet do not have plantation forestlands in the time of the survey; however it does not mean Tay households do not have chance to plant, because a large forestland area of Tat is currently unused sloping lands as presented in Table 4.1. If

these unused lands are allocated to the households, Tay farmers will have much more land for planting than Muong farmers. Recently, Tay households have the chance to plant trees into the protection forestlands for forest enrichment.

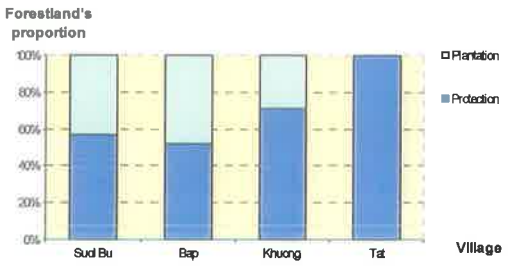

Figure 4.13 Forestland's proportion of households of all wealth classes in the 4 villages studied in Hoa Binh Province

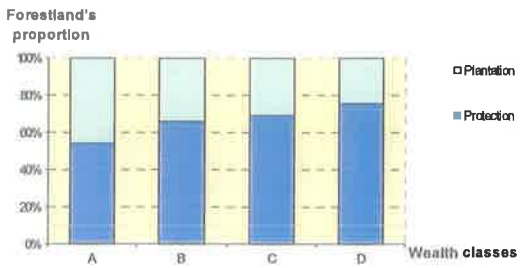

Figure 4.14 Forestland's proportion of households of each of the 4 wealth classes across the 4 villages studied in Hoa Binh Province

Sources: Synthesized results of Household interviews, 2005

Across wealth classes, the proportion of plantation area of wealthy households seems higher than others, accounting for about 45% of total forestland area of the households. Moderately wealthy and moderately poor households have the equivalent plantation's proportion of about 30%, while poor farmers have about 25% of total forestland area of the households. It indicates that the wealthy households have more chance to increase planting trees than others (Figure 4.14).

Forestry management of the communities

The forestry management status the study communities of is briefly presented in Table 4.8. This section indicates the forest management of the communities in terms of forestland allocation, and types of forest management.

Forestland allocation

As presented in Table 4.8, forestland allocation differs between the study villages. In all villages, the allocation of forestlands for the households begun in 1995 or 1996, and the land tenure is 50 years. The allocation was completed in 1999 in three Muong villages: Suoi Bu, Bap, and Khuong. In contrast, in Tat Hamlet the allocation was done with protection forests. A large area, planned as forestland by Da Bac District authorities, is currently swidden land and bare land. In Suoi Bu, Khuong and Tat Villages, the protection forestlands were allocated to most households, but 12 households in Bap village. In Tat Hamlet, the protection forest area allocated to the households is generally

near and coming right up to the back of houses. Differently, 12 households of Bap village, the earliest households, were actively agreed protecting forests, and they are most the wealthy class A. Like 12 households of Bap village, the households of the class A not only have larger forestlands but also their protection forests are located near home that is easy to manage especially in Suoi Bu and Khuong villages.

Table 4.8 Forestry status of the households in the study villages

Status		Suoi Bu Village	Bap Village	Khuong Village	Tat Hamlet
Forest area per household (m^2)	Total	58,000	20,436	20,104	30,714
	Protection	32,850	11,250	14,292	30,714
	Plantation	25,150	10,474	5,813	-
Year of allocation		1996 - 1999	1996 - 1999	1995 - 1999	1996
Land tenure (years)		50	50	50	50
Forestland allocation		Both protection and plantation forestlands	Both protection and plantation forestlands	Both protection and plantation forestlands	Only protection forestlands
Land certificate		*Red Book*	*Red Book*	*Red Book*	*Red Book*
Management types		Based on individual households	Based on individual households	Based on individual households	Based on individual households and community
Protection forest management		Forest protected promise	Forest protected promise	Forest protected promise	Forest protected promise
Households have protection forests		Most households	12 households	Most households	Most households
Tree species of protection forests		*Neohouzeaua dullooa* *Dendrocalamus patellaris* *Castanopsis chinensis* *Pasania ssp* *Engelhardtia chrysolepis* *Ormosia balansae* *Knema conferta*	Mainly iron wood regeneration: *Erythrophloeum fordii* Others: *Neohouzeaua dullooa* *Castanopsis chinensis* *Pasania ssp* *Engelhardtia chrysolepis* *Canarium album* *Michelia mediocris*	*Neohouzeaua dullooa* *Castanopsis chinensis* *Pasania ssp* *Engelhardtia chrysolepis* *Styrax tonkinensis* *Aleurites montana*	*Neohouzeaua dullooa* *Castanopsis chinensis* *Pasania ssp* *Engelhardtia chrysolepis* *Styrax tonkinensis* *Aleurites montana* *Melia azedarach* *Livistona cochinchinensis*
Protection forest border		Clear Identification	Clear Identification	Clear Identification	Unclear Identification
Protection		Forbidding 'slash and burn', and timber harvest	Forbidding 'slash and burn', and timber harvest	Forbidding 'slash and burn', and timber harvest	Forbidding 'slash and burn', and timber harvest
Harvesting protection forest products		Fuel wood, and non wood products	Fuel wood, and non wood products	Fuel wood, and non wood products	Fuel wood, and non wood products

Sources: Synthesized results of the Focus Group Discussions and household interviews (2005)

Across the wealth classes (link with Figure 4.14), wealthy households have much more chance for planting than others in terms of land availability. Wealthy households not only have a larger forestland area, but also better land and nearer home than others, because they were more confident to adopt forestland early when land allocation policy was implemented than others. They were the earliest households to own forestlands, so they had chance to choose the good places. At the time that land was made available the villagers of other wealth classes had the same opportunity to adopt forestland but did not take it. They waited to observe the wealthier farmers gaining benefit from the forest before they gained confidence in doing this themselves. The poorest households were

even slower to adopt forestland and so received the poorer land at distance from the village.

Forest management types

Generally, there are two types of forest management in the study villages: that based on the individual household, and that based on the community. All forestlands of three Muong villages were allocated to the households, so the forest management in their communities is based on the individual household. Particularly, in Tat Hamlet the forests are managed not only based on the households but also based on the community. The difference of forest management between Muong villages and Tay Hamlet is much clearer in terms of the protection forest management.

The protection forests of all villages are most naturally secondary forests that the main tree species is shown in Table 4.8. In particular, most protection forests of Bap village are ironwood regeneration, which are the high value timber forests. That is a chance for Bap villagers to develop their ironwood plantings with the available seed sources. Muong villagers can identify the borders of their protection forests, while many Tay villagers could not realize the borders of their forestlands that indicate Muong farmers will adopt planting and forest management better than Tay villagers. Generally, most villagers of all villages are aware that they are forbidden to slash and burn, and harvest timber from the protection forests. However, some individuals of Suoi Bu village illegally burn the protection forest area to grow acacia (Notes from the fieldwork).

Box 4.2 Forest management of Tay in Tat community of Hoa Binh Province

Two types of protection forest management in Tat hamlet are household management and community management.

- Most protection forests were allocated to households managed with the Red Books issued in 1996. However, the borders between households are not clarified. Some households cannot identify the border of their forests. Some households manage a large area up to 7 hectares of protection forest. Nevertheless, the average area is about 1.7 hectares per household. Farmers can harvest dry firewood and non-wood forest products in the protection forests, but swidden is entirely forbidden.
- The community forests of Tat hamlet, the old secondary forests mixing timber trees and bamboo, are the watershed forests. Two tracts of community forests are located in Dau Voi *(Elephant Head)* and Suoi Muong *(Muong Stream)* totalling 25 hectares. These forests are managed by Tat Cooperative, which is led by the Chief of the hamlet. Like the forests protected by households, swidden is also banned, but the Cooperative members can harvest firewood and non-wood products. The Cooperative's rules let the members to harvest bamboo stems by seasons, usually twice per years. Actually, not only the members, but also others can harvest products at any time, particularly bamboo shoots, bamboo stems and other non-wood products.

Results of Focus group discussion (2005)

In contrast, the forest management in Tat Hamlet is based on households and community forests managed by Tat Cooperative (see Box 4.2). This Cooperative is the institution through which farmers may collaborate in trees planting and management.

However, it is a relict of the old pre-*Doi Moi* era cooperatives. In other villages, these cooperatives transformed into more sophisticated organisations that adapted to *Doi Moi* policies. The Tat Cooperative provides much more limited services and its Chief has not been trained in new policies and management as other Village Chiefs.

Forest harvest and households' perception

Existence of forest harvest of the villages

Table 4.9 presents the dimensions of forest harvesting activities of the villages. Nearly 100 percent of the households of the study villages participate in the forest harvesting. Excepting Khuong village, the others villages all have harvesting professionals, or woodmen, accounting for 18 persons, 10 persons, and 25 persons of Suoi Bu, Bap and Tat villages/hamlet, respectively. Moreover, woodmen were identified only in about 30 households Tat Hamlet most of which belonged to wealth classes C and D. It means that the households of groups C and D are more dependent upon natural forest products than households of groups A and B. So, while the wealthy and moderately wealthy households are approaching the new ways of their economic development, the moderately poor and poor villages are still stuck in the old ways to develop their livelihoods with the dependence of natural forests. So it seems that there farmers perception of the utility of natural forests differs across the wealthy and poor classes.

Table 4.9 Characteristics of forest harvest in the study villages

Villages	Harvesters		Middle-men		Processing men			Notes
	General	Professional	Local	Outside	Carpenters	Traditional Doctors	Woodmen	
Suoi Bu	100 % households	18 persons	2 persons	7 persons	0	0	0	Bamboo harvesters are professional harvesters. They earn much from bamboo harvesting. However, bamboo forests are now died that cuts the living way of many villagers.
Bap	100 % households	10 persons	0	11 persons	10 persons	5 persons	10 persons	10 persons are the professional harvesters. 5 persons are middle-men of bamboo collecting; 6 persons are middle-men of wood collecting. There are 10 carpenters, but they work out site the village.
Khuong	80 % households	0	0	6 persons	10 persons	5 persons	0	Villagers harvest forest products when they have orders of Middleman. Villagers do not harvest for processing and store.
Tat	100 % households	25 persons	5 persons	10 persons	3 persons	0	30 households	Villagers harvest forest products when they have orders of middlemen. 5 local middlemen collect mainly NTFPs from villagers to sell to outside middlemen. There is only one carpenter workshop in the village: saw-mill and carpenter. About 30 households harvest fuel wood for sale. About 25 persons still harvest timber from Phu Tho Province illegally.

Sources: Results of the Focus group discussions (2005)

Timber processing at the village level is very limited. Some carpenters and traditional doctors can use a few products for processing. Some of them are mainly working outside the villages. Currently, the demands for forest products by these people are low

and still being met by the existing forests. So, there is little stimulus for tree planting from this sector of the community.

Forest products and household's perception

According to the Law of Forest Protection and Development issued in 1992, households have the right to harvest all forest products of their plantations. However, only a few forest products are actually taken from plantations and most forest products are taken from the natural forests. Forest products fall into two major categories: Wood or timber products, and non-timber forest products (NTFPs). (See photos in Appendix C6a).

Table 4.10 Forest products of the study villages in Hoa Binh Province

	Forest products	Vietnamese names	Tree species scientific names	Harvesting in the villages				Sources
				Suoi Bu	Bap	Khuong	Tat	
Timber	Wood of low quality	Go tap	-	A	-	A	A	Plantation and natural forests
	Rose wood	Go hong sac	-	-	-	-	A	Natural forests
	Acacia	Keo	*Acacia sp.*	-	A	-	-	Plantation
	-	Lat hoa	*Chuckrasia tabularis*	A	A	-	-	Plantation
	Jack-fruit	Mit	*Artacarpus heterophyllus*	-	A	-	-	Plantation
	Longan	Nhan	*Euphoria longan*	-	A	-	-	Plantation
	-	Soi	*Pasania sp.*	-	-	-	A	Natural forests
	Bead-tree	Xoan	*Melia azedarach*	A	A	-	A	Plantation and natural forests
Non timber forest products (NTFPs)	Bamboo shoot and stems	Buong	*Gigantochloa scribneriana*	A	A	A	A	Plantation
		Giang	*Dendrocalamus patellaris*	A		A	A	Natural forests
		Luong	*Dendrocalamus membranaceus*	A	A	A	A	Plantation
		Nua	*Neohouzeaua dullooa*	A	A	A	A	Natural forests
		Tre	*Bambusa arundinacea*	A	A	A	A	Plantation and natural forests
		Vau	*Phyllostachys bambusoides*	A	-	A	A	Plantation and natural forests
	Fruits	Tai chua	*Garcinia cowa*	-	-	A	-	Plantation and natural forests
		Tram	*Canarium album*	-	A	A	-	Plantation
	Fuel wood	-	-	A	A	A	A	Plantation and natural forests
	Medicinal plants							
	Liquorice	Cam thao	*Abrus precatirius*	-	-	A	-	Natural forests
	-	Ba kich	*Monrinda officinalis*	-	-	A	-	Natural forests
	-	Cu ba muoi	*Sp.*	-	-	A	-	Natural forests
	Loris	Culi	*Sp.*	-	-	-	A	Natural forests
	-	Day tang	*Sp.*	-	-	-	A	Natural forests
	-	Sam cau	*Peliosanthes teta*	-	-	A	A	Natural forests
	-	Khuc khac	*Heterox milaxgaudich-audiana*	-	-	A	A	Natural forests
	Fomes japonicus	Linh chi	*Sp.*	-	A	-	-	Natural forests
	-	Ngu day	*Sp.*	-	-	A	-	Natural forests
	-	Nhuong	*Sp.*	-	-	A	-	Natural forests
	-	Vo bat	*Sp.*	-	-	A	-	Natural forests
	-	Vo chua	*Sp.*	-	-	A	-	Natural forests
	-	Xa vang	*Sp.*	-	-	A	-	Natural forests
	Seeds							
	-	Gioi xanh	*Michelia mediocris*	-	A	-	-	Plantation and natural forests
	-	Lim xanh	*Erythrophloeum fordii*	-	A	-	-	Natural forests
	Animals							
	Bees	Ong	*sp.*	-	-	A	-	Natural forests
	Civet	Cay	*sp.*	-	-	A	-	Natural forests
	Frog	Ech	*Sp.*	-	-	A	-	Natural forests
	Gecko	Tac ke	*Sp.*	-	-	A	-	Natural forests
	Jungle fowl	Chim rung	*sp.*	-	-	A	-	Natural forests
	Snake	Ran	*sp.*	-	-	A	-	Natural forests
	Stone snail	Oc da	*Sp.*	-	-	A	-	Natural forests
	-	Bim bip	*Centropus sinensis*	-	-	A	-	Natural forests
	Others							
	Banana leaf	La chuoi	*Musa acuminata*	A	-	-	-	Natural forests
	-	La dong	*Phrynium*	A	-	-	-	Natural forests
		Re	*Sp.*	A	-	-	-	Natural forests
	Cat's ear (peziza)	Moc nhi	*Sp.*	-	-	-	A	Natural forests
	Broom flower	Chit	*Thysano lacnamaxina*	A	-	A	-	Natural forests
	-	Guot	*Sp.*	-	-	-	A	Natural forests
	Palm leave	La co	*Livistona saribus*	-	-	-	A	Plantations in the protection forests

'A' Forest products are available and harvested at the villages/hamlets; '-' Forest products may exist in the villages, but were not identified and collected by villagers.

Sources: Results of the Focus group discussions (2005)

As presented in Table 4.10, most wood products are not high-value timber. The main exception to this is the timber of *Pasania sp.*, which is illegally cut by some villagers of

Tat Hamlet from Phu Tho Province that is the border province of Hoa Binh. That mentions Tat people are able to engage in illegal harvest of natural timber easier than Muong villages. Only in Bap village, is all wood cut and sold from plantations. In the other villages most timbers are taken from natural forests.

Non-timber forest products are very diverse. Most non-wood products are collected from the natural forests excepting two species of bamboos which are mostly grown in plantations: *Gigantochloa scribneriana (Buong),* and *Dendrocalamus membranaceus (Luong)*. Bamboos and medicinal plants are the main NTFPs harvested. Other species, such as *Garcinia cowa* and *Canarium album* for fruits; *Michelia mediocris* and *Erythrophloeum fordii* for seed; banana leaf, palm leaf, and broom flower are harvested depending on their availability in each village. Households can harvest any non-wood products if they can sell or use them as food including wild animals. In terms of the numbers of non-wood species, Khuong village have many more non-wood products collected by the households than in other villages that implies Khuong villagers know more species than villagers in others. It also mentions that the more NTFP species people harvest the more they have more income sources. That may encourage farmers regarding to forest management, and plantings.

Classification of forest products and household's perception

Table 4.11 shows the forest product classification of farmers of the study villages. In the timber product category, farmers mainly classify wood from the plantations, especially wood of acacia, because timber from natural forests always belongs to good wood category. Further more, natural forest wood is not legal availability to harvest. It is the fact that villagers only cut and saw mill for the good timber inside the forests, and they leave branches and slabs at the forests because they are illegal harvesters. Timbers are mainly classified by the diameter. In terms of the non-wood products, bamboos are classified carefully of 5 classes of bamboo stems. However, the indicators for classification are different in the study villages that depend on the orders of middlemen.

Table 4.11 Classification of forest products in the study villages of Hoa Binh Province

Forest products		Vietnamese names	Tree species scientific names	Classification	Description			
					Suoi Bu Village	Bap Village	Khuong Village	Tat Hamlet
Timber	Low quality	Go tap	-	-	Diameter > 20 cm	-	Styrax, Kapok	Length: 2.5 m; Diameter: 15 cm
	Rose wood	Go hong sac	-					
					Chestnut	-	-	Timber box: 20cm x 15 cm x 2.5 m
	Acacia	Keo	*Acacia sp.*	I	-	Diameter: > 45 cm	-	-
				II	-	Diameter: 20 - 40 cm	-	-
				III	-	Diameter: < 20 cm	-	-
	-	Lat hoa	*Chuckrasia tabularis*	I		Diameter: > 45 cm	-	
				II	-	Diameter: < 40 cm	-	-
	Jack-fruit	Mit	*Artacarpus heterophyllus*	I	-	Diameter: > 40 cm	Non description	
				II	-	Diameter: < 40 cm	Non description	-
	Longan	Nhan	*Euphoria longan*	-	-	-	Non description	-
	-	Soi	*Pasania sp*	-	-	-	Non description	-
	Bead-tree	Xoan	*Melia azadarach*	I	Diameter: > 20 cm	Diameter: > 45 cm, length: >3,5 m	Non description	Length: > 2.5 m; Diameter: > 20 cm
				II	-	Diameter: < 40 cm length: <3,5 m	Non description	Length: 2.5 m; Diameter: 15 cm
Non timber forest products (NTFPs)	Bamboo shoot	Buong	*Gigantochloa scribneriana*	-	Fresh bamboo shoot	-	-	Fresh bamboo shoot
		Giang	*Dendrocalamus patellaris*	-	Fresh bamboo shoot	-	-	-
		Luong	*Dendrocalamus membranaceus*	-	Fresh bamboo shoot	-	-	Fresh bamboo shoot
		Nua	*Neohouzeaua dullooa*	-	Fresh bamboo shoot	-	-	Fresh bamboo shoot
		Tre	*Bambusa arundinacea*	-	-	-	-	-
		Vau	*Phyllostachys bambusoides*	Bitter	-	-	-	Fresh bamboo shoot
	Bamboo stems	Buong/Luong	*Gigantochloa scribneriana; Dendrocalamus membranaceus*	I	Length: > 6m; Diameter: > 10 cm	Length: > 6m; Diameter: > 10 cm	Length: > 6m; Diameter: > 10 cm	-
				II	Length: < 6m; Diameter: < 10 cm	Length: < 6m; Diameter: 8 - 10 cm	Length: < 6m; Diameter: < 10 cm	-
				III	-	Length: < 6m; Diameter: < 8 cm	-	-
				IV	-	Length: cut by 2,5 m	-	-
		Giang	*Dendrocalamus patellaris*	-	Diameter: 3 - 4 cm	-	-	-
		Nua	*Neohouzeaua dullooa*	I	Diameter: 7 cm; length: 80 cm	-	Diameter: 4-5 cm	Diameter: 4-5 cm; Length: 4-5m
				II	Diameter: 5 - 6 cm; length: 60 cm	-	Diameter: 3 - 4 cm	Diameter: 3-4 cm; Length: 4-5m
				III	Diameter: 3 - 4 cm; length: 60 cm	-	Diameter: 2 - 3 cm	-
				IV	Diameter: 2 cm	-	Diameter: 2 cm	-
				V	The first smallest stem called "Tep"	-	The first smallest stem called "Tep"	-
		Tre	*Bambusa arundinacea*	I	-	-	Stem in full, Length: > 6 m, Diameter: < 7 cm	-
				II	-	-	Using as stake; Length: 1.5 m; Diameter: < 6 cm	-
		Vau	*Phyllostachys bambusoides*	I	-	-	Diameter: 4-5 cm	-
				II	-	-	Diameter: 3 - 4 cm	-
				III	-	-	Diameter: 2 - 3 cm	-
				IV	-	-	Diameter: 2 cm	-
				V	-	-	The first smallest stem called "Tep"	-
	Fruits	Tai chua	*Garcinia cowa*	-	-	-	Fresh fruit	-
		Tram	*Canarium album*	-	-	-	Fresh fruit	-
	Fuel wood	-	-	I	From stone mountains	Tree-trunk	Stems, chopped length 2.5 m	Stems, chopped length 2.5 m
				II	Non from stone mountains	Branches	Branches, cut and bunched ~ 7kg/bunch	Branches, cut and bunched ~ 3 kg/bunch
	Medicinal plants							
	Liquorice	Cam thao	*Abrus precatirius*	-	-	-	Fresh	-
	-	Ba kich	*Morinda officinalis*	-	-	-	Fresh	-
	-	Cu ba muoi		-	-	-	Fresh	-
	Lots	Cat		-	-	-	Fresh	Fresh
	-	Day tang		-	-	-	Fresh	Length: 50 - 60 cm; Fresh
	-	Sam cau	*Peliosanthes tela*	I	-	-	Fresh	Small root, fresh
				II	-	-	Fresh	Big root, fresh
	-	Khuc khac	*Helerox milaxgaudich-audiana*	Fresh	-	-	Fresh	-
				Dry	-	-	Fresh	Cut and dry
	Fomes japonicus	Linh chi		-	-	-	Fresh	-
	-	Ngu day		-	-	-	Fresh	-
	-	Nhuong		-	-	-	Fresh	-
	-	Vo bat		-	-	-	Fresh	-
	-	Vo chua		-	-	-	Fresh	-
	-	Xa vang		-	-	-	Fresh	-
	Seeds							
	-	Giot	*Michelia mediocris*	-	-	Dry seed	-	-
	-	Lim xanh	*Erythrophloeum fordii*	-	-	-	-	-
	Animals							
	Bees	Ong	*sp*	-	-	-	-	-
	Cavet	Cay	*sp.*	-	-	-	Alive	-
	Frog	Ech		-	-	-	Alive	-
	Gecko	Tac ke		-	-	-	Alive	-
	Jungle fowl	Chim rung	*sp.*	-	-	-	Alive	-
	Snakes			-		-	Grass-snake	
		Ran	*sp.*	-	-	-	Copperhead	-
	Stone snail	Oc da		-	-	-	Alive	-
	-	Bim bip	*Centropus sinensis*	-	-	-	Alive	-
	Others							
	Banana leaf	La chuoi	*Musa acuminata*	-	Fresh	-	-	-
	-	La dong	*Phrynium placentarium*	-	Fresh	-	-	-
	-	Re		-	Packing 100 stems/bunch	-	-	-
	Cat's ear	Moc nhi		-	-	-	-	Dry
	Broom flower	Chit	*Thysano lacnamaxina*	-	Fresh	-	-	
				-	Dry	-	-	-
	-	Giuot		-	-	-	-	Length: > 1 m, good and dry
	Palm leave	La cot	*Livistona saribus*	-	-	-	-	Pack of 10 leaves (fresh leave)

Sources: Results of the Focus group discussions (2005)

Legality of forest harvest and household's perception

Table 4.12 shows the legality of harvesting various forest products. It also indicates the understanding of farmers on forest harvesting policy/law. The farmers of all villages have the same understanding of forest products which are they can or cannot harvest. However, the perception and understanding of the paperwork and taxes concerning forest harvesting differs in different villages. Farmers of Tat hamlet do not know anything concerning the paperwork or taxes. In other villages, farmers have to get the agreement of the authorities when harvesting forests. All taxes or fees are paid by outside middlemen or outside buyers.

In comparison with legislations of the government, the awareness of the households is very limited. The details of this are being discussed in turn of the following chapters.

Table 4.12 Understanding of the legalities of forest harvesting in the villages of Hoa Binh Province

Forest products	Sources	Harvesting legality at the villages				Paper-works and taxes			
		Suol Bu	Bap	Khuong	Tat	Suol Bu	Bap	Khuong	Tat
Timber	Natural forests	Illegal	Illegal	Illegal	Illegal	-	-	-	-
	Plantations	Legal	Legal	Legal	Legal	• Buyers usually request legal papers that are confirmed by the Committee and mark of Forestry Guard Department • All wood and bamboo stems are paid taxes • Resource tax: 4 %	• Confirmation paper of the Commune officer if buyers needs • Do not know about taxes	• Confirmation paper of the Committee and mark of Forestry Guard Department • Resource tax: 15%	Do not need any papers/agreement of committees
Fuel wood	Natural forests	Legal	Legal	Illegal	Legal	• No any papers • Buyers pay fee for the committee	Only branches if harvesting from the protection forests.	Only branches if harvesting from the protection forests.	Do not need any papers/agreement of committees
	Plantations	Legal	Legal	Legal	Legal				
Bamboo stems and shoot	Natural forests	Legal	Illegal	Legal	Legal	• No any papers • Buyers must be paid committee fee of 5000 VND for about 1000 bamboo tubes	-	-	Agreement of the Forest Guard Department
	Plantations	Legal	Legal	Legal	Legal		(None)	• No any papers • 10% resource tax	(None)
Wild animals	-	Illegal	Illegal	Illegal	Illegal	-	-	• Fine from 200,000 to 500,000 VND • Releasing	-
Others NTFPs	-	Legal	Legal	Legal	Legal	• No any papers • Buyers pay fee for the committee	(None)	(None)	Do not need any papers/agreement of committees
		Notes				• All taxes and fees are paid by outside middleman • Legal papers usually need when farmers harvest a large area. Farmers do not ask legal papers if thinning.	-	Taxes are payed by middlemen	Do not know about taxes

Sources: Results of the Focus group discussions (2005)

Markets of forest products and household's perception

Most farmers do not know about the forest produce markets beyond their villages. Within the village, a forest produce market is established when middlemen come and to buy forest products. It is very convenient to farmers that forest product middlemen buy directly at the villagers' homes or plantations. Otherwise the farmers would have to transport their products to the district markets. However, the downside of this

arrangement is that farmers have no option other than accept the price offered by the middlemen.

Table 4.13 Prices of forest products in the study villages of Hoa Binh Province

	Forest products	Vietnamese names	Tree species scientific names	Classification	Prices of forest products at the villages				Units
					Suoi Bu	Bap	Khuong	Tat	
Timber	Low quality	Go tap	-	-	250,000	-	200,000	150,000	VND/m3 ste
	Rose wood	Go hong sac	-	-	700,000	-	-	800,000	VND/m3
	Acacia	Keo	*Acacia sp.*	I	-	200,000	-	-	VND/tree
				II	-	100,000	-	-	VND/tree
				III	-	40,000	-	-	VND/tree
	-	Lat hoa	*Chuckrasia tabularis*	I	-	2,000,000	-	-	VND/m3
				II	-	1,500,000	-	-	VND/m3
	Jack-fruit	Mit	*Artacarpus heterophyllus*	I	-	3,000,000	350,000	-	VND/m3
				II	-	2,500,000	-	-	VND/m3
	Longan	Nhan	*Euphoria longan*	-	-	1,000,000	350,000	-	VND/m3
	-	Soi	*Pasania sp.*	-	-	-	-	1,200,000	VND/m3
	Bead-tree	Xoan	*Melia azedarach*	I	500,000	400,000	350,000	600,000	VND/m3
				II	-	250,000	-	4,000	VND/each
Non timber forest products (NTFPs)	Bamboo shoot	Buong	*Gigantochloa scribneriana*	-	3,000	2,500	2,800	1,000	VND/kg
		Giang	*Dendrocalamus patellaris*	-	2,300		2,300	-	VND/kg
		Luong	*Dendrocalamus membranaceus*	-	3,000	2,500	2,800	1,000	VND/kg
		Nua	*Neohouzeaua dullooa*	-	2,300		2,300	2,000	VND/kg
		Tre	*Bambusa arundinacea*	-	-		-	-	VND/kg
		Vau	*Phyllostachys bambusoides*	Bitter	-		-	2,500	VND/kg
	Bamboo stems	Buong and Luong	*Gigantochloa scribneriana; and Dendrocalamus membranaceus*	I	10,000	9,000	10,000	-	VND/stem
				II	8,000	6,000	8,000	-	VND/stem
				III	-	4,000	-	-	VND/stem
				IV	-	2,500	-	-	VND/stem
		Giang	*Dendrocalamus patellaris*	-	2,000	-	-	-	VND/tube
		Nua	*Neohouzeaua dullooa*	I	500 (per tube)	-	400	300	VND/stem
				II	300 (per tube)	-	300	250	VND/stem
				III	100 (per tube)	-	200	-	VND/stem
				IV	80 (per tube)	-	60	-	VND/stem
				V	70 (per tube)	-	40	-	VND/stem
		Tre	*Bambusa arundinacea*	I	-	-	6,000	-	VND/stem
				II	-	-	3,000	-	VND/stem
		Vau	*Phyllostachys bambusoides*	I	-	-	400	-	VND/stem
				II	-	-	300	-	VND/stem
				III	-	-	200	-	VND/stem
				IV	-	-	150	-	VND/stem
				V	-	-	100	-	VND/stem
	Fruits	Tai chua	*Garcinia cowa*	-	-	-	2,000	-	VND/kg
		Tram	*Canarium album*	-	-	-	2,000	-	VND/kg
	Fuel wood	-	-	I	120	80	50	100	VND/kg
				II	80(per kg)	500	2,000	800	VND/bunch
	Medicinal plants								
	Liquorice	Cam thao	*Abrus precatirius*	-	-	-	250	-	VND/kg
	-	Ba kich	*Morinda officinalis*	-	-	-	1,500	-	VND/kg
	-	Cu ba muoi		-	-	-	300	-	VND/kg
	Loris	Culi		-	-	-	-	800	VND/kg
	-	Day tang		-	-	-		1,000	VND/kg
	-	Sam cau	*Peliosanthes teta*	I	-	-	6,000	2,000	VND/kg
				II	-	-	-	5,000	VND/kg
	-	Khuc khac	*Heterox milargaudich-audiana*	Fresh	-	-	1,000	800	VND/kg
				Dry	-	-	-	3,000	VND/kg
	Fomes japonicus	Linh chi		-	-	-	-	-	VND/kg
	-	Ngu day		-	-	-	300	-	VND/kg
	-	Nhuong		-	-	-	300	-	VND/kg
	-	Vo bal		-	-	-	300	-	VND/kg
	-	Vo chua		-	-	-	300	-	VND/kg
	-	Xa vang		-	-	-	2,500	-	VND/kg
	Seeds								
	-	Gioi	*Michelia mediocris*	-	-	400,000	-	-	VND/kg
	-	Lim xanh	*Erythrophloeum fordii*	-	-	2,000	-	-	VND/kg
	Animals								
	Bees	Ong	*sp.*	-	-	-	40,000	-	VND/beehive
	Civet	Cay	*sp.*	-	-	-	120,000	-	VND/kg
	Frog	Ech		-	-	-	25,000	-	VND/kg
	Gecko	Tac ke		-	-	-	25,000	-	VND/each
	Jungle fowl	Chim rung	*sp.*	-	-	-	40,000	-	VND/each
	Snakes			-	-	-	20,000		VND/kg
		Ran	*sp.*	-	-	-	120,000	-	VND/kg
	Stone snail	Oc da		-	-	-	5,000	-	VND/kg
	-	Bim bip	*Centropus sinensis*	-	-	-	50,000	-	VND/each
	Others								
	Banana leaf	La chuoi	*Musa acuminata*	-	600	-	-	-	VND/kg
	-	La dong	*Phrynium plasentarium*	-	1,400	-	-	-	VND/kg
	-	Re		-	4,000	-	-	-	VND/bunch
	Cat's ear	Moc nhi	*Peziza*	-		-	-	30,000	VND/kg
	Broom flower	Chit	*Thysano lacnamaxina*	-	1,000	-	-		VND/kg
				-	5,000	-	-	-	VND/kg
	-	Guot		-	-	-	-	6,000	VND/kg
	Palm leave	La co	*Livistona saribus*	-	-	-	-	700	VND/pack

Currency exchange: 1 Australian Dollar = 12,000 Vietnamese Dong (VND)

Sources: Synthesized results of the Focus group discussions and households interviews (2005)

As presented in Table 4.13, the prices of forest products of the study villages are listed paralleling the classification of forest products shown in Table 4.11. The prices of forest products differ in different villages because of the control of middlemen. High-value timbers are higher prices than the prices of others. For example, rose wood is 700,000 – 800,000 VND per cubic metre, while low quality wood is 150,000 – 250,000 VND per cubic metre. High value timber such as 'Lat hoa' - *Chuckrasia tabularis* is 2,000,000 VND per cubic metre that is ten times higher than low quality wood. In particular, acacia wood is easier selling than native wood because it is from plantations. The good acacia wood is 200,000 VND per cubic metre. Farmers get the best price for acacia if acacia wood is big enough for sawmill, especially *Acacia mangium*. However, just a few villagers know about that. The price of bead-tree wood is also high of 350,000 – 600,000 VND per cubic metre. Timber prices at the villages may be lower than that in the outside markets; however these prices are very good to growers.

The non wood products are all low prices, however farmers can annually harvest with large volume, especially bamboo stems and bamboo shoots. NTFP prices vary in different villages that depend on the available access of middlemen. Nevertheless the ready market for bamboo, and the fact that it can be openly transported without interference (illegally cut native timber is difficult to conceal during transportation), encourages farmers to grow bamboo even though the prices are low. Further reasons are presented in following sections.

Conflicts relate to forestry in the study villages

This section looks for the conflicts that relate the planting of the households. Table 4.14 shows the conflicts occurred at the villages, and identified by such villagers.

The main conflicts occurring across the communities are between the households and authorities, and middlemen. Notably, the significant conflicts that directly affect the planting of households are land borders and farming activities. These conflicts occur often in Bap village and Tat Hamlet. In Bap the conflicts are with one of four neighbouring villages. In Tat, it may be more serious, because the conflict occurs between the households within the village. Within the farming systems in Tat, free grazing, swidden cultivation, and tree planting share the same area. This presents a challenge to the decision makers of Tay households regarding tree planting.

Table 4.14 Conflicts of forest management at the study villages of Hoa Binh Province

Conflicts	Statement			
	Suoi Bu Village	Bap Village	Khuong Village	Tat Hamlet
Between harvester and officer	-	-	Illegal harvest Seize and keep; to be fined	Illegal harvest Seize and keep; to be fined
Between household and the authorities	Household slashes and burns into the protection forests for new planting.	-	-	Household slashes and burns into the protection forests for swidden
Between harvester and protection households	Harvesting products owned by other persons	-	Stolen harvest Harvesting products owned by other persons Fighting over selling Envying others who can harvest much more	Harvesting products owned by other persons
Between harvesters and outside middlemen	Middlemen reduces prices Banning other middlemen buy products of the harvesters	-	The products are not as good as the offer Do not agree about prices Lack of legal papers Middleman reduces prices	-
Between Middleman and officer	-	-	Do not obey the rules: taxes, fees...	-
Between middlemen	Buying with different prices of one product Fighting over to buy	-	Buying with different prices of one product Fighting over to buy	-
Border conflicts	-	Borders between the forestlands of Bap and other villages	-	Between the households
Farming activities	-	-	-	Between free grazing and new plantings

Sources: Results of the Focus group discussions (2005)

4.2.2. Tree planting

Generally, the households in Hoa Binh Province currently plant tree species with and/or without incentives. However, there are differences between household classes and between households of the communities regarding the activeness of planting. Households plant acacia, bamboo, and/or native wood tree species. As presented in Table 4.15, many households of the study sites are aware and active in terms of planting acacia species, and bamboo species. In contrast, planting native timber tree species of the households is very limited.

Table 4.15 Planting characteristic of the study villages in Hoa Binh Province

Plantings	Planting characteristics of the households in the villages/hamlet			
	Suoi Bu	Bap	Khuong	Tat
Acacia species	Widely and actively	Widely and actively	Increasingly and actively	No planting
Bamboo species	Widely and actively	Widely and actively	Limited planting	Incentive of 661 Project
Native wood tree species	Beginning awareness	Limited planting	Rarely	Incentive of 661 Project

Sources: Synthesized results of the Transects, Focus group discussions and Household interviews (2005)

Planting acacia and bamboo species

Planting area of acacia and bamboo species

The areas planted to acacia and bamboo is often not clearly delineated. This is especially so in Suoi Bu village. Thus, planting of acacia and bamboos of the households is considered here in the same sub-section. (See photos in Appendix C6b).

The relative sizes of area planted to acacia and bamboo species varies across the study villages. As illustrated in Figure 4.15, acacia species are mainly planted by the farmers of Muong villages including Suoi Bu, Bap and Khuong. The planting area of acacia is the largest in Suoi Bu village, accounting for about 13,000 m^2 per household. The households of Bap village also have near one hectare of acacia planting per household. By way of contrast, households of Khuong village began planting acacia species later than that in Suoi Bu and Bap villages. The current area of acacia is about 5,000 m^2 per household. However, this area planted to acacia is increasing. Only in Tat Hamlet, acacia species have never been introduced, and farmers also lack information of acacia planting.

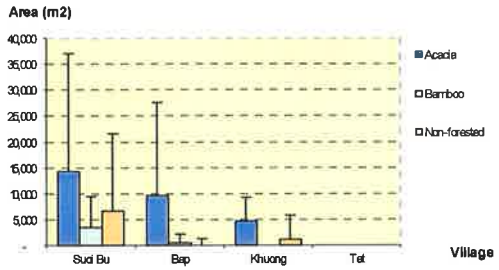

Figure 4.15 Average plantation area of the households of the study villages in Hoa Binh Province

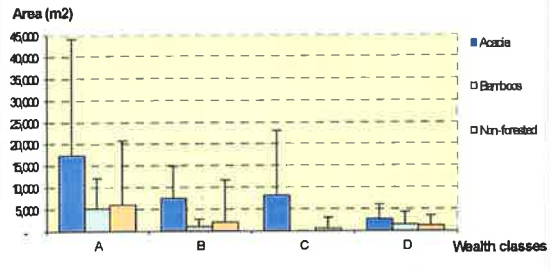

Figure 4.16 Average plantation area of the household of each of wealth classes across the villages in Hoa Binh Province

Note: Error bars represent standard deviation.

Sources: Synthesized results of Household interviews, 2005 (see Appendix B.4)

As with acacia, the households Suoi Bu village also have the biggest area of bamboos, accounting for about 3,000 m^2 per household. Farmers in Khuong village and Tat Hamlet were observed to have planted bamboo species; but the area is very small and scattered. No interviewees of either village identified the area of their bamboo planting.

Farmers in Suoi Bu still have larger *Red Book's* forestland area available for planting than farmers in other study villages. It accounts for 8,400 m^2 per household in average (Figure 4.15).

The planting area of acacia and bamboo varies strongly between the household classes (Figure 4.16). Wealthy households not only have the largest area of forestland, but also plant the biggest area of acacia and bamboo, accounting for about 17,000 m^2 and 5,000 m^2 per household that occupy 32% and 9% of the forestland area, respectively. In contrast, the households of class D have not only small forestland area, but also the smallest planting area of about 3,000 m^2 and 2,000 m^2 of acacia and bamboos species per household that account for 15% and 8% of the forestland area, respectively.

Especially, households of class B and class C are similar planting area of about 7,000 – 8,000 m^2 per household. The acacia ratio of the households of classes B and C is about 30% of the forestland area, respectively. The households of class B plant bamboo that its ratio is 4% of the total forestland area, but the households of class C do not plant bamboo species (Figure 4.17).

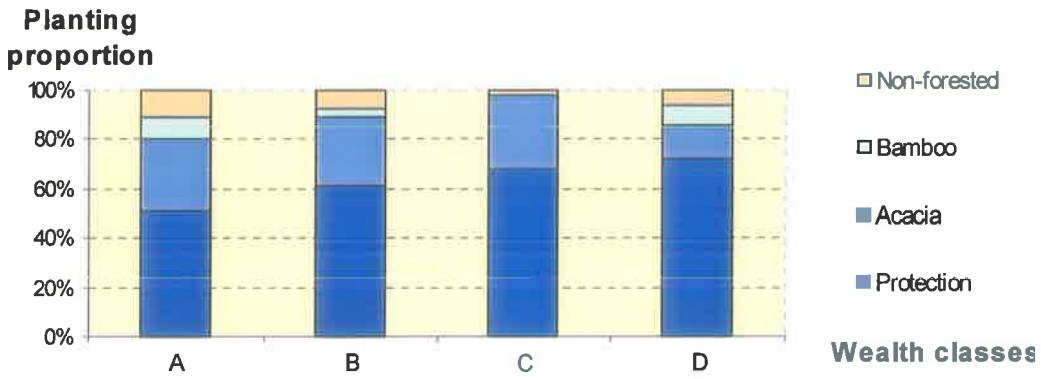

Figure 4.17 Relative proportion at forest landuse of households of each of wealth classes in the study villages in Hoa Binh Province

Sources: Synthesized results of Household interviews, 2005 (see Appendix B.4)

Note: Non-forested means land that has been allocated in the Red Book for forestry, but has not yet been planted and it is usually under swidden cultivation.

Figure 4.17 clearly illustrates that plantation area is versus protection forestland area within the household of each of wealth classes. The planting proportion of the wealthy households is highest of 46 %, and it is lower thorough the households of wealth classes B, C, and D, accounting for 34%, 30%, and 23%, respectively. In contrast, the highest proportion of protection forestland is of poor households, accounting for 76%, and the lowest is of wealthy households, accounting for 54%.

Figures 4.15, 4.16, and 4.17 clearly indicates that the preference of the upland households of Hoa Binh Province for planting acacias over bamboo species. Figure 4.17 also implies that the households of classes B and C prefer to develop acacia plantings rather than bamboo plantings within the limitation of forestland area. The households of class A is purely forestland availability for plantings. In contrast, the households of class D is very limited forestland for plantings, but they still follow the general trend of tree plantings. Acacias is relatively easy to grow and are grown for 8 to 10 years per rotation. Acacias will claim better prices on the market and this may explain the farmer's preference for growing them. Those farmers that plant bamboo may do this for the reason of bamboo's sub-product, especially bamboo shoot. Farmers can begin

picking bamboo shoot when bamboo species are at four or five years of age, and they can annually harvest its products during 30 years or more, but only one time transplanting.

Within the *Red Book's* land area, wealthy and moderately wealthy households have the chance to increase their plantings with about 10% and 8% non-forested land respectively, while its opportunity of the others is very small.

Planting techniques of acacia and bamboo species

The characteristics of silviculture of acacia and bamboos practised by the households shown in Table 4.16 are similar across the four study villages.

All households planting acacia in the study villages chose *Acacia mangium* using similar establishment and management techniques. Particularly, few households only of Suoi Bu village collected seed from the mature acacia trees and sowed directly on the fields. In Suoi Bu village, some villagers like planting acacia in monoculture, but others like planting in mixture. In contrast, most households of Bap and Khuong villages like planting acacia in monoculture.

Planting bamboos is more popular in Suoi Bu and Bap. Villagers in Suoi Bu plant two major species including *Gigantochloa scribneriana* and *Dendrocalamus membranaceus*, while most villagers in Bap grew *Dendrocalamus membranaceus*. In Suoi Bu, farmers establish bamboo by planting stumps, while farmers in Bap can use both bamboo stumps and branches for planting.

Most growers buy seedlings from nurseries, although a few growers can collect seed and raise seedlings by themselves. However, some farmers attempt to direct-seed acacia for the obvious reason that it requires less time and labour. These are farmers who already have mature acacia plantings and access to seed. They also have some familiarity with the tree and feel confident that direct-seeding will be successful. There is a relationship between sizes of acacia and bamboo plantings and the silviculture techniques applied indicating the different silvicultural awareness of farmers in different villages (Table 4.16). The awareness of Muong farmers is very good, especially in Suoi Bu and Bap villages. Also, the awareness of wealthier households is clearly greater than others.

Table 4.16 Silvicultural characteristics of planting acacia and bamboos applied by the households in the villages of Hoa Binh province

Techniques		Study villages/hamlet			
		Suoi Bu	Bap	Khuong	Tat
Acacia species	Main species	*Acacia mangium*	*Acacia mangium*	*Acacia mangium*	(Do not plant acacia and bamboo)
	Seedling	Self nursery Buying from outside village Self collecting seed	Self nursery Buying from inside or outside village	Self nursery Buying from outside village	
	Land preparation	Land preparation for swidden before planting trees	Land preparation for swidden before planting trees	Land preparation for swidden before planting trees	
	Planting	Growing seedling into the swidden crops Sowing seed directly in the prepared land	Growing seedling into the swidden crops	Growing seedling into the swidden crops	
	Maintaining	Maintaining trees by the two first years together swidden crops	Maintaining trees by the two first years together swidden crops	Maintaining trees by the two first years together swidden crops	
	Harvest	Thinning Clearing	Thinning Clearing	*(Not available)*	
	Planting types	Monoculture Mixture planting	Monoculture	Monoculture	
	Rotation	7 – 8 years Regeneration from seed is naturally kept after clearing harvest	7 – 8 years Regeneration from seed is naturally kept after clearing harvest	*(Not available)*	
Bamboos	Main species	Gigantochloa scribneriana Dendrocalamus membranaceus	Dendrocalamus membranaceus		
	Seedling	Self collecting the stumps Buying from inside village	Self nursery by separating branches Buying from inside or outside village Self collecting the stumps		
	Land preparation	Land preparation for swidden before planting trees	Land preparation for swidden before planting trees		
	Planting	Planting bamboo stumps	Planting bamboo stumps or/and separated branches	*(Not available)*	
	Maintaining	Maintaining trees by the two first years together swidden crops	Maintaining trees by the two first years together swidden crops		
	Harvest	Thinning the mature stems	Thinning the mature stems		
	Planting types	Mono silviculture Mixture planting	Mono silviculture Planting around the borders of acacia fields		

Sources: Synthesized results of the Focus group discussions and Household interviews (2005)

Planting native wood tree species

As presented in Table 4.15, native wood tree species (high value timber trees species) are planted in Bap village and Tat Hamlet, while they are rarely grown in Suoi Bu and Khuong villages. In particular, only the households of Tat Hamlet are growing high-value timber tree species with the support of 661 Project, which belongs to the 5MHRP of Vietnamese Government. Farmers totally depend on the incentive of 661 Project including supports of seedling, techniques. Within 661 Project, 34 households have participated in tree planting of about 63 hectares these tree species into the forestlands (note of the Tat Hamlet Chief in 2005). Apart from planting high value wood tree species into the forestlands as Tat Hamlet, most Muong households have not grown, particularly in Suoi Bu and Khuong. However, most these tree species are planted in their home gardens.

The area planted to native wood tree species is relatively limited. As presented in Table 4.17, there are 12 wood tree species of seven families planted in the study villages. Of

which, *Canarium album, Cinnamomum cassia, Dracontomelum mangiferum, Garcinia cowa,* and *Michelia mediocris* are five species planted that currently provide higher value of non-timber forest products than timber: fruits, bark, and seed for food spice.

Table 4.17 Existing native wood tree species planted in the study villages

Native wood tree species		Planting at the villages/hamlet							
		Suoi Bu		Bap		Khuong		Tat	
Scientific name	Family	Garden	Forestland	Garden	Forestland	Garden	Forestland	Garden	Forestland
Canarium album	Burseraceae	P	-	P	P	P	-	P	P
Chuckrasia tabularis	Meliaceae	P	-	P	-	P	-	-	P
Cinnamomum balancae	Lauraceae	-	-	P	-	-	-	-	-
Cinnamomum cassia	Lauraceae	P	-	P	-	-	-	-	-
Cinnamomum iners	Lauraceae	-	-	-	-	-	-	-	P
Dracontomelum mangiferum	Anacardiaceae	P	-	P	-	-	-	-	P
Erythrophlouem fordii	Caesalpiniacea	-	-	P	P	-	-	-	-
Garcinia cowa	Guttiferae	-	-	P	-	-	-	-	-
Manglietia fordiana	Mangnoliaceae	-	-	-	-	-	-	-	P
Manglietia glauca	Mangnoliaceae	P	-	-	-	-	-	-	P
Melia azedarach	Meliaceae	P	-	P	-	P	-	P	P
Michelia mediocris	Mangnoliaceae	-	-	P	-	-	-	-	-

Notes: 'P' Trees are planted at the villages

Sources: Synthesized results of the Transects, Focus group discussions and Household interviews (2005). Farmers supply local names which were matched with scientific names from {Le Mong Chan et al., 1967 #62}

Excepting trees planted in Tat hamlet, most of these trees planted were identified in home gardens. Only one high value tree species planted in the forestlands of Bap village is ironwood (*Erythrophlouem fordii).*

The households of Bap village are more active in planting native wood tree species compared with the other villages. As presented in Table 4.17, nine high value wood tree species are planted in Bap village. In fact, a large area of regeneration forests of *Erythrophlouem fordii,* which is one of four ironwood species in Vietnam, exists in the village. In difference to Tat Hamlet, where people plant native tree with the incentive of 661 Project, farmers in Bap plant these trees without incentive. Thus, planting of Bap village is analysed as a representative case of planting native tree species of Hoa Binh Province.

Table 4.18 shows the status of planting native tree species of the interviewed households in Bap village. Bap farmers plant native tree species without incentive and purely for their own interest. The range of number or area of these tree species planted is very small. Farmers are just interested and they plant scattered in their lands. As presented in Table 4.18, 16 farmers answered that they are interesting in planting

Michelia mediocris, Erythrophloeum fordii, Chuckrasia tabularis, Cinnamomum balancae, and *Canarium album.* However, according to the data, more households plant *Chuckrasia tabularis, Canarium album, Melia azedarach. Michelia mediocris,* and *Erythrophloeum fordii* than other trees, accounting for 16, 13, 12, 8, and 5 households of 26 interview households. Farmers said that they are interested in these tree species, but they have not planted them, yet. The reasons of not planting are analysed in the following sections.

(See photos in Appendix C6c).

Table 4.18 Existing native wood tree species planted by the interview households in Bap village

Names of interviewees	Quantity of native tree species									The most interesting in native trees
	Chuckrasia tabularis	*Canarium album*	*Dracontomelum mangiferum*	*Michelia mediocris*	*Melia azedarach*	*Erythrophloeum fordii*	*Cinnamomum balancae*	*Cinnamomum cassia*	*Garcinia cowa*	
Bui Van Lun	30	1	-	1	-	-	-	-	-	Michelia mediocris
Bui Thi Thu	-	-	-	-	x	-	-	-	-	-
Bui Van Nam	1	5	-	1	x	-	-	-	-	-
Quach Thi Hien	-	1	-	-	-	-	-	-	-	-
Bui Van Dien	1	-	-	-	x	1	-	-	2	Erythrophloeum fordii
Quach Van Luc	80	-	-	-	x	-	-	-	-	Chukrasia tabularis
Bui Van Nui	7	-	-	-	x	-	-	-	1	Michelia mediocris
Bui Van Tuan	-	-	-	-	x	-	-	-	-	-
Bui Van Rui	4	-	-	4	x	-	-	-	-	Michelia mediocris
Bui Thi Luon	3	5	-	-	x	30	-	-	-	Erythrophloeum fordii
Tran Thi The	30	-	12	-	-	-	70	-	-	Cinnamomum balancae
Bui Thi Loan	30	-	-	-	-	-	-	-	-	-
Quach Tiem	1	30	-	-	-	-	-		-	Canarium album
Bui Van Nhan	2	21	-	-	-	10	-	-	-	Canarium album
Quach Thi Khoang	3	-	-	1		-	-	-	-	Michelia mediocris
Bui Van Kia	-	100	-	-	x	17	-	-	-	Erythrophloeum fordii
Do Phuong	-	-	-	-	x	-	26	-	-	-
Bui Van Trung	-	5	-	2	-	x	-	1	-	Canarium album
Bui Thi Van	2	3	-	-	-	-	-	-		Erythrophloeum fordii
Bui Van Mech	2	5	-	4	x	-	-	-	-	-
Bui Thi Am	5	-	-	3	-	-	-	-	-	Erythrophloeum fordii
Bui Van Von	20	2	-	-	x	-	-	-	-	Canarium album
Bui Thi Min	-	-	-	-	-	-	-	-	-	-
Bui Thi Xinh	-	-		-	-	-	-	-		-
Bui Thi Vien	-	15	-	6	-	-	-	-	-	Michelia mediocris
Bui Thi Tu	-	13	-	-	-	-	-	-	-	-
Numbers of households	*16*	*13*	*1*	*8*	*12*	*5*	*2*	*1*	*2*	*16*

Notes: 'x' Tees are planted at the villages, but were not identified the quantity

Sources: Synthesized results of the Household interviews (2005)

Estimate input and output of plantings

This section will make an estimate of the inputs and outputs of tree planting and compare this between pure planting with integrated planting.

The Ministry of Agricultural and Rural Development (MARD) of Vietnam has determined the cost of establishing acacia and bamboo and several native timber species

(MARD, 2005a). In this study, the costs to establish and maintain trees species for estimates are based on the information collected during the surveys and official standard. This information included the cost of native seedlings being sold within the villages and the purchase cost of timber from these species. The seedlings being sold and the timber being purchased were: *Dracontomelum mangiferum, Michelia mediocris, Chuckrasia tabularis, Erythrophloeum fordii,* and *Peltophorum tonkinensis*.

Estimates of income from wood tree plantings are based only on timber, because it is difficult to calculate the amount of fuelwood that would derive as residues from timber harvest. So it is a conservative under-estimate of the likely market value of these trees.

According to Tran Duc Vien (2003), the income that farmers in Hoa Binh Province got from traditional swidden cultivation is about VND 5.5 millions per hectare per rotation of 4 years. The information referred in Box 4.1 (above) shows farmers can get additional VND 12 millions from bead-tree timber (*Melia azedarach)* when they integrate bead-tree into swidden agriculture during the fallow rotation. So, within 8 years farmers can earn VND 13.5 millions in cash per hectare. Based on this reference, inputs and outputs of integrated planting are calculated. Expenditure for site preparation, transplanting, and maintaining during first three years is applied for pure plantings, but not for integrated plantings because this expenditure is paid by swidden cultivation. Additionally, the incomes of integrated plantings add more cash from swidden crops.

These calculations are summarised in Table 4.19, while the details are provided in Appendixes B.5, B.6, B.7, and B.8.

Table 4.19 Estimated inputs, and outputs of plantings (hectare/rotation)

Tree species	Planting type	Input '000VND	Output '000VND	Years
Acacia	Pure	4,275	48,000	10
	Integrated	3,075	51,750	
Native tree	Pure	8,400	360,000	30
	Integrated	7,200	363,750	
Bamboo	Pure	5,810	156,000	30
	Integrated	4,610	159,750	

Sources: Appendixes B.5, B.6, B.7, and B.8.

Table 4.19 shows that the amount farmers need to invest in native species planting is clearly higher than bamboo and acacia plantings. These account for about VND 7 - 8 millions, 4 – 5 millions, and 3 – 4 millions per hectare per rotation of native species, bamboo, and acacia, respectively. In contrast, native planting can provide much income

to farmers at the end of the planting rotation. Within 30 years of planting rotation, farmers may get about VND 360 millions from native trees, while they may get approximate VND 160 millions. In particular, acacia planting has the lowest output of about VND 50 millions per rotation, but only within 10 years.

Within one rotation of swidden cultivation, farmers get about VND 5 million per hectare in four years (Tran Duc Vien, 2003). Based on that, the inputs and outputs of integrated plantings are calculated. So, Table 4.19 also clearly indicates the inputs of integrated plantings are lower than that of pure plantings; surprisingly outputs of integrated plantings are higher than pure plantings. The reason is that farmers do not need to pay for site preparation and maintaining in the first 3 years if they intercrop with swidden cultivation. These fees are paid for swidden cultivation, and furthermore farmers can additionally get about VND 3 - 4 millions per hectare of first 3 years from swidden crops.

To clarify, the net present value (NPV) of plantings are calculated and illustrated in Figure 4.18. NPV of all plantings is calculated within the duration of 30 years that means one rotation of bamboo, and native trees, and 3 rotations of acacia.

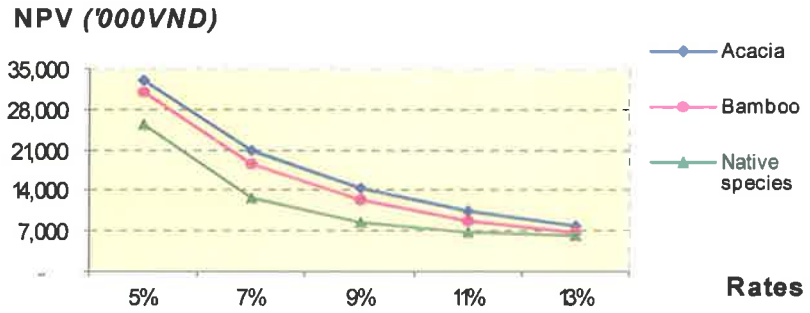

Figure 4.18 Estimate NPV of plantings in Hoa Binh Province

Source: Appendix B.8

As illustrated in Figures 4.18, NPV of acacia planting is clearly higher than that of bamboo, and native tree plantings at a range of interesting rates from 5% to 11%, and NPV of native tree planting is lowest. Interestingly, at 13% of interesting rate NPV all acacia, bamboo, and native tree planting orients to the same value of about VND 7 millions per hectare in the duration of 30 years.

As analysed above, income of native wood tree planting per rotation is highest, but farmers have to wait for 30 years. So, to make sure and compare the values of plantings, internal rate of return (IRR) is analysed in Figures 4.19 and 4.20.

Contrasting the values of incomes, IRR of native timber species is the lowest. It accounts for 7% of pure planting and 9% of integrated planting, while IRR of acacia is 13% of pure and 21% of integrated planting, and it's of bamboo is 13% and 23% of pure and integrated plantings, respectively.

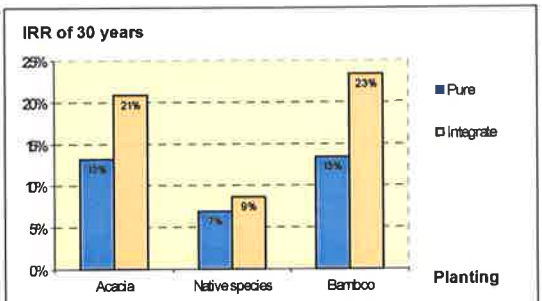

Figure 4.19 Estimate internal rate of return (IRR) of plantings in Hoa Binh Province

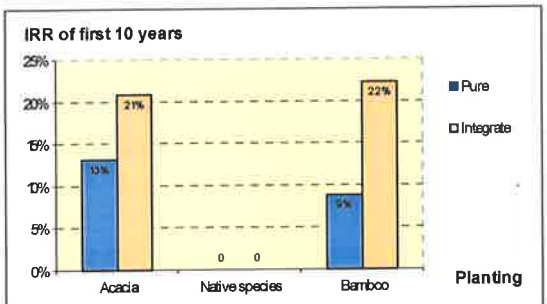

Figure 4.20 Estimate IRR of first 10 years of plantings in Hoa Binh Province

In addition, IRR of integrated plantings is clearly higher than that of pure plantings, particularly IRR of integrated bamboo, and acacia plantings is higher than their pure plantings about 8% and 10 - 13%, respectively. There are a little bit different levels between pure and integrated plantings of native trees, accounting for 7% and 9%, respectively (Figures 4.19 and 4.20).

Figure 4.20 shows the IRR within first 10 years of plantings. Both acacia and bamboo plantings can provide high IRR, but there is not any return from native timber planting. So, farmers can get the income from acacia and bamboo plantings earlier and the higher rates than from native timber tree plantings. That may be an additional reason to prove that farmers prefer planting acacia and bamboo than native wood trees.

High NPV that farmers can get from plantings is the most important stimulus not only to encourage growers to increase their plantings, but also for official planners, policy makers, and managers to develop plans in terms of plantings, and extension. Hopefully, farmers can be aware of the benefits of plantings.

Perception on planting

Perception on planted tree species

Table 4.20 shows the evaluation of farmers understanding and experience of tree planting in Bap and Khuong villages. The most widely planted tree species are *Acacia mangium* and Bamboos (*Gigantochloa scribneriana and Dendrocalamus membranaceus*). The reasons given for this preference are that these species are easy seedling, easy plating, fast growth, early harvest, and its adaptation to soils.

Table 4.20 Perception of farmers on tree species planted in Bap and Khuong villages

Tree species	Easy seedling	Easy planting	Fast growth	Early harvest	Values		Soil adaptation	Low investment	Protecting land	Integrated growing	Total	Preference of individual participant								
					Timber	NTFPs						A	B	C	D	E	F	G	H	Σ
Bap village																				
Acacia mangrium	10	10	10	10	5	0	10	8	0	5	68	10	10	10	10	10	10	10	10	80
Bamboos	10	8	10	10	0	5	8	10	2	5	68	8	9	10	9	10	9	9	10	74
Canarium album	5	7	5	4	3	8	9	4	5	8	58	9	7	10	9	10	8	9	8	70
Chuckrasia tabularis	5	10	7	6	10	0	5	4	5	6	58	5	9	6	8	5	8	6	8	55
Drecontomelum mangiferum	4	7	2	4	6	8	9	-	6	10	56	5	5	8	7	7	6	5	6	49
Garcinia cowa	0	8	3	3	3	5	9	2	7	8	48	8	4	10	9	7	8	7	9	62
Melia azedarach	10	10	10	8	8	0	5	10	8	10	79	7	8	10	10	8	10	10	8	71
Michelia mediocris	3	6	2	4	7	10	8	2	6	8	56	10	8	8	10	8	9	10	10	73
Khuong village																				
Acacia mangrium	8	10	10	8	7	0	8	6	2	8	67	10	9	10	10	10	10	10	na*	69
Bamboos	10	8	9	10	0	8	8	8	2	2	65	8	9	10	10	10	10	10	na*	67
Canarium album	3	5	5	6	7	8	6	6	4	6	56	5	4	5	6	6	10	9	na*	45
Chuckrasia tabularis	5	10	4	5	10	0	6	6	4	6	56	6	5	4	4	4	5	6	na*	34
Melia azedarach	9	10	9	8	6	2	10	10	7	9	80	4	7	7	6	7	9	8	na*	48

Notes: The evaluation was practised by village participants with marks from 0 to 10. *na* - not available*

Sources: Synthesized results of the Focus group discussions and individual scoring (2005)

Households of Suoi Bu popularly also grow acacia and bamboos and they provided two more reasons for planting acacia and bamboos: following the neighbours, and having available land. Some farmers in Suoi Bu village illegally slash and burn the protection forests for planting acacia.

As shown in Table 4.20, the native wood tree species are scored lower than acacia and bamboos, especially *Chuckrasia tabularis.* The species in the table were volunteered by farmers during the group discussion as being interest. However, *Erythrophlouem fordii* and *Cinnamomum balancae* were identified as being of interest when conducting the household interviews after the focus group discussions. The ironwood (*Erythrophlouem fordii*), a special tree naturally growing in Bap village all farmers annually collect seed of ironwood for sale. Indeed, five households in the village pick ironwood seedlings

from the forest for trial plantings. Although the villagers lacked silvicultural knowledge they still collected seedlings from natural forests to plant. They answered that they planted ironwood for the next family's generations because it is a very good timber and commands a high price. It seems that there are some good preconditions to Baps' farmers growing and increasing their native wood tree plantings.

Perception of households on silviculture

Apart from plantings in Tat Hamlet, most plantings in Bap, and Khuong villages are monoculture. Particularly in Suoi Bu, some plantings are in monoculture, but others are in mixture. Table 4.21 shows the planting silviculture applied by the interview households of Suoi Bu village as an example of silviculture.

Table 4.21 Silvicultural application of the interviewed households in Suoi Bu Village

No	Interviewees	Tree species	Silviculture		Notes
			Mono-culture	Mixture	
1	Bui Thi Nhung	Acacia	Mo	-	-
2	Bui Thi Xuan	Acacia and bamboos	-	Mi	Mixing bamboos, regeneration acacia and some maintaining native trees
3	Bui Thi Bin	Acacia and bamboos	Mo	-	-
4	Bui Van Trong	Acacia and bamboos	-	Mi	Bamboos was planted around the field
5	Bui Van Dinh	Acacia and bamboos	Mo	-	Regeneration acacia
		Cinnamomum cassia, Dracontomelum mangiferum and *Canarium album*	-	Mi	Support of the Forestry University on forest enrichment by planting more trees (planted in 1990 and 1999)
6	Bui Van Tien	Acacia and bamboos	Mo	-	-
7	Bui Thi Lien	Acacia, *Dracontomelum mangiferum, Chuckrasia tabularis,* and *Cinnamomum iners*	-	Mi	Mixing all together
8	Bui Thi Dung	Acacia and bamboos	Mo	-	-
9	Bui Thi Cuong	Acacia and bamboos	Mo	-	-
10	Bui Van Dang	Acacia	Mo	-	-
11	Bui Van Bao	-	-	-	-
12	Bui Thi Dien	-	-	-	-
13	Dinh Thi Van	-	-	-	-
14	Dinh Cong Tuan	-	-	-	-
15	Bui Van Quy	Acacia	Mo	-	-
16	Dinh Cong Hieu	-	-	-	-
17	Bui Van Nhan	Acacia and *Manglietia glauca* Bamboos and *Chuckrasia tabularis*	-	Mi	Supported by forestry development project
18	Bui Thi Anh	Acacia and bamboos	Mo	-	-
19	Bui Van An	-	-	-	-
20	Bui Quang Thuong	Acacia and bamboos	-	Mi	-

Notes: Mo – mono-culture; Mi - mixture

Sources: Synthesized results of the Household interviews (2005)

As presented in Table 4.21, 14 households of 20 interviewed households plant trees. Of which, 9 households have monoculture plantings, and 6 households have mixture plantings (one household have both monoculture and mixture plantings). Some households have mixture plantings of native tree species that were supported by outside project, for instance the project of Forestry University. Some are mixed planting between acacia and bamboos together. The reasons that farmers grow mixed plantings or monoculture plantings are presented in Table 4.22.

Table 4.22 Reasons of silvicultural application of the interview households in Suoi Bu Village

		Quantification of reasons on applying silviculture										
	Numbers of households applied	Better growth	Easy planting	Easy harvest	Easy management	Easy for next rotation	Following neighbours	Insurance	Keep growth straight up	Less labour	Constant harvest	Following projects
Mono-culture	9/14	3	5	6	5	5	7	1	0	5	0	0
Mixture	6/14	5	2	1	5	0	0	2	3	0	2	3

Sources: Synthesized results of the Household interviews, and Focus group discussions (2005)

As presented in Table 4.22, many households mentioned that the reasons of monoculture planting are easy planting, easy harvest, easy management, easy for next rotation, less labour, and following neighbours. In contrast, the households planting trees in mixture have main reasons: better growth, and easy management. Notably a reason given for planting mixtures was stability. They did not believe, or were not aware of, the possibility that mixed plantings may have benefits for the environment or pest management.

Perception on high-value native timber tree species

Table 4.23 presents the villagers knowledge of high-value native wood species. Overall villagers knew, could identify and offered names of 28 high-value timber tree species of 16 families that grow naturally in the forests of the villages. Of which, the villagers of Suoi Bu, Bap, Khuong, and Tat identified 22, 15, 15, and 12 species, respectively. The villagers of Suoi Bu have considerably better perception on high-value wood tree species than the villagers of other villages. Of 22 species, only one species, *Garcinia fagraeoides,* is mentioned as being not possible to plant. Villagers explained that this tree species only grows in lime-mountains. Further reasons of not planting are presented in the following section. In the other hands, villagers of Khuong and Tat were aware that 3 and 5 species are able to plant, respectively.

The main species that the villagers thought to be suitable for planting include 8 species: *Castanopsis chinensis, Dracontomelum mangiferum, Manglietia fordiana, Michelia mediocris, Chuckrasia tabularis, Erythrophloeum fordii, Ormosia balansae,* and *Peltophorum tonkinensis.* All exist scattered in the gardens or forestlands of farmers. This is an opportunity to introduce and encourage farmers to plant these trees. Moreover, seed sources of these trees may be available at the villages.

Table 4.23 Farmers knowledge of planting high-value native timber trees

No	Scientific names	Families	Vietnamese names	Suoi Bu	Bap	Khuong	Tat
1	*Bassia pasquieri*	Sapotaceae	Sến	Able	no*	Unable	Unable
2	*Cassia siamea*	Caesalpiniacea	Muồng đen	Able	no*	no*	no*
3	*Castanopsis chinensis*	Fagaceae	Dẻ gai	Able	Able	no*	Able
4	*Chuckrasia tabularis*	Meliaceae	Lát hoa	Able	Able	no*	no*
5	*Cinnamomum balancae*	Lauraceae	Vù hương	Able	Able	no*	Able
6	*Cinnamomum iners*	Lauraceae	Re hương	Able	Unable	Unable	Unable
7	*Cinnamomum obtusipholium*	Lauraceae	Re bầu	Able	Unable	Unable	Unable
8	*Dracontomelum mangiferum*	Anacardiaceae	Sấu	Able	Able	Able	Able
9	*Duabanga sonnerratioides*	Sonneratiaceae	Phay sừng	Able	no*	no*	Unable
10	*Engelhardtia chrysolepis*	Juglandaceae	Chẹo tía	Able	no*	no*	Unable
11	*Erythrophloeum fordii*	Caesalpiniacea	Lim xanh	no*	Able	Able	no*
12	*Garcinia fagraeoides*	Guttiferae	Trai lý	Unable	no*	Unable	no*
13	*HexaneurocarponBrilletii*	Bigniniaceae	Đinh thối (Quao)	Able	no*	Unable	no*
14	*Horsfieldia amygdalina*	Myristicaceae	Máu chó lá to (Sang)	Able	no*	Unable	no*
15	*Knema conferta*	Myristicaceae	Máu chó lá nhỏ	Able	no*	no*	no*
16	*Machilus bonii*	Anonaceae	Kháo vàng	Able	Unable	no*	no*
17	*Manglietia fordiana*	Mangnoliaceae	Vàng tâm	Able	Able	no*	Able
18	*Markhamia stipulata*	Bigniniaceae	Đinh thiết	Able	Unable	Unable	no*
19	*Michelia mediocris*	Mangnoliaceae	Giổi xanh	Able	Able	no*	Able
20	*Ormosia balansae*	Papilionaceae	Ràng ràng mít	Able	Able	no*	no*
21	*Parapentace tonkinensis*	Tiliaceae	Nghiến	Able	no*	Unable	no*
22	*Parashorea stellata*	Dipterocarpaceae	Chò chỉ	no*	Unable	Unable	no*
23	*Pasania sp.*	Fagaceae	Sồi	Able	Unable	no*	Unable
24	*Peltophorum tonkinensis*	Caesalpiniacea	Lim xẹt	no*	Able	Able	no*
25	*Vatica tonkinensis*	Dipterocarpaceae	Táu	Able	no*	no*	Unable
26	*Sp.*	-	Heo (M)	no*	no*	Unable	no*
27	*Sp.*	-	Trâm (M)	no*	no*	Unable	no*
28	*Sp.*	-	Ngốt (M)	no*	no*	Unable	no*

Notes: 'Sp.' Tree species are not identified their scientific names; 'M' Muong names; no - Tree species are not known to be grown in the areas*

Sources: Synthesized results of the Focus group discussions (2005)

Table 4.24 shows the advantages and disadvantages of planting good native wood trees species that villagers have identified. It indicates the understanding of villagers of these trees and their plantings. It partly mentions the reasons of planting or not planting of farmers.

Table 4.24 Analysis of advantages and disadvantages on planting native tree species in the villages of Hoa Binh Province

Advantages	Disadvantages
• Good timber	• Difficult to seedling
• High price, and easy to sell	• Difficult nursing young plants
• Markets are always available at the villages	• Slow growth
• Adapting with local conditions: land, climate	• Very late to harvest
• Land is available to plant	• Lack of techniques/silviculture
• Long growth of plants to be good to environment	

Sources: Synthesized results of the Focus group discussions (2005)

Reasons for not planting native tree species

To identify the reasons that farmers do not plant native tree species, three major questions were raised, and the answers are shown in Table 4.25.

Table 2.25 Reasons for not planting native timber tree species at the villages of Hoa Binh Province

Questions	Answers			
	Suoi Bu Village	Bap Village	Khuong Village	Tat Hamlet
Why some species are unable to plant that they naturally grow in the forests of the villages?	Garcinia fagraeoides species only grows in the limestone mountains	not available	• Several trees grow in stone mountains • Do not know the seed and young plants • No villager grows in trial	• Do not know the seed and young plants • No villager grows in trial • Lack of knowledge on nursing and planting
Why do not villagers plant these trees, which these species are able to plant?	• Farmers lack nursing knowledge of young plants • Some tree species they know seed, but no one trial planting • Farmers did not see these species seeds or young trees in the forests	not available	• Lack of credit • Lack of seedling • Slow growth	Still harvesting wood from forests, so no body things about planting
Why do not villagers extend growing these trees, which villagers have used to planting?	not available	• Lack of seed/seedling • Too long to harvest • Land is priority to crops or some trees that are soon to harvest	• Too long to harvest • Difficult to seedling • Do not know where to buy seedling • It is not the priority investment of households due to high risk • Many households are still poor so they need the current income • The villagers still remain the habit of use natural wood, but do not have the opinion of planting.	not available

Sources: Synthesized results of the Focus group discussions (2005)

Many farmers are not interested in planting native timber tree species or even planting these trees they are used to growing. The main reasons of not planting good wood species of farmers are following:

- Lack of knowledge on nursing young plants and growing
- The lack of trial or model plantings of high-value native trees to be able to assess their worth.
- Native wood tree species are slow growth so plantings of these trees are not priority of villagers.
- Many villagers are still keeping the habit of harvesting natural forest products.

However, some farmers are beginning to be aware of the value of planting indigenous tree species. They have planted some good wood trees in their forestlands as trial without incentive.

Summary

In general, to understand the decision of the upland households about planting, the chapter determines two main categories: upland farming systems, and existence of forestry of the upland communities and households.

There are several physical and time constraints that form the barriers to farmers planting trees. These are following:

- Physical farm structure: There are five components, which correlative five landuse types of the upland households, including flat land cultivation, home garden, livestock, sloping land cultivation, and forestry. Within these components, flat land and home gardens are separated land areas, but livestock and swidden cultivation share the areas of forestlands that can form the conflicts between these activities and planting.
- Temporal farm structure: Most farming activities focus on the rainy season, including planting. Furthermore, these activities in the households always interpose between each other. These time conflicts can impact the farmers' decisions about planting trees.
- Nature of household:
    - Wealthier households currently are more disposed to planting trees. However, more than 50% of the households over the study sites are moderately poor and poor. Furthermore, the educational level of household decision makers of most households is relatively low. So, these will be the serious barriers to farmers making the decisions on tree planting.
    - Within the needs of the upland households and communities, timber and fuel wood are concerned less important and dominant than food, and water. Further more, wood is still available in the upland villages. So internal demand for domestically-used wood is not so intense as to make it a high priority, except for one village.
    - There are few off-farm activities in the uplands particularly those activities using materials from forest products. So these activities do not create the demand to plant material trees.

The perceptions of the upland households on forestry are determined through the analysis of the existence of forestry, including forest management and plantings.

Farmers are allocated forestlands and forests to protect and plant trees. Farmers engage in forest management, particularly with the protection forestlands. Most protection forestlands are managed on the basis of the individual households and a small part of these forestlands is managed on a community basis. Farmer's awareness of silviculture and the potential for developing further forest-based activity, beyond acacia and bamboo, is limited.

Farmers in Hoa Binh Province widely plant acacia and bamboo, and they increasingly engage in their plantings without incentive. The main reasons of wide plantings of acacia and bamboo are: easy seedling, easy planting, fast growth, early harvest, and able to intercrop with annual crops. Farmers plant acacia and bamboo in monoculture rather than mixtures because of: easy planting, easy harvest, easy management, easy for next rotation, less labours, and following the example of neighbours.

Only a handful of farmers are planting native timber trees on their own initiative. All other farmers who show interest in planting native trees require the incentives provided by government and NGO projects. However, the majority of farmers do not engage in planting of high-value wood trees in the forestlands because of the conflicts with time and the perception that the commercial returns from these trees are low.

There are three types of configuration, which farmers integrate to plant trees into their farming systems:

- Acacia and bamboo are intercropped with annual crops as plots in the forestlands.
- Bead-tree (*Melia azedarach*) intercrops with swidden cultivation
- Native wood trees are scattered in home gardens.

Chapter 5
Physical, Socio-economic and Institutional Environment of Reforestation

While the previous chapter provided details of the farming systems on four study villages, Chapter 5 will present the broader geographical context of the study. It covers the physical, socio-economic, and institutional environment that impacts on reforestation and in particular the planting of high value timber species in upland communities. This material presented in this chapter is largely based on secondary sources during the period of field study in 2005 that answers the question: *How does the physical, socioeconomic, institutional, and policy environment support the planting of integrated mixed species into farming systems of Hoa Binh Province?*

5.1 Physical environment

Topography and climate

Vietnam has a special climate that is defined as a tropical climate in the South and tropical monsoonal climate in the North that means warm all year in the South and cool winters in the North. According to the classification of Hydrometeorology Bureau, the main land of Vietnam is divided into 8 climatic regions (excepting sea zones) that are also the agri-ecological regions: (1) North West, (2) North East, (3) Red River Delta, (4) North Central, (5)

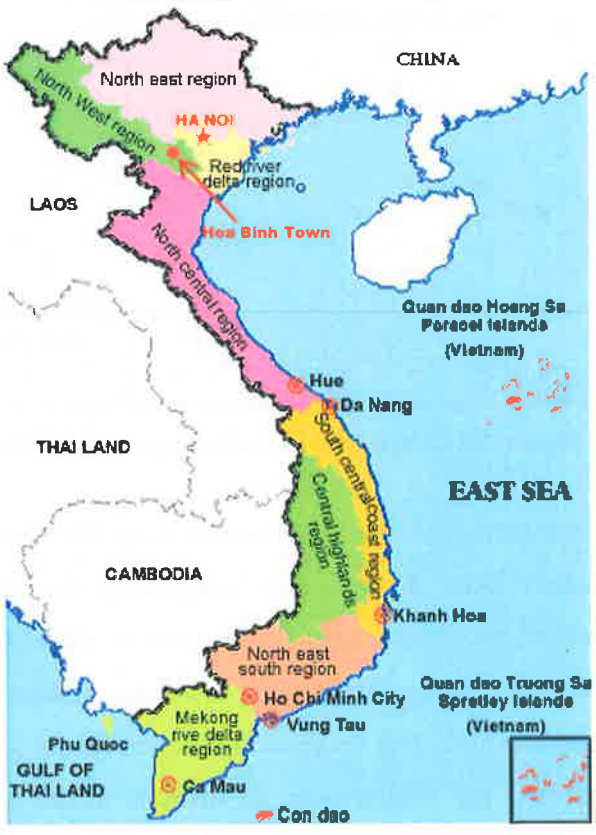

Figure 5.1 Map of 8 agro-climatic zones of Vietnam

Source: Vietnam Map Bureau

Southern Central Coast, (6) Centre Highlands, (7) North-east South, and (8) Mekong River Delta Regions. In some studies, however, scientists divide the old North East Region into two regions (Centre North Region and North East Region) (A. Terry Rambo, 1997; Nguyen Thi Mui, 2005; Thai Phien and Nguyen Tu Siem, 2002; Vu Huu Tuynh, 2001).

The Northwest region includes Hoa Binh, Son La, Dien Bien, and Lai Chau Provinces. The region mountainous and is the watersheds of two big rivers that are Da River and Ma River. In contrast to neighbouring regions, the Northwest is protected from the prevailing winds from the northeast and southeast. So, the winter of this region is relatively drier and it has hot wind in the summer coming from the southwest (Thai Phien and Nguyen Tu Siem, 2002). The winter is cold with hoarfrost at higher altitudes. The mean maximum temperatures for the region range from 12 to 14^{0}C, and the mean minimum temperatures range from -0.8 to 3.9^{0}C during the winter. Summer comes early, in March, in this region. The average temperature is about 29^{0}C, and the maximum temperature is up to 42.5^{0}C. The rainfall of the Northwest region is about 1500 mm/year.

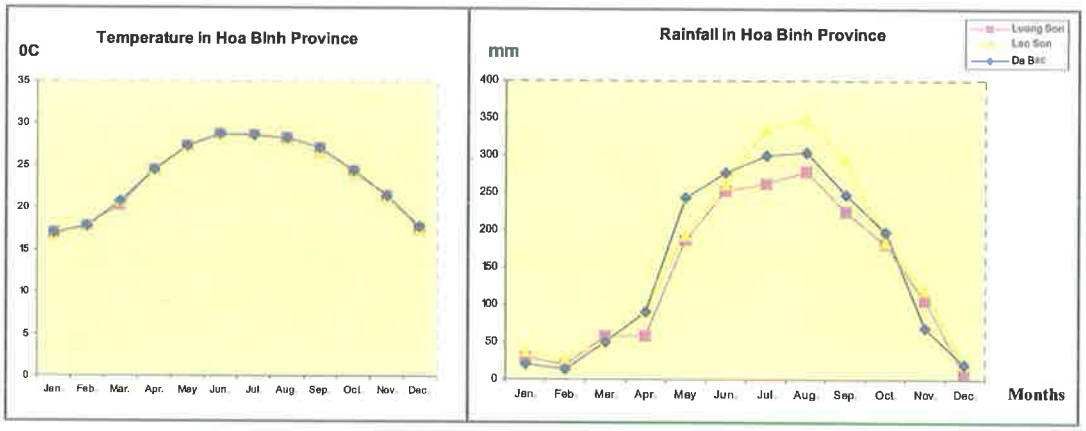

Figure 5.2 Characteristics of climate in Hoa Binh Province

Hoa Binh has two high mountainous districts including Da Bac and Mai Chau, with other, lower districts still being relatively hilly. The complex and sinuous terrains, which are separated by streams, rivers, and Hoa Binh Reservoir, create different micro-climatic areas. These differences are reflected more in differences in rainfall than temperature. The temperature ranges (about 28 - 29^{0}C in summer, and 17 - 18^{0}C in winter) are similar over all districts in the province (Figure 5.2). However, rainfall differs across the Districts of Hoa Binh Province and this is the strongest climatic

determinant of farming systems and vegetation. Overall, the rainfall in Hoa Binh Province is about 1800 mm/year, higher than others of the Northwest region. Most rains are in the wet season from May to October. The dry season last for four to five months with the driest time is in February. Thus, water shortages for drinking and cultivation always occur from February to late April.

Soils

The diverse terrains of the Northwest region are divided into three main latitude levels: high mountains which are over 2,000 meters; average mountains which are from 1,000 to 2,000 meters; and low mountains which are less than 1,000 meters (Nguyen Thi Mui, 2005). The soils of this region are yellow-red soils, yellow-red humus group on the mountains and humus soil on high mountains. The soils on the level land are alluvial, black, deposited soil, brown soil on neutral and volcanic rocks, and red-brown soil on calcareous rocks. However, the yellow-red humus soil is the most common, accounting for 61% of the total land of the region. The surface of this soil is thick on average of 50 - 100 centimetres (Thai Phien and Nguyen Tu Siem, 2002). The characteristics of yellow-red humus soil are shown in Table 5.1.

Table 5.1 Characteristics of yellow-red humus soil

Soil depth (cm)	Ratio of particle size (%)				pH_{KCl}	OM %	Total (%)		Availability (mg/100g soil)		Exchangeable Cation (me/100g soil)		
	> 0,1 (mm)	<0,001 (mm)	>0,01 (mm)	<0,01 (mm)			N	P_2O_5	P	K_2O	Ca^{++}	Mg^{++}	H^+
0 - 20	12,67	18,69	48,01	51,99	4,1	6,34	0,24	0,24	3,2	18,6	1,12	0,51	5,85
20 - 40	11,56	37,58	35,30	64,70	-	2,02	-	0,08	1,5	5,0	0,84	0,84	3,98
40 - 60	12,64	34,60	35,00	65,00	4,2	1,86	0,14	0,12	1,5	10,5	0,80	0,40	6,75
60 - 80	3,64	52,28	23,33	76,67	4,1	2,34	0,27	0,14	1,5	12,5	0,68	0,28	2,59
80 - 100	6,78	41,88	29,57	70,43	4,1	2,10	0,19	0,16	2,2	12,7	0,71	0,31	3,4

Source: Thai Phien and Nguyen Tu Siem, 2002

Generally, the yellow-red humus soil weathered from schist rocks and is thick, with fairly high clay content, and fertile. This soil is good for a wide range of perennial crops, special products crops, medicinal plants, cereal crops, and forest tree species. However, this soil is easily eroded and degraded, especially under the environment of tropical monsoon climate in Vietnam. Furthermore, most hill sloping soils are deeply weathered down to 5 meters, and they are generally acidic with poor nutrients (Rambo and Tran, 1999). Following the highly varied terrain and microclimates, there is a lot of diversity in how the soils in Hoa Binh Province present for agricultural use.

Biodiversity

Table 5.2 Tree species of the Northwest region for use and conservation

No	Tree species		Important use	Numbers of regional seed distribution	Priority for gene conservation
	Scientific names	Vietnamese names			
1	*Acacia mangium*	Keo tai tuong	I	5	-
2	*Aleurites montana*	Trẩu	I	174	-
3	*Altingia takhtajanii*	Tô hạp	-	30	GC
4	*Aquilaria crassna*	Trầm	I	0	GC
5	*Burretiodendron tonkinense*	Nghiến	-	0	GC
6	*Calamus rudentum*	Cây song	I	0	-
7	*Calamus tenuis*	Mây nước	I	0	-
8	*Camellia sasanqua*	(Cây họ chè)	I	0	-
9	*Canarium* spp.	Trám	I	20	-
10	*Chuckrasia tabularis*	Lát hoa	-	57	GC
11	*Cinnamomum balansae*	Vù hương	I	0	GC
12	*Cinnamomum cassia*	Quế	I	0	-
13	*Cocos nucifera*	Dừa	I	0	-
14	*Cupressus funebris*	Bách diệp	-	0	GC
15	*Dendrocalamus membranaceus*	Luồng	-	80	-
16	*Diospyros mun*	Mun	-	0	GC
17	*Dysoxylum cauliflorum*	(Giổng Chặc khế)	-	0	GC
18	*Erythrophleum fordii*	Lim xanh	-	0	GC
19	*Fokienia hodginsii*	Pơ mu	-	0	GC
20	*Hexaneurocarpon brilletii*	Đinh thối	-	0	GC
21	*Illicium verum*	Hồi	I	0	-
22	*Keteleeria davidiana*	Tô hấp	-	0	GC
23	*Litsea sebifera*	Bời lời nhớt	I	0	-
24	*Madhuca pasquieri*	Cây Sến	I	0	GC
25	*Magnolia dandyi*	(Họ mộc lan)	-	0	GC
26	*Parashorea chinensis*	Chò chỉ	-	0	GC
27	*Pinus khasya*	Thông ba lá	I	80	-
28	*Pinus massoniana*	Thông đuôi ngựa	I	50	-
29	*Pinus merkusii*	Thông nhựa	I	0	-
30	*Podocarpus fleuryi*	Kim giao	-	0	GC
31	*Podocarpus neriifolius*	Thông tre	-	0	GC
32	*Camelia oleosa*	Sở	-	12	-
33	*Sterculia lychnophora*	Cây Sảng	I	0	-
34	*Styrax tonkinensis*	Bồ đề	I	0	-
35	*Talauma gioi*	Giổi xanh	-	0	GC
36	*Taxus chinensis*	Bụt mọc	-	0	GC
37	*Tectona grandis*	-	-	20	-
38	*Toona sinensis*	Xương mộc (Lát khét)	I	0	-
39	*Vatica odorata*	Táu	-	0	GC

Note: I – important use; GC – genetic conservation

Source: Selected data from Nguyen Hoang Nghia (Nguyen Hoang Nghia, 2003) and Nguyen Xuan Lieu (Nguyen Xuan Lieu, 2001)

Vietnam is known as one of the richest biological regions on the earth (World Bank, 2005). This biodiversity is defined regarding to three categories: genetic diversity, species diversity, and ecosystem diversity. The country has an estimated 12,000 plant species (of which only 7,000 have been named) in 1,850 genera and 290 families. There

are about 275 mammal species, 800 bird species, 180 reptile species, 80 amphibian species, 2,470 fish species, and 5,500 insect species (VGov, 1995). Vietnam territory is divided into 10 eco-regions regarding to the biodiversity, and Hoa Binh still belongs to the Northwest region.

In the Northwest, the forests of this region represent well-defined ecosystems at different altitudes. Biodiversity per unit area may be low, but there are about 38 rare animal species and several important plant species such as ginseng and *Fokienia hodginsii* (World Bank, 2005).

Table 5.2 shows 39 tree species those are significant for use (19 species) and or conservation (20 species) in the Northwest region. This region also has 528 areas from which seed resources of at least 10 high-value tree species are selected.

Hoa Binh Province has three Natural Reserves including Hang Kia – Pa Co of Mai Chau District, Thuong Tien of Kim Boi District, and Phu Canh of Da Bac District. These Natural Reserves can conserve and provide seed of several tree species. Actually, several endemic tree species are still conserved in the secondary forests, for example the secondary forests of *Erythrophleum fordii* in Lac Son, and Tan Lac Districts. Further more, some high value tree species including *Talauma gioi, Cinnamomum balansae, Chuckrasia tabularis, canarium sp., etc* exist in home gardens and protection forests of the households in Hoa Binh Province. These are the available seed sources that local farmers can access. This marks an opportunity to farmers widening these tree plantings.

5.2 Socio-economic environment

As outlined in Chapter 2, Vietnam has developed forward into a market economy since the '*Doi moi*' period. This economic development, which grows about 7 - 8% per year, is largely as a response to industrial development in the cities and lowland agricultural development. However this has been reflected in the economic development of the uplands.

The economy of Hoa Binh Province also is growing similar to the general economic development of Vietnam. The gross domestic products increased by year, accounting for VND 1,825 billions, 1,965 billions, 2,167 billions, 2,396 billions, 2,871 billions, and 3,389 billions of from 2000 to 2005, respectively (Hoa Binh Statistic Office, 2005).

While the growth of agricultural, forestry, and fishery sector has decreased, its industrial and constructional sector, and service sector rises. This trend is also reflected in the ratio of GDP of the sectors. These changes are considered as good sign that the economy of the province is shifting from subsistence agriculture to market agriculture orientation.

The living standard of people improves gradually. The average income grew from VND 3.35 millions to about VND 4 millions per person per year in 2000 and 2005, respectively. Access to services also improves. Roads and electricity services are available to the centre of most communes. People have easy access to telephone and other information services at the centres of communes. In Hoa Binh, 195 remote and poor communes have 'cultural post offices' where people have access to communication and information, although the service is still limited (Hoa Binh People's Committee, 2001a, 2006).

Surprisingly, the numbers of poor households decreased strongly from 2000 to 2004, but suddenly increased in 2005, accounting for 14.5%, 9.81% and 31.31% in 2000 to 2004 and 2005, respectively. The reason of that is the change of the indicators. In 2005, the Ministry of Labour, Invalids and Social Affairs (MOLISA) applied the new form with new indicators with the living standard at cost in 2005 to define poor households, while the old form used the living standard at cost in 1994. So, by the new indicators the ratio of poor households in Hoa Binh was 31.31% in 2005. Most poor households are the upland households that indicate the limited capacity of these households to plantings. The numbers of poor households above mention the high risk that poverty reduction program is facing (Hoa Binh People's Committee, 2005, 2006).

In the period of 1996 – 2000, the investment in Hoa Binh fell into 5 categories which are from: government (32%), organizational projects (27%), national financial institutions (5.7%), private individual (23%), and foreign investment (10.7%); of which, 46.7 % was invested in building infrastructure (Hoa Binh People's Committee, 2001a). In 2005, the investment was the same trend. The total investment of Hoa Binh Province in 2005 was 758 billion VND, off which 610 billion VND was invested in infrastructure, and 148 billion VND was invested in all socio-economic and productions. However, investment in agriculture and forestry is not a high priority. Indeed, most investment in tree planting shifted from the provincial sources to private households in 2005. These

households invested in re-planting forests that had originally been funded by government (Hoa Binh People's Committee, 2006).

5.3. Policy and Institutional environment

Policies

There are four levels of government in Vietnam: state, provincial, district and commune. State policies are implemented through these levels although Province People's Committees may issue their own policies autonomously. This section analyses the policies regarding to forestry development, especially planting of the upland households that they have been issued since the '*Doi moi*' began in 1986. The implementation of these policies in Hoa Binh Province is also discussed.

Land tenure

Land tenure is very important to farmers which impacts strongly not only on their livelihoods but also on the sustainable use of the land (Le Vinh, 2003). Land tenure is grouped into five categories, which are:

(1) Access: the right to walk on a piece of land

(2) Withdrawal: the right to obtain the products of land

(3) Management: the right to regulate internal use patterns and transform the land by making improvements

(4) Exclusion: the right to determine who will have an access right, and how that right may be transferred

(5) Alienation: the right to sell or lease the rights of management and exclusion

(Sikor et al., 2003)

Since '*Doi moi*' began, Vietnamese Government has issued a series of policies and legislation aiming at the developing the productivity and efficient use of land. Several policies, which are very important regarding to land holders, are listed in Table 5.3. These policies, which are all relatively recent, have formalised the right of individuals and organisations to use agricultural and forestland for commercial purposes. They do so by clarifying land tenure rights and responsibilities.

The Land Law issued in 1993 is the key to define the tenure rights to land owners. The Land Law firstly affirms that land is the property of Vietnamese people. Individuals and households not only have the 'use rights', but also have responsibilities. The 'use rights' includes the right to use the land, to exchange the land with other landholders, to

transfer and lease out the land temporarily to other persons, to use the landuse right as collateral for obtaining bank loans, and to pass the land on to their children. The Land Law revised in 1998 added one more right to the landholders, which is the right to contribute the landuse rights as investment. In return, it is the responsibility of landholders to pay landuse taxes, and return the landuse rights to the state, with compensation, if the land is needed for public interest.

Table 5.3 Characteristics of key land policies in Vietnam

Policies and legislation	Key characteristics
Instruction of Prime Minister No 60-HDBT, dated 14/04/1998 on **implementing land law** which was affirmed by National Assembly on 29/12/1987	Basic legislation of the full Land Law issued in 1993
Land Law issued in 1993	Accords landholders five specific rights which was called 'use rights' by Sikor (Sikor et al., 2003)
Decree of Government No 64-CP, dated 27/09/1993 on the **Allocation of agricultural land to individuals** and households aiming at long usage of cultivation.	• Allocating agricultural land to individuals and households including annual crop, perennial crop, and aquaculture lands. • Allocating annual crop land for usage of 20 years; perennial crop land for usage of 50 years.
Decree of Government No 02/CP, dated 15/01/1994 on the **Allocation of forestlands** to organizations, households, and individuals aiming at long usage of forestry.	• The allocation land includes the land primary forest, and plantation forest covering; and the land which is planned for plantation, maintain and protection of vegetation. • Land tenure is 50 years. If the tree duration is more than 50 years, landholders can make an inquiry to extend the time until harvest.
Land Law revised in 1998, and 2003	Added one more right for land holders which is the right to contribute the price of landuse rights as investment
Decree of Government No 85-CP, dated 28/08/1999 on **Revision of the allocation of agricultural land** to individuals and households aiming at long usage of cultivation.	The land was specifically classified. The land used for salt production along the coast was added into this category.
Decree of Government No 163/CP, dated 16/11/1999 on the **Allocation and rent of forestlands** to organizations, households, and individuals aiming at long usage of forestry.	• Forestlands which are allocated and rent are: o Special use of forestland o Protection forestland o Production forestland • Land is allocated to households, individuals, and organizations (excepting foreign organizations). • All households, individuals, and organizations (including foreign organizations) can rent forestlands for forestry productions.
Decree of Government No 80/CP, No 87/CP and 89/CP, and No 38/2000/ND CP	Accorded landuse taxes

Source: Legislation documents of Vietnamese Government (VGov, 1987, 1993 a, 1993 b, 1999 a, 1999 b; Vietnamese Government, 1994, 1998)

Four Decrees shown in Table 5.3 were issued to clarify and reinforce land ownership, especially forestland holders which are called 'chu rung' in Vietnamese. That legislation entrusts landholders to an upper limit of 30 hectares of forestland for their use for 50 years. If more land is required then that is available from the Government on the basis of a leasehold arrangement, and if more time is required after finishing 50 years then that is available until harvests. In particular, Decree No 163/CP recognises that long-term tenure of forestland is crucial for the economic development of upland households.

Up to 2003, the Hoa Binh People's Committee allocated 237,259 hectares forestland to 65,826 households and communes (Bui Van Chuc, 2003). In the study sites, land allocation had been completed at three of the sites. Land allocation, especially of forestland, is being very slowly implemented not only in Tan Minh Commune, but also in many other communes of Da Bac District. This is likely to be due to the limited administrative capacity of local district and commune officials.

Forestry policies

Table 5.4 Characteristics of key forestry policies in Vietnam

Policies and legislation	Key characteristics
Law of **forest protection and development** affirmed by National Assembly on 19/08/1991	The law accords legislation of forestry protection, plantation, harvest, management etc. that is the basic of other forestry development policies
Decision of Prime Minister No 327/TC, dated 15/09/1992 on **usage of spare land, bare hills, forest,** coastal waters, and water land.	Focussing on the reforestation on bare hills/bare land that was called '327 Program'
Decision of Prime Minister No 202/TTg, dated 02/05/1994 on **allocating forests aiming at protecting and remaining forests**	Government signed contract with the households/individuals and paid them for their protection and remaining the forests
Decision of Prime Minister No 556/TTg, dated 12/09/1996 on reinforcing the **327 Program**	Focussing on remaining and protecting the existent forest areas, planting new protection and special use forests.
Decision of Ministry of Agricultural and Rural Development No 3013/1997 QD-BNN&PTNT, dated 20/11/1997 on **defining the borders and landmark of forest types**	Defining the landmark for protection forests, special use forests, production forests, and remained natural forests.
Resolution of Vietnam National Assembly No 08/QH10, dated 05/12/1997 on **Five Million Hectare Reforest Program** (5MHRP).	• 5MHRP program began to run. The program has been undertaken from 1998 to 2010 aiming at planting 5 million hectares of new forests.
Decision of Prime Minister No 661/QD-TTg, dated 29/07/1998 on objectives, duties, policies and **implementation of 5MHRP**	• Beneficiary mechanism recorded is clear and detailed for each forestland, type of land holders, and type of planting investment.
Decision of Prime Minister No 160/QD-TTg, dated 04/09/1998 on plan of material areas for **paper industry** up to 2010	Planning 640,000 hectares of material forests for paper mill
Decision of Prime Minister No 245/1998/QD-TTg, dated 21/12/1998 on **duties of forestland management** of government levels	Clearly defining the duties of government official levels on forest and forestland management that aims at encouraging forestland holders in terms of forestry development
Decision of Prime Minister No 08/TTg, dated 11/01/2001 on **management mechanism of three types of forests**	Clearly defining the benefits that forestland holders have the right to access/harvest products in three forest types
Decision of Prime Minister No 178/2001/QD-TTg, dated 12/11/2001 on **benefits and duties of households and individuals who hold forestlands**	

Source: Legislation documents of Vietnamese Government (MARD, 1997b; VGov, 1991, 1992, 1994c, 1998b, 1998c, 1998d, 2001a; Vietnamese Government, 1996, 2001; Vietnamese National Assembly, 1997)

Table 5.4 lists the key policies and legislation concerning forest and plantation management. The 'beneficiary mechanism' is the most important in terms of this study. In particular, three documents concerning the beneficiary of forestland holders that are Law of forest protection and development issued in 1991, Decision of Prime Minister No 661/QD-TTg dated in July 29th 1998 on 5MHRP, and Decision of Prime Minister No 178/2001/QD-TTg dated in September 12th 2001.

Currently, many upland households participate in 5MHRP and this is particularly in Hoa Binh Province. So, in terms of the benefits to households, the policies recorded in

the Decision 661/QD-TTg needs to be focused on. The benefits are divided based on three types of forests that the households hold.

Article number 7 of the Decision 661/QD-TTg records the benefits as following:

- ***Special use forests and Protection forests:*** Households are paid to protect or/and plant to enrich forests. Households sign contracts with Government or organizations.
    - For protecting critical protection forests, households are paid 50,000 VND/ha/year, and access or harvest fuel wood, and NTFPs under the canopy.
    - For maintaining and planting to enrich forests, households profit all products from thinning, and NTFPs under the canopy.
    - For planting protection forests, households profit all products from thinning, agricultural products, and NTFPs under the canopy.
- ***Production forests***
    - Households who invest in planting are deemed to be the forest owners, and decide to harvest themselves whenever they want, but have to reforest within the next 2 years after harvesting.
    - All products from the plantations; bamboo and NTFPs from natural forests are freely traded.

      Wood and other products harvested from secondary forests belonging to the production forestlands are freely traded (excepting the special plants and animals which belongs to the banning list recorded in Decree of Government number 18/HDBT dated in January 17th 1992). Households need to notify the Forestry Guard Department or Commune People's Committee their intention to harvest and trade forest products. They receive formal documentation acknowledging their right to harvest and trade.

Article number 8 of the Decision 661/QD-TTg also impresses that incomc gaincd from forest products harvested from production forests which are maintained as natural forests is tax-free. A tax-free status also applies to middle-level trading of legal forest products from plantations and NTFPs from natural forests. Furthermore, households are allowed to use 20% of total forestlands allocated to households for agricultural

cultivation. This actually includes so-called protection forestlands, but 'critical protection forestlands' are excluded from such use.

Processing and market policies

Processing and market policies have been designed to encourage the processing and trading of forest products by opening up the market to all, e.g. the Decision No19/TTg dated in February 03rd 2000 shown in Table 5.5. Previously, prices for forest products were set on the basis of separated market areas. This policy has been replaced with strategies to allow the market to determine the price. Business activity is allowed across all domestic regions and internationally. In addition, value added tax (VAT), and business income taxes have been lifted from agricultural and forestry commodities to encourage export.

Table 5.5 Characteristics of key processing and market policies in Vietnam

Policies and legislation	Key characteristics
Decision of Ministry of Agricultural and Rural Development No 2375/NN-CBLS/QD, dated 30/12/1996 on regulation of giving **licence to forest product processing company**	• The regulation recorded that The Chief of Agricultural & Rural Development Department have the right to give permission to companies, enterprises, households, and individuals in terms of forest product processing. • The licence is given without fees
Decision of Ministry of Agricultural and Rural Development No 392/NN-CBLS/QD, dated 19/03/1997 on **revised regulation** of giving licence to forest product processing company	
Decision of Prime Minister No19/TTg, dated 03/02/2000 on **abrogation of all previous documents which is against the business Law.**	All previous documents including the Decisions No 2375/NN-CBLS/QD and No 392/NN-CBLS/QD are abrogated.
Decision of Prime Minister No 624/TTg, dated 29/12/1993 on **export of timber goods and forest products**	Accorded the timber goods and forest products, which are exported including 16 products.
Decision of Prime Minister No 1124/1997/QD-TTg, dated 25/12/1997 on **export of timber goods and forest products, and import of wood material**	Accords the timber goods and forest products which can be exported that includes 16 products
Decision of Prime Minister No 65/TTg, dated 24/03/1998 on **export of timber goods and forest products, and import of wood material**	Products from production forests and products from natural forests excepting the banning products recorded in the Forest Protection and Development Law are accepted to export.
Decision of Prime Minister No 19/CT-TTg, dated 16/07/1999 on **implementation of encouraging methods to sell production wood.**	Allowing business to export products of production forests, and applying the advantage taxes for these products
Decree-law of **resource taxes** issued on 30/03/1990, and revised on 28/04/1998	Implement to every one and organizations that exploit and use natural resources.
Circular of Ministry of Finance No 69/TC dated 27/11/1991 on Instruction to **collect natural resource taxes**	Resource taxes are not collected from people who collect and use dry wood, which is cut from branches. People who live in the forests legally harvest forest products to use themselves have to pay a haft taxes. The taxes are abrogated for remote minority people harvest to use.
Circular of Ministry of Finance No 91/2000/TT/BTC, dated 06/09/2000 on Instruction to **abrogate VAT and business income taxes to encourage selling agricultural and forestry products**	VAT and income taxes are not applied to the trading from afar businesses with rough products of Agriculture and forestry

Source: Legislation documents of Vietnamese Government (MARD, 1996, 1997a; Ministry of Finance, 1991, 2000; VGov, 1993 c, 1997, 1998 e, 1999 c, 2000 b)

Technology and extension policies

Policies concerning the development of forestry technology and its extension have also been devised particularly in relation to the 5MHRP program (see Table 5.6). By 'forest technology' is meant the production and establishment of seedlings, silvicultural techniques for farm forestry and the transfer of this technology to farmers. These policies mention 'building technology models'; however, these policies and the actual activities are not appropriate as adoption of technology has been very poor. That is the challenge. The reasons are that these policies and technologies are rarely expressed to farmers, but mainly lay in government offices. In the other hands, farmers could not be able to accept and understand with their low level of knowledge. In terms of extension, crops are currently more concentrated than tree plantings. In Hoa Binh, extension programs focus on acacia and bamboo plantings for forest material programs than native wood tree plantings.

Table 5.6 Characteristics of technology and forest extension policies in Vietnam

Policies and legislation	Key characteristics
Decision of Ministry of Science, Technology and Environment No 930/1999/QD-BKHCNMT dated 25/05/1999 to approve the program of **'Building models of technology application to develop the rural and mountainous socio-economic in period of 1998-2010'**	In the Northern mountainous region: one of the priority models to develop is planting and forest management.
Resolution of Government No 03/2000/NQ-CP dated 02/02/2000 on economic farm development.	Emphasizing to develop forest farm by using the unused upland area.
Circular of Ministry of Agricultural and Rural Development on Instruction to **plan the economic farm development.**	

Source: Legislation documents of Vietnamese Government (MARD, 2000; MSTE, 1999; VGov, 2000 c)

Credit and investment policies

The Vietnamese Government has used both federal and ODA funds to invest in forestry and rural development, especially the upland areas. Most funds have been used and invested in forestry based on the 5-year or 10-year objective programs, for example PAM (World Food Program), 133, 135, 327 Projects and currently the 661 Project of 5MHRP.

The funds which households can directly access are very limited, particularly for planting. However, as shown in Table 5.7, several policies have been launched to cope with the lack of household capital for investment. These policies intend to make access to capital loans and credit much easier. However, the borrowing money to invest in tree planting by upland households is still under discussion. Currently, farmers have several sources to loan: Agricultural Bank, Poor Bank (Fund of poor deduction program – 135). However, as the risk of investment in forest is high, and the capital management skills

of upland households are extremely limited, banks hesitate to lend money to farmers for these purposes. Given the current state of farmer knowledge and forest technology, the banks' fear that farmers cannot return capital in an appropriate time is probably well justified. Poor bank also limits the capital that households can borrow of up to ten million VND with loan period of 5 years. So, with 5-year loan period farmers difficultly return if they invest their capital in plantings. This is a barrier to farmers widening their plantings.

Table 5.7 Characteristics of credit and investment policies in Vietnam

Policies and legislation	Key characteristics
Decree of Government No 14/CP dated 02/03/1993 on **allowing households to borrow money for agricultural, forest, and aquaculture productions**	Households can borrow with prestigious guarantee Borrowing period is 36 months
Decisions of Government No 67/TTg dated 30/03/1999, and No 148/TTg dated 07/07/1999 on Policies of **bank and credit for agricultural and rural development.**	Households can borrow up to 10 million VND without property guarantee. Borrowers have to show the certificates of their land areas.
Decree of Government No 43/1999/ND-CP dated 29/6/1999 on **Credit and development investment of Government**	Three types of credit investment of Government: investment loan, support the benefits after investment, and guarantee credit investment.
Decree of Government No 51/1999/ND-CP dated 08/07/1999 on **Implementation of the Encouraging Investment Law**	Encouraging the investment in agricultural, forest product processes; material forest plantation, perennial industry crops, fruit tree planting, aquaculture, and cow feeding.

Source: Legislation documents of Vietnamese Government (VGov, 1993 d, 1999 d, 1999 e, 1999 f)

Institutional environment

Governing management

The management of forestry development across the four levels of government is presented in Figure 5.3. The community-based development of forestlands involves institutions dealing separately with land and with agricultural and forestry production. Two ministries (MARD and MSTE) are involved, and as would be expected with over-lapping jurisdiction, there are opportunities for confusion, or even open conflict in community-based forest activities.

The fact that this overlapping jurisdiction is replicated over three levels of government does not make the management and implementation of community-based forest activities any easier. This is surely a significant barrier for communities and households to understand, or even to be aware of, the forestry development program and other programs. Furthermore, the limited management capacity of the government officials especially at the commune level is also a big challenge for forestry development.

In Hoa Binh Province, four Departments play important roles in terms of forestry development. The Land Department and the Forestry Guard Department are responsible

for land and forest allocation and forestry management. Commune authorities assist District authorities in this role; e.g. the '*Red Book*s' of the households are signed by the District authorities. The Centre of Extension belonging to Agricultural and Rural Development Department, and Forestry Development Department are responsible for transferring forest technology and encouraging households to plant trees.

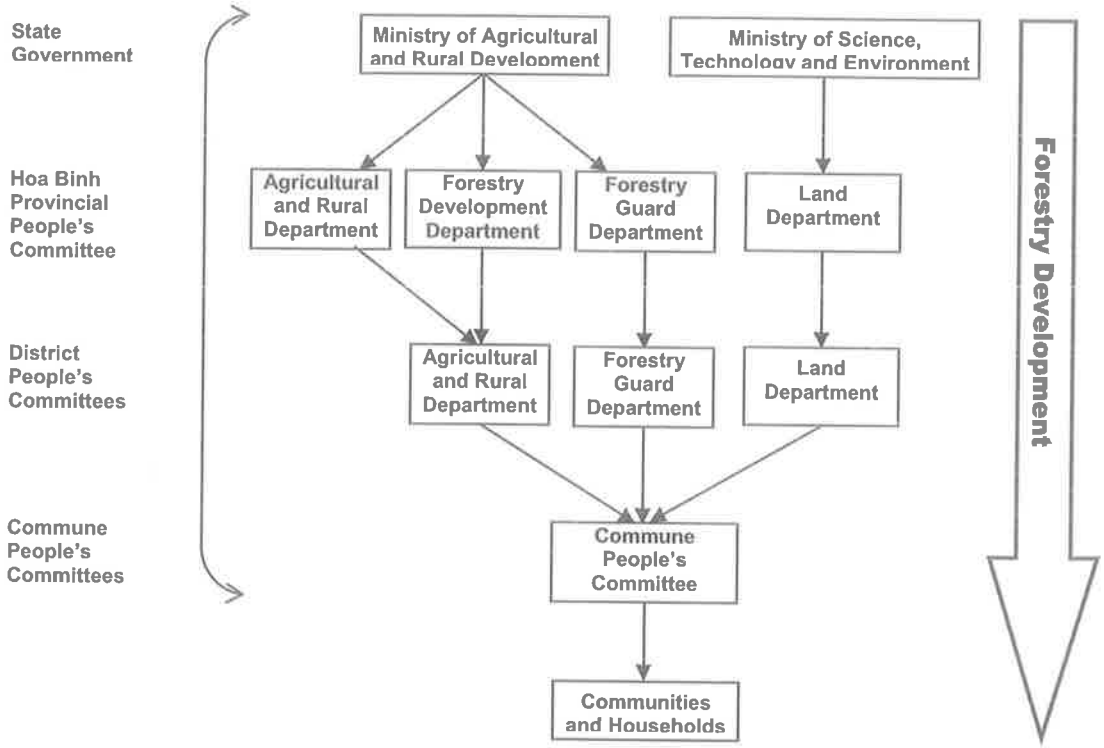

Figure 5.3 State management of Forestry Development in Hoa Binh Province

Forestry Development in Hoa Binh Province

Several projects relating to agricultural, forestry and rural development in Hoa Binh Province in the period of 2001 – 2010, are shown in Table 5.8.

With respect to forestry development, there are two government-funded projects of interest. The 661 Project plants annually 6000 – 8000 hectares per year and is fully funded investment from the State budget (Hoa Binh People's Committee, 2006). The project concentrates on to enrich the protection forest areas of the province that includes remaining the secondary forests and planting native tree species. The 'Afforestation for Material Project' of Hoa Binh Forestry Company uses the credit fund of the government. The company co-operates the upland households to plant about 12,000 hectares of

Acacia mangium plantations based on five afforestation Yards, which are located in 5 districts: Luong Son, Ky Son, Kim Boi, Cao Phong and Da Bac.

Aiming at implementing the policies of Vietnamese Government, Hoa Binh People's Committee had issued several sub-policies to introduce and implement the task of forestry development. For example, the intention of Plan number 208-KH/TU dated in April 22nd 1998 of Hoa Binh was to hasten the process of forestland classification and border definition of the three types of forests. The completion of this task is necessary before land can be allocated. As a result, in 1999, the landuse planning was completed at the provincial level. Additionally, the Decree No 08 NQ/TU dated January 20th 1999, and Paper No 259-KL/TU dated in October 01st 2003 of Hoa Binh Province were issued to enforce the implementation of 5MHRP in the province. Land allocation is basically completed (Hoa Binh People's Committee, 2006). However, land that was used for swidden cultivation was classified as 'unused land' and this land has not been allocated. Nevertheless, farmers continue to use this land without permission. While this use is in fact illegal and penalties may be enforced for burning forest, there is no actual penalty for using this land.

Table 5.8 Key projects in the period of 2001 - 2010 in Hoa Binh Province

Projects	Characteristics	Fund sources	Investors (Managerial agency)
Poor alleviation Project	Invest in infrastructure, and credit loan for poor households	World Bank	Hoa Binh People's Committee Poor alleviation management Board
Song Da Reservoir bed population stabilization and socio-economic development (DA 747)	Now shift to 472 Project that mainly invests in infrastructure	State budget	Hoa Binh People's Committee 747 Project management Board
Aquaculture Project	Investing 1000 fish cages around Song Da Reservoir	Not defined	Hoa Binh Agricultural and rural development department
'Snow tea' Project	Planting *Camellia sinensis* var Shan for special tea production	State budget	Hoa Binh Agricultural and rural development department Hoa Binh settlement and new economic zone development department
Fruit trees for fruit processing Project	500 ha orange, 800 ha pineapple, and 200 ha Taiwan asparagus	State credit fund	Hoa Binh Agricultural and rural development department Song Boi state farm
Sugar cane Project	Planting annually 7000 ha sugar cane for providing material to processing company	State credit people's fund	Hoa Binh Sugar cane Company
Afforestation for material of MDF mill Project	Planting 35,000 hectares of material forests	Credit fund	Hoa Binh Forestry Company
Afforestation for material of chip board production Project	Planting 15,000 hectares of material forests	Joint venture	Hoa Binh Forestry Company
661 Project	Forestry development	State budget	Hoa Binh Agricultural and rural development department Hoa Binh Forestry Company

Source: Hoa Binh People's Committee, 2000

According to the Hoa Binh Agricultural and Rural Development Department (2005 b), the total forest area that was planned is 249,577 hectares, of which 134,551 hectares of natural forests; 31,800 hectares of plantations; and 83,226 hectares of unused land. Annually, about 8,000 hectares of new plantations are planted in Hoa Binh Province, for example 8,097 hectares of new plantations were planted in 2004, and 7,154 hectares in 2005. Moreover, about 363,750 scattered trees were planted in 2005 within the campaign of 'Tet trong cay' that means 'Planting Festival'. So, forest cover increased to 43.7% in 2005 (Hoa Binh People's Committee, 2006). Despite the claim that the forest cover of Hoa Binh has grown in the recent years, the quality of this forest has not been clearly assessed.

Forest technology transfer

Paralleling the projects of forestry development of Government, many other projects, which are funded by outside organizations, have been carried out in Hoa Binh Province. These projects, referred to in Chapter 2, deal mainly with technology development, such as tree planting trials, but they do not undertake the role of transferring this technology to farmers. Forestry extension is left to the Extension Centre of DARD of Hoa Binh Province. The centre has implemented not only the programs of Government, but also collaborated with the Social Forestry Support Program (SFSP). Within the SFSP, several planting techniques and agroforestry systems have been promoted.

Moreover, the Hoa Binh Forestry Company, which is a state economic unit, plays an important role in terms of planting forests for materials used in chipboard and MDF (medium density fibre) manufacture. The company operates the is the main forest tree species nursery for Hoa Binh and other mountainous provinces that it annually raises approximately 8 – 10 million tree seedlings (Hoa Binh Agricultural and Rural Development Department, 2005 b).

While all this forestry activity is of great benefit to the Province, it does tend to concentrate on the project sites, and disregards many areas of the Province. Thus, many farmers have no chance to approach the extension services and supply of seedlings and technology on offer.

5.4 Market of forest products

The development of the forestry sector in upland regions depends strongly on the market for forestry products; this fact has been acutely realised since the opening up of Vietnam to the market economy. So the land tenure, forest and trade polices outlined above underpin the discussion in this section on the market of forest products. This discussion is the critical hinge point for our understanding of the potential for tree planting in upland communities which is undertaken in the next chapter.

Demand of forest products

Market sources need to be firstly defined, and then the demand of them will be analyzed. Generally, the market of forest products in Vietnam falls into 6 categories (Vo Dai Hai, 2005). These are markets for materials of:

- paper and pulp production;
- pillars and posts, mainly for the mining sector;
- manufacturing fibre boards ;
- timber for civil construction;
- woodwork market for domestic consumption and export
- and special non-timber forest products (NTFP) such as, pine resin, cinnamon, anise etc.

The forest area estimated to satisfy this demand up to 2010 is as follows (MARD, 2001):

- 1,000,000 hectares for pulp and paper mill;
- 500,000 hectares for fibre board;
- 80,000 hectares for mine poles/pillars;
- 180,000 hectares for furniture;
- 140,000 hectares for civil construction; and
- 100,000 hectares for special products.

In Vietnam, one of the most important markets to buy forest products from upland households is the paper industry. According to the Decision No 160/1998/QD-TTg dated in September 04th 1998, the Prime Minister passed the general plan of paper

industry up to 2010 that defined the plan of material forest areas (VGov, 1998c). Table 5.9 shows the investment projects of pulp and paper mill in the whole Vietnam.

Table 5.9 Lists of investment projects in the period of 1998 - 2010

Projects		Paper rating *(Tons/year)*	Paper mill rating *(Tons/year)*
Extending investment	Bai Bang Paper Company	100.000	200.000
	Tan Mai Paper Company	65.000	60.000
	Dong Nai Paper Company	40.000	16.000
	Viet Tri Paper Factory	30.000	-
	Others	105.000	80.000
New investment	Joint-venture Hai Phong Paper	50.000	-
	Cau Duong Wood Factory	10.000	-
	Kon Tum Paper Mill Factory	-	100.000
	New projects	750.000	580.000

Note: Paper rating means product – 'paper'; Paper mill rating means material for paper production

Source: Decision No 160/1998/QD-TTg dated 04/09/1998

To deal with the input for these companies, seven material forestation regions have been planned including Northern hill and mountainous region, Southeast regions, Northwest Thanh Hoa Province, North Kon Tum Province, Hoa Binh and Son La Provinces, Bac Kan and Thai Nguyen Provinces, and Coastal Central region (VGov, 1998c).

Table 5.10 Lists of pulp and paper mill Projects of Hoa Binh Province

Projects	Places	Rating Tons/year	Material demand Tons/year	Planning material areas (hectares)
Pulp and paper mill	Ky Son District	Pulp mill – 3,000 Paper – 1,000	15,200	2,432
Pulp mill	Van Mai Commune, Mai Chau District	6,000	22,800	3,648
Pulp and paper mill for export	Da Bac District	12,000	45,600	7,296
Bamboo sticks and pulp mill	Trung Minh Commune, Ky Son District	Sticks – 1,440 Pulp mill – 2,880	16,416	2,627
Pulp mill	Tu Ly Commune, Da Bac District	2,000	7,600	1,216
Bamboo sticks and pulp mill for export	Dong Bang Commune, Mai Chau District	Sticks – 1,500 Pulp mill– 3.600	19,000	3,040
Total			126,616	20,259

Source: Agricultural and Rural Development Department of Hoa Binh, 2005

In Hoa Binh Province, there are six investment projects of pulp and paper mill production. Table 5.10 presents the characteristics of six pulp and paper mill projects, which have been carried out in Hoa Binh. These projects have been built at the district level aiming at sourcing forest products from farmers. The major forest products, which have been consumed, are bamboos and plantation wood (Agricultural and Rural Development Department of Hoa Binh, 2005). The Hoa Binh Paper Mill currently

consumes 17,000 ton-materials of bamboos, acacia and eucalypt. The Project to produce artificial fibre board has been estimated to require about 25,899 hectares of planting material area (Agricultural and Rural Development Department of Hoa Binh, 2005).

In addition, Vietnam needs 2 million m^3 of wood annually from both natural and plantation forests for producing furniture. Wood furniture products are exported to EU, Japan, and China. In 2002, China consumed 24.3 millions m^3 round wood, 5.4 million m^3 sawn timber, and 636,000 m^3 man-made planks that considers it is a huge market. Surprisingly, Vietnam still has to import wood for furniture production from Laos, Cambodia, and Myanmar due to the lack of wood materials. As the export of furniture increases Vietnam has to increase its import of wood materials (Ministry of Agricultural and Rural Development). There is clearly a climate for import substitution that should stimulate the production of high-value timber species on farms.

In Vietnam, NTFPs are very diverse and fall into nine groups: fibres, resins, essential oils, fatty oils, tannin, medicine, drying agents, wicker (bamboos and rattan), and starch (FAO, 2002). Currently, market of NTFPs is for domestic consumption, and domestic materials of handicraft, especially bamboos and rattan. Some others products are exported to China such as, medicinal plants, anise, cinnamon. However, there are still no in-depth local or national studies into the market and trade of NTFPs in Vietnam.

Market channels

Due to the policy of restricting access to natural forests, forest products, particularly wood products, are mainly legally harvested from plantations. Figure 5.4 presents the consumption channels of planted forest products and NTFPs in the Northern Mountainous Provinces of Vietnam. Farmers who do not have access to supplying pulp for the paper and fibre-board industry ('factories' and 'semi-process' in figure 5.4) they need to be able to sell their forest products to other consumers. A better understanding of these consumption channels is needed to be enhancing the opportunities for farmers to plant trees.

In general, there are great demands of forest products in both the local and national markets that are good opportunities to farmers to plant trees. However, the consumption channels seem less beneficial to farmers, because farmers cannot directly sell their forest products to consumers, but mostly through middlemen. Farmer cannot be active with the consumption channels that form a barrier to them to widen tree plantings.

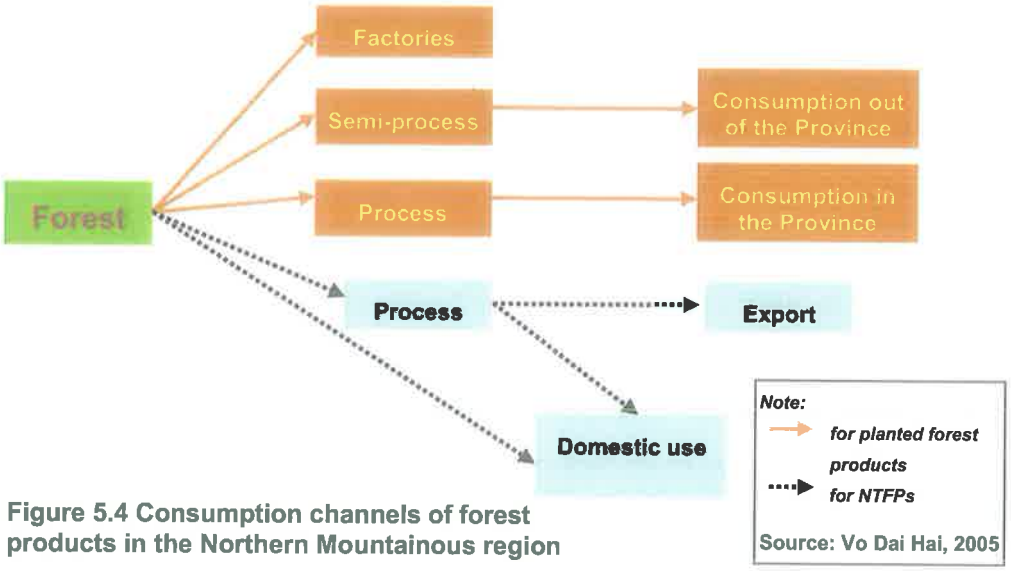

Figure 5.4 Consumption channels of forest products in the Northern Mountainous region

Summary

In general, there is a supportive physical and economic environment for upland farmers to plant trees in Hoa Binh Province. The climate and soils are relatively favourable for tree planting and there already exists a wide diversity of commercially-suitable native and introduced species. The increasing activity of the market economy is increasing the demand for agricultural and forestry production, both within the Province and throughout Vietnam. This, along with institutional arrangements that clarify the security of land tenure and access to forest resources, have in general improved the circumstances of upland households. It seems that there is an environment of good opportunities for upland farmers to engage in commercial tree planting. This is particularly the case for those farmers within range of large projects associated with industrial processing of forest products. However, herein lies the problem for most upland farmers in Hoa Binh Province; they cannot participate in these projects. The barriers faced by these farmers are:

- poor access to forestry information such as silviculture and comparative economic value of tree production over other forms of landuse. This is largely due to the inadequacy of forestry extension services which focus on the large projects but not small-holder activity.
- poor access to capital to invest in tree planting
- undeveloped market channels for the products of small-holder tree production.

Chapter 6
The Potential to Integrate Native Tree Species into the Upland Farming Systems in Hoa Binh Province

The previous two chapters described and analysed the biophysical and socioeconomic structures of upland farming systems and the larger environment in which they rest. This chapter takes these findings and explores the potential of planting tree species into the upland farming systems in Hoa Binh Province. It does this by discussing in turn: the structural, institutional and socioeconomic, and finally silvicultural potential for integrating trees into farming systems. This discussion will lead to the formulation of recommendations which will be presented in Chapter 7.

6.1 Structural potential for integrating trees into upland farming systems

As show in Chapter 5, the particular geography of Hoa Binh creates diverse microclimates, soils, and ecological communities such that the province can be considered as four distinct regions with varied environment for upland farming systems that are basis to the discussion on techniques in section 6.3.

1. the hilly region including the four districts Luong Son, Ky Son, Kim Boi and Cao Phong, is of relatively low altitude, low hill slope and low rainfall. Because of this the ratio of flat land cultivation to swidden, homegarden, livestock and forestry practice is higher than others regions. In addition, sedentary sloping land cultivation is wider practiced in this region than others.
2. the low mountain region including the three districts Lac Son, Tan Lac, and Lac Thuy, the mid-elevation region with moderately sloping land but the highest rainfall. Apart from the higher terrains and rainfall, the ratio of flat to sloping land is similar here to the hilly region, so farming systems are also similar. In both the hilly and low mountain regions, Muong farming systems are majority.

3. the high mountain region includes Da Bac and Mai Chau Districts. In this region the gradient of the slopes is high and the rainfall is intermediate between the lower regions. The ratio of flat to sloping land is much smaller than the lower altitude regions and those crops grown on flatland are relatively poor. There is widespread swidden cultivation and much more free grazing.

A fourth region within Region 3 could be considered as the area around the Hoa Binh reservoir which consists of part of Hoa Binh Town, Cao Phong, Da Bac and Mai Chau Districts including 28 communes. These communes need to be separated from the region 3 as a special area because this area contains not only sloping lands but access to opportunities for fishing and aquaculture.

While the varied farming systems of four regions are diverse it is possible to discern some essential similarities among them and discuss the potential to integrate trees into these systems as a whole. In summary it will be shown that the structure of upland farming systems are such that it may be difficult to integrate trees; i.e. the structure of the farming systems are a constraint on the adoption of tree growing.

According to the landuse classification analysed in chapter 4, the upland household farming systems have five landuses: flat land, home garden, swidden land, grazing, and forestland.

Flat land areas are particular priority for annual crops, especially food crops. So, there is no chance to integrate tree planting into this landuse type. Home gardens are the land that farmer like to plant mixed tree species in these. Unfortunately, the area of home garden is small so the potential of planting is limited.

Forestlands include the land which has forest vegetation covering, and so-called "unused sloping land" which is actually used for swidden cultivation. In Hoa Binh, the forestland is divided into special use forests, protection forests, and production forestlands. Special use forests are set aside for conservation of wildlife and managed by the State. There are no opportunities for access to these forests. However there are some opportunities in protection forestlands, production forestlands, and 'unused sloping land'. In particular:

The area available to increase planting into the protection forestlands is generally smaller than into the production forestlands. However, the opportunities offered by the

government are greater than into the production forestlands provided that one plants native wood tree species. The plantings in this land are mainly aiming at forest enrichment supported by the 661 Project.

Most of the area available for farmers to plant trees is in the planned production forestlands. A large area of this land is the so-called unused sloping lands, where farmers actually cultivate swidden crops. So at this point there is a competition for land between tree cultivation with relatively long-term returns and swidden cultivation with relatively short-tem returns. An optimistic solution is to encourage farmers to plant trees mixed into the swidden cultivation as a part of agroforestry systems.

In 2005, there was about 135,000 hectares of unused sloping land in Hoa Binh Province, accounting for 29% of the total land area of the province (Hoa Binh Agricultural and Rural Development Department, 2005 b). All of this land is planned for either protection forests or production forests. While there is tremendous potential to increase forest area, the record has so far been modest. Between the 5 years from 2001 to 2005, the new plantation areas established across the whole province was only 36,590 hectares (Hoa Binh Communist Party's Board, 2005). At this rate this forest development plan may be realised by 2023. If the options available to farmers to grow trees are expanded, e.g. swidden-replaced by agroforestry, then perhaps this afforestation rate could be improved. The real problem is that swidden land and grazing land are not recognised in the planning process at the provincial level. There are very real and strong social drivers behind swidden cultivation and free grazing; ignoring them in the planning process will not make them disappear. They still exist and share the forestlands in many communities this is cause for conflicts. These conflicts occur not only between the provincial planners and the village households but also and between the households at the village level. So unclear and inappropriate landuse planning is itself a barrier to farmers planting trees.

6.2 Institutional and socioeconomic potential for integrating trees into upland farming systems

6.2.1 Legislation and policies

Apart from the inadequacies of landuse planning described above, the general framework of legislation and policy is relatively favourable for encouraging upland

households to be active in forestry development, particularly planting tree species. The most important policies concern land tenure, which clearly defines the landuse rights and beneficiary mechanisms of land ownership. These policies encourage farmers to choose the most beneficial ways to use their land, which includes being active in planting trees. Farmers will only plant trees in land that is allocated to them under the *Red Book* scheme. In contrast, land tenure is not completely defined in the Districts of the province, especially the sloping lands in Da Bac District. Farmers use sloping land for swidden cultivation do so without it being allocated to them under the *Red Book*. They do not plant trees into this unallocated land, because they do not trust they will receive benefits from such efforts. So to encourage farmers to plant trees on this land used for swidden cultivation some consideration must be given to including it under the *Red Book* scheme.

Another constraint on expansion of private forest development is the lack of knowledge among farmers of policies and opportunities that do exist. Adding to this the general low educational level of most farmers, it is difficult for them to find appropriate information in a form that they can understand. Village level officials generally have similar education as their farmers and are of little help in understanding the policies and opportunities available. Farmers know of the existence of policies regarding to the planting, beneficiary of planting, forest management, and forest product exploitation taxes, but they do not know the important details. They have no knowledge at all about policies related to the planning of material forest areas, forest product processing and markets, and forestry extension.

It seems that before farmers can realise some of the opportunities that are available to participate in the forest product economy they need to have clearer and more specific knowledge to empower them as individuals and communities.

6.2.2 Industry support

Hoa Binh is the province in the Northwest region of Vietnam where the implementation of forest development policies has progressed furthest. There is indeed a Hoa Binh Forestry Company that works to achieve the important forestry target of the province. The company currently has 12,000 of 24,820 hectares acacia plantations of the province including hybrid acacia and *Acacia mangium*. Other provinces in the north-west do not have such institutions.

As presented in chapter 5, Hoa Binh has a strategy to develop pulp and paper mill industry. So, the province has policies and institutional structures to encourage the development of 'material forest' plantations for pulp. The pulp industry can accept material form native trees species but all of the plantation development has been of acacia and bamboo, obviously because they are faster growing than most native timber species. So while pulp industry favours the general planting of trees it does not generally favour the planting of native timber species.

The positive aspect of the pulp industry is that it has created a culture of tree growing among some farmers in the Province. Advantage of this situation could be taken to shift the interests of more progressive farmers to grow species other than pulp species. However, this will need some industry support; i.e. clear signals from the market that timber from native tree species can be sold, a prominent, and most likely institutionalised, purchaser of this material, and some government support for stimulating this industry.

6.2.3 The capacity of upland households to engage in tree planting

The general socio-economic status of Hoa Binh Province is in a period of fast growth and, as a whole, the life of upland households is improving. The vitality of the regional economy is favourable for the development of new industries, perhaps even those based on native tree species. However, the capacity for upland households to join this new economy is low because of low levels of savings, poor access to credit and poor access to good information about forest policy, silviculture and markets.

In 2005 the average income in the province was US$280 per person per year, which was the same as the national average income. However, about 31% of households in Hoa Binh were classified as poor, and most of these were in the rural uplands (Hoa Binh People's Committee, 2006). For example, the average income of the Tay households in Da Bac District was US$209 per year (Nguyen Thanh Lam et al., 2004). When this income is distributed around an average of 4 persons per household, this equates to about US$52 per person per year. As the living costs in this region for someone above the poverty line is in the order of at least US$80 per person per year, it is clear that the investment capital of the households is virtually zero.

The opportunity to access to the capital credit of the households is very limited. Although the Government has issued several priority policies to encourage farmers to borrow money to plant trees (see Table 5.7), there are many hurdles to jump. Under these policies a farmer with a written official reference can borrow up to 10 million VND (about US$700), without showing any property guarantee such as a *Red Book*, for any agricultural activity including tree planting. This reference must be obtained from the Farmer Union and Commune Peoples' Committee to say that they are worthy of the loan. However, it is difficult to get a reference without personal contact with Committee members.

Furthermore, it seems that the banks still consider upland farmers to be a credit risk and so are reluctant to lend for this purpose. Several of the farmers interviewed in this study were able to access credit with low interest rates from the Agricultural Bank and Poverty Alleviation Fund that allows farmers to borrow, but could only use the money for activities such as livestock breeding, growing fruit trees, and aquaculture but not for tree plantings.

It is clear from this study that those farmers who plant trees tend to be relatively wealthy in land, labour and capital, but not necessarily higher in education. More important than education is farmer's awareness of the world beyond their village and more progressive attitudes. This may be brought about by their better access to travel and information. For example, the Muong farmers who live in the lower regions are more aware and more positive about tree planting than the remote-living Tay farmers.

Low levels of education among local Commune officials, however, may be a barrier to tree planting as these people carry the information about laws, policies, and support resources to those households. Even those farmers who by attitude are disposed to tree planting often rely on local officials for information and advice on how to access government support. Thus, the ability to make decisions to benefit from government-encouraged tree planting is poor. As the only information available on tree planting concerns acacia and bamboos, this is all that it planted. To encourage the planting of native tree species will require not only suitable species and systems but also education of the local Commune officials of the benefits and programs available to support their establishment.

The capital needed to invest to establish one hectare of acacia or bamboo is just VND 2-3 million. For farmers in poor households (i.e. those in Categories C and D in Chapter 4) that amount of money is too much. These people are also unlikely to be well-connected enough to get references from the Commune People's Committee. Even if one can get a loan, the period to pay back the loan is 5 years, but the planting rotation is 8 to 10 years.

As shown in Chapter 4, the NPVs of tree plantings are very high. However, farmers do not know about NPVs. Even if they did, it is likely that their personal discount rates are far higher than those used in conventional NPV analysis (in this study the discount rates used were from 5-13%). Most of a farmer's productive capacity is in their family labour, not their capital. Family labour is more readily employed in annual swidden crops rather than tree crops. So the 8-10 year rotation of a tree crop, which requires capital more than labour, has to compete against the one year rotation of a swidden crop which requires labour more than capital. To make tree planting a favourable investment over annual agriculture, it should probably be treated to a different credit environment.

To enhance the capacity of farmers to access credit for tree planting it seems several changes need to be made. Firstly, there needs to be a more equitable arrangement for farmers to access loans that are not impeded by their social connections. Secondly, the length of loan repayment period should reflect the expected time taken to benefit for the investment. Thirdly, there should be a loan scheme for tree planting separate for that available for other agricultural investments with shorter payback times. Finally, there should be an improvement in the delivery of information on tree planting programs and support by local government officials.

6.2.4 Forest product market

Vietnam will become a party to World Trade Organisation at the end of 2006. This will further open up Vietnam to the great international demand for forestry products. Currently Vietnam is securing a position in the export of wood furniture and this requires species other than the acacia and bamboo grown on farms. Indeed much of this market is met by rainforest timber imported from Cambodia, Laos, and Myanmar. So, as shown in Chapter 5, the demand of forest material for processing, and forest products for trade, is huge while the existent forests can not meet these demands.

There is also a critical dis-connection between the demand for forest products and the ability of Vietnamese landowners to supply. Opening up of international markets at the demand side does not automatically create capacity at the supply side. Indeed, more open and wider markets may make it even more difficult for upland communities to participate. If they have problems participating in a domestic market, how can they participate in an international market?

The previous sections have shown that there are both opportunities and barriers to developing supply capacity at the biophysical, farm structural, policy and institutional levels. While there is a notional opportunity for farmers to link with the expanding markets, a key barrier is market knowledge. The only source of market knowledge available to farmers is from the middlemen who buy their products. The middlemen will naturally position themselves as price-setters. These middlemen are also embedded in, or react to, supply chains that they have little control over. They respond to the demands from companies that process the wood for MDF and pulp for paper both relatively low-value end uses of wood. They will accept native-tree species but are not ready to pay prices beyond those received for acacia and bamboo. Several forest processing factories have been built in Da Bac, Mai Chau, and Ky Son Districts and there is official perception that this will create more opportunities for planting trees. But this potential is mainly for material forest production with acacia and bamboo, not for native or high-value timber tree species plantations.

If a forest product economy based on native tree species is to develop, then it must do so at all stages in the supply chain. It seems that a likely market for high-value native tree species will be along value-adding market chains such as furniture production for export. Currently, this supply chain is met from unsustainable logging of Cambodian, Laotian, and Myanmar forests (MARD, 2006). International consumers of forest products are increasingly concerned that these products are sourced from sustainably managed forests and plantations. One way of approaching this new market is by adopting management practices that qualify for certification from the Forest Steward Council. Alternatively, sourcing timber from plantations can be readily marketed as eco-friendly (Forest Stewardship Council, 2006). A first step to encourage farmers to grow high-value tree species would be for a national-level strategy to establish eco-friendly labelling of exported forest products.

As this national export market is established then existing forest processing companies could diversify to take advantage of it. This may need encouragement at a national or provincial level. However, while it is important to create these market channels at a national and provincial levels, there still much capacity building to be done at the district and village level. It was mentioned in Chapter 2 that, while there is a growing interest in the agroforestry research in Vietnam, there is little in the way of research into markets for agroforestry product markets (Tran Duc Vien, 2005). This seems a serious oversight as forestry products may occupy larger quantity of an export market than annual crop products. A more open market for forestry product markets will only have an effect at the district and village level if the agroforestry systems generate products that fit neatly into the larger market.

Farmers' knowledge of forest product markets and how they can be entered is very limited. This may partly be attributing to low educational levels but as shown in the previous chapter, the relationship between wealth and education at the village level is weak. So some other factor must be responsible for farmers' inability or reluctance to broaden their engagement with the forest trade. If a provincial market for high-value timber is established as outlined above, then the best encouragement for farmers to participate would be clear information on the value of the timber; i.e. clear market signals. Farmers may still deal with middlemen in the transaction but will have better information to negotiate for the best price. With information comes power and from this will come more confidence. As the leading farmers in a community engage in this market, then other farmers will follow in time.

6.2.5 Community-based forest management

There are two types of forest management at the village level in Hoa Binh Province:

- based on the individual household, and
- based on the community.

At the village level, household-based forest management is clearly defined by the government policy. Community forests are also legally defined and allocated to the communities with *Red Books* and representatively managed by the village authorities. However, most community forests are poor secondary forests, and community-based forest management is just a protection activity as the case of Tay community in Tat

Hamlet (see Box 4.2). This protection for community forests is defined in the village regulation.

Beside the community forests, upland villages have some areas where every household can use for grazing, called 'unused sloping land'. These 'unused sloping land' areas are very suitable to develop for forests or agroforestry based on community management. However, for this to happen the village customary regulations need to be altered to a cultural and policy environment that allows community forest development. That is, rather than community forest management being a process whereby the community manages protection forests, this institution should be developed so that communities are actively involved in planting new forests on 'unused sloping land'. These forests would ideally be mixed plantings of native species; but to allow true participatory processes to unfold, the option for the community to plant monocultures of acacias and bamboos should probably still be allowed. Appropriate incentives could be introduced to "tip the balance" so that communities choose to plant native species.

In Hoa Binh Province, about 54,000 hectares of forests which exist as the community forests were allocated to 178 communes. Several trial models of community-based forest management were built in the province by Social Forestry Support Program (SFSP). The structure of this community-based forest management is shown in Figure 6.2 that indicates the management is based on group of households led by the village authority. Beside this structure, there is a group of village guards who protect the community forests (Dinh Duc Thuan, 2001). However, this community-based forest management was separated as a single activity (i.e. it was not linked to other land use activity) and the benefits to the households in this were not clearly defined. So this model was actually not successful.

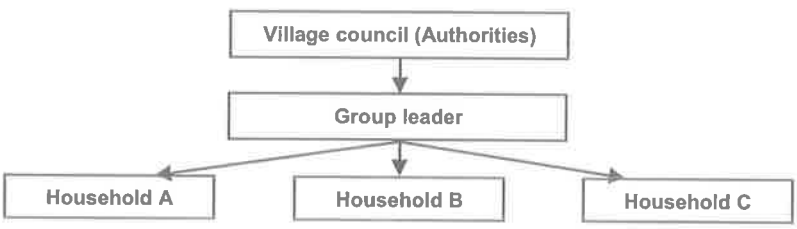

Figure 6.1 Management Structure of Community-based forest management model in Hoa Binh Province

Source: Dinh Duc Thuan, 2001

Legalising tenure of community forestland creates a chance to better protection of community forest; however government offices have not yet a comprehensive program to encourage community-based forest management.

Beyond legalising the rights of community forestland, a comprehensive program should be built to enforce community-based forest development with the suitable way of organisational structure and management. This program may need to deal with: enforcing the village regulation, encouraging the collaboration of farmers, and training village authorities on community forest management and forest products markets. If this program is established, there are four opportunities to encourage community-based forestry development in:

- Improved community forest management systems should be developed to ensure sustainable management and harvest. Currently there is little 'forest science' in the management of these forests.
- Privately-owned 'protection forestlands' could be better managed if there was collaborative management among the owner-farmers. This management needs to be informed by forest science and facilitated by a third party.
- Privately-owned 'production forestland' or plantations may be more easily and profitably managed if farmers can collaborate in buying and planting trees. That is by operating in a collaborative way farmers could take opportunities afforded by 'economies of scale' by establishing larger plantations. Such a community-based forest cooperative could help overcome some of the problems farmers have in marketing their forest produce. In particular, this environment would also make it easier for farmers to be involved in mixed plantations including native tree species.
- The 'unused sloping land' areas should be allocated to the communities for plantations or agroforestry. It is important that the ownership of land and trees is made very clear at the outset of such a venture. The advantage of community engagement is that larger areas of trees can be planted. If it is the form of a plantation, then it is more likely that collective ownership will work; access to the trees will be decided by the village officials who also manage the community protection forest. If the trees are planted in agroforestry configurations, then the

ownership of the trees should go to the farmer who manages the crops underneath. This will also mean that tenure to that land must also go to the farmer.

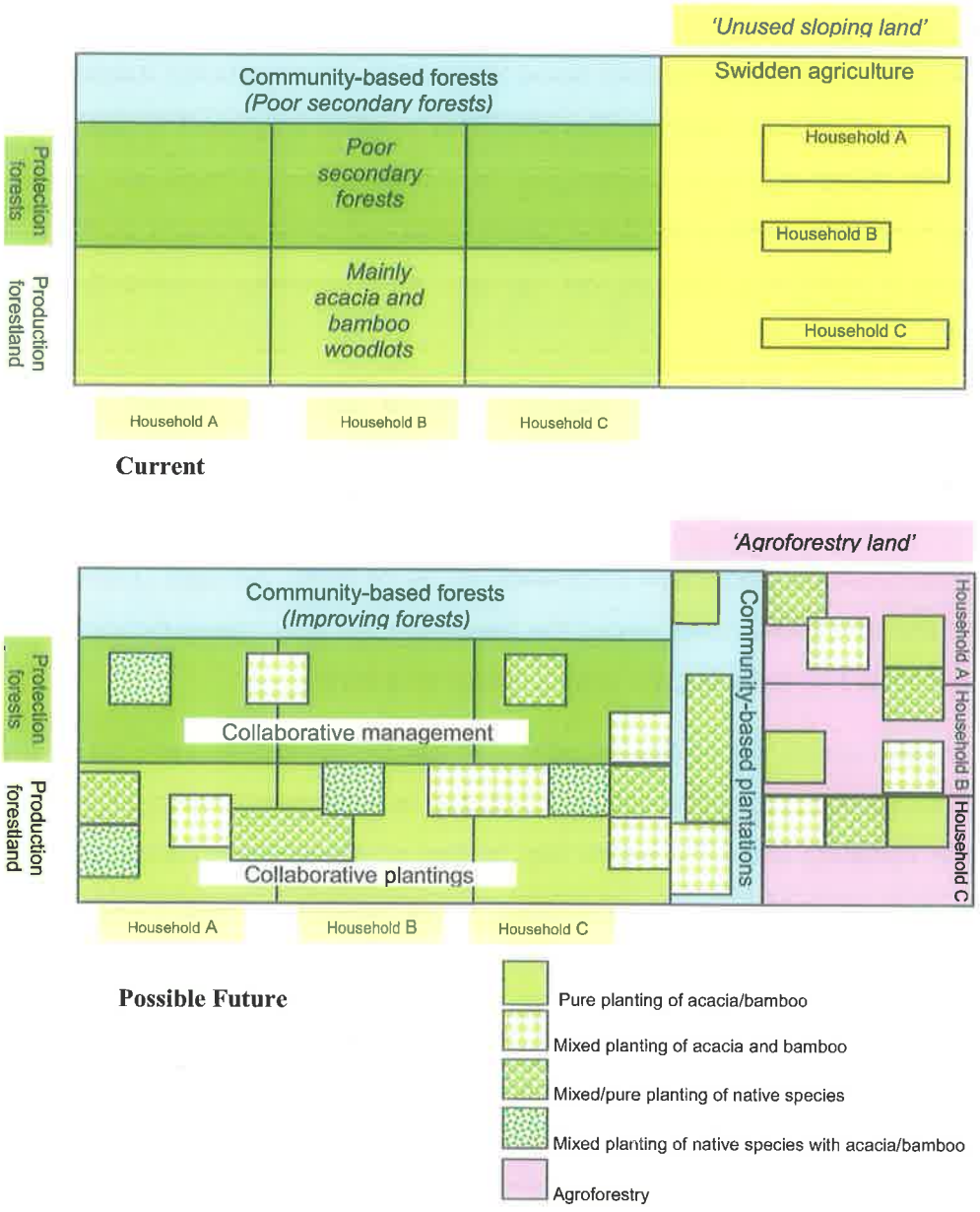

Figure 6.2 Schematic diagram represents current and possible future community-based forest management

These opportunities are illustrated in the schematic represented the current and possible future community-based forest management (see Figure 6.2). To adapt to the possible future scheme at the village/commune level, an initiator of community-based forest management may be a cooperative that it may be called '*Agroforestry*

Cooperative'. This cooperative may be a new establishment, or developed from the existing old form of agriculture Cooperative. This cooperative will link farmers together in forestry management and planting, and it will also link farmers to extension services, farmers to forest product factories and markets, and provide farmers all materials for agroforestry productions (seedlings, fertilisers, tools). However, the cooperative manager and staffs have to be trained to cope with the new form, new tasks, and new environment.

6.3 Silvicultural considerations for integrating trees in upland farming systems

This section will consider the opportunities for integrating high-value trees into upland farming systems on the basis of farmers existing silvicultural knowledge. It will also identify what critical information is not known and raises appropriate research questions. This discussion firstly focuses on integrating native trees in existing plantations and secondly within agroforestry configurations.

6.3.1 Tree knowledge

Farmers have free access to seed sources of timber species in the secondary forests surrounding the villages, in mature scattered trees planted in homegardens, and in mature acacia plantations. As shown in Table 4.23 a wide range of native timber species are known but this knowledge across the communities under study is not uniform. Some farmers know a lot, while others know only a few species. Furthermore, some farmers have good silvicultural knowledge of acacia plantations while others do not (e.g. see Tables 4.15 and 4.16). If this indigenous tree and silvicultural knowledge was more widely shared, then the forestry culture and activity would have more chance for development. For example, farmers who can identify and use locally available seed will be able to reduce the investment required for tree planting, thereby opening up opportunities to widen their plantings. Currently many farmers do not realise that they have good seed sources available locally, and they do not have knowledge of raising native tree species.

Those upland farmers that do have forestry experience and knowledge of indigenous species and techniques have much to offer their neighbours; but also some of the limitations in their silvicultural understanding has to be addressed before others can

fully benefit. For example, they have learnt to plant *Acacia mangium* rather than hybrid acacia because the wind resistance of *Acacia mangium* is better than hybrid species. Furthermore, these farmers can raise *Acacia mangium* seedlings in the nursery by themselves. They have also learnt to direct-seed *Acacia mangium* into the swidden fields. They also can take full the advantage of natural regeneration from *Acacia mangium* seed as the second rotation. However, while the growth rates of hybrid acacia species are much greater than *Acacia mangium* the seed is also very costly, so farmers prefer the cheaper, easier to manage *Acacia mangium* over the expensive but ultimately more productive hybrid. So for all farmers to benefit from the introduction of hybrid cultivars then these issues must be understood and addressed by extension services.

Bamboos are a native species in the province, and as a traditional commodity their silviculture is well understood in upland communities. All farmers including Tay and Muong peoples own the indigenous knowledge regarding to nursing, planting, and using bamboos.

Regarding native timber tree species planting, the Muong people in Lac Son District, plant native tree species as scattered plantings around home gardens, along roads, and public areas in the annual planting campaign called 'Planting festival' in the spring. These festivals have been in progress over the last 15 years and *Chuckrasia tabularis* in particular has been widely planted in Lac Son. However, it is not planted as forest plantations. In Da Bac District, *Melia azedarach* is an indigenous agroforestry practice occasionally observed in the traditional swidden cultivation. Muong households are aware and plant native trees into the sloping fields without the incentives. Some households have taken the advantage of the native tree seedlings that are available at the village forests to plant, particularly the species of *Erythrophlouem fordii* in Lac Son, and *Manglietia fordiana* in Luong Son.

Despite these occurrences this study found that, accepting the plantings of native wood tree species supported by 661 Project and RENFONDA Project, few households are aware of indigenous timber tree species plantings.

6.3.2 Mono versus mixed plantings

Farmers prefer to plant acacia and bamboo over native wood tree species, and when they do they prefer to plant these species in monoculture rather than mixtures. The key reason given for these preferences is the ease of silviculture (e.g. Table 4.20). Moreover, mono-plantings of acacia and bamboo can create a larger material product volume. However, while monoculture plantations of acacia and bamboos grow without too many problems in the first rotation it is possible that there could be problems with later rotations or as the mono-specific forest resource becomes a dominant feature of the landscape. Problems of forest fire, pest and diseases epidemic have already been reported in Vietnam.

In the 1980s Leucaena grown in monocultures as a fodder resource was widely infested with psyllids as it was in much of South-East Asia at the time (Ich B. V. and Tru D. Q., 1989). In 2003, a caterpillar epidemic widely occurred and attached thousands of hectares of pine plantations in the Central Region and Tay Nguyen Region of Vietnam including Thanh Hoa, Nghe An, Ha Tinh, and Kontum Provinces (VietnamNet, 2003a). Also, another similar epidemic damaged about 70 hectares of cinnamon plantations in Quang Nam Province (VietnamNet, 2003b). Farmers in Hoa Binh are likely to have little knowledge of this problem and do not realise the implicit risks of mono-plantations that may challenge forestry if it is to develop in this region.

Farmers are not compelled to plant mono-plantations. They can choose to plant in mixtures at least at a landscape level. As the consequence of swidden cultivation most households own several sloping land plots in different areas of the village landscape. Each plot are usually about 3,000 – 5,000 m^2. So, if different households plant different tree species in the same area of the village landscape, this could create a mosaic of tree species. However, it is not known whether there is any benefit, in terms of suppression of pest, disease or fire outbreaks, with this sort of planting. Do these plots have similar interactions as the natural mixed forests or not?

Further to this, little is know about how native tree species can be most readily established. Several studies indicate that the indigenous timber tree species require a canopy to cover and protect them in the early duration of plantings or young planting duration (Pham Xuan Hoan, 2002, Pham Xuan Hoan, 2003, Tran Huu Vien, 2004). This information is the basis to support for mixed planting of high-value wood tree

species. However, there is no research on how much canopy each native tree species require and for how long. Actually, within the 661 Project, farmers have been guided to plant native tree species into cleared fields and these plantations in Da Bac District are still alive after three years. The farmers grow these trees into the swidden fields after land are already prepared by 'slash and burn'. These tree species grow without the canopy of annual crops such as upland rice, maize, and cassava. It is not sure that the canopy of crops is enough to help the growth of native trees in the early duration or not? These trees may be alive, but have they prospered? It is possible that growth rates of these trees may be much greater if they are established under shade that mimics conditions of a natural forest. Research to answer this question would be essential for our understanding to improve native tree production systems.

The potential of planting native tree species in some sort of mixture in Hoa Binh is very high given that the area of existent plantations is 24,820 hectares of acacia plantations, and about 15,000 hectares of bamboo plantations. The existent acacia and bamboo canopy could be used as an environment for the establishment of native timber tree species.

Natural mixtures of native bamboo and timber tree species are common in secondary forests in the province, and this mixture also occurs naturally regenerates after swidden cultivation. So to grow native trees under bamboo is an easy concept for farmers to accept. Indeed, several farmers in Lac Son and Luong Son Districts have grown *Erythrophlouem fordii* and *Manglietia fordiana* into the bamboo plantations as trials without incentives. And at least in one formal study, *Erythrophlouem fordii* was found to establish well planted with bamboo (*Dendrocalamus membranaceus*) (FSIV and JICA, 2003). There appears to be no similar studies on under-planting native tree species in acacia plantations.

Bamboo plantations seems more suitable for under-planting compared to acacias simply for the reason that more diffuse light reaches the ground under bamboo than acacia. Even weeds cannot grow under acacia plantations. This is the reason why farmers feel that acacia would not be suitable for intercropping (Table 4.20). However, it appears that no-one has considered the possibility of growing native trees under wider-spaced acacia plantations.

Regardless of the whether native trees are grown under acacia or bamboo, farmers could thin their plantations, and then plant native tree directly into the plantations. If farmer could practise those techniques, they could still deal with both their current and long term incomes, particularly with bamboo plantations. However, it needs to study more about the silviculture of mixture plantings to answer the following questions:

- *Which native wood tree species can be best grown under the canopy of acacia plantations, and bamboo plantations?*
- *How much canopy does each native tree species require in the early phase of planting rotation? This is a question of tree spacing.*
- *How long do native trees grown under acacias need this protection? When should the acacias be removed to the advantage of the native trees?*
- *What specific techniques are required for establishing and maintaining mixed plantings?*
- *What is the most appropriate process for encouraging farmers to adopt mixed tree plantings?*

These questions are the challenges that remain to be addressed to further the development of mixed plantings of native tree species.

6.3.3 Agroforestry

A final consideration to discuss is that of agroforestry. This is a not a new concept for upland farmers as there is significant evidence of traditional agroforestry systems. It may actually be a concept, if appropriately acknowledged, developed and packaged by government programs, that will greatly further the widespread planting of native tree species.

The following agroforestry systems are currently practised in the uplands of Hoa Binh Province are:

- Traditional agroforestry system is the practice that the Tay Da Bac practises as an indigenous agroforestry of intercropping between swidden crops and bead-trees (*Melia azedarach*). This practise is defined as a fallow improvement rotation. The Muong households also apply this agroforestry system. This

practice is also widely applies in Yen Bai Province with cinnamon trees - *Cinnamomum cassia* (Pham Xuan Hoan, 2003).

- Intercropping practice is a cultivation of annual crops such as upland rice, and cassava in first three years among and acacia or/and bamboos. Most households of the province practise this type of agroforestry.
- Mixed planting crops, wood tree species, and non-timber tree species or multi-purpose tree species. This practise is applied by several households in Lac Son Districts.
- Mixed forestry farm includes annual crops, tree species and livestock. This agroforestry system tends to be practised by the households in Luong Son District.
- Multi-layer gardens are a traditional agroforestry that are applied by most upland households.
- Agroforestry mixed fish cultivation: this model can be applied mainly by the households located at the Hoa Binh Reservoir bed that include the households of 28 communes as of the fourth Region classified above.

(See photos in Appendix C7).

Government policy states the households can use 20% forestlands for agricultural cultivation (VGov, 2001). This is crucial to meet subsistence needs of upland households and farmers cannot immediately stop swidden to plant tree species. Agroforestry is a very suitable alternative precisely because it is not a new concept and could be introduced as a minor modification of existing practices. Native tree species rotations may be too long to make plantations an attractive option; tying up land for too long. Agroforestry configurations may allow these trees to be grown while the land is also being profitably used to provide other agricultural products.

Currently the language of landuse planning deals with forestry versus agriculture; i.e. one or the other. If agroforestry was adopted as a specific landuse at the provincial planning level, then some of the existing conflicts between forestry and agriculture would settle by themselves. Reforestation programs to increase the resource base for MDF and pulp factories are naturally going to focus on monoculture plantations; the

objective is to grow enough wood resource for the factory. Reforestation programs that have other development criteria are needed to favour agroforestry plantings that contain high-value native tree species. Such programs should focus on linking the products of agroforestry with high-value commodity markets such as furniture timber. This need not exclude linkage with low value wood products, but for native tree species to economically competitive against acacia, then alternative markets and production systems need to be sort.

Summary

This discussion has revealed that there is some inherent potential to integrate native timber trees into upland farming systems and, where there are barriers to this process, some suggestions and questions were raised.

The structure of the farming systems are such that the best opportunities for introducing tree production systems are in the areas either designated as planned production forestlands or as 'unused' forest land, i.e. swidden cultivation. The discussion went further to suggest alternatives of inter-planting high-value native species in bamboo, and maybe acacia plantations, or integrating trees within agroforestry systems. It raised several questions that need research to better understand the silviculture of mixed plantations. It argued agroforestry would be more readily adopted because agroforestry is already practiced in a traditional context.

It was also shown that unclear and inappropriate landuse planning is itself a barrier to farmers planting trees and that to encourage farmers to plant trees on land used for swidden cultivation some consideration must be given to including it under the *Red Book* scheme. Indeed, it was argued that introducing 'agroforestry land' as a separate and distinct planning category may create an institutional environment that favours tree planting other than mono-culture plantations of relatively low-value acacia and bamboo.

This chapter showed that knowledge and systems for delivering that knowledge are important for farmers to be able to participate in the forest product economy, especially one that comprise native timber trees. Farmers need unambiguous knowledge of forest policies and market signals. They also need a clear market channel

for high-value native tree species if they to be an attractive alternative to acacia and bamboo.

So it was suggested that the national and provincial governments need to develop and support such and industry, just as they have supported material forests for MDF and pulp factories. The discussion also suggested changes in the form of credit systems appropriate for relatively long term forestry investments.

All these considerations, questions, and issues raised in this Chapter will be brought together with those raised in preceding chapters 4 and 5 in the next chapter, Conclusions and Recommendations.

Chapter 7
Conclusions and Recommendations

Chapter 1 raised several research questions and objectives in this attempt to understand how high-value native tree species can be integrated into the upland farming systems of Hoa Binh Province. Chapters 4, 5 and 6 provided answers to these questions and discussed the implications of them. The purpose of the current chapter is provided a summary of these answers and the key recommendations that have arisen from them. The subheadings reproduce the original research questions. The answers to the final question (Section 7.6) suffice for specific recommendations derived from this study.

7.1 What physical and time constraints present barriers to farmers planting trees?

There are five components in the upland farming systems: flat land cultivation, home garden, livestock, sloping land (swidden) cultivation, and forestry. The relative proportions of these components vary across communities based on geography (mainly altitude) and wealth of household. Regardless of these differences, there is relatively consistent activity across the farming system such that household labour is always occupied. There is relatively little spare time for taking on new enterprises. Any new activity such as planting trees has to compete in an already full seasonal calendar. So there has to be a clear return for the investment in time in tree planting.

Within the farming system, the flat land cultivation and home gardens occupy separate land areas. Flat lands are not an opportunity for extensive tree growing because this is where the major income is produced from paddy cultivation. Home gardens are relatively small and do not offer much space for tree growing. Planting native trees in these areas, perhaps as boundary markers, is not excluded, and just limited in terms of potential tree numbers. In contrast, livestock and swidden cultivation share the areas of 'forestlands'. This planning category includes sub-categories 'production forests', 'protection forests' and 'unused sloping lands'. This last sub-category is a misnomer as here is where most of the swidden cultivation is undertaken. The 'production forests' are where farmers plant acacia and bamboo. These areas offer opportunities for inter-

planting with native tree species. The 'unused sloping lands' or swidden areas offer opportunities for mixed-plantations of native trees or agroforestry plantings.

So, the main structural conflicts with planting native trees are concerned with their biophysical ability to be integrated with existing plantations or with grazing and swidden cultivation as they are currently practiced.

7.2 Do upland farmers plant trees and why, or why not, do they engage in this activity?

The answers for this question are mixed with the answers of question 7.3 (following).

7.3 Of those farmers that plant trees, why do they plant some species and not others?

Currently, the farmers of Muong ethnicity in Hoa Binh Province widely plant acacia, and bamboos without incentives. Farmers in the poorer Tay community studied (Tat hamlet) do not plant trees without incentives. Farmers consider the benefits of acacia and bamboos to be as follows:

- relatively low investment,
- they can be integrated with annual crops in first two or three years,
- they are fast growing (8-10 years),
- and there is some opportunity for mixed livestock (buffalo, cattle, pigs and chickens) grazing under canopy of plantations.

Acacia and bamboo plantings meet the demands of a local forest-product economy based on a resource for poles, some sawlog, and pulp processing factories. This supplies a modest but irregular income for farming households.

Some farmers have good knowledge of trees, both exotic and native, and simple silvicultural practices. However, this knowledge is not uniform across the communities studied. The general attitude to native tree species is one of dis-interest. They have little awareness of the biodiversity benefits of native wood tree species. While they may know that the prices paid for the timber of these species is good, those farmers interested in planting trees only think of acacia and bamboo. So in general, knowledge of native species, their silviculture and markets, present a barrier to widening the plantings to include native trees.

Those households that do plant high-value native timber tree species do so with the support of government-sponsored development projects. The projects provide incentives in the form of free seedlings and some instructions on establishment. Twelve species were identified but the main species planted are: *Chuckrasia tabularis, Canarium album, Melia azedarach, Michelia mediocris,* and *Erythrophloeum fordii.* The preference for these species was based on the good price for their wood. *Canarium album* also provides fruit and the seed of *Michelia mediocris* is sold as culinary spice. However, the relatively slow growth rates of these species is a deterrent for wider planting as they may take 30 years before being ready for timber harvest. It takes 15 years for the trees to even provide fruit and seed.

These species do not compare favourably against acacias and bamboo under Net Present Value analysis. Perhaps farmers' preference for acacia and bamboo is an intuitive understanding of this analysis. The fact that the cost of native tree seedlings are ten to twenty times higher than acacias must also be a significant deterrent for farmers to plant these trees without incentives. Irrespective of the costs and returns of native trees farmers lack the technical knowledge: of being able to identify natural seedlings (which could be transplanted); of harvesting seeds in raising seedlings in a nursery; and of establishing seedlings in the field. Finally, in more remote regions farmers still illegally access wood of native species from 'protection forests'.

Despite these disincentives to plant native trees a handful of farmers in the communities studied were experimenting with mixed plantings of native high-value tree species between acacia and bamboos. These farmers could not be grouped on the basis of wealth, education or geography. Their only commonality was an interest to leave something of value to the next generation. They had good knowledge of indigenous species and their silviculture, and were aware of their multiple products, the high value of timber, and that there is a market for the trees. So, any efforts to encourage the planting of native species should consider developing a culture to plant for the next generation. This will need to be supported with appropriate training in the silviculture of native species.

7.4 In what configurations do farmers integrate trees into their farming systems?

There are five models of tree planting that farmers practise without incentives:

1. Single-species plantings of acacia or bamboos. These are intercropped with annual crops in first 2 or 3 years.
2. Traditional agroforestry of swidden cultivation with bead-tree (*Melia azedarach*). Annual and short term intercrops are grown for 3 years and then the land under trees is left for grazing.
3. Traditional multi-layered home gardens. These comprise a rich mixture of vegetable and fruit species with native trees planted occasionally for boundary demarcation, shade and aesthetics.
4. Mixed plantings of acacia with bamboos. Bamboos are mainly planted around the borders of plantations. Early stage annual intercrops are also employed.
5. Mixed plantings of native high-value wood tree species between acacia and bamboos. Early stage annual intercrops are also employed. (The indigenous experimental approach mentioned in previous section).

All of these systems occur on the sloping lands except for the homegardens. The annual and short term intercrop species grown in all these systems are for subsistence production and rarely sold. They are a critical component of the household economy taking full advantage of family labour. It also makes it easy to establish the trees this way. While most farmers buy seedlings to establish these systems, some farmers have the skills to source seed and seedlings locally at low or even no cost.

Farmers stated their preference to plant acacia and bamboo in monoculture rather than mixture of tree species because of the ease of planting, harvest, management, ability to coppice, easy for next rotation, and it requires less labour. They also stated that their preference was based on "following neighbours" that is not surprising as this is a consistent driver behind technology adoption across most rural cultures (van den Ban and Hawkins, 1996).

There already exist modern and traditional models of tree planting in which native trees can be planted. There is no need for radically different planting configurations. Models 1, 2 and 3 are commonly known. However, not all farmers will know of Models 4 and 5 or appreciate them to be of value or something that they could adopt and modify themselves.

7.5 How does the physical, socioeconomic, institutional, and policy environment support the planting of integrated mixed species into the farming systems of Hoa Binh Province?

There is a supportive physical, institutional and economic environment for upland farmers to plant trees in Hoa Binh Province. The climate and soils are relatively favourable for tree planting and there already exists a wide diversity of commercially-suitable native and introduced species. Land tenure policy is a key condition to encourage farmers engaging in acacia and bamboo plantings because these policies allow farmers to enjoy the full benefits of land ownership and investment of their capital and labour. There are also credit schemes for agricultural investment and incentive schemes to plant native trees. Finally the increasing activity of the market economy is increasing the demand for agricultural and forestry production, both within the province and throughout Vietnam that is an advantage to farmers widen their plantings.

The main constraints on planting native trees are:

- Landuse planning is conceived in terms of forestry versus agriculture with a curious categorisation of swidden systems as a landuse sub-category called "unused sloping land" within the category "forestry". Forestry is normally conceived in terms of mono-culture plantations. The best opportunities for planting native trees are arguably within mixed plantations and agroforestry configurations. The thinking behind landuse planning is not favourable for promoting agroforestry systems based on native species.
- To plant trees without incentives farmers need to access credit. The pay-back period of the loan tree planting is much shorter than the rotation cycle of tree crops, especially native trees.
- Even though there is a nascent culture for planting tree crops based on acacia and bamboo it does not yet generally include native trees. There is a lack of information generally available of the identification, silviculture and marketing of native tree products.

7.6 Based on the understanding of these systems, what interventions will further the integration of high-value native trees?

These interventions fall into the categories of land tenure, extension and education, access to credit, market development and research. Most of them will require policy change at a national and provincial level.

Land tenure

- The provincial landuse planners could be persuaded to modify the sub-category "unused sloping land" into a special "agroforestry" category. As land allocation to the households with *Red Books* are completed that land classification will influence other policy makers and officials as well as farmers to consider the multiple benefits of planting trees (some of which will be native species) along with agriculture practice. It will clearly define the land tenure for farmers being trusted to planting trees but allow them the opportunity to continue necessary subsistence agriculture. To enforce farmers to use their land appropriately and profitably, landuse planning needs to be implemented not only at the provincial or district levels, but also at the community level with farmer's participation. Landuse planning must be suitable to the using demands of farmers.

Extension and Education

- A comprehensive program of community-based forest management with appropriate organisational structure and management should be built and supported by the government. The concept of CBFM should be expanded to include community-led planting of woodlots and agroforestry configurations on 'unused sloping lands'. It would also include structures to facilitate neighbour-to-neighbour collaborative management of privately-owned protection and production forests. While high-value native species will be encouraged, acacia and bamboo options should not be excluded from this activity.
- A primary activity of extension and education agencies – either within or outside of the CBFM structures - should be to encourage a culture of tree planting. This should focus on providing a source of prosperity for the next generation. This activity can be delivered through the forestry extension

services, the Farmers' Union, the Women's Union, the schools and youth groups, as well as public broadcast and print media.

- The Provincial Extension Centre in Hoa Binh city should develop information packages on identification, nursery techniques, silviculture, and marketing of native tree species. These packages should also present the different agroforestry configurations in which these trees can be grown.
- The Provincial Extension Centre should also devise appropriate delivery mechanisms for these packages. This may require training of village government officials or perhaps participatory research and development techniques.
- The extension effort should cove not only technical aspects of tree planting but also provide organisational support for farmers in terms of credit information, and training farmers in dealing with the banking paperwork.

Access to credit

- A policy should be implemented whereby the banks establish a separate category loan for farmers borrow to plant trees with long payback period or flexible payback period.
- There needs to be a more equitable arrangement for farmers to access loans that is not impeded by their social connections. Government extension services could provide information and involve Farmers Union and Women's Union in this effort.

Market development

- Market channels whereby farmers avoid the middlemen may give more power and income to the farmer. The wood–processing factories could buy directly from farmers either through a representative from The Farmers Union or individual contracts of a joint-venture nature. An appropriate initiator and facilitator of this process could be the Farmer's Union, or the Government extension services, or even a non-government organisation interested in rural development,

- The national and provincial governments need to develop and support an export industry based specifically on sustainably-grown native tree species. This material could be further value-added via the burgeoning export furniture market from Vietnam.
- There needs to be clear market channel for high-value native tree species if they to be an attractive alternative to acacia and bamboo. There must also be clear market signals of the real value of the timber. The extension services could regular publish prices of timber at various regional markets. This should not be an attempt at price-setting but reporting the actual fluctuating price.

Research and development of farming systems based on high-value native trees

- The mixed planting of native timber species into the acacia and bamboo plantations (Tree planting model No. 5) needs to be better understood so that extension services can more effectively promote it as a viable option. The following research questions will help this effort:
    - *Which native wood tree species can be best grown under the canopy of acacia plantations, and bamboo plantations?*
    - *How much canopy does each native tree species require in the early phase of planting rotation? This is a question of tree spacing.*
    - *How long do native trees grown under acacias need this protection? When should the acacias be removed to the advantage of the native trees?*
    - *What specific techniques are required for establishing and maintaining mixed plantings?*
    - *What is the most appropriate process for encouraging farmers to adopt mixed tree plantings?*

Reference list

Alther et al., (Alther C., Novosad P., Castella J. C., Rousseau E., and Tran Trong Hieu). 2002. Impact of accessibility on the range of livelihood options available to farm households in the mountainous areas of northern Vietnam: Mountain Agrarian Systems Programme.

Ban and Hawkins, (A.W. vanden Ban and H.S. Hawkins). 1996. *Agricultural Extension*: Blackwell Science.

Bui Dzung The, Nguyen Quoc Chinh, and Minh Ha, ed. 2004. *Rewarding upland farmers for environmental services: experience, constraint and potential in Vietnam*: World Agroforestry Centre (ICRAF).

Bui Quoc Toan et al., (Bui Quoc Toan, Elke Foerster, Nguyen Van Chien, Thu Nhung Mlo, Thu Nhung Mi Duon Du, Ulrich Apel, and Vuong Xuan Tinh). 2004. Vietnam Customary Land Tenure Study: East Asia and Pacific Region of the World Bank.

Bui The Hung. 2001. Analysis and Assessment of New Farming Systems for the Vietnam - Sweden Mountain Rural Development Programme in Phu Tho Province. Ha Noi: Vietnam - Sweden Mountain Rural Development Programme (MRDP).

Bui Van Chuc. 2003. Forestry allocation and Community forestry management of Hoa Binh Province: Department of Forestry Development of Hoa Binh Province.

Cao Duc Phat. 2006. The development of agriculture creates the basic achievement of the 'Doi moi'. In *Nhan dan*, ed. Cao Duc Phat (Minister of MARD): http://www.nhandan.com.vn/tinbai/.

Chambers, Robert. 1994. The Origins and Practice of Participatory Rural Appraisal. *World Development* 22, No7:953-969.

Chu Huu Quy. 2002. Ten years of Socio-economic Development in the Uplands. In *Sustainable Development in Vietnam Upland Areas: A look at the Past 10 Years and Arising Issues*, ed. Le Trong Cuc and Chu Huu Quy. Ha Noi: Agricultural Publishing House.

Dang Kim Son, Nguyen Ngoc Que, Phan Sy Hieu and Truong Huu Chi. 2004. Forest development and the planting of native trees in the three muontainous Northern Provinces. Hanoi: MARD.

Dixon et al., (John Dixon, Aidan Gulliver, and David Gibbon). 2001. *Farming systems and poverty: improving farmers' livelihoods in a changing world.* Rome and Washington D.C.: FAO and World Bank.

References

Do Dinh Sam. 1994. Shifting Cultivation in Vietnam: its social, economic and environmental values relative to alternative land use. Hanoi: Forest Science Institute of Vietnam.

Dollar, David. 2002. Reform, Growth, and Poverty in Vietnam: The World Bank.

Donovan et al., (Donovan D., Rambo, A.T., Fox, J., Le Trong Cuc and Tran Duc Vien). 1997. *Development Trends in Vietnam's Northern Mountain Region: An overview and analysis* .vol. 1: National Political Publishing House.

Fleming and Hardaker, (Euan Fleming and Brian Hardaker). 1993. Integrating Farming and Marketing Systems Approaches in Agricultural Development Project Planning. *Agricultural Systems* 42 (1993):pp 227-244.

Forest Stewardship Council, (FSC - United States). 2006. Green Building Market Report 2006: www.fscus.org/images/documents/Green_Building_Market_Report_2006.pdf.

FSIV and JICA, (Forestry Science Institute of Vietnam and Japan International Cooperation Agency). 2003. *Use of Indigenous Tree Species in Reforestation in Vietnam*: Agricultural Publishing House, Hanoi.

Hoa Binh Agricultural and Rural Development Department. 2005a. Official dispatch: Review of Material Forestry Areas for Pump Mill and Artificial Wood. In *NN-PTNN (Agricultural and Rural Development)*.

Hoa Binh Agricultural and Rural Development Department. 2005b. Report of semi-assessment of 5MHRP period 1999 - 2004 in Hoa Binh Province. Hoa Binh.

Hoa Binh Communist Party's Board. 2005. Synthesis report of five years (2001 - 2005) for Hoa Binh Communist Party's meeting XIV. Hoa Binh.

Hoa Binh Forestry Development Department. 2003. Project proposal of RENFODA.

Hoa Binh People's Committee. 2000. Welcome Hoa Binh Province: http:\\www.hoabinh.gov.vn.

Hoa Binh People's Committee ed. 2001. *Current landuses of Hoa Binh Province in 2000*: Hoa Binh.

Hoa Binh People's Committee. 2001a. Assessment of the socio-economic of Hoa Binh Province from 1991 to 2000.

Hoa Binh People's Committee. 2005. Report on target implementation of socioeconomic, Security and Defence of 2004. Hoa Binh.

Hoa Binh People's Committee. 2006. Report on target implementation of socioeconomic, Security and Defence of 2005.

Hoa Binh Statistic Office ed. 2005. *Statistics of Hoa Binh Province 2000 - 2005*. Hoa Binh: Hoa Binh Province.

References

Ich B. V. and Tru D. Q. 1989. Research on *Heteropsylla cubana* Crownford in Vietnam. Paper presented at *Proceeding of an International Workshop held January 16-21 on Leucaena psyllid: problem and management*, Bogor, Indonesia.

Lacviet Dictionary. Lacviet Dictionary Software 2002.

Lamb, David. 1998. *Agroforestry with high value trees*: Rural Industries Research and Development Corporation.

Lamb, David. 2001. Project proposal: Mixed species plantations of high-value trees for timber production and enhanced community services in Vietnam and Australia, Australian Centre for International Agricultural Research (ACIAR), The University of Queensland.

Le Mong Chan et al., (Le Mong Chan, Doan Sy Hien, and Le Nguyen). 1967. *Forest Tree Species in Vietnam*: Educational Publishing House, Hanoi.

Le Quoc Doanh, and Bui Huy Hop. 2003. Vietnam Agroforestry Capacity-Building/Agroforestry Support Programs (VACB/ASP - Vietnam and Laos). *Agroforestry today* No 6 2003.

Le Sy Viet and Pham Van Dien. 2003. Result on Building model of Reforestation in the Wet Land of Hoa Binh Reservoirs: Vietnam Forestry University.

Le Vinh. 2003. Speech for national workshop. Paper presented at *Land Tenure in Vietnam Upland Area*, Hanoi.

Mai Trong Thong, Dang Kim Nhung, Nguyen Thi Hien, Hoang Luu Thu Thuy, Hoang Xuan Co, Nong Thi Loc. 1996. Impact of Hoa Binh Reservoir to the rainfall, fog, and storm of this region. In *Technology magazine, Hydrometeorology Bureau*.

MARD, (Ministry of Agricultural & Rural Development). 1996. Decision of Ministry of Agricultural and Rural Development No 2375/NN-CBLS/QD, dated 30/12/1996 on regulation of giving licence to forest product processing company.

MARD, (Ministry of Agricultural & Rural Development). 1997a. Decision of Ministry of Agricultural and Rural Development No 392/NN-CBLS/QD, dated 19/03/1997 on revised regulation of giving licence to forest product processing company.

MARD, (Ministry of Agricultural & Rural Development). 1997b. Decision of Ministry of Agriculture and Rural Development No 3013/1997 QD-BNN&PTNT, dated 20/11/1997 on defining the borders and landmark of forest types.

References

MARD, (Ministry of Agricultural & Rural Development). 2000. Circular of Ministry of Agricultural and Rural Development on Instruction to plan the economic farm development.

MARD, (Ministry of Agricultural & Rural Development). 2001. Five Million Hectare Reforestation Program.

MARD, (Ministry of Agricultural & Rural Development). 2004. Decision on Announcement of the National Forestry and Bare Land Areas in 2003. In *1281/QD/BNN-KL*.

Marsh et al., (Marsh, S.P., Hung, P.V., Chinh, N.Q. and MacAulay, T.G.). 2004. Farm income and income diversity on Vietnam's small Household Farms. Paper presented at *48th Annual Conference of the Australian Agricultural and Resource Economics Society*, Sheraton Towers, Melbourne.

McConnell and Dillon, (Douglas J. McConnell and John L. Dillon). 1997. *Farm Management for Asia: a Systems Approach*: FAO Farm Systems Management Series - 13. Rome: FAO.

Ministry of Finance. 1991. Circular of Ministry of Finance No 69/TC dated 27/11/1991 on Instruction to collect natural resource taxes.

Ministry of Finance. 2000. Circular of Ministry of Finance No 91/2000/TT/BTC, dated 06/09/2000 on Instruction to abrogate VAT and business income taxes to encourage selling agricultural and forestry products.

Ministry of Foreign Affairs. 2006. Basic information of the relationship between the nations and regions and Vietnam: http://www.mofa.gov.vn.

MSTE, (Ministry of Science, Technology and Environment). 1999. Decision of Ministry of Technology and Environment No 930/1999/QD-BKHCNMT dated 25/05/1999 to approve the program of 'Building models of technology application to develop the rural and mountainous socioeconomic in period of 1998-2010'.

NAC. 2006. About Agroforestry: National Agroforestry Center, The United States Department of Agriculture (USDA) http://www.unl.edu/nac/agroforestry.html.

Nguyen Hoang Nghia. 2003. Conservation of forest genetic resources in Vietnam. Paper presented at *The XII World Forestry Congress, 2003*, Quebec City, Canada.

Nguyen Thanh Lam et al., (Nguyen Thanh Lam, Aran Patanothai, and A. Terry Rambo). 2004. Recent Changes in the Composite Swidden Farming System of Da Bac Tay Ethnic Community in Vietnam's Northern Mountain Region. *Southeast Asian Studies* 42:Pages 273 - 293.

Nguyen Thi Mui. 2005. Country Pasture/Forage Resource Profiles: FAO.

References

Nguyen Thi Yen et al., (Nguyen Thi Yen Huynh Duc Nhan, Nguyen Quang Duc and Tran Huu Chien). 2003. Annual report: Research on Growing and Yield of High Timber Value Tree Species in Doan Hung District, Phu Tho Province: Forest Research Centre - Phu Ninh.

Nguyen Xuan Lieu. 2001. Conservation, utilization and management of forest genetic resources in Vietnam. Paper presented at *The Southeast Asian Moving Workshop on Conservation, Management and Utilization of Forest Genetic Sources from 25 February to 10 March 2001*, Bangkok, Thailand.

Norman et al., (D.W. Norman, F.D. Worman, J.D. Siebert and E. Modiakgotla). 1995. *The farming systems approach to development and appropriate technology generation*. Rome: FAO.

Nuberg, Ian. 2006. Agroforestry for Natural Resource Management: http://www.iannuberg.net/agroforestry/.

Obiri et al., (Obiri J., Lawes M., and Mukolwe M.). 2002. The dynamics and sustainable use of high-value tree species of the coastal Pondoland forests of the Eastern Cape Province, South Africa [1 August 2002]. *Forest Ecology and management* 166:131 - 184.

Pham Xuan Hoan. 2002. Research results of replantation by native tree species. *Agricultural and Rural Development (Tap chi Nong nghiep & PTNN Vietnam)* 10.

Pham Xuan Hoan. 2003. Cinnamon-based Fallow in Vietnam. *Vietnam Journal (Agricultural and Rural Development Journal in English)* 1 - 2.

Rambo, A. Terry. 1997. The development trends of the northern mountainous region of Vietnam. In *The development trends of the northern mountainous region of Vietnam*, ed. A.Terry Rambo Deanna Donovan, Jefferson Fox, Le Trong Cuc, and Tran Duc Vien. Hanoi: National Political House.

Rambo, A. Terry. 1998. The composite swidden agro-ecosystem of the Tay ethnic minority of the North-western Mountains of Vietnam. In *Land Degradation and Agricultural Sustainability: Case-study from Southeast and East Asia*, ed. Aran Patanothai. Khon Kaen: SUAN Regional Secretariat.

Rambo and Tran, (A. Terry Rambo and Tran Duc Vien). 1999. Background description of Tat Hamlet. In *Composite swidden farmers of Ban Tat: A case study of the environmental and social conditions in a Tay ethnic minority community in Hoa Binh Province, Vietnam*, ed. Le Trong Cuc and A. Terry Rambo: Center for Natural Resources and Environmental Studies (CRES).

Rambo and Tran, (A. Terry Rambo and Tran Duc Vien). 2001. Social Organization and the Management of Natural Resources: A Case Study of Tat Hamlet, a Da Bac

Tay Ethnic Minority Settlement in Vietnam's North-western Mountains. *Southeast Asian Studies* 39 No. 3 December 2001: pages 299 - 323.

SAM. 2003. Innovative research nudging upland agriculture toward sustainability, 3: Mountain Agrarian Systems Programme, FAO, Hanoi, Vietnam.

Sikor et al., (Thomas Sikor, Tran Thi Que and Vuong Xuan Tinh). 2003. Why study land tenure in the northern mountains of Vietnam? Paper presented at *Workshop Proceeding: Land Tenure in Vietnam Upland Area*, Hanoi.

Sikor, T. 1998. Forest policy reform: from State to Household forestry. In *Stewards of Vietnam's Upland Forests*, ed. M. Poffenberger: Asia Forest Network. Pages 5 - 17.

Thai Phien, and Nguyen Tu Siem. 2002. *Upland sustainable usage in Vietnam*: Agricultural Publishing House, Hanoi.

Tran Duc Vien. 2001a. *Gain and Challenge on Resource Management and Improving Upland Resident of Vietnam*: National Political Publishing House, Hanoi.

Tran Duc Vien. 2003. Culture, Environment, and Farming Systems in Vietnam's Northern Mountain Region. *Southeast Asian Studies* 41: Pages 180 - 205.

Tran Duc Vien. 2005. Reviewing agroforestry and agroforest markets in Vietnam's uplands. In *Marketing and Agroforestry Development in Vietnam's Uplands*, ed. Tran Duc Vien: Agricultural Publishing House, Hanoi.

Tran Huu Vien. 2004. *Scientific Bases on Building the Solutions of Sustainable Forestry Management in the Limestone Mountains of Vietnam*: Agricultural Publishing House, Hanoi.

VGov. 1988. Instruction of Prime Minister No 60-HDBT, dated 14/04/1998 on implementing land law which was affirmed by National Assembly on 29/12/1987.

VGov. 1991. Law of forest protection and development affirmed by National Assembly on 19/08/1991.

VGov. 1992. Decision of Prime Minister No 327/TC, dated 15/09/1992 on usage of pare land, bare hills, forest, costal warp, and water land.

VGov. 1993a. *Land Law*: National Political Publishing House.

VGov. 1993b. Decree of Government No 64-CP, dated 27/09/1993 on the Allocation of agricultural land to individuals and households aiming at long usage of cultivation.

VGov. 1993c. Decision of Prime Minister No 624/TTg, dated 29/12/1993 on export of timber goods and forest products.

VGov. 1993d. Decree of Government No 14/CP dated 02/03/1993 on allowing households to borrow money for agricultural, forest, and aquaculture productions.

VGov. 1994. Decree of Government No 02/CP, dated 15/01/1994 on the Allocation of forestlands to organizations, households, and individuals aiming at long usage of forestry.

VGov. 1994c. Decision of Prime Minister No 202/TTg, dated 02/05/1994 on allocating forests aiming at protecting and remaining forests.

VGov. 1996. Decision of Prime Minister No 556/TTg, dated 12/09/1996 on reinforcing the 327 Program.

VGov. 1997. Decision of Prime Minister No 1124/1997/QD-TTg, dated 25/12/1997 on export of timber goods and forest products, and import of wood material.

VGov. 1998. Land law revised in 1998.

VGov. 1998b. Decision of Prime Minister No 661/QD-TTg, dated 29/07/1998 on objectives, duties, policies and implementation of 5MHRP.

VGov. 1998c. Decision of Prime Minister No 160/QD-TTg, dated 04/09/1998 on plan of material areas for paper industry up to 2010.

VGov. 1998d. Decision of Prime Minister No 245/1998/QD-TTg, dated 21/12/1998 on duties of forestland management of government levels.

VGov. 1998e. Decision of Prime Minister No 65/TTg, dated 24/03/1998 on export of timber goods and forest products, and import of wood material.

VGov. 1999. Decision of Prime Minister on Ratifying the List of Mountainous and Remote Communes Belonging 135-Program.

VGov. 1999a. Decree of Government No 85-CP, dated 28/08/1999 on the revise of the allocation of agricultural land to individuals and households aiming at long usage of cultivation.

VGov. 1999b. Decree of Government No 163/CP, dated 16/11/1999 on the Allocation and rent of forestlands to organizations, households, and individuals aiming at long usage of forestry.

VGov. 1999c. Decision of Prime Minister No 19/CT-TTg, dated 16/07/1999 on implementation of encouraging methods to sell production wood.

VGov. 1999d. Decisions of Government No 67/TTg dated 30/03/1999, and No 148/TTg date 07/07/1999 on Policies of bank and credit for agricultural and rural development.

VGov. 1999e. Decree of Government No 43/1999/ND-CP dated 29/6/1999 on Credit and development investment of Government.

References

VGov. 1999f. Decree of Government No 51/1999/ND-CP dated 08/07/1999 on Implementation of the Encouraging Investment Law.

VGov. 2000b. Decision of Prime Minister No19/TTg dated 03/02/2000 on abrogation of all previous document which against the business Law.

VGov. 2000c. Resolution of Government No 03/2000/NQ-CP dated 02/02/2000 on economic farm development.

VGov. 2001. Decision of Prime Minister No 08/TTg dated 11/01/2001 on management statute of natural special use, protection, and production forests.

VGov. 2001a. Decision of Prime Minister No 178/2001/QD-TTg dated 12/11/2001 on beneficiary and duties of households and individuals who hold forestlands.

VGov, and Global Environment Facility (GEF). 1995. The National Biodiversity Action Plan, pp 208. Hanoi.

Vietnamese National Assembly. 1997. Resolution of Vietnam National Assembly No 08/QH10, dated 05/12/1997 on Five Million Hectare Reforest Program (5MHRP).

Vietnamese National Communist Party Board IX. 2006. Draft Political Report for Instrument of the National Communist Party Meeting X, 2006. In *Nhan Dan Newspaper* *(http://www.nhandan.com.vn/tinbai/?top=36&sub=47Article=53384)*.

VietnamNet. 2003a. Caterpillar epidemic widen in Kon Tum and Central region provinces. In *Caterpillar epidemic*: http://vietnamnet.vn.

VietnamNet. 2003b. Caterpillar epidemic attachs protection mangrove forests in Kien Giang Province: http://vietnamnet.vn.

VietnamNet. 2004. Soc Trang: a serious caterpillar: http://vietnamnet.vn.

VietnamNet. 2005. Vietnam poverty rate has reduced about 60%: http://vietnanet.vn/kinhte/2005/09/490105.

Vo Dai Hai. 2005. The market of planting production forest products in the Northern mountainous provinces and development policies. In *Market and Agroforestry Development in Vietnams Uplands*, ed. Tran Duc Vien, pp 146 - 166. Hanoi: Agricultural Publishing House.

Vu Huu Tuynh. 2001. Analysis and Assessment of the Implementation of Forest Management Policy and Institution at 5 Provinces under the Vietnamese Sweden Mountainous Rural Development Programme: Ministry of Agricultural and Rural Development.

World Bank. 2005. Vietnam Environment Monitor 2005: Biodiversity.

www.GraphicMaps.com. Asia Maps.

Appendices

Appendix A: Research Framework

Appendix A1: Group working Framework

Day 1

In the morning

- The Research Team travel to village, and announce to the local officers.
- Arranging everything for work in the afternoon.

In the afternoon: Village walk/transect and Mapping

	Group 1	Group 2
Participants	1. 2. 3.	4. 5. 6.
Researchers	a) b)	c) d)

→ ***Outcome***: a map is drawn that describes the outline of the landuse of the village landscape. The information is used to answer question 1, 3, 4, 5. Also, it is the based information of other sections.

→ ***Making plan for day 2:***

- Preparing the names of all householders (getting from the Head of the village).
- Arranging some old and aware participants.

Day 2

	Group 1	Group 2
Contents	- Wealth ranking - History line - Demand analysis	- Description of land use in the village - Gathering forest products and their use
Participants	1) 2) 3) 4) 5)	6) 7) 8) 9) 10)
Researchers		

Wealth ranking

- Using the list of householder's names
- Ranking by farmers under the guide of researchers

→ ***Outcome:***

- Identifying the classes of households: 1, 2, 3, and 4… (Consisting names of households in each class)
- Indicators of each class.

History line

→ ***Outcome:*** the outline history of the village is described (population, ethnic groups, natural conditions, culture, cultivation).

Demand analysis

Demands	Main sources	Importance	Priority	Reasons
Food				
Cash				
....				

Analysis of wood/timber demand of local community (not of the market)

Types of timber/wood	Purposes	Sources		Notes
		Self consumption	Buy	

Description of land use in the village

→ ***Outcome:***
- Identifying types of landuses
- Identifying and describing crops, fruit trees, industrial trees, and forest trees…

Gathering forest products and their use

Products	What for	How to use	Where	How to harvest	Sustainability

→ ***Outcome:***
Forest products are identified that
- what are they used for?
- how are they used?
- where are they harvested?
- how are they harvested?
- are they used sustain ably? And why/how?

Day 3

	Group 1	Group 2
Contents	- Existing tree growing activities	- Seasonal calendar
Participants	1) 2) 3) 4) 5)	6) 7) 8) 9) 10)
Researchers		

Seasonal calendar

Farming activities

Rainfall												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Flat land												
Sloping land												
Grazing												
Forestry												
Labours												

Off-farm activities

Rainfall												
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Handicraft ….												
Labours												

→ ***Outcome:***

- Detailed analysis of each activities/each crops is described
- Marching labours spending for each activity

Existing tree growing activities

Silviculture of Exotic trees:

Exotic trees	Seedling	Growing	Harvesting	Products

Exotic trees	Where	Why	How to know to grow

Silviculture of Native trees:

Indigenous/native trees	Wood (√)	Non-wood		Description the natural conditions
		(√)	Products	

Native trees	Seedling	Growing	Harvesting	Products

Native trees	Where	Why	How to know to grow

Mixed plantation

Types of mixed plantations	Species	Ecology		Structure
		Land	Others	
Type 1				
…				

Scoring: (including exotic and native trees)

Trees	Indicators							Note
	Seedling	Growing	Value	...			Preference	

→ *Outcome:*

- A description trees planted.
- A classification of exotic, non-wood, and wood trees
- Perception of farmers in seedling, growing, harvesting, and managing.
- Perception of farmers in conditions for these trees
- Perception of farmers in choosing trees
- Perception of farmers in mix/monoculture/or both, and their reasons.

Day 4

	Group 1	Group 2
Contents	- Sources and quality of local harvested forest products - Classifying and semi- processing forest products - SWOT analysis of planting high value trees	- VENN analysis of the social structure - Attitude, market of forest products - Awareness of policies - Conflict between harvesters and middle-men, protectors, officers
Participants	1) 2) 3) 4) 5)	6) 7) 8) 9) 10)
Researchers		

Sources and quality of local harvested forest products

Trees	Sources		Area		Quantity	Quality			Note
	Planted	Natural	Planted	Natural		Not good	Moderate	Good	

Classifying and semi- processing forest products

Products	Product A		Product B			
	Type 1	Type 2	Type 1	Type 2	Type 3	
Price						

Attitude, market of forest product

Gathers	Middle-men	Processors			Note
		Sawmills	Carpenters	...	

Prices of forest products

Products	Prices of the inside markets			Prices of the outside markets		
	Market A	Market B	...	Market C	Market D	...
Timber ...						

More information: How far from the village to markets? How are the roads from village to markets?

Awareness of policies of forest products

Trees	Sources		Sale		Taxes/ paper-works	Note
	Planted	Natural	Legal	Illegal		

Conflict between harvesters and middle-men, protectors, officers

Conflict	Description
Prices ...	

SWOT analysis of planting high value trees

→ *Suggesting solutions:*

Day 5 + 6: Interview households

Questionnaire will be used to ask farmers aiming to add more information and check information.

Notes

- The research team will review the activities every day at the end of day. It aims to analyse the working day and to plan next day.
- Participants will be changed every day.

Appendix A2: Questionnaire for household interview

Name of householder: Male/Female Level of education
Name of interviewee: Male/Female Level of education
Village: Commune: District: Province:
Hoa Binh
Date: Interviewer:

1. General information

1.1. How many people has your family got? ....., including:

Age	Persons			Highest education person			Notes
	Σ	Male	Female	Gender	Level	Occupation	
Under 16							
16 – 55							
Upper 55							

1.2. Ethnic group: Kinh Muong: Dao: Other:
1.3. Religion:
1.4. How long has your family stay here?
.....
1.5. What are the properties has your family got?
1.5.1. Houses

Strong house	Semi-strong house		Cottage	Other

1.5.2. Vehicles

Motorcycle	Bicycle	Other

1.5.3. Information tools

TV	Radio	Other

1.5.4. Others

2. Description of household farming systems

2.1. Breeding

a) What animals do you breed? How many? Purposes?

Animals	Quantity	Purposes		
		Self consumption	Sale	Ploughing

b) How do you graze your cattle? Where? Area and types of grassland?

Animals	Grazing		Places		
	Tending	Releasing	Grassland	Forests	Fields

Notes: Extending to ask that why do you tending/releasing? Why do you graze your animals in the forests/fields? Do you want to develop your cattle? Why? How? Where? What relation between grazing and planting forest trees?

c) Has any trees planted in your fields/grassland? What trees? Who plant? When? Why these trees are planted? Who can harvest?

Names of trees	Number or/and area	Age	Who plant	Purposes	Harvest

2.2. Pond

a) How many ponds have you got? Where? Area? What do you feed? How?

Ponds	Place	Area	Types of fish	Breeding	Feeding

b) Has any trees planted round your ponds? What trees? Who plant? When? Why these trees are planted? Who can harvest?

Names of trees	Number or/and area	Age	Who plant	Purposes	Harvest

Note:

2.3. Paddy field

a) How many plots have you got? Where? Area and description lands? Crops? What types of crops? Yields?

N_0	Name of fields	Area	Numbers of crops	Types of crops/cultivars	Yields of crops
1					
2					
....					

b) Has any trees planted round your fields? What trees? Who plant? When? Why these trees are planted? Who can harvest?

Names of trees	Number or/and area	Age	Who plant	Purposes	Harvest

Note:

2.4. Garden

a) How many gardens have you got? Where? Area and description lands? What types of crops/trees? Yields?

No	Names of gardens	Area	Types of crops/trees	Yields
1				
...	....			

b) What forest trees do you plant in your gardens? Why? When? How are these trees planted?

Names of trees	Area or No of trees	Purposes	Ages of trees	Seedling	Planting	Managing	Harvesting

Note:

2.5. Sloping land

a) How many plots have you got? Where? Area and description lands? Crops? What types of crops/trees? Yields?

No	Name of fields	Area	Numbers of crops	Types of crops/trees	Yields of crops
1					
...					

b) Why do you plant forest trees in your fields? How are these trees planted?

Names of trees	Area or No of trees	Purposes	Ages of trees	Seedling	Planting	Managing	Harvesting

2.6. Planted forest

a) How many plots have you got? Where? Area? Description lands before trees planting? What types of trees? Yields?

No	Name of fields	Area	Types of trees	Planting years	Silviculture (mono or mix)	Products and yields
1						
2						

b) Why these trees in the plot A/B/C are planted in mixture/monoculture?

Plots		A	B		
Species					
Mixture or monoculture					
Reasons	Insurance				
	Better growth				
	Easy management				
	Others				
Notes					

c) Why do you plant these trees? How have you applied the silviculture (seedling, planting, managing, harvesting)?

Names of trees	Area or No of trees	Purposes	Ages of trees	Seedling	Planting	Managing	Harvesting

Note:

2.7. Protection forest

a) How many plots have you got? Where? Area? When have you started to protect? What types of trees? How do you protect and regenerate?

No	Name of fields	Area	Starting year of protection	Types of trees	Protection and regeneration	Products and yields
1						
...						

b) What trees are planted to regenerate? Why? How have you applied the silviculture (seedling, planting, managing, harvesting)?

Names of trees	Area or No of trees	Purposes	Ages of trees	Seedling	Planting	Managing	Harvesting

Note:

2.8. Perception of farmers on planting native trees

a) What are native trees in these trees you planted? What are the wood trees? Which is the good wood?

Native trees			Usage		Ranking	Notes
Name	Non-wood	Wood	Furniture	Others		

b) Why do you like planting X tree species?

Species (name)						
There is a known market nearby						
Growing faster						
Given free seedling						
Using products (wood, fruit...) themselves						
Getting an early cash flow						
Following the neighbours						
Good for soil						
Good prices						
...						

Note:

c) Summarizing questions (What farmers thought were the incentives or disincentives for planting trees)

- What make you decide to plant trees? Or what do not make you decide to plant trees for wood?

.....

- To what extent do current policies encourage or discourage planting?

.....

.....

- What more might the Government do to help planting?

.....

.....

.....

3. Firewood and alternative fuels

3.1. Firewood

a) What types of firewood do you use? Sources? How? When? Who collect? And how many m^3/year? How far?

Types	Sources	Time	Person (Who)	Quantity	Distance	Notes

b) Which firewood do you like? Which are the wood/timber trees? Native trees?

Types	Quality			Exotic trees	Native trees		Easy collecting	Ranking
	Bad	Moderate	Good		Non-wood	Wood		

Notes: Whether farmers collect firewood easily or not? Why?

3.2. Alternative fuels

What types of alternative fuels can you use?

How do you use?

What are the weak/strong points of alternative fuels?

How many percent do they replace firewood?

4. Household investments

4.1. Capital

a) How much did you invest in your farm in the last year?

Landuse types	**Capital (VND)**	**Percentage (%)**
Breeding		
Ponds		
Gardens		
Paddy fields		
Sloping land cultivation		
Planted forests		
Protection forests		
Total		100 %

b) What capital sources do you use? How much? What is the tenure of credit?

Types of landuse	**Sources and Quantity**			**Notes**
	Family	Credits	Others	
Breeding				
Ponds				
Gardens				
Paddy fields				
Sloping land cultivation				
Planted forests				
Protection forests				

c) How much have you invested in planting trees species? (May be: for 5; 10 years – depending on each household)

Species (Names of trees)	Area	Plots	Capital (VND)	Notes (including seedling, transporting, free/buy, prices, sources…)

4.2. Planing investment

What is your planing investment in farm activities?

Types of landuse	Capital		Area	Labours		Description tree
	VND	%		Man-day	%	
Breeding						
Ponds						
Gardens						
Paddy fields						
Sloping land cultivation						
Planted forests						
Protection forests						

Note:

4.3. Labour

4.3.1. How many labours do you use in your farm activities?

Types of landuse	Labours (days/year)			%	Notes
	Family labours	Rental labours	Total		
Breeding					
Ponds					
Gardens					
Paddy fields					
Sloping land cultivation					
Planted forests					
Protection forests					

4.3.2. How many labours do you use in your off-farm activities?

Off-farm activities	Labours (days/year)			%	Notes
	Family labours	Rental labours	Total		

Note: Which month do you spend much more labours? Which activities?

Income and outcome analysis

Income		Outcome	
Types of the income sources	Amount	Types of the outcome	Amount

Note: Whether do you invest the amount of spare money for planting high value trees? Why?

Appendix B: Data analysis

Appendix B1 - Statistics of the interviewed households Hoa Binh Province

No	Names of interviewees	Villages	Wealth ranking classes	Gender	Ages of interviewees	Educational levels	Number of persons	Number of labours
1	Bui Thi Thu	Bap	A	F	40	7	5	2
2	Quach Thi Hien	Bap	A	F	54	1	4	4
3	Quach Thi Tri	Khuong	A	F	27	6	7	4
4	Quach Thi Bay	Khuong	A	F	39	7	4	2
5	Bui Thi Nhung	Suoi Bu	A	F	44	6	7	4
6	Bui Thi Xuan	Suoi Bu	A	F	53	9	3	3
7	Bui Thi Bin	Suoi Bu	A	F	53	7	3	3
8	Bui Thi Lien	Suoi Bu	A	F	49	7	7	5
9	Lo Thi En	Tat	A	F	50	4	5	4
10	Bui Van Lun	Bap	A	M	40	5	7	4
11	Bui Van Nam	Bap	A	M	42	7	6	2
12	Bui Van Dien	Bap	A	M	55	7	3	2
13	Quach Van Luc	Bap	A	M	78	1	7	6
14	Quach Van Nanh	Khuong	A	M	32	8	6	2
15	Quach Van Quam	Khuong	A	M	50	6	6	4
16	Quach Van Nang	Khuong	A	M	25	8	7	4
17	Bui Van Nham	Khuong	A	M	35	11	4	2
18	Bui Van Trong	Suoi Bu	A	M	38	5	4	2
19	Bui Van Dinh	Suoi Bu	A	M	50	7	6	6
20	Bui Van Tien	Suoi Bu	A	M	68	>12	6	4
21	Bui Thi Luon	Bap	B	F	43	7	5	4
22	Tran Thi The	Bap	B	F	43	7	3	3
23	Bui Thi Loan	Bap	B	F	48	7	10	6
24	Quach Thi Khoang	Bap	B	F	79	1	17	7
25	Quach Thi Chon	Khuong	B	F	43	7	6	3
26	Quach Thi Sim	Khuong	B	F	30	4	6	3
27	Quach Thi San	Khuong	B	F	45	3	6	2
28	Bui Thi Dung	Suoi Bu	B	F	43	4	6	4
29	Bui Thi Cuong	Suoi Bu	B	F	48	4	3	3
30	Xa Thi Tim	Tat	B	F	44	3	4	3
31	Bui Van Tuan	Bap	B	M	28	7	4	2
32	Bui Van Rui	Bap	B	M	40	6	6	4
33	Quach Tiem	Bap	B	M	50	7	8	5
34	Bui Van Nhan	Bap	B	M	51	4	6	6
35	Quach Van Tang	Khuong	B	M	43	10	5	3
36	Quach Van San	Khuong	B	M	52	1	6	2
37	Quach Van Hoi	Khuong	B	M	44	7	5	2
38	Bui Van Dang	Suoi Bu	B	M	39	7	7	3
39	Bui Van Bao	Suoi Bu	B	M	51	7	4	4
40	Xa Van Lien	Tat	B	M	37	7	6	2
41	Xa Van Lan	Tat	B	M	40	7	4	3
42	Xa Van Em	Tat	B	M	67	3	4	3
43	Bui Thi Van	Bap	C	F	43	7	5	4
44	Bui Thi Am	Bap	C	F	52	3	5	3
45	Quach Thi Ninh	Khuong	C	F	40	6	4	2
46	Bui Thi Dien	Suoi Bu	C	F	35	10	7	3
47	Dinh Thi Van	Suoi Bu	C	F	46	9	4	2
48	Bui Van Kia	Bap	C	M	32	3	5	2
49	Do Phuong	Bap	C	M	34	7	4	2
50	Bui Van Trung	Bap	C	M	38	5	4	2
51	Bui Van Mech	Bap	C	M	51	4	7	6
52	Bui Van Von	Bap	C	M	68	1	6	3
53	Bui Van Phuong	Khuong	C	M	39	6	4	2
54	Quach Van Num	Khuong	C	M	44	7	6	4
55	Quach Van Nien	Khuong	C	M	63	1	5	2
56	Bui Van Mien	Khuong	C	M	65	1	6	2

57	Dinh Cong Tuan	Suoi Bu	C	M	26	9	7	3
58	Bui Van Quy	Suoi Bu	C	M	37	5	5	2
59	Dinh Cong Hieu	Suoi Bu	C	M	40	7	4	3
60	Bui Van Nhan	Suoi Bu	C	M	47	7	5	5
61	Lo Van Manh	Tat	C	M	26	6	3	2
62	Bui Thi Min	Bap	D	F	30	7	3	2
63	Bui Thi Xinh	Bap	D	F	32	3	4	2
64	Bui Thi Vien	Bap	D	F	36	5	4	2
65	Bui Thi Tu	Bap	D	F	53	1	6	5
66	Quach Thi Be	Khuong	D	F	27	3	3	2
67	Quach Thi En	Khuong	D	F	42	3	5	3
68	Quach Thi Hoa	Khuong	D	F	62	1	4	1
69	Bui Thi Anh	Suoi Bu	D	F	32	9	3	1
70	Bui Van Luu	Khuong	D	M	40	7	6	4
71	Quach Van Phan	Khuong	D	M	50	4	10	7
72	Bui Van Chu	Khuong	D	M	39	7	6	3
73	Quach van Phong	Khuong	D	M	47	4	8	3
74	Bui Van An	Suoi Bu	D	M	24	8	5	3
75	Bui Quang Thuong	Suoi Bu	D	M	58	5	4	1
76	Lo Van Toan	Tat	D	M	36	6	4	1

Appendix B2 - Relationship between wealth classes and educational levels, and forestland area

Correlation

	Wealth classes	*Educational levels*	*Total forestland area*
Wealth classes	1		
Educational levels	-0.213125996	1	
Total forestland area	-0.308486424	0.10093337	1

Wealth ranking classes		Educational levels	Total forestland area (m2)
A	1	7	180,000
A	1	7	10,000
A	1	6	87,000
A	1	7	100,000
A	1	9	60,000
A	1	7	-
A	1	7	110,000
A	1	5	6,600
A	1	7	5,000
A	1	11	30,000
A	1	12	108,000
A	1	5	65,000
A	1	4	70,000
A	1	7	20,000
A	1	1	78,000
A	1	6	22,000
A	1	1	-
A	1	8	38,000
A	1	8	22,000
A	1	6	21,000
B	2	4	76,000
B	2	4	10,000
B	2	7	1,000
B	2	7	12,000
B	2	7	47,000
B	2	7	56,000
B	2	4	10,000
B	2	6	8,000
B	2	7	5,000
B	2	7	19,000
B	2	1	130,000
B	2	3	15,000
B	2	4	9,000
B	2	7	11,300
B	2	7	14,000
B	2	1	20,000
B	2	10	25,000
B	2	7	-
B	2	3	25,000
B	2	3	13,000
B	2	7	26,000
B	2	7	25,000
C	3	3	3,000
C	3	10	22,000
C	3	7	-
C	3	3	45,000
C	3	4	6,000
C	3	1	17,500
C	3	7	57,000
C	3	6	15,000
C	3	5	88,000
C	3	5	-
C	3	1	5,000
C	3	7	50,000
C	3	9	39,000
C	3	9	16,000
C	3	7	-
C	3	6	38,000
C	3	6	19,000
C	3	1	5,000
C	3	7	88,000
D	4	5	28,000
D	4	9	51,000
D	4	7	5,000
D	4	1	80,000
D	4	5	-
D	4	3	-
D	4	8	-
D	4	7	18,000
D	4	7	10,000
D	4	6	18,000
D	4	3	5,000
D	4	3	10,000
D	4	1	-
D	4	4	30,000
D	4	4	10,000

Appendix B3 - Relationship of forestland with household and planting

No	Names of interviewees	Villages	Wealth ranking classes	Forestland area (m2)			Planting areas (m2)	
				Total	Plantation	Protection	Acacia	Bamboos
1	Bui Thi Thu	Bap	A	100,000	-	100,000	5,000	-
2	Quach Thi Hien	Bap	A	78,000	78,000	-	78,000	-
3	Quach Thi Tri	Khuong	A	22,000	6,000	16,000	6,000	
4	Quach Thi Bay	Khuong	A	20,000	10,000	10,000	10,000	
5	Bui Thi Nhung	Suoi Bu	A	87,000	87,000	-	87,000	-
6	Bui Thi Xuan	Suoi Bu	A	60,000	20,000	40,000	10,000	10,000
7	Bui Thi Bin	Suoi Bu	A	180,000	50,000	130,000	10,000	5,000
8	Bui Thi Lien	Suoi Bu	A	10,000	10,000	-	10,000	-
9	Lo Thi En	Tat	A	70,000	0	70,000		
10	Bui Van Lun	Bap	A	6,600	6,600	-	-	6,600
11	Bui Van Nam	Bap	A	5,000	5,000	-	5,000	-
12	Bui Van Dien	Bap	A	-	x	x	x	x
13	Quach Van Luc	Bap	A	-	-	-	-	-
14	Quach Van Nanh	Khuong	A	22,000	6,000	16,000	6,000	
15	Quach Van Quam	Khuong	A	21,000	-	21,000	-	
16	Quach Van Nang	Khuong	A	38,000	20,000	18,000	-	
17	Bui Van Nham	Khuong	A	30,000	-	30,000	-	
18	Bui Van Trong	Suoi Bu	A	65,000	45,000	20,000	44,000	x
19	Bui Van Dinh	Suoi Bu	A	110,000	40,000	70,000	x	20,000
20	Bui Van Tien	Suoi Bu	A	108,000	90,000	18,000	23,000	15,000
21	Bui Thi Luon	Bap	B	12,000	12,000	-	12,000	
22	Tran Thi The	Bap	B	-	-	-	-	-
23	Bui Thi Loan	Bap	B	1,000	1,000	-	-	1,000
24	Quach Thi Khoang	Bap	B	130,000	30,000	100,000	30,000	-
25	Quach Thi Chon	Khuong	B	19,000	3,000	16,000	3,000	
26	Quach Thi Sim	Khuong	B	9,000	-	9,000	-	
27	Quach Thi San	Khuong	B	15,000	9,000	6,000	9,000	
28	Bui Thi Dung	Suoi Bu	B	10,000	10,000	-	5,000	5,000
29	Bui Thi Cuong	Suoi Bu	B	76,000	50,000	26,000	2,500	2,500
30	Xa Thi Tim	Tat	B	25,000	0	25,000		
31	Bui Van Tuan	Bap	B	5,000	5,000	-	5,000	-
32	Bui Van Rui	Bap	B	8,000	8,000	-	8,000	
33	Quach Tiem	Bap	B	11,300	11,300	-	9,800	
34	Bui Van Nhan	Bap	B	10,000	10,000	-	10,000	-
35	Quach Van Tang	Khuong	B	25,000	15,000	10,000	15,000	
36	Quach Van San	Khuong	B	20,000	10,000	10,000	10,000	
37	Quach Van Hoi	Khuong	B	14,000	6,000	8,000	6,000	
38	Bui Van Dang	Suoi Bu	B	56,000	10,000	46,000	10,000	-
39	Bui Van Bao	Suoi Bu	B	47,000	-	47,000	-	-
40	Xa Van Lien	Tat	B	25,000	0	25,000		
41	Xa Van Lan	Tat	B	26,000	0	26,000		

42	Xa Van Em	Tat	B	13,000	0	13,000		
43	Bui Thi Van	Bap	C	-	-	-	-	-
44	Bui Thi Am	Bap	C	3,000	3,000	-	3,000	x
45	Quach Thi Ninh	Khuong	C	19,000	8,000	11,000	8,000	
46	Bui Thi Dien	Suoi Bu	C	22,000	2,000	20,000	-	-
47	Dinh Thi Van	Suoi Bu	C	16,000	6,000	10,000	-	-
48	Bui Van Kia	Bap	C	45,000	45,000	-	45,000	
49	Do Phuong	Bap	C	-	-	-	-	-
50	Bui Van Trung	Bap	C	-	-	-	-	-
51	Bui Van Mech	Bap	C	6,000	6,000	-	6,000	
52	Bui Van Von	Bap	C	5,000	5,000	-	5,000	-
53	Bui Van Phuong	Khuong	C	15,000	5,000	10,000	5,000	
54	Quach Van Num	Khuong	C	88,000	13,000	75,000	13,000	
55	Quach Van Nien	Khuong	C	5,000	-	5,000	5,000	
56	Bui Van Mien	Khuong	C	17,500	7,500	10,000	-	
57	Dinh Cong Tuan	Suoi Bu	C	39,000	-	39,000	-	-
58	Bui Van Quy	Suoi Bu	C	88,000	8,000	80,000	8,000	-
59	Dinh Cong Hieu	Suoi Bu	C	50,000	-	50,000	-	-
60	Bui Van Nhan	Suoi Bu	C	57,000	50,000	7,000	50,000	-
61	Lo Van Manh	Tat	C	38,000	0	38,000		
62	Bui Thi Min	Bap	D	5,000	5,000	-	5,000	
63	Bui Thi Xinh	Bap	D	-	x	-	-	-
64	Bui Thi Vien	Bap	D	-	-	-	-	-
65	Bui Thi Tu	Bap	D	80,000	10,000	70,000	6,000	x
66	Quach Thi Be	Khuong	D	5,000	5,000	-	5,000	
67	Quach Thi En	Khuong	D	10,000	-	10,000	-	
68	Quach Thi Hoa	Khuong	D	-	-	-	-	
69	Bui Thi Anh	Suoi Bu	D	51,000	15,000	36,000	4,000	6,000
70	Bui Van Luu	Khuong	D	10,000	-	10,000	-	
71	Quach Van Phan	Khuong	D	30,000	9,000	21,000	9,000	
72	Bui Van Chu	Khuong	D	18,000	7,000	11,000	-	
73	Quach van Phong	Khuong	D	10,000	-	10,000	-	
74	Bui Van An	Suoi Bu	D	-	-	-	-	-
75	Bui Quang Thuong	Suoi Bu	D	28,000	10,000	18,000	8,000	x
76	Lo Van Toan	Tat	D	18,000	0	18,000		

Synthesis

Wealth class A			Wealth class B			Wealth class C			Wealth class D		
Total	Plantation	Protection	Total	Plantation	Protection	Total	Plantation	Protection	Total	Plantation	Protection
100,000	-	100,000	12,000	12,000	-	-	-	-	5,000	5,000	-
78,000	78,000	-	-	-	-	3,000	3,000	-	-		-
22,000	6,000	16,000	1,000	1,000	-	19,000	8,000	11,000	-	-	-
20,000	10,000	10,000	130,000	30,000	100,000	22,000	2,000	20,000	80,000	10,000	70,000
87,000	87,000	-	19,000	3,000	16,000	16,000	6,000	10,000	5,000	5,000	-
60,000	20,000	40,000	9,000	-	9,000	45,000	45,000	-	10,000	-	10,000
180,000	50,000	130,000	15,000	9,000	6,000	-	-	-	-	-	-
10,000	10,000	-	10,000	10,000	-	-	-	-	51,000	15,000	36,000
70,000	0	70,000	76,000	50,000	26,000	6,000	6,000	-	10,000	-	10,000
6,600	6,600	-	25,000	0	25,000	5,000	5,000	-	30,000	9,000	21,000
5,000	5,000	-	5,000	5,000	-	15,000	5,000	10,000	18,000	7,000	11,000
			8,000	8,000	-	88,000	13,000	75,000	10,000	-	10,000
-	-	-	11,300	11,300	-	5,000	-	5,000	-	-	-
22,000	6,000	16,000	10,000	10,000	-	17,500	7,500	10,000	28,000	10,000	18,000
21,000	-	21,000	25,000	15,000	10,000	39,000	-	39,000	18,000	0	18,000
38,000	20,000	18,000	20,000	10,000	10,000	88,000	8,000	80,000			
30,000	-	30,000	14,000	6,000	8,000	50,000	-	50,000			
65,000	45,000	20,000	56,000	10,000	46,000	57,000	50,000	7,000			
110,000	40,000	70,000	47,000	-	47,000	38,000	0	38,000			
108,000	90,000	18,000	25,000	0	25,000						
			26,000	0	26,000						
			13,000	0	13,000						

ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	19	1032600	54,347	2.3E+09
Column 2	19	473600	24,926	9.6E+08
Column 3	19	559000	29,421	1.4E+09
Column 4	22	557300	25,332	8.8E+08
Column 5	22	190300	8,650	1.4E+08
Column 6	22	367000	16,682	5.5E+08
Column 7	19	513500	27,026	7.8E+08
Column 8	19	158500	8,342	2.1E+08
Column 9	19	355000	18,684	6.5E+08
Column 10	15	265000	17,667	5E+08
Column 11	14	61000	4,357	2.6E+07
Column 12	15	204000	13,600	3.5E+08

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	3.6E+10	11	3.24E+09	4.36092	6.864E-06	1.8340245
Within Groups	1.6E+11	212	743064657			
Total	1.9E+11	223				

Appendix B4 - Planting area

Planting area (m2/household)															
A				B				C				D			
Plantation	Acacia	Bamboos	Non-forested	Plantation	Acacia	Bamboos	Non-forested	Plantation	Acacia	Bamboos	Non-forested	Plantation	Acacia	Bamboos	Non-forested
-	5,000	-	5,000	12,000	12,000		-	-	-	-	-	5,000	5,000		-
78,000	78,000	-	-	-	-	-	-	3,000	3,000		-		-	-	-
6,000	6,000		-	1,000	-	1,000	-	8,000	8,000		-	-	-	-	-
10,000	10,000		-	30,000	30,000	-	-	2,000	-	-	2,000	10,000	6,000		4,000
87,000	87,000	-	-	3,000	3,000		-	6,000	-	-	6,000	5,000	5,000		-
20,000	10,000	10,000	-	-	-		-	45,000	45,000		-	-	-		-
50,000	10,000	5,000	35,000	9,000	9,000		-	-	-	-	-	-	-		-
10,000	10,000	-	-	10,000	5,000	5,000	-	-	-	-	-	15,000	4,000	6,000	5,000
0			-	50,000	2,500	2,500	45,000	6,000	6,000		-	-	-		-
6,600	-	6,600	-	0			-	5,000	5,000	-	-	9,000	9,000		-
5,000	5,000	-	-	5,000	5,000	-	-	5,000	5,000		-	7,000	-		7,000
			-	8,000	8,000		-	13,000	13,000		-	-	-		-
-	-	-	-	11,300	9,800		1,500	-	5,000		- 5,000	-	-	-	-
6,000	6,000		-	10,000	10,000	-	-	7,500	-		7,500	10,000	8,000		2,000
-	-		-	15,000	15,000		-	-	-	-	-	0			-
20,000	-		20,000	10,000	10,000		-	8,000	8,000	-	-				
-	-		-	6,000	6,000		-	-	-	-	-				
45,000	44,000		1,000	10,000	10,000	-	-	50,000	50,000	-	-				
40,000		20,000	20,000	-	-	-	-	0			-				
90,000	23,000	15,000	52,000	0			-								
				0			-								
				0			-								

ANOVA: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Column 1	19	473600	24,926	9.56E+08
Column 2	17	294000	17,294	7.22E+08
Column 3	11	56600	5,145	50232727
Column 4	20	123000	6,150	2.1E+08
Column 5	22	190300	8,650	1.37E+08
Column 6	18	135300	7,517	52605000
Column 7	9	8500	944	3027778
Column 8	22	46500	2,114	91855519
Column 9	19	158500	8,342	2.05E+08
Column 10	18	148000	8,222	2.19E+08
Column 11	10	0	-	0
Column 12	19	10500	553	6413743
Column 13	14	61000	4,357	26093407
Column 14	14	37000	2,643	11478022
Column 15	4	6000	1,500	9000000
Column 16	15	18000	1,200	5171429

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	11209172346	15	747278156.4	3.728193	6.777E-06	1.7091253
Within Groups	47103345025	235	200439766.1			
Total	58312517371	250				

Appendix B5 - Costs and benefits of integrated plantings

Costs

	Acacia		Ironwood, Lat, Gioi		Bamboo	
	(Days/ha)	Amount (VND 1000)	(Days/ha)	Amount (VND 1000)	(Days/ha)	Amount (VND 1000)
Establishment						
Site preparation and planting	100	2,000	50	1,000	33	660
Fertilising	0	-	0	-	0	-
Maintain - year 1	0	-	0	-	0	-
Maintain - year 2 and 3	0	-	0	-	0	-
Protection, each year	5	100	5	100	5	100
Seedlings		**375**		**3,500**		**1,250**
Number/ha	1500		700		500	
Cost per seedling (VND 1000)	0.25		5		2.5	
Materials						
Fertilizer - year 0 (VND 1000)	0					
Fertilizer - year 1 (VND 1000)	0					
Other cost parameters						
Daily wage rate (VND 1000)	20					
Taxes (provincial and local)	0					
Total		**3,075**		**7,200**		**4,610**

Benefits

	Acacia			Ironwood, Lat, Gioi			Bamboo		
	Quantity	Price (VND 1000/m3)	Amount (VND1000)	Quantity	Price (VND 1000/m3)	Amount (VND1000)	Quantity	Price (VND 1000/m3)	Amount (VND1000)
Product (m3/yr)							**Product (stems/yr)**			
Rational length (years)	10			30			Rational length (years)	30		
MAI (m3)	24			8			Stems/year			
Proportion chipwood	1			1			*From yr 8 to 14*	500	6	3,000
Chipwood	240	200	48,000	240	1500	360,000	*From yr 15 to 30*	1000	6	6,000
Fuelwood	0	60	-	0	100	-	Shoot (kg/plumb)			
							From yr 5 to 10	500	2	1,000
Other assumptions							*From yr 11 to 30*	1000	2	2,000
Real discount rate										
							Other assumptions			
							Real discount rate			
Swidden (yr 1 to 3) per year			1,250				Swidden (yr 1 to 3) per year			1,250
Total			**51,750**			**363,750**				**159,750**

Appendix B6 - Costs and benefits of pure plantings

Costs

	Acacia		Native trees		Bamboo	
	(Days/ha)	Amount ('000VND)	(Days/ha)	Amount ('000VND)	(Days/ha)	Amount ('000VND)
Establishment						
Site preparation and planting	100	2,000	50	1,000	33	660
Fertilising	0	-	0	-	0	-
Maintain - year 1	30	600	30	600	30	600
Maintain - year 2 and 3	30	600	30	600	30	600
Protection, each year	5	100	5	100	5	100
Seedlings		**375**		**3,500**		**1,250**
Number/ha	1500		700		500	
Cost per seedling (VND 1000)	0.25		5		2.5	
Materials						
Fertilizer - year 0 (VND 1000)	0					
Fertilizer - year 1 (VND 1000)	0					
Other cost parameters						
Daily wage rate (VND 1000)	20					
Taxes (provincial and local)	0					
Total		4,275		8,400		5,810

Benefits

	Acacia			Ironwood, Lat, Gioi				Bamboo		
	Quantity	Price ('000VND)	Amount ('000VND)	Quantity	Price ('000VND)	Amount ('000VND)		Quantity	Price ('000VND)	Amount ('000VND)
Product (m3/yr) Rational length (years)	10			30			**Product (stems/yr)** Rational length (years)	30		
MAI (m3)	24			8			Stems/year			
Proportion chipwood	1			1			*From yr 8 to 14*	500	6	3,000
Chipwood	240	200	48,000	240	1500	360,000	*From yr 15 to 30*	1000	6	6,000
Fuelwood	0	60	-	0	100	-	Shoot (kg/plumb)			
							From yr 5 to 10	500	2	1,000
Other assumptions Real discount rate							*From yr 11 to 30*	1000	2	2,000
							Other assumptions Real discount rate			
Total			48,000			360,000				

Appendix B7 - Inputs and outputs of plantings in Hoa Binh Province

Tree species		Input '000VND	Output '000VND	years
Acacia	Pure	4,275	48,000	10
	Integrate	3,075	51,750	
Native tree	Pure	8,400	360,000	30
	Integrate	7,200	363,750	
Bamboo	Pure	5,810	156,000	30
	Integrate	4,610	159,750	

Appendix B8 – Net present value (NPV) and Internal rate of return (IRR) of plantings

NPV and IRR of acacia plantings

Pure planting					
Year	Costs (VND 1000)	Income (VND 1000)	Year	Costs (VND 1000)	Income (VND 1000)
-	2,375	-	-	2,375	-
1	-	1,250	1	-	1,250
2	-	1,250	2	-	1,250
3	-	1,250	3	-	1,250
4	100	-	4	100	-
5	100	-	5	100	-
6	100	-	6	100	-
7	100	-	7	100	-
8	100	-	8	100	-
9	100	-	9	100	-
10	100	48,000	10	100	48,000
11	2,375	1,250	11	2,375	1,250
12	-	1,250	12	-	1,250
13	-	1,250	13	-	1,250
14	100	-	14	100	-
15	100	-	15	100	-
16	100	-	16	100	-
17	100	-	17	100	-
18	100	-	18	100	-
19	100	-	19	100	-
20	100	48,000	20	100	48,000
21	2,375	1,250	21	2,375	1,250
22	-	1,250	22	-	1,250
23	-	1,250	23	-	1,250
24	100	-	24	100	-
25	100	-	25	100	-
26	100	-	26	100	-
27	100	-	27	100	-
28	100	-	28	100	-
29	100	-	29	100	-
30	100	48,000	30	100	48,000
Total	9,225	155,250		9,225	155,250

Net Present Value	
5%	33,036
7%	20,888
9%	14,269
11%	10,387
13%	7,975

Internal Rates of Return	
IRR	21%
First rotation irr	21%

Integrated planting					
Year	Costs (VND 1000)	Income (VND 1000)	Year	Costs (VND 1000)	Income (VND 1000)
-	2,375	-	-	2,375	-
1	600	-	1	600	-
2	600	-	2	600	-
3	600	-	3	600	-
4	100	-	4	100	-
5	100	-	5	100	-
6	100	-	6	100	-
7	100	-	7	100	-
8	100	-	8	100	-
9	100	-	9	100	-
10	100	48,000	10	100	48,000
11	2,975	-	11	2,975	-
12	600	-	12	600	-
13	600	-	13	600	-
14	100	-	14	100	-
15	100	-	15	100	-
16	100	-	16	100	-
17	100	-	17	100	-
18	100	-	18	100	-
19	100	-	19	100	-
20	100	48,000	20	100	48,000
21	2,975	-	21	2,975	-
22	600	-	22	600	-
23	600	-	23	600	-
24	100	-	24	100	-
25	100	-	25	100	-
26	100	-	26	100	-
27	100	-	27	100	-
28	100	-	28	100	-
29	100	-	29	100	-
30	100	48,000	30	100	48,000
Total	14,625	144,000		14,625	144,000

Net Present Value	
0.05	33,036
0.07	20,888
0.09	14,269
0.11	10,387
0.13	7,975

Internal Rates of Return	
IRR	13%
First rotation irr	13%

NPV and IRR of native tree plantings

Pure planting						
Year	Costs	Income		Year	Costs	Income
	(VND 1000)	(VND 1000)			(VND 1000)	(VND 1000)
-	4,500	-		-	-4,500	-
1	0	1,250		1	-	1,250
2	-	1,250		2	-	1,250
3	-	1,250		3	-	1,250
4	100	-		4	-100	-
5	100	-		5	-100	-
6	100	-		6	-100	-
7	100	-		7	-100	-
8	100	-		8	-100	-
9	100	-		9	-100	-
10	100	-		10	-100	-
11	100	-		11	-100	-
12	100	-		12	-100	-
13	100	-		13	-100	-
14	100	-		14	-100	-
15	100	-		15	-100	-
16	100	-		16	-100	-
17	100	-		17	-100	-
18	100	-		18	-100	-
19	100	-		19	-100	-
20	100	-		20	-100	-
21	100	-		21	-100	-
22	100	-		22	-100	-
23	100	-		23	-100	-
24	100	-		24	-100	-
25	100	-		25	-100	-
26	100	-		26	-100	-
27	100	-		27	-100	-
28	100	-		28	-100	-
29	100	-		29	-100	-
30	100	360,000		30	-100	360,000
Total	7,200	363,750				

Integrated Planting						
Year	Costs	Income		Year	Costs	Income
	(VND 1000)	(VND 1000)			(VND 1000)	(VND 1000)
-	4,500	-		-	-4,500	-
1	600	-		1	-600	-
2	600	-		2	-600	-
3	600	-		3	-600	-
4	100	-		4	-100	-
5	100	-		5	-100	-
6	100	-		6	-100	-
7	100	-		7	-100	-
8	100	-		8	-100	-
9	100	-		9	-100	-
10	100	-		10	-100	-
11	100	-		11	-100	-
12	100	-		12	-100	-
13	100	-		13	-100	-
14	100	-		14	-100	-
15	100	-		15	-100	-
16	100	-		16	-100	-
17	100	-		17	-100	-
18	100	-		18	-100	-
19	100	-		19	-100	-
20	100	-		20	-100	-
21	100	-		21	-100	-
22	100	-		22	-100	-
23	100	-		23	-100	-
24	100	-		24	-100	-
25	100	-		25	-100	-
26	100	-		26	-100	-
27	100	-		27	-100	-
28	100	-		28	-100	-
29	100	-		29	-100	-
30	100	360,000		30	-100	360,000
Total	9,000	360,000				

Net Present Value		Internal Rates of Return
		IRR 9%
0.05	25,218	
0.07	12,565	
0.09	8,396	
0.11	6,853	
0.13	6,157	

Net Present Value		Internal Rates of Return
		IRR 7%
0.05	25,218	
0.07	12,565	
0.09	8,396	
0.11	6,853	
0.13	6,157	

NPV and IRR of bamboo plantings

Pure planting

Year	Costs	Income			Year	Costs	Income
		Total	Stem	Shoot			
	(VND 1000)	(VND 1000)	(VND 1000)	(VND 1000)		(VND 1000)	(VND 1000)
-	1,910	-	-	-	-	1,910	-
1	-	1,250	-	-	1	-	1,250
2	-	1,250	-	-	2	-	1,250
3	-	1,250	-	-	3	-	1,250
4	100	-	-	-	4	100	-
5	100	1,000	-	1,000	5	100	1,000
6	100	1,000	-	1,000	6	100	1,000
7	100	1,000	-	1,000	7	100	1,000
8	100	4,000	3,000	1,000	8	100	4,000
9	100	4,000	3,000	1,000	9	100	4,000
10	100	4,000	3,000	1,000	10	100	4,000
11	100	5,000	3,000	2,000	11	100	5,000
12	100	5,000	3,000	2,000	12	100	5,000
13	100	5,000	3,000	2,000	13	100	5,000
14	100	5,000	3,000	2,000	14	100	5,000
15	100	8,000	6,000	2,000	15	100	8,000
16	100	8,000	6,000	2,000	16	100	8,000
17	100	8,000	6,000	2,000	17	100	8,000
18	100	8,000	6,000	2,000	18	100	8,000
19	100	8,000	6,000	2,000	19	100	8,000
20	100	8,000	6,000	2,000	20	100	8,000
21	100	8,000	6,000	2,000	21	100	8,000
22	100	8,000	6,000	2,000	22	100	8,000
23	100	8,000	6,000	2,000	23	100	8,000
24	100	8,000	6,000	2,000	24	100	8,000
25	100	8,000	6,000	2,000	25	100	8,000
26	100	8,000	6,000	2,000	26	100	8,000
27	100	8,000	6,000	2,000	27	100	8,000
28	100	8,000	6,000	2,000	28	100	8,000
29	100	8,000	6,000	2,000	29	100	8,000
30	100	8,000	6,000	2,000	30	100	8,000
Total	4,610	166,750					

Net Present Value	
0.050	30,985
0.070	18,685
0.090	12,358
0.110	8,858
0.130	6,785

Internal Rates of Return

IRR	23%
10 years irr	22%

Integrated planting

Year	Costs	Income			Year	Costs	Income
		Total	Stem	Shoot			
	(VND 1000)	(VND 1000)	(VND 1000)	(VND 1000)		(VND 1000)	(VND 1000)
-	1,910	-	-	-	-	1,910	-
1	600	-	-	-	1	600	-
2	600	-	-	-	2	600	-
3	600	-	-	-	3	600	-
4	100	-	-	-	4	100	-
5	100	1,000	-	1,000	5	100	1,000
6	100	1,000	-	1,000	6	100	1,000
7	100	1,000	-	1,000	7	100	1,000
8	100	4,000	3,000	1,000	8	100	4,000
9	100	4,000	3,000	1,000	9	100	4,000
10	100	4,000	3,000	1,000	10	100	4,000
11	100	5,000	3,000	2,000	11	100	5,000
12	100	5,000	3,000	2,000	12	100	5,000
13	100	5,000	3,000	2,000	13	100	5,000
14	100	5,000	3,000	2,000	14	100	5,000
15	100	8,000	6,000	2,000	15	100	8,000
16	100	8,000	6,000	2,000	16	100	8,000
17	100	8,000	6,000	2,000	17	100	8,000
18	100	8,000	6,000	2,000	18	100	8,000
19	100	8,000	6,000	2,000	19	100	8,000
20	100	8,000	6,000	2,000	20	100	8,000
21	100	8,000	6,000	2,000	21	100	8,000
22	100	8,000	6,000	2,000	22	100	8,000
23	100	8,000	6,000	2,000	23	100	8,000
24	100	8,000	6,000	2,000	24	100	8,000
25	100	8,000	6,000	2,000	25	100	8,000
26	100	8,000	6,000	2,000	26	100	8,000
27	100	8,000	6,000	2,000	27	100	8,000
28	100	8,000	6,000	2,000	28	100	8,000
29	100	8,000	6,000	2,000	29	100	8,000
30	100	8,000	6,000	2,000	30	100	8,000
Total	6,410	163,000					

Net Present Value	
0.050	30,985
0.070	18,685
0.090	12,358
0.110	8,858
0.130	6,785

Internal Rates of Return

IRR	13%
10 years irr	9%

Appendix C – Study albums

Appendix C1 - Fieldworks

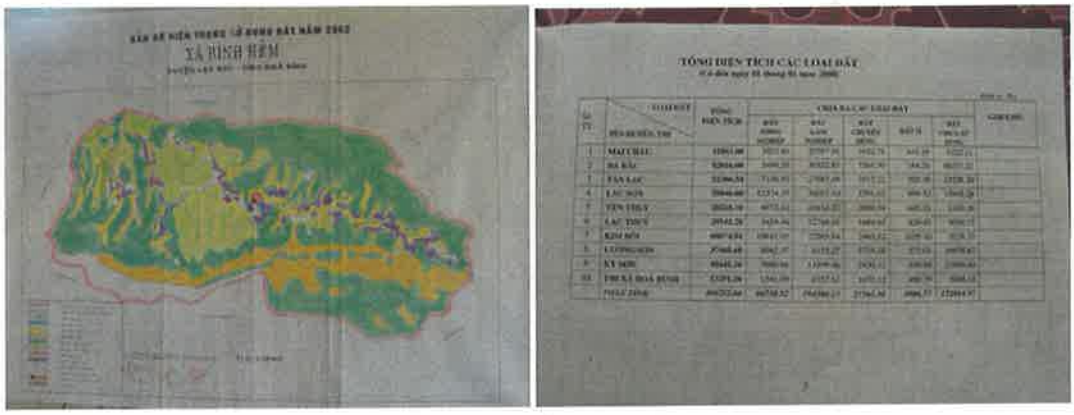

Photo C1.1 Map and data collected from the People's Committees

Photo C1.2 Meeting with the village participants to introduce the study fieldwork

Photo C1.3 Village participants in Hoa Binh Province

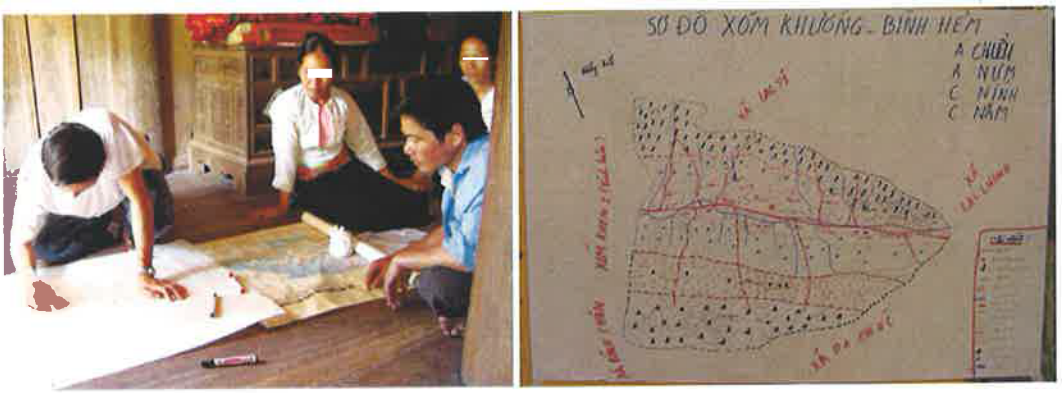

Photo C1.4 PRA tool: Mapping

Photo C1.5 PRA tool: Village transect

Photo C1.6 Discussing on tree planting on the way to take the village transect

Photo C1.7 PRA tool: Household wealth ranking

Photo C1.8 PRA tool: Focus group discussions

Photo C1.9 PRA tool: Household interview

Appendix C2 - Village landscape in Hoa Binh Province

Photo C2.1 Village landscape in Hoa Binh Province

Appendix C3 – Farming components

Appendix C3a - Rice fields in the upland villages

Photo C3.1 Paddy field of the upland villages in Hoa Binh Province

Photo C3.2 Weeding in the paddy rice field

Photo C3.3 Traditional irrigation systems of Muong people

Appendix C3b - Home gardens

Photo C3.4 Home garden of Tay household

Photo C3.5 Vegetable in Tay garden

Photo C3.6 Home garden of Muong household

Photo C3.7 Home gardens of Muong households

Fish ponds

Photo C3.8 Fish pond in Lac Son

Photo C3.9 Pond of Muong household in Luong Son

Photo C3.10 Fish pond of Tay household

Appendix C3c - Livestock

Photo C3.11 Harvesting party of buffaloes

Photo C3.12 Buffaloes in Lac Son

Photo C3.13 Buffaloes tended under the house on stile of Tay people

Photo C3.14 Raising pigs in Lac Son

Photo C3.15 Raising pigs in Lac Son

Photo C3.16 Raising chickens of Muong people

Photo C3.17 Raising goat of Muong households

Appendix C3d - Swidden cultivation

Photo C3.18 'Slash and burn' in Hoa Binh

Photo C3.19 Hoe upland for cassava cultivation of Muong people

Photo C3.20 Upland field of Tay village

Photo C3.21 Upland rice seed of Tay people

Photo C3.22 New upland rice variety used by Tay people

Photo C3.23 Sowing upland rice into the maize fields in Da Bac Tay village

Photo C3.24 Maize and cassava fields in uplands

Photo C3.25 Weeding in the upland cassava field in Lac Son

Photo C3.26 Cassava rotation after acacia harvested

Photo C3.27 Intercropping field of maize, cassava, and taro in the upland of Tay people

Photo C3.28 Fallow field of Da Bac Tay people

Appendix C4 - Houses of the upland households in Hoa Binh Province

Photo C4.1 Houses of the wealth households in Hoa Binh Province (Class A)

Photo C4.2 House of the moderated wealth households in Hoa Binh Province (Class B)

Photo C4.3 House of the moderated poor households in Hoa Binh Province (Class C)

Photo C4.4 Houses of the poor households in Hoa Binh Province (Class D)

Appendix C5 - Off-farm activities of the upland households in Hoa Binh

Wine-making

Photo C5.1 Distilling wine of Muong people

Photo C5.2 Traditional tools for wine-making of Muong people

Photo C5.3 Drinking 'Ruou can' of Muong people in Hoa Binh Province

Textile of Muong people

Photo C5.4 Silkworm cocoon of Muong household

Photo C5.5 Textile fabric of Muong people

Photo C5.6 Sun drying fibre in Muong household

Photo C5.7 Muong elder is rolling silk fibre

Photo C5.8 Muong woman is rolling silk fibre

Photo C5.9 Muong girl is weaving fabric with the traditional loom

Photo C5.10 Muong girl is weaving cloth

Appendix C6 – Forestry activities

Appendix C6a - Forestry products

Photo C6.1 Collecting forest products in Hoa Binh Province

Photo C6.2 Fuel-wood and bamboo cut and arranged for sale in Hoa Binh Province

Photo C6.3 Timber and fuel-wood stored under houses of the households in Hoa Binh Province

Photo C6.4 Semi-processing bamboo of Muong people

Photo C6.5 Bamboo packed for transportation by motorbikes

Photo C6.6 Cutting and packing bamboo of Muong villager

Photo C6.7 Collecting non-timber forest products of Muong villagers

Photo C6.8 Drying non-timber forest products

Photo C6.9 Medicinal plant collected, cut, and packed in Hoa Binh Province

Photo C6.10 Collecting palm leaves of Tay women

Photo C6.11 Making roofing pieces from palm leaves of Tay villager

Photo C6.12 Tay children with non-timber forest products

Photo C6.13 Semi-processing fruit of Tai chua *(Garcinia cowa)* in Lac Son District

Appendix C6b – Acacia and Bamboo Plantings

Bamboo plantings

Photo C6.14 Bamboo species planted into the upland fields

Dendrocalamus membranaceus *Gigantochloa scribneriana*

Photo C6.15 Bamboo fields of Muong households

Acacia plantings

Photo C6.16 Acacia seed and acacia nursing garden of Muong household (Lac Son)

Photo C6.17 Acacia field sown directly with seed of Muong household (Suoi Bu) – the first year

Photo C6.18 Second years Acacia field of Muong household

Appendix C6c - Native wood tree plantings

Photo C6.19 Rang rang mit *(Ormosia balansae)* raised as trial of Muong villager

Photo C6.20 Raising Tram trang *(Canarium album)* of Muong household in Bap village

Rang rang mit (Ormosia balansae) *Chestnut species (Castanopsis chinensis)*

Photo C6.21 Tree species plot remained of Muong households (Suoi Bu)

Photo C6.22 Lat hoa *(Chuckrasia tabularis)* planted in home garden of Muong household (Suoi Bu)

Photo C6.23 Lat hoa *(Chuckrasia tabularis)* planted in home garden of Muong households

Photo C6.24 Vu huong *(Cinnamomum balancae)* planted in home garden of Muong household (Bap)

Photo C6.25 Gioi xanh *(Michelia mediocris)* and Tram trang *(Canarium album)* planted in home gardens

Photo C6.26 Tree species planted along the borders of home gardens (Bap)

Photo C6.27 High-value wood tree species planted in Tay village (661 Project)

Photo C6.28 Iron wood *(Erythrophloeum fordii)* planted under acacia canopy as trial of Muong households (Bap)

Photo C6.29 Iron wood *(Erythrophloeum fordii)* planted under the bamboo canopy of Muong households (Bap)

Photo C6.30 Regenerating iron wood *(Erythrophloeum fordii)* forest in Lac Son

Appendix C7 - Agroforestry

Photo C7.1 Agroforestry of Da Bac Tay in Hoa Binh Province

Photo C7.2 Bead tree *(Melia azedarach)* plot after swidden of Da Bac Tay

Photo C7.3 Intercropping maize and fruit tree in Da Bac District

Photo C7.4 Intercropping maize and bead-tree *(Melia azedarach)* in the uplands

Photo C7.5 Maize and sugar cane grown under bead tree *(Melia azedarach)* canopy

Photo C7.6 Agroforestry of Muong people in Luong Son District (Intercropping tea and tree species)

Photo C7.7 Intercropping cassava and acacia in Luong Son

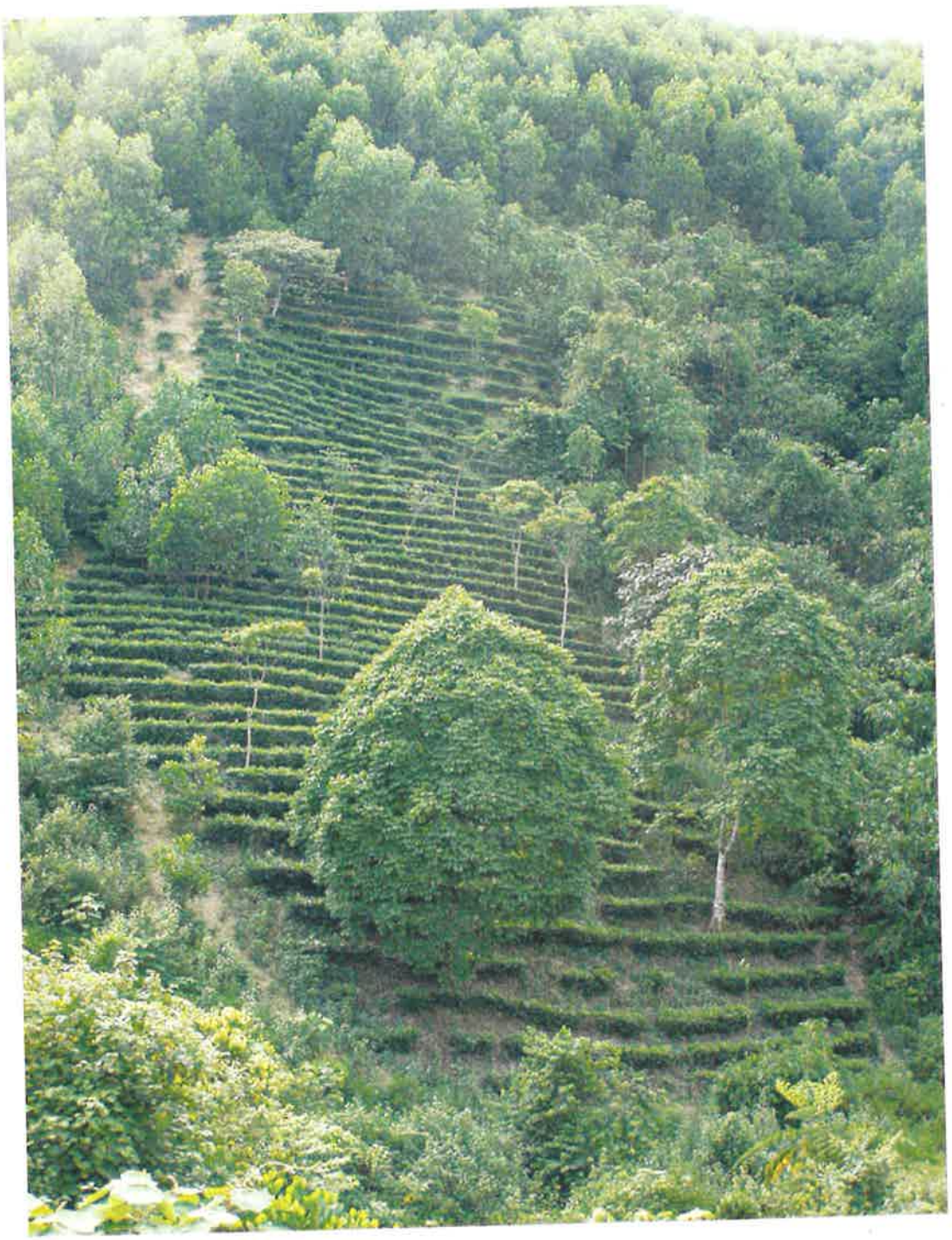

Photo C7.8 A plot of tea grown as agroforestry