Assessment of

Indigenous agricultural Knowledge of ethnic minorities

in upland area of Yen Bai province - vietnam

(supported by AFAP)

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We would like to express our profound gratitude to the assistance, facilitation and participation to the assessment on indigenous agricultural knowledge conducted in Yen Bai province of the Directorate and staff of Yen Bai Agricultural Extension Centre, Yen Bai Women's Union, the People's Committees and Women Unions of districts and Van Chan and Luc Yen and communes Suoi Bu, Suoi Giang, Tu Le, Nam Lanh (of Van Chan district), Tan Linh and Vinh Lac (of Luc Yen district); agricultural and extension cadres from both districts and all the people of the communities in Van Chan and Luc Yen of Yen Bai Province we visited, discussed and interviewed.

This report summarizes the findings of an assessment conducted by the Institute of Ecological Economy on indigenous agricultural and forestry knowledge of the different minority groups living in certain areas of Yen Bai Province. The institute assigned Mr. Dau Quoc Anh to lead the field assessment team throughout June 2000 with enthusiastic participation of Dr. Nguyen Hung, PhD in Agriculture (Vietnam Institute of Agricultural Sciences and Techniques, Hanoi), Mr. Nguyen Phuc Cuong, Forestry Engineer (Yen Bai Province Agricultural & Forestry Extension Centre), Ms. Ha Thi Ha (Van Chan District Women's Union), Ms. Bui Bich Thuy, Forestry Engineer (Luc Yen District Women's Union).

The Eco-Eco would like to sincerely thank the substantial and efficient collaboration of the team members. We are also grateful to AFAP for supporting the realization of this assessment.

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1. PREFACE
Through out the four thousand year old history of national construction and defense the Vietnamese people have accumulated, preserved and built their wide indigenous and traditional knowledge related to agricultural production and management of natural resources. Today Vietnam remains a basically agricultural country with approximately 70 percent of the population living on agriculture. The community of 54 brother ethnic groups across the country has created an enormous treasure of indigenous agricultural knowledge and techniques.

People living in rural areas have their own knowledge and techniques related to diverse aspects of life and the environment they live in. They are able to identify crop-species that can grow in their locality and know how to sow, weed and fertilize accordingly, harvest and process food in a simple and effective manner. They can skillfully make use of and protect a wide range of forest plants that can cure human and animal diseases, protect the environment, land and water sheds so as to sustain their livelihoods given the very sensitive and little sustainable local eco-system.

Generally such indigenous knowledge represents a diverse and constantly developing source of information from the community which has been supporting the everyday life of millions of farmers in adapting to their ever changing habitat and living conditions. Water-reels made from bamboo and forest trees can bring water without using oil or gas from rivers and streams up to a height of 5-10 meters to feed the land; automatic water-driven rice mortars are still working untiringly today to serve the life of minority people living on the mountains; Cinnamon gardens grown by Dao people in Yen Bai, 300 to 500 year old tea products by H’Mong people in Yen Bai’s Suoi Giang are widely popular in Hanoi. Produce like Doan Hung grapefruits, Luc Yen oranges, Bo Ha oranges, Tu Le sticky rice, Hai Hau fragrant rice, Xa Doai oranges, Phuc Trach grapefruits, Mekong Delta durians, Muong Khuong pigs, Mong Cai pigs, Dong Cao chickens, Luc Yen castrated roosters are uncountable across the country. Mentioning their names alone gives Vietnamese generations a sense of pride in and love for our country.

However it is obviously seen nowadays such indigenous knowledge and techniques have been largely neglected or forgotten, especially in delta regions and urban outskirts. Only in certain mountainous and remote areas are some indigenous knowledge and techniques kept and applied to agro-forestry production and protection of natural resources and everyday life.

It is against the background of the current ecological and environmental deterioration and of the life of human beings in general and that of those living in rural areas presently facing numerous difficulties and challenges that we have started to realize that indigenous agricultural knowledge (IAK) is an important source of national resources which can significantly help to achieve the objective of sustainable agricultural growth and participatory making of decisions on community issues in rural areas.

Indigenous knowledge is knowledge of a particular locality and is peculiar to a certain culture or society. Often is IAK different from or even contradictory to the international system of knowledge which is built on by research institutions, universities and agricultural production enterprises on a massive and industrialized manner. IAK provides the basis for community - level decisions related to agricultural production and natural resource management and is the subject of other activities among people living in rural areas. IAK is transferred from one generation to another mainly by way of practice self-earned lessons and verbally. Indigenous knowledge is valuable not only to the local community but also to scientists, researchers and managers, plan designers and policy makers who are interested in the improvement of socio-economic, environmental and living conditions of the rural community.

IAK is of great importance to a wide range of developmental activities. The solutions proposed by a project can be hardly successful or sustainable unless they are in line with the indigenous knowledge of the local people.

IAK can also help to identify more relevant alternative strategies and solutions. Local techniques and technology that have been used effectively in one locality may be applied to address difficulties faced by another with a similar ecological and socio-economic system. A good combination of multiple approaches drawn from different systems will practically benefit the community.

Given such a background, within the capacity of a small one-year project funded by AFAP, IEE with collaboration of some agricultural scientists and co-operation of Yen Bai Province’s Agricultural Extension Centre and Women’s Union, the PCs and line agencies of Van Chan and Luc Yen districts; and cadres and people of Suoi Bu, Suoi Giang, Nam Lanh, Tu Le (Van Chan district), Tan Lanh and Vinh Lac (Luc Yen district) has undertaken a primary assessment on IAK among the Mong, Dao, Tay, Nung and Kinh groups who are living in the two said districts of Yen Bai province.

We chose agriculture to work on in order to identify the most common and popular knowledge of the hill tribes
who have been living on agricultural cultivation. However throughout the course of the assessment, relevant cultural and factors were taken into account.

Yen Bai was selected as the site of the assessment for the reason that it is a mountainous province where live many hill tribe groups. 80% of its population rely on agriculture. The province has been able to maintain, preserve and apply substantial IAK known with names of Suoi Giang tea, Van Yen cinnamon, Tu Le sticky rice, Luc Yen orange and seedless persimmon, Dai Minh orange and kumquat, Van Chan longan and Luc Yen castrated rooster...

The assessment was proceeded on two visits, one in May and the other in June 2000. The list of team members and those who worked with the team during the time of the assessment are given in the Appendix. We also refereed to the Yen Bai Statistic Book 1998.

2. ASSESSMENT OBJECTIVES

2.1 To study and collect IAK of the hill tribes with participation of the local community.

2.2 To analyze, together with the community, local experiences in agricultural production and make projections on the development tendencies of IAK and associated techniques and the main reasons for Yen Bai people’s continuation or discontinuation of using such IAK.

2.3 To prepare some models for Yen Bai’s rural mountainous villages to preserve IAK with the participation of the local farmer community.

3. ASSESSMENT CONTENTS

3.1 Scope

- 3-4 upland/mountainous communes of the two afore-mentioned districts of Yen Bai province
- Ethnic groups: Mong, Dao, Tay, Nung, Thai, Kinh and others.

3.2 Assessment Scheduling

To organize a discussion on the objectives and contents of the IAK assessment with relevant provincial and district agencies to agree upon the contents and schedule of the work done at the respective districts, communes and villages.

3.3 Assessment Sites

* To arrange 1 or 2 assessment visits to villages/hamlets of the following localities:
  - Van Chan District: Suoi Giang and Suoi Bu communes (indigenous tea growing areas)
  - Tu Le commune (sticky rice growing area)
  - Luc Yen District: Tan Linh commune (indigenous orange growing area)
  - Vinh Lac commune (seedless persimmon and castrated rooster growing area)

* To conduct an assessment on cinnamon production in both districts (the team is not in a position to visit Van Yen which is Yen Bai’s biggest traditional cinnamon growing area).

3.4 IAK to be assessed

- IAK about land use, irrigation, cropping techniques and plant protection
- IAK about animal husbandry and veterinary services
- Farming tools
- Agriculture-related resources
  + Forest resources
  + Flora resources, domesticated species and other useful plants
  + Water resources
  + Soil resources
- Fertilizer sources for plants and trees
- Human resources
- Exchange of agricultural experiences within the local community
- Gender issues related to the preservation of IAK

3.5 To organize a discussion on IAK with villagers at the assessment sites

3.6 To organize trainings at the villages or communes on the possibility of developing certain IAK and preparing some small models for IAK preservation and development (e.g. growing Shan tea in the traditional way, promoting herbal medicine gardens for the villages/hamlets)

3.7 To recommend, on basis of the local community’s expectations and views, some small scale projects, so as to preserve and develop the system of general knowledge and IAK in Yen Bai’s upland areas and other mountainous provinces.

4. METHODOLOGY

4.1 IAK and Indigenous Information Channels Identified by the Local Community

Decisions by the local level at the community level are to be based on IAK. Such an assumption also applies to the case of indigenous agriculture. Although in recent years a great deal of advanced techniques in animal husbandry, planting, forestry and fishery have introduced to rural areas they are, in fact, not necessarily accepted voluntarily and applied to household production.

Normally before deciding the application new techniques the farmer will carefully challenge it to local settings and their own household conditions. It is on thorough understanding about local land, climatic and socio-economic conditions that indigenous agricultural systems have been preserved and developed. Such agricultural systems somehow reflects the strategies that help the farmer to avoid or mitigate risks, losses or instabilities involved in investing in the inputs to production and the marketability of its outputs which are agro-forestry produce. In line with changes in the local natural and socio-economic factors IAK systems are also changing so as to adapt to and better benefit the local community.

In Vietnam, especially in mountainous areas where there is limited coverage of mass media, information about IAK of the local people is often conveyed through indigenous channels, verbally or means of study tours, discussion, informal learning from within the locality and practice of such knowledge/techniques.

4.2 Design of Assessment Visits

Concerns of the farmers mentioned above are essential to the design of this assessment.

- The site of the assessment should be an area where much of IAK is maintained and applied.
- Those people who participate in the assessment activities should represent the poor community of the
locality, consisting of aged old people with much farming experience, women who are the main labor force on the field and middle-aged and young people of both Kinh and minority groups; local cadres including village elders, village chiefs and those from mass organizations from district to commune levels.

- The list of interview questions are prepared in a semi-structured manner whereby only discussion topics are designed in advance and specific questions are open to actual circumstances.

- The timing of the visits should fit the local season calendar for agricultural production so as to allow assessment on IAK accordingly. We therefore designed two visits during the spring and summer crops when it is easy to observe plants, forest trees and animals in their development season.

- to ensure the smooth flow of information between the team and people in the community. For example, for tea growing Suoi Bu and Suoi Giang of Van Chan District where live mainly the Mong group we used an interpreter to translate from Mong into Vietnamese. In other discussions the WU staff spoke Mong and Dao themselves. Particularly the Thai, Tay and Nung spoke very fluent Vietnamese.

On the June 2000 visit to Van Chan and Luc Yen districts (Yen Bai) the team started the assessment with a discussion on the objectives, contents and methodologies with cadres of Yen Bai Province’s AEC and of the two districts’ WUs and agricultural extension stations and communal leaders to reflect on their views and interest in the IAK system and to seek their assistance in the assessment in the villages.

The villages to be assessed were selected in accordance with suggestions by the community in order to include poor villages; Mong, Dao, Tay Nung, Thai villages, remote and distant villages and those with special features about IAK such as Suoi Giang (tea), Tu Le (sticky rice), Tan Linh (oranges) and Vinh Lac (seedless persimmons).

Household interviews were conducted with both women and men, on the field and in their respective homes, at discussions with local leaders and the community. The interviews were more informal and qualitative than quantitative and based more on the community’s reflections than specific measures.

The assessment was centered on indigenous agricultural knowledge and techniques mainly related to cropping, animal husbandry, veterinary services, forestry and production and use of herbal medicines. The interviews were followed by briefings with the local people in order for them to comment on and provide inputs to the findings of the assessment.

5. NATURAL AND SOCIO-ECONOMIC BACKGROUND TO THE SURVEY AREA

5.1. Natural and Socio-Economic Characteristics of Yen Bai Province

Yen Bai Province was separated from the former Hoang Lien Son Province (which included Yen Bai, Nghia Lo and Lao Cai) in 1991. The present Yen Bai includes 3 districts of the former Nghia Lo (Van Chan, Tram Tau and Mu Cang Chai) and excludes Bao Yen and Van Ban districts which now belong to Lao Cai.

5.1.1. Natural Background

The town of Yen Bai is 183 km from Hanoi by road access. Yen Bai borders with Lao Cai in the North, Phu Tho in the South, Tuyen Quang in the East and Son La in the West. The province spreads within Eastern longitudes 103°05’ - 105°07 and 21°01’ - 22°01’6” Northern latitudes. Yen Bai has a total area of 6,882.9 km² ranking 20th largest in the country and 8th among the 11 mountainous provinces in the North. It has 7 districts and 2 townships.

Table 1. Area and Population of Yen Bai’s Districts

(Yen Bai Statistic Bureau -1998)

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<tr>
<th>Number of communes</th>
<th>Number of wards/towns</th>
<th>Area (km²)</th>
<th>Population as of 1998</th>
<th>Population Density (persons/km²)</th>
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Although located well inland, Yen Bai is considered as the gateway of the North-Western region and junction of various transportation routes linking the North-Western and North-Eastern parts of the country, Hanoi and Lao Cai Port. Particularly Yen Bai has railway, river way, road and airline transportation systems, which provides Yen Bai with great development opportunities and convenient and fast connections with national economic centers and international ports.

* Topography*

The territory of Yen Bai is spread over the adjacent area of mountainous North East and North West and links midland Phu Tho province to upland Lao Cai. Yen Bai’s topography is thus sloppy towards the North West. The lowest part is the field area of Minh Quan commune, Tran Yen District on a height of 20 metres with Phu Luong (2985 m above sea level) as its peak.

The South Eastern part of Yen Bai consists of ranges of circling hills with flat sides of 40m - 60m height characteristic of a hilly area. This is the ending part of Mount Con Voi (Elephant) - a truck of Hoang Lien Son Range running along Red River Valley. More than 70% of the area of Yen Bai is categorized as upland and highland belonging to the 3 mountain systems: Hoang Lien Son, Con Voi and the limestone range.

Hoang Lien Son occupies the whole natural area on the right bank of Red River in the North The mountain sides are so deeply split that they make it a secondary topography in a right angle against the main direction of the whole range. The old Con Voi is located between Red River and ‘Chay’ River, in the North West - South East direction, at a height of 400-800 m, along with earthen mountains and low hills to the North East and partly to the East of the province. In-between high mountains and low hills are valleys banked up by rivers and streams and relatively flat plateau.

Thac Ba Lake was built in 1972 in Yen Bai with a length of nearly 90 km and a total surface area of over 19,000 ha. Within the boundary of the lake there are more than 1300 big and small islands and a plenty of peninsulas.

Topographically the province has advantages to expand its infrastructure and transportation systems along its length (North West - South East) rather than along its width. There is only one road connection between the two major regions (East and West) running in the South of the province. The difference between sub-regions caused by high mountains and streams is very dramatic. The crow line between Yen Bai Town and the district capital Mu Cang Chai is only 120 km while it is 200 km by road access. The capital district if Van Yen is only 30 km from Luc Yen on the crow line while it is actually more than 100 km by road. Therefore it is a necessity for Yen Bai to construct a transportation and infrastructure system to ensure the smooth exchange between the different parts of the provinces both horizontally and vertically.

In terms of altitude and population density Yen Bai can be split into 2 main areas: low land and up land.

The upland area is typically of 600m above sea level, including 70 communes, which occupies more than 67% of the province's total area. The climate is characterized by Asian-tropical, cold Winter with hoer fog and occasional frost. Its population takes more than 30% of that of the whole province and mainly belongs to the Mong, Dao, Kho Mu and other minority groups. Agricultural production is the principal source of income but is not yet sufficient to secure all year round consumption given the inadequate and weak infrastructure system. Mu Cang Chai and Tram Tau are among the 9 focus upland districts of the country's Northern part.
The lowland area is of between 100m and 500 m above sea level. It is in fact an area of low mountains and hills, plateau and valleys along big rivers and streams. Inhabiting on the lowland area are mainly Tay, Thai and Nung groups.

* Soil Resources

In terms of soil formation, Yen Bai has two main types of soil: locally formed soil, alluvium and semi-alluvium.

Locally formed soil is found over an area of approximately 642,000 ha and can be categorized into two types. Elite soil on 1800-2800 meter high mountains covers about 54,000 ha. This kind of soil has rich nitrogen, poor kali content, and average phosphorous and structure elements.

Feraltic soil is available in a total area of 588,000 ha, which is the resultant of a weathering process of transformed rocks, acid marmoreal rocks and limestones. The humid and hot climate has led to a fast, vigorous and complete weathering process and the formation of a thick cover layer of soil (up to dozens of meters in depth) on top of the original stone layer. Feraltic soil normally has rich in nitrogen but average/poor phosphorous and kali contents in those areas deforested or afforested in a slash-and-burn manner. It is typically acid (pH: 4.5 - 5.5) with exception of the weathered limestone soil. The common feature of Yen Bai’s feraltic is that it is of good deposition and thick enough to accommodate most of annual or perennial crops.

There is a 65,000 ha area of alluvial and semi-alluvial aggraded by river and stream alluvia. This type of soil is highly humid and has average/high nitrogen, poor phosphorous and kali content and rather high acidity (except the Red River alluvial), which is suitable for agricultural crops. However the area of such soil takes up only 8.3% of Yen Bai’s natural land.

In terms of purposes of land use the categorization can be made to include:

- Agricultural land: less than 25% of slope, totaling 66,700 ha or 9.7% of the province’s natural land, of which rice crops accounting for 2.8%, perennial plant crops 11.460 ha (tea: 9.500 ha, coffee: nearly 2,000 ha), fruit crops 4,800 ha.

- Forestry land: 266,700 ha or 38.7% of the province’s natural land including 180,000 ha of natural forests, 86,700 ha of planted forests (40,000 ha for paper production, 18,000 ha of cinnamon trees), 305,600 ha of barren land or 44.3% of the province’s natural land.

* Water Resources

The surface water stock of Yen Bai comes from two sources: Red River and River Chay and local precipitation. On average there is about 1.15 km length of river/stream over every square kilometer. The biggest reservoir is Thac Ba with a 2.9 billion-m³ capacity. The water level in all rivers and streams drops sharply during the dry season sometimes causing draughts detrimental to crops, inhabitants and animals. During the rainy season it rises very quickly resulting in slash floods and inundation in the area along Red River.

* Weather and Climate

Yen Bai lays in monsoon affected tropical area. However, since it is close to the Northern Tropic its level of radiation is lower than that of the Red River Delta. The actual radiation level if between 80 and 100 kcal/cm²/year, which is suitable for plants with short photosensitive period. The average sunlight coverage is 10-13.5 hours/day with the total temperature of 7500 - 8000°C/year. Winter in the lowland area lasts for 4 months from November to March while in the upland area it begins earlier and finishes later. Particularly in those upland areas of over 1500 m above sea level (ASL) there is hardly summer climate given the average temperature of below 20°C.

At the beginning of winter (November-December) it is often dry and becomes drizzling towards the end. Yen Bai is the most drizzling part of the country. It often rains a lot during the hot season bringing along cyclones, hailstorms, slash floods, inundation and erosion. Rainfall patterns are distributed according to the local topography and tend to be falling in the East-West direction across the province except the River Chay valley area where the opposite is found. Given such topographical and monsoon features it is more rainy on the Eastern side than the Western side of Hoang Lien Son Range. The province’s rainfall averages 1500-2000 mm/year while the average evaporation level 700 mm/year and the humidity level 83-87%. Yen Bai is therefore considered highly humid.
Yen Bai is also characterized by its wind pattern. The North-Eastern monsoon blows in the North East-South West direction being shielded by the mountains the River Lo Arc and River Gam Arc and directed largely towards the delta and back to Yen Bai along the Red River and River Chay valleys, which makes the winds less strong and cold. Hot and humid Summer winds with their aquatic characteristics blows in the East-West direction along the Red River and River Chay valleys back to the North and is blocked by high mountains, which causes torrential rains in front of the mountains. The Western side of Hoang lien Son is however, affected by the hot dry South Western wind (known as Laotian Wind) which makes the climate of this area totally different from that of the Eastern side. Winds in Yen Bai have its own speed and direction characteristics blowing most strongly during the transition of winter to summer. There are Eastern or South Eastern winds almost all year round in Yen Bai Town, Thac Ba and Luc Yen. Typhoons coming from the East Sea are very rare.

5.1.2 Agricultural Production

Agro-forestry is Yen Bai principal industry given 80% of the population being farmers and living in the rural area. As of 1999 agro-forestry accounts for 51% while services takes up 30% industry and construction only 19% of the local economy.

As for agriculture, rice (especially wet rice) production plays the most important role. The 1998 converted food output amounted to 181,400 tons (140,000 tons of paddy plus 41,400 tons of converted food crops). The average per food output per head in 1998 was 271 kg with Tran Yen as the top producer (323 kg).

Maize has a big share of the food production with its output reaching 14,100 tons in 1998. Van Chan District alone produced 4,400 tons. Sweet potato production tends to fall (from 88,000 tons in 1995 to 74,000 tons in 1998) though the sweet potato growing area is slightly expanding. Cassava is grown mainly in Van Chan, Van Yen and Yen Binh. Vegetables and beans are grown in all districts with an output of 39,00 tons in 1999.

Annual industrial trees are not yet widely promoted in Yen Bai. In 1999 the provinces produced 25,100 tons of sugarcane, 640 tons of peanuts, 460 tons of soybeans, 50 tons of cotton (mainly in Van Chan with 103 ha and an output of 46,3 tons).

The most important industrial trees are tea and coffee. Yen Bai is currently producing about 40,00 tones of tea per annum (especially known is Shan Tea grown in Van Chan) and 300-400 tons of coffee. Fruit crops including oranges, kumquats, grapefruits, persimmons, longans, apricots, plums, litchis, papayas, bananas and jackfruits were produced at 20,000 tons in 1998.

Forests and forestry are also an advantage of Yen Bai.

Of the total 266,700 hectares of forestry land, natural forests, planted forests, material forests (mainly to serve paper production) and cinnamon forests (mostly grown in Van Yen but scattered all over the province) take up 180,000 ha; 86,700 ha; 40,000 ha and 18,000 ha respectively. Forest coverage has increased from 16% in 1990 to 37% in 1999.

In terms of wood stock, there is currently an estimate of 15 million m³ of logs (of which 11 million m³ are natural forest wood) and about 65 million bamboo/nodding bamboo (vÇu) and neohouzeauna (nøa) trees. On average there are approximately 0.3 ha of forest and 20 m³ of log per person.

Yen Bai is considered as the most potential province in forestry. Since the reform policy was introduced in the late 1980s, forests and forestry in Yen Bai have been gradually restored and developed. Given favorable climatic and soil conditions forest regeneration can be very fast. Forest protection, projection and regeneration are identified as the primary tasks of Yen Bai’s forestry sector. In addition, afforestation including that of indigenous trees are being promoted, especially on a concentrated or scattered basis under household management on officially allocated land according to the Land Law.

In Yen Bai’s forests various indigenous types of wood trees can be found such as bassia (sÔn), teak (t,u), sindora (gô), ironwood (lín), permu, parashra stellata (chô chÔ), brown stellata (chô nØu), mahogany (l,t hoa), oak (sãi), canary (vung Øn) and other valuable bamboo varieties and medical plants namely cardamom (bÔch truÈt), acathompanax aculeatum (ngô gia bx), gingseng (Øm), campanumae javanica (®¼ng sØm), amomum (sa nhØn), camphor tree (long n·o) and cinnamon. Yen Bai’s cinnamon is well known for its high quality and output. There are thousands of households mainly of the Dao group in Van Yen currently growing cinnamon. Tay, Nung, Muong, Thai and Kinh also grow cinnamon on various scales. They are typically able to generate relatively good income from cinnamon production. Particularly in Van Yen cinnamon has become the primary source of income among the Dao community.
As for animal husbandry, the hilly topography is ideal for Yen Bai to develop diverse and efficient animal production. Statistics show the province's livestock in 1998 consisting of 81,000 buffaloes, 30,000 cows, 260,000 pigs, 5,600 horses, 20,000 goats and 2 million chickens/ducks/geese. Meat production in 1998 amounted to 10,000 tons, of which 7,400 tons was pork. Most of farmer households raise buffaloes/cows, pigs and poultry. Statistics on fishery and bee-keeping are not yet available but their development has been seen as considerable in recent years.

5.1.3 Population, Ethnicity and Infrastructure

According to the April 1st 199 survey Yen Bai has a population of 679,684 with a density of 97 people/km², least concentrated in upland districts such as Tram Tau (25 people/km²), Mu Cang Chai (31 people/km²) and more concentrated in lowland districts such as Tran Yen (132 people/km²) and Yen Binh (125 people/km²).

About 80% of the population lives in the rural area, only 20% in towns and townships. The overall population growth rate has fallen gradually from 2.7% in 1991 to 2.2% in 1998. The urban population grew at 1.1% in 1998 while the rural population did at 2.5%.

There are presently 30 brother minority groups living together in Yen Bai of which the seven most populated groups are Kinhn, Tay, Dao, Mong, Thai, Muong and Nung.

The Kinh group makes up half of the population and is concentrated in the Town of Yen Bai, Tran Yen and Yen Binh districts. The Tay accounts for another 18%, of which 40% living in Luc Yen and the remaining in Tran Yen, Yen Binh, Van Yen and Van Chan. The Dao which are as many as 10% of the province's population, 35% of which residing in Van Yen District and making up about a quarter of its population. The Mong group or 9% of the province's population is concentrated in the western upland part accounting for 75% of Tram Tau district's population and 90% of Mu Cang Chai's. The Thai group or 6% of the province's population, of which 90% lives in Van Chan. The Nung group or 2% of the province's population live mainly in Yen Binh and Luc Yen. The Cao Lan or 1% of the province's population largely live in Yen Binh.

Yen Bai's per capita GDP in 1999 was estimated at US$160 compared to the national average of US$ 352.

There are 7 districts and 2 townships, 180 wards and communes (159 communes and 21 wards), 143,900 households with an average size of 5 member.

According to Decision 1232/QDD-TTg dated 24 December 1999 of the Prime Minister 61 communes are classified as especially difficult, of which 13 belonging to Mu Cang Chai, 11 belonging to Tram Tau, 10 belonging to Luc Yen, 8 to Van Chan, 7 to Tran yen and 5 to Yen Binh. So except for the 2 townships all the 7 districts have especially difficult communes.

We have arrived at an initial comment that a number of communes which are well known for their IAK (e.g. Suoi Giang for Shan tea and Tu Le for sticky rice in Van Chan district; Tan Linh for oranges and Vinh Lac for seedless persimmons in Luc Yen district...) are not among the especially difficult ones. This is a very encouraging fact and it justifies that IAK can contribute substantially to poverty reduction in upland and remote areas of the province.

As far as infrastructure is concerned all kinds of transportation systems are available namely roadway, railway, waterways and airway. The Hanoi-Lao Cai railway route has a length of 87 km running through Yen Bai. There are also 4 national highways with a total length of 372 m, 8 provincial roads totalling 291 km and inter-district and inter-commune roads with a total length of 2.080 km. Yen Bai has 2 waterway routes linking Red River, River Chay and Thac Ba Lake and an airport.

160 out of 180 communes and wards have road access to their respective centres. 88 of them have telephone connections. There is 1.1 telephone sets for every 1000 people. 100% of the communes have clinics. 77 communes and 21 wards or 55% of the province's households have electricity.

Those figures show that Yen Bai is on the rise and is gradually lifting itself out of poverty and isolation.

5.2 Background information on Van Chan and Luc Yen districts

5.2.1. Luc Yen District
5.2.2.1 Natural conditions

Luc Yen is a mountainous district located in the furthest North part of Yen Bai bordering Lao Cai, Tuyen Quang and Ha Giang to the North, Lao Cai to the West, Van Yen and Yen Binh districts to the South and Tuyen Quang and Yen Binh district to the East. The total natural area is 807 km$^2$ of which nearly 8,000 ha are agricultural land, 34,300 ha forestry land and 33,000 ha unused. Rice fields take up only 3,580 ha while upland fields 1,400 ha, fruit tree and perennial industrial tree growing area 1,430 ha.

Luc Yen is part of River Chay and Thac Ba Lake’s upstream forest area thus making the total area of protected forest area reach 14,000 ha and planted forest area 12,400 ha. The average natural land and agricultural land per head is 0.84 ha and 0.07 ha respectively.

As a mountainous district of Yen Bai with the National Highway # 70 passing through along the length of the district connecting Luc Yen and Yen Bai Town to Lao Cai. The district capital of Luc Yen is Yen The Township 100 km Northwards from Yen Bai Town.

There are two distinct seasons in Luc Yen: the hot and rainy season from April to September and the cold hardly rainy season from October to March. The average all-year-round temperature is about 23.5°C. It is coldest in January and February (around 17°C) and hottest in July (about 29°C).

River Chay with its many tributaries, big and small streams running through the province is an abundant source of water for the development of agro-forestry, hydro-power production and services as well as for daily consumption of the local people.

5.2.1.2. Socio-economy and Agricultural Production

Luc Yen district consists of 23 communes and Yen The township. It has a population of 94,289 (as of 1998) of which 46,674 are men and 47,615 are women. 6,463 people live in the township while the remaining 87,826 live in the countryside. The population density is 117 people per km$^2$. 10 of the 23 communes of the district are recognized amongst the most difficult ones of the country. Those include Minh Tien, Minh Chuan, Tan Lap, Phan Thanh, An Phu, Khai Trung, Tan Phuong, Khanh Thien, Lam Thuang and Phuc Loi. There are about 10 ethnic minority groups living in Luc Yen, the biggest group being Tay, Nung, Kinh, Dao, Mong and Thai.

In terms of agriculture the total cultivated area as of 1999 is 11,027 ha of which food crops accounting for 9,370: rice 7,108 ha (6,696 ha of wet rice and 412 ha of upland rice), maize 932 ha, cassava 853 ha, sweet potato 367 ha, vegetable 734 ha, soybean 282 ha, peanut 387 ha, sesame 30 ha, sugarcane 86 ha.

Food output in 1999 is broken down into: rice 28,000 tons, maize 1,730 tons, cassava 8,500 tons, sweet potato 2,000 tons, other root crops 1,000 tons, vegetables 11,000 tons, soybeans 282 tons, peanuts 556 tons, sesame 15 tons, sugarcane 10,000 tons.

Animal husbandry is fairly well developed in Luc Yen. The district owns a herd of 16,300 buffaloes (including 12,000 draught buffaloes), 300 cows, 35,000 pigs, 242,000 poultry and animals (200,000 chickens, 38,000 ducks, 3,880 goats, 46 horses).

Cropping land allocation to households has been completed across the district. Forest allocation is however being implemented.

Through government-funded development and socio-economic projects and programs such as the Resettlement Program, Program 327 on ‘greening barren land’, agro-forestry and combined resettlement and agro-forestry models have gained initial achievements. The resettled people are taking steps to stabilize their life and production. However, the life and production of people in Luc Yen remain in difficulty:

- Despite vast land and scope for expansion of food crops there is still a lack of water in certain areas, especially during the Winter Spring crop. As a result the food output remains low. Upland rice fields are very likely to fail in years with limited rainfall at the beginning of the Winter Summer crop.
- The local infrastructure remains in poor conditions. Many communes do not have road access to their centres (e.g. Tan Phuong, An Phu, Minh Thanh...). Many may get completely isolated during the rainy and floody season. Telephone connection is not available in three thirds of the communes. Most of the population use stream/river/well water for everyday consumption, Clean water is seriously inadequate. Electricity has reached only 10% of the district’s population. The living conditions of the minority groups are at a low level, which leads to limited investment in intensive farming.
The level of knowledge and application of advanced agricultural techniques by households are very limited and not similarly among the minority groups, especially those in the upland and remote areas where agricultural extension is hardly available.

The agriculture extension network has reached out to the commune level but it is still limited in operation. Due to trivial funding for agricultural extension activities and difficult road access to the villages from the district centre extension cadres hardly manage to visit them. There are presently only a few communes (e.g. Vinh Lac) that have communal level agricultural extension clubs. Agricultural extension for remote villages, poor and hungry households remain difficult and constrained.

Luc Yen is considered as one of the districts that are able to preserve IAK (e.g. oranges in Tan Linh, Lieu Do, Minh Xuan, Lam Thuong; seedless persimmons in Vinh Lac, Muong Lai; castrated roosters and breed buffaloes in various communes).

5.2.2. Van Chan District

5.2.2.1. Natural conditions

Van Chan is a big district located in the Southern part of the province bordering Tran Yen, van Yen, Mu Cang Chai to the North, Phu Tho and Son La provinces to the South, Phu Tho province to the East and Mu Cang Chai, Tram Tau and Son La province to the West. It has a total natural area is 1,223 km$^2$, a population of 137,050 and a population density of 112 people/km$^2$.

The national highway #37 spreads along the length of the district from Minh Anh in the South via Van Chan, Nghia Lo Town and Tu Le in the far Western part of Van Chan to meet Mu Cang Chai district at Khau Pha Pass which is well known for its terrace rice fields. Van Chan is famous across the North Western region of Vietnam for its vast Muong Lo Field - one of the largest fields of the region compared to Muong Thanh (Dien Bien Phu, Lai Chau province) and Muong Than (Than Uyen, Lao Cai province). River Ngoi Thia flows from Tram Tau to Van Chan, and Van Yen and meets Red River in the North East. Stream Nam Bung in Tu Le starting from Mt. Khau Pha also runs into Red River. Since the district have so many dense streams and brooks the names of many communes begin with ‘suoi’ (stream) (e.g. Suoi Giang, Suoi Bu, Suoi Quyen) or ‘nam’ (brook) (e.g. Nam Bung, Nam Lanh and Nam Muoi).

From the provincial town of Yen Bai to Van Chan the distance is about 110 km and 12 km from Nghia Lo Township. The National Highway #37 passes through Van Chan with a length of more than 100 km via 14 communes, towns and townships. This is the compared to the blood vein of the district.

As far as climate is concerned Van Chan has its own meteorological station, which is one of the only three meteorological stations of Yen Bai (the other two located in Yen Bai Town and Mu Cang Chai).

According to Van Chan Meteorological Station the average temperature is about 23ºC, being lowest in January and February (from 15.5ºC to 17ºC) and highest in June and July (28ºC). It is hot during the rainy season and dry during the cold season. The local precipitation ranges between 1,300 mm (in 1998) to 1,800 mm (in 1995), which is similar to that of Yen Bai. The rainy season in Van Chan begins in March and finishes in October while the dry season starts in November and ends February. The rainy season lasts relatively long (8 months), which is favourable to agricultural production.

5.2.2.2. Socio-economy and Agricultural Production

Van Chan District consists of 31 communes, one town and 2 townships that make 34 administrative units. The district (excluding Nghia Lo Town) has a population of 137,050 (as of 1998), with 67,897 men and 69,153 women. The urban population is 14,945, while the rural population is 122.105 (or 89% of the district’s population). The population density is 112 people/km$^2$.

There are about 20 ethnic groups living in Van Chan, the largest groups being Kinh, Thai, Tay, Mong, Nung, Dao and Muong.

A number of minority groups have been settling for ages in Van Chan, for example the Mong group in Suoi Giang have been residing for a few hundreds of years now. There are tea trees as old as 300 - 500 years grow in high mountains in Suoi Giang (1.370m above sea level) by the Mong. That explains why the Mong remain there.
Of the 31 communes 8 are classified as among the 1,870 especially difficult ones in the whole country and are to benefit from the Program 135 in 2000. Those include Nam Bung, Nam Muoi, Nam Lanh, Sung So, Nghia Son, An Luong, Suoi Quyen and Suoi Bu.

In terms of agro-forestry production the total territory area is 122,340 ha, of which agricultural land is only 13,500 ha (11%), including the following types:

1. Area under annual crops: 6,978 ha
   
   of which
   
   a) wet rice: 4,106 ha
   
   b) upland rice: 2,522 ha
   
   c) other annual crops: 350 ha

2. Household gardens: 659 ha

3. Perennial trees: 4,835 ha
   
   of which
   
   - tea: 3,558 ha
   
   - coffee: 133 ha
   
   - fruit trees: 906 ha
   
   - other perennial trees: 237 ha

4. Pasture: 827 ha

5. Aqua-production ponds and lakes: 208 ha

As for forestry, the total forestry land is 7,526 ha

of which

- natural forests: 31,912 ha
- planted forests: 5,613 ha
- cinnamon growing area: 620 ha

Unused land in hilly and mountainous areas is as much as 64,840 ha or more than half of the district’s natural land.

The converted paddy output in 1998 of the district reached 43,100 tons. One average every person produces 317 kg/year, which ranks the second in the district only after Tran Yen (323 kg/person/year). With the largest rice field known as Muong Lo the rice output of Van Chan in 1998 amounted to 32,130 tons making it the top rice producer of the district.

Maize output is mostly produced in Van Chan at 4,400 tons which is higher than any part of the province. Van Chan also tops in cotton production (46,3 tons as of 1998, or 92% of the province’s total cotton output (50,5 tons).

Van Chan is having 2,608 ha of tea plantation or 27% of the province’s total tea growing area, higher than any other districts. Its tea output in 1998 also ranks first in the province (13,610 tons or 36% compared to 38,000 tons of the whole province).

Van Chan and Luc Yen are leading the province in terms of orange/mandarin/grapefruit production with an average of 1,000 tons/year/district.

In comparison with other districts of the province Van Chan has more advantageous natural and socio-
economic conditions for agricultural production including wet rice, tea, fruit trees, cotton, etc. The local farmers also have more experiences and IAK. For example farmers in Tu Le for hundreds of years have been very well known across the province for their experience in fragrant sticky rice production. The Mong farmers, especially women in Suoi Giang commune (1300 m above sea level) have developed the nation-wide famous Shan tea which is being replicated in many other communes in the region. Women farmers in Van Chan, especially Thai women are famous for maintaining the traditional cotton production and fabric weaving.

However Van Chan is currently facing numerous challenges:

- There remains plenty of barren land; the over-exploitation of water and forest resources in previous years has caused substantial damage to the practice of intensive farming and animal production.
- The material and spiritual life and the level of education among a large proportion of the minority groups are very limited, which affects the ability to invest in intensive farming.
- Infrastructure facilities remain very backward especially in those communes far off the national highways. Many communes in the district do not have access to electricity/telephone networks and motorways. Community-based health stations in the villages and communes are in poor conditions and limited operation. Due to transportation constraints high quality agro-products are likely to have very difficult market access (e.g. Suoi Giang tea grown only 15 km from the national highway but the route is in fact very sloppy and rough during the dry season and becomes very dangerous during the rainy season. Besides the price of tea buds is being held low, which is very discouraging to the producers.

Van Chan District has identified the different steps it is to make in the coming years to take full advantage of its potentials and gradually improve the life of the local population and protect its ecological environment.

6. FINDINGS OF THE HOUSEHOLD-BASED ASSESSMENT ON INDIGENOUS AGRICULTURAL KNOWLEDGE AND TECHNIQUES IN YEN BAI

6.1 Indigenous knowledge on agricultural systems

In the 6 communes of the two districts visited (Suoi Bu, Suoi Giang, Tu Le, Nam Lanh of Van Chan and Tan Linh and Vinh Lac of Luc Yen) the team had an opportunity to observe and hold interviews with farmers households on how they think about and practice the local agricultural systems.

The following points are drawn from such assessments:

1. The assessed agricultural system clearly manifests its indiginity and suitability to the natural, socio-economic and ethnic characteristics of the locality.

The Shan tea growing area (1000-1300 m above sea level) in Suoi Giang commune, Van Chan district is an example for the suitability of the indigenous agricultural system.

Suoi Giang is a upland commune with a total area of 5,922 ha, split into 8 hamlets with 316 households or 1896 people. 99% of the population is Mong, only 1% being Kinh. The Mong’s indigenous agricultural system includes: cropping of tea and wet rice and raising of buffaloes, cows, pigs and especially horses. Horses are used for transportation of goods to markets. The main source if income comes from rice and tea crops and cattle raising. The agricultural system of cropping of perennial starchy and nitrogen-rich plants (soybeans) combined with a livestock of buffaloes, cows and horses on the highland have been existing for approximately 500 years now in the commune. It is observed that:

- The Mong group has been living here for at least 5000 years (as per the age of the local tea gardens)
- The existing agricultural system responds to a combination of cropping and watershed upstream forest protection. Therefore forest coverage is still high (about 50%) and there is an abundant source of stream water, rich layer of cultivating soil though mountains/hills have been in use for hundreds of years now.
- The agricultural system relies almost entirely on the human resources and material inputs locally available which are at low cost and have been sustainable over years.
- It is an indigenous agricultural system with very few techniques imported from outside and non-use of chemical fertilizers/pesticides/herbicides/growth substances. Rather green manure and organic manure are used. This is in deed a clean organic agricultural system.
- The indigenous agricultural system here has utilized all favorable factors of the ecological environment as well as mitigated potential risks. For instance the Mong group chose areas on above 1000 m ASL for tea cropping. Particularly to harvest the Shan tea trees with big hairy buds, wide canopies and large
systems such as cropping, animal husbandry and forestry are being practiced in Suoi Giang and Tu Le, Tan Linh commune of Luc Yen District which is a few hundred kilometres to the North from Van Chan. As early as a long time ago a road was built to connect Van Chan and Mu Cang Chai. There is also a route between Van Chan and Yen Bai Town. Given the vast valley land that could be cleared for wet rice cropping and the water source coming from stream Ngoi Hut which flows along the commune, the Thai group in Tu Le made a very intelligent decision of developing and preserving the locally grown sticky rice very well known as Tu Le sticky rice across Yen Bai and in Hanoi. It is recognised with its special fragrance and quality. Further more they made it into a double crop structure along with food crops such as maize, soybeans and vegetables. The raising of buffaloes, cows, pigs and ducks particularly have also gained strong momentum. Those animals are kept in almost every household. The double-crop rice growing area, which is all year round full of water coming from stream Ngoi Hut has become ideal for raising the locally tamed bau ducks, which can grow fast and fat and marketable. According to the Thai farmers a combination of ducks and wet rice proves to be very efficient. The ducks can be very helpful in enriching the soil in between the two crops. Buffaloes provide draught while cows gives beef for sale in the neighborhood or lowland areas, which together with ducks and double-crop rice production makes an agricultural system very peculiar to the Thai group traditionally experienced in lowland cultivation. In Tu Le each household produces at least 500 kg of sticky paddies per year. On average the output can reach as much as 3000-3500 kg/year. The Thai can make dozens of different kinds of cakes out of their sticky rice such as green bamboo rice (cooked in fresh bamboo tubes), steamed rice, sticky cakes, fried cakes, squared cakes... They eat sticky rice almost all year round. It is explained by the Thai women that sticky rice is more nutritious than plain rice. Cooked sticky rice can also last longer and do not need any other food to go with. Those advantages help maintain its sustainable production within the diverse agricultural system in the Thai’s Tu Le, which according to the local Party Secretary and Commune PC Chairman, has been existing for a few hundred years now.

Unlike Van Chan’s Suoi Giang and Tu Le, Tan Linh commune of Luc Yen District which is a few hundred kilometres to the North from Van Chan, is unique with it lowland and valley topography along River Chay. The low flat hills and upstream forests along with thick soil layers, cool weather and very rare powerful storms the Nung farmers in Tan Linh and neighboring communes such as Tan Lap and Yen Thang have experimented and developed an efficient agricultural system for growing sanh (dark brown) oranges and root crops in their upland gardens, wet rice in lowland fields and raising buffaloes for draught, cows and castrated roosters for meat. Luc Yen’s sanh orange trees which have been developed for hundreds of years now are very special
and well known their bumper fruits, thick density, neat canopies, pest-resistance and high quality. Those orange fruits are grown to ripe about a month around Tet holiday. They have thick spiky peels and of sanh color and can last for 2 - 3 months, even 4 months without getting rotted. Given such a characteristic Luc Yen's oranges can be transported down to Hanoi and other provinces within a couple of months.

The raising of castrated roosters is also an art. It is actually a regular source of income for the Nung people in Luc Yen, making the local agricultural system work with high efficiency at low cost. Production of castrated roosters takes about two years. The roosters are raised in gardens in the shadows of fruit trees such as sanh oranges, mandarins or seedless persimmons in Vinh Lac. They also eat worms and pests to protect the trees and under their shadows they can stay away from the mountain ravens and grow fast given little risk of diseases thanks to such a healthy habitat.

6.2 Indigenous Knowledge on Land use

Land in the two districts Van Chan and Luc Yen of Yen Bai is diverse in its structure, topography, physiochemical and biological characteristics. Local farmers of the different ethnic groups have creatively developed their rich experiences in using land rationally and efficiently to fit the conditions of individual areas, households and livelihoods of their ethnicity.

Mong ethnic minority people in the high mountainous area as Suoi Giang and Suoi Bu of Van Chan district has known how to plant the tea trees in a thinly density, with wide halo and high body as a forest tree's halo in order to keep soil and water. Under the halo of tea tree, the farmers has cut the grass instead of clearing them to avoid land erosion. By keeping the natural forest and planting tea trees as "forest garden" so the land has been really good for hundreds of years with cool and thick layer and has not been eroded, even in the sloppy area.

Experience in land use of Thai people is quite appropriate with the flat valley, which is irrigated by streams. Thai people often live in low land area so they have experience in wet-rice cultivation and supplement trees plantation. They have reclaimed the valleys to a terrace fields and made full use of water in streams to have 2 rice crops/a year and to plant vegetables or Soya bean in winter – good rotational cultivation with two rice crops and 1 supplement crop. The co-efficiency of land use is 2.5-3 times/a year and the technique of using fertilizer is as good as one of Kinh people. With intensive cultivation, the traditional glutinous sticky rice has still got high productivity 4-4.5 tons/ha/crop. Now, food security has been reached though the total land area is small, and each person has only 400 m² of field area.

For many generations, Thai farmers have plant winter Soya bean after 2 rice crops in order to have better land and be less damaged by caterpillars. The banks of fields and gardens are caring well for keeping water and avoiding erosion.

In some unstable areas, farmers have put stones in the fields banks to prevent devolution in flood season and the damage of animals to fields and gardens. There are many terrace fields in Tu Le and its neighboring communes as Nam Bung (Van Chan district) or Khau Pha, Nam Co (Mu Cang Chai district next to Tu Le Commune), which are famous for their terrace cultivation. Being aware of the important role of wet-rice cultivation in sustainable food security, people here have made full use of streams for irrigation. With the method of terrace cultivation, people can take water to the fields in the middle of the mountain. The height of fields is quite different, with the change is up to hundreds of meters. Because of sloppy land and partial topography, the higher land the smaller terrace area it has and the fields are curved along the sloppy mountain. There are some fields, which are only 2m wide (only "one raking line" as local people often say) but 50m – 70m long. Local people often try to make good banks for the terrace fields to have more area. Everybody, who comes from other region, respects the excellent design of ethnic minority people of previous generations on the hilly terraces arrangement, where they plant wet rice.

Tu Le PC staff and people informed that its glutinous sticky rice could only transplant in Tu Le land or in the neighboring communes as Khau Pha, Nam Co (Mu Cang Chai) or in some area of Nam Bung Commune. The sticky rice is not well smell and glutinous if planting it in other area. They explained that is because the wet-rice fields are irrigated by streams coming from Khau Pha mountain, which lies in the border of Van Chan and Mu Cang Chai.

The water here may have a microelement so the rice is more perfumed and glutinous. It may be a scientific thesis that the researchers can analyze and conclude.

In the recent years, the sticky rice area in Tu Le commune has been approximately 1000 ha. Sticky rice is planted in summer crop and rice is planted in spring crop. Nam Co and Khau Pha have similar rice yields with
Tu Le. People said that the sticky rice here is suitable with the land and the water conditions of the locality so crop failure rarely happened. Sticky rice is mainly for food of households and for sell in other district and provinces. At present, supply doesn’t meet the demand and Tu Le leaders said that only Hanoi market required 400-500 tons of Tu Le sticky rice at Tet holiday, out of the local possibility. Due to convenient transportation, with national Road No 37 running through Tu Le Commune and conecting with Nghia Lo township, the agricultural products market becomes more crowded and people are very glad to plant this special glutinous rice.

The soil of Tan Linh and Vinh lac communes, Luc Yen district is different with Tu Le and Suoi Giang communes. Its topography is mainly the low hilly land or fields in Chay river basin. The soil is created by the calcareous mountain and it has thick layer, less sour and is suitable for perennial fruit trees, especially orange, mandarin, apricot, plum and non-pip persimmon. Nung ethnic minority people have the knowledge of this production for a long time. They have settled down here for hundreds of years and the non-pip persimmon gardens are nearly 100 years old, and the oldest persimmon tree of this commune, which is in Mr. Hoang Van Ke’s home garden (He is Tay and 88 years old) is 129 years old – as told by Mr. Ke

Persimmon, orange and mandarin trees are getting on well with the land, the weather (as described in the natural characters of Yen Bai province) so they have high productivity, good quality and get the fame not only in Yen Ba but also in other provinces. The non-pip persimmon productivity Vinh Lac commune 180 tons/a year. The oldest persimmon tree of Mr. Ke is planting in a valley, which is closed with 2 crops rice field. Though it is 129 years old, its annual productivity is still 200 – 300 kg. It has 250 kg of good fruit and gave 1 – 1.5 million VND a year. Mr. Ke said most households in Vinh Lac commune plant persimmon, with 10 – 50 trees/each household and they mainly come from his oldest persimmon tree. With such perennial fruit trees in Luc Yen, Nung and Tay ethnic minority people has longer known how to arrange the suitable density for them in the connection with land characters and the intensive cultivation. In general, farmers are tend to plant scarcely the persimmon trees (7x5m, about 300 trees/ha) and plant rather closely the orange and mandarin trees (3x3m or 3x2.5m, about 1000-1200 trees/ha). Orange, mandarin and apricot trees are planted as terracing plantation to prevent erosion. In particularly, people often choose the stone gardens for planting apricot as old farmers mentioned that apricot trees only liked the stony land area and the apricot trees are fruitful, delicious and costly.

6.3. Indigenous knowledge on water management

In comparison with Cao Bang and Bac Can, where the bamboo and wood water driven wheels are used for pushing up the water level in streams and rivers to irrigate the fields, Yen Bai farmers have made use of the water source in a different way, which is appropriate to local conditions. As said by old farmers in Van Chan and Luc Yen, the water driven wheels are good for utilizing in large fields (as in Trung Khanh – Cao Bang) or in the small fields, which have stable water source all the year round, and have been less affected by slash floods that swept away all the bamboo pipes. In Yen Bai, the rainfall is high and the slash floods come annually so Thai, Tay, Nung, Dzao and Mong ethnic minority people have selected the terrace cultivated method to take water uphill and to manage well the water for cropping. The small canal systems are quite developed and the close and open of the systems have been wonderfully managed for providing enough water for whole area.

With the technique of using water for irrigation, local farmers in Van Chan and Luc Yen district have known the method of empty the fields at the time that rice finish tillering and starts the panicle initiation period. The fields are left empty for 3-5 days and then water is taken back with 5-10 cm high. This method is similar to its of farmers in Red river delta area, which makes the rice get better panicle initiation and improves the rice yield. In brief, indigenous knowledge on water management of local ethnic minority people is as good as the knowledge of Kinh people in low and middle land area.

In the visited communes, we saw many water-based mortars with a small stream running by the village. People often make a small tent covering the mortar. By water force the mortar operates automatically and each night, it pestles 5-7 kg of rice. This has helped to reduce work load for women and children. In other words, it is also a cultural character of ethnic minority peoples: people in a community believe in each other, they are not afraid of being stolen when putting rice in the water-based mortar and leaving it in the tent the whole night.

6.4. Indigenous knowledge on using fertilizer

The difference in agricultural production of the upland area of Yen Bai in comparison with low and middle land area is that the people here haven’t yet used or have rarely used the chemical fertilizer, pesticides or biological products. In the interview, people in the commmunity gave feedback to the questions on this matter as follows:

- People are poor and not well feeding or being well feed but they do not have money to pay for chemical fertilizer or pesticides.
In tradition, ethnic minority people are only familiar with using manure fertilizer. The price of chemical fertilizer in the mountainous area is too expensive, not appropriate with the living condition of poor households. Otherwise, the service network has not provided the fertilizer and pesticide to villages. The agricultural extension information on fertilizer utilizing has not yet well-informed. Poor transportation, which creates difficulties for the inputs and outputs of agricultural products. An important reason is that local farmers would like to have clean and safe agricultural products.

Even Thai farmers in Tu Le, a commune that is close to Highway, have rarely used chemical fertilizers and pesticides. People said that it was an important reason of keeping love of people, both local and external ones, to the glutinous rice.

Mong farmers in Suoi Giang informed that their Shan tea fields had not used chemical fertilizers or pesticides for hundred years. They said Shan tea was only good if planting the tree in high mountain, where the environment is clean, the weather is cool, foggy and not using any kind of chemical fertilizer, pesticide or other chemical products.

Other fruits in Luc Yen as apricot, plum, orange, mandarin and non-pip persimmon are clean agricultural products because of not using chemical products.

Using manure and green fertilizer, especially in the rice fields of surveyed communes, is increasing. Farmers in Suoi Bu, Tu Le, Nam Lang (Van Chan district) and Tan Linh, Vinh Lac (Luc Yen district) said, for the recent 10 years, more and more households have used manure and green fertilizer in rice fields or in maize and potato fields.

By using manure, our houses are cleaner and our fields are greener and better, we will have better rice yields, more maize and potato productivity. Green manure is mainly made of thorough worts (or Cho de tree), which are available everywhere. In a few minutes we can cut a big load, which is enough for one Sao - said happily the farmers.

Green manure is cut and chopped and fattened on May a month before rice transplanting. Women are the ones who do this work. The important thing is that the fields must have enough water after being fattened green manure until transplanting time. "Using green manure the rice fields will help to prevent caterpillar so all households have saved time for making green manure, at least 2 loads (about 60 kg) for 1 Sao and up to 4-5 loads.

6.5. Indigenous knowledge on crop management:

6.5.1 Assure sowing, planting, weeding, water managing and harvesting in right cropping time.

All farmers in 6 visited communes, who are Mong or Dzao or Thai or Nung or Tay ethnic minority people, agreed that implementing in right cropping time the following activities: sowing, planting, weeding, water managing, and harvesting is the most important factor in agricultural production of the locality. Farmers in each area have their experience in observing moon, stars, sun, cloud, flowers and halo of wide trees to foresee the weather to identify the right time for planting. As usual, village head or elder is the one who recommends the right cropping time each year for the whole village. In the recent years, thanks to agricultural extension activities in districts, the extension worker have informed commune staff of the good cropping time for each area. The highland is often affected by floods, rats, insects, wild animals or cattle so people are paid more attention on in time harvesting or early harvesting because having green products at home.

6.5.2. Rotation cultivation of crops/ cropping patterns

The main crops cycle of Tu Le is: spring rice + summer rice (sticky rice) + winter vegetables (short time)

This cropping pattern, with Soya bean or vegetables, will improve the microbic condition of soil, by planting the dry trees in 2-3 months after 2 wet rice crops, which will help to control the insects. And planting fabacous tree will give land more nitrogen from nodule bacterium of its root.

6.5.3. Planting alternately the short and tall trees

For increasing the productivity, upland people of Van Chan and Luc Yen district have experience in planting alternately, for example: planting maize with peanut or black bean; or planting maize with sweet potato. Maize
crop is high while peanut and sweet potato are low so planting alternately these crops will take full use of the land area, and will have better productivity than practicing mono-cropping.

6.5.4 The fields are embanked carefully and mended annually.

For rice field, at the time of raking, Thai, Tay, Nung, Mong and Dzao people have experience of saving time for repairing fields banks, damming big banks with the aim to:

- Manage better water in the field.
- Destroy the caterpillar, mice and insects in the grass bushes in the banks. Clean and firm banks will keep water inside, prevent mice and insects and the rice will grow better.
- Protect the fields of being swept away in rainy season.

6.5.5. Developing suitable farming tools for upland region:

Due to the fact that cultivating methods are basically traditional the tools used by the ethnic minority groups are local traditional. The improved tools or mechanized tools are not so widely used. The typical tools are scythes (hai), which have been used traditionally for hundreds of years. They are 10 cm long with a handle of 6 cm in length and a blade of 4 - 5 cm in length and sharp cogs. Perhaps this is the instrument of the smallest size in northern Vietnam. As compared to the scythes used by Bac Kan or Cao Bang farmers, those used by Yen Bai farmers are of similar shape but somewhat neater with thicker and sharper blades. The scythe is used for common harvesting, or possibly for selecting rice seeds. Using these scythes, Yen Bai people can conserve and develop their better rice species among which there is famous glutinous rice of Tu Le area, which is kept purebred throughout long periods of hundreds of years without being crossbred.

Ploughs and rakes in Yen Bai highlands are also different from those of the delta areas. They are of smaller size but with firmer trunks, their blades being heavier and their rakes being thicker, often with seven rakes (teeth) of shorter and bigger lengths. These tools prove to be suitable for the conditions of mountainous areas with mixed clay, heavier soil occasionally of mixed rocks (in avoidance of being broken when bumping into rocks). The rakes must be small to suit their activities in terraced fields along hillsides.

The hoes (land rails) in the highlands also get wood handles, steady and with movable knot for fixing blades, but not with bamboo handles in the delta areas. Such hoes are suitable to work on the soil with mixed rocks.

On the highlands of Yen Bai areas, every family has got some bamboo dossier (gui - baskets) used for carrying loads of goods, farm produces and vegetables back home from rice fields. These baskets are made of bamboo and cane with two thick handles to make it easier and more comfortable when carrying heavy loads. When fixing them on the shoulders, the bottom of the baskets is often of the same level with the carrier’s waist. With that way of carrying the basket, it will be easier for these farmers to walk through forests, along mountain pass and across brooks. The size and shape of the basket and its decoration vary in accordance with the ethnic group and the locality where they live. The adults’ baskets may carry up to 50 - 60 kg, but they usually carry 30 - 35 kg. The children's baskets are often small, capable of carrying some 10 - 15 kg. Knitting these bamboo baskets is an art and also interest of the elders and the children in their spare time.

Apart from the afore-said tools, there are also small baskets/boxes for daggers, boxes with lids for carrying job’s ear or medical herbs taken from the jungle, or carrying bask-whackers, sledge-hammers typical of mountainous dwellers.

6.6. The indigenous knowledge on plant breeding:

The farming of the communes under the survey up till now is basically sort of locally traditional farming. The natural sources of genetic botanies here are more abundant and variable than in the delta areas.

As for cultivation, if we take into consideration the essential cereals such as rice, maize, manioc, sweet potatoes, edible yam, arrowroot, edible cannas, etc. Each has got at least a dozen of local species. Hmong farmers of Suoi Bu, Suoi Giang communes told us they have tens of local maize species which are different in growth time, corn skin, grain glutting, the size of ear and grain, seed-sowing season and its suitable soil for growing. A Dzao woman in Nam Lanh commune (Van Chan) district said that she could distinguish a lot of oppositifolius yam species growing naturally in the local wood having different flavors, qualities and uses. Particularly there is a species of good smell, little roots that may be used as very good tonic for the elders, women and children. The fragrant Tu Le glutinous rice species has undergone hundreds of years of cultivation but remains purebred, maintaining its own quality. From one commune of Tu Le, nowadays three other communes in the neighboring areas have applied the cultivation of this species and it is now on sale
throughout a lot of provinces in the country.

The Shan tea species of the H'mong people in Suoi Giang has got its fame for hundreds of years and has been expanded to be cultivated in the area of 500 - 700 ha so that in 2005 it will yield about 55,000 tons of fresh tea buds to make 12,500 tons of dried tea. In Suoi Bu commune alone in the year 2000 some more 50 ha of Shan tea will be planted among the farmer's households.

Yen Bai province is famous for its Van Yen cinnamon trees. Cinnamon is a specialty of Yen Bai areas, especially cinnamon areas of Dzao people in Van Yen. At present, cinnamon plantation has extended to other districts than Van Yen. In the two districts of Van Chan and Luc Yen, people of Dzao, Thai, Nung, H'mong, and Tay ethnic groups are expanding the areas of cinnamon plantation. Up to early 2,000 the whole province has got over 16,000 ha of cinnamon trees. Together with Tra Mi cinnamon in Quang Nam province, Van Yen cinnamon has been appreciated as of high quality throughout the country and abroad.

Cinnamon trees are considered to be those of forestry, but they actually belong to industrial and medical trees as well. These trees, green all the year round, may be 15 - 17m tall, with their dark brown barks and 15 - 20 cm long alternate leaves. These trees prefer to be planted on the heights of 500m upwards, favoring rainy climate and 22 - 20°C temperature. On fertile soil, cinnamon trees of ten - year age can offer the first harvest of their barks, and on bad soil at the age of 15, 60% of the planted trees can be exploited. The older the trees are, the thicker their barks and the higher their essential oil capacity will be, hence their higher values. The cinnamon trees of 15 - 20 years can offer 6 - 7 kg of dry barks each, so each hectare can yield 20 - 25 tons of barks. If they are exploited earlier at the age of 10 - 15, each hectare can yield only 10 - 15 tons of dry barks.

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Traditional knowledge on edible wild and domestically grown vegetables:

Vegetables are important part of daily rations of Yen Bai residents. The local people often say, "A meal without vegetables is like illness without medicine" or "When hungry take vegetable, and when ill take medicine". This asserts the significance of vegetable in their daily life. Yen Bai residents, like residents in other areas make use of a lot of vegetables from the common ones as water lilies, cabbage, turnips, spinach to vegetables taken from fruit plants such as pumpkin, gourd, loofah, papaya, beans, etc. The roots of certain plants or trees which were once classified as foods together with rice, corn in starving times are in fact sorts of vegetables: taro, Man potatoes, manioc, etc. A lot of vegetables such as bean sprout or groundnut sprouts and spices in Yen Bai are also well known.

Apart from vegetables, upland people in Yen Bai also make use of edible forest vegetables such as canellas, pruslane, amaranth, sour-tasting fruits such as wild mangosteen, tonkin mangosteen, baccareua, etc can be used for cooking soups of different kinds.

Some of the forest trees supplying roots for flour can be directly cooked for food or made into fry powder such as oppositifolius yam, which is very precious.

A lot of forest vegetables are also treated as medical herbs favored by local residents such as purslane, amaranth and vegetables taken in summer for lowering temperature such as cantella, tamarind, etc.

Each locality and each ethnic group have their own ways of eating forest vegetables in accordance with their own taste. There are a lot of ways and techniques of treating these kinds of vegetables:

- Eating them prematurely: lettuce, centella, purslane, or use as spices: coriander, apricot leaves, or eat as desert (some sour-tasting fruits)
- Eating boiled, fried leaves and buds.
- Eating them in mixture with forest vegetables
- Picking them
- Treating vegetables, ridding their bad smells and viscosity

+ Getting rid of their itching and acridity: chop and clean before cooking or boil and squeeze the vegetable
+ Cooking them in mixture with other acetic fruit and leaves
There are also a lot of ways of treating these sorts of forest vegetables to make them edible food, such as: boil carefully, chop and put in sour water and then cook; put in cinder water or in salted water, etc....

We paid visit to the family of Mr. Tang Van De, a Nung man living in Lang Lo village, Yen Thang commune, and Luc Yen district. His family has got a very big garcinia pedicellata (tai chua) tree, planted some twenty five years ago at his gate. The tree has got a wide 10m halo and is 15m tall. Mr. De said that he can get 800 kg of fruit from this tree every year, getting about 1 million dongs annually. This kind of fruit is sliced, fdried into acidic spice on good sale in Hanoi Markets. This tree is also the biggest in the area supplying biggest fruit.

Thus, we can say that natural resources of edible vegetables in Yen Bai forest are very abundant and the local people have got much experience in conserving, utilizing and developing these sources.

6.8. The indigenous knowledge on preservation and use of local medical plants

In the six surveyed communes, when visiting different households of H’Mong, Dzao, Thai, Tay or Nung ethnics we can realize that their common interest is to conserve and utilize effectively some local herbal plants available in their woods as cures for human and animal diseases.

For typical examples:

Vang A De of H’Mong ethnic group in Ba Cau village, Suoi Bu commune, Van Chan district, gets experience in using leaves of Rau Nua (H’Mong name) plant, dipped in salted water and given to buffaloes and cows to help them cured from a deathly disease (which is disease creating maggots in the ulcers under their skins and costs a lot of money for their treatment in western countries. After the animals eat the salted raunua leaves, all the maggots from the wounds will crawl out and we just kill them to help animals wounds healed.

In village No. 6, Tan Linh commune (Luc Yen district), we interviewed Mr. Hoang Van Ngoc – Nung ethnic minority people, about his own experience in using local medicine to cure animals from maggots, handed down by ancestors, which consists of a certain number of materials mixed together in a certain ratio (including some flowers, mugwort, fig tree bark). To cure people from poisonous snakebites Ngoc has also got a very effective mixture of about 12 plants and substances to be an ointment to cover on the snakebite. More particularly, the local residents have special medicine to prevent pregnancy and to cause abortion a herbal plant named ‘Hacnam’.

In Mr. Ngoc’s house there are a lot of herbal plants: which may be used to cure testinal diseases (cá suối), fever and ulcers among the children (mÇn t¬i), headache and female diseases (mugwort), stomachage at cold weather (®Þa ®iÒn) etc.

In a number of discussions with various groups of farmer’s residents in Van Chan and Luc Yen district revealed that natural resources of medicinal plants are extremely abundant and highly effective to substitute for western medicine. These plants include:

- Mentha arvensis (b¹c lµ) (L) growing wildly in the forest used to cure common colds, fevers, headache, angina
- Dioscorea persimiliz (cá mµi) growing wildly or in the garden used as a tonic to reduce temperature, indigestible diseases, testinal inflammation, cholera, etc.
- Polygonum multiflorum (hµ thñ « ®á) growing wildly used as a tonic for blood faster, keeping hair black and young age.
- Armeniaca vulgaris (m¬): growing wildly or in the garden. Their fruit is used to cure coughing, asthma, cholera, etc. It may also be used as a drink and in sweets making.
- Amomum longiligulare (sa nh©n) (rooted grass plant) growing wildly used to cure indigestible diseases, cholera, oedema, etc and also as sort of spice.
- Amomum aramaticum (th¶o qu¶): growing wildly or in gardens. Its seed is used for treating malaria, cough, and cholera, remitting distended stomach and also as spice in confectionary.
- Morinda officinalis (Bà KYch): growing wildly or planted. Its root is used to treat spermatorrhoea, rheumatism, irregular menses or also as tonic.
- Catharanthus roseus (dôa c¹n) L. growing wildly or planted as bon-site used to treat indigestibility, dysentery
- Coleus aromaticus (hông chanh): growing wildly or planted in the garden, used to cure colds, flu, cough, and oedema or to cover wounds caused by centipide or scorpion-bite, and also used as spice.
- Asparagus cochinchinensis (c©y th³n m¬n ®ång): growing wildly or planted. Its roots are used to cure cough, fevers and as a tonic.
- Pauzolzia zeylanica (c©y bâ m³m): growing wildly. Its whole body my be uses, fresh or dried, to cure
tuberculosis, or to clear digestion

- Oroxylon indicum (cô y nọc m¾c) growing wildly, used to cure stomachache, long-term cough, or ground into powder to cover ulcers

6.9 Indigenous knowledge on preservation and use of local forests resources

Forrest resources include botanies and animals — the animal living being of the forest ecosystem. The forest habitat also includes inanimate factors, climate and soil.

In the six communes under our survey, forest natural resources always play an important role in the daily life of the ethnic minority communities.

The aforesaid part reveals the indigenous knowledge of the ethnic groups in two districts — Yen Bai province — on making effective use of certain aspects of forest resources. This is the use of medical herbs taken from forests and vegetables taken locally. The H'Mong ethnic group in Suoi Bu, Suoi Giang, Dzao people in Nam Lanh, Thai people in Tu Le, Tay, Dzao and Nung people in Luc Yen — all of them are conscious of conserving and making rational exploitation of forest resources of medical herbs and vegetables taken from local forests and have made great efforts in bringing certain herbs to be grown in their own gardens. For those herbs that are not botanically movable they try to protect them on the spot for permanent use.

Apart from the medical plants and wild vegetables, forest resources also comprise a lot of precious wood, trees containing essential attar, fat oil, tannin, and other precious and rare animals and botanies

In terms of the local trees, ethnic people have told or shown us the ones which have special value

The types of wood trees, which are banned or restricted to exploit are as follows:

- Taxus Chinensis (th¬ng ®â)
- Chukrasia sp. (l.t chún)
- Forkenia hodginsi (p¬mu)
- Madhuca pasqueri (sÔn mÈt)
- Padocarpus fleuryi (kim giao)
- Chukraisia tabularis (l.t hoa)
- Markhamia Pierrei (®inh)
- Erythrophloeum fordii (lim xanh)
- Amomum tsaoaka (thï[o qu¶]

The types of wood trees, which are used for making paper include:

- Manglietta fordiana (vµng tÔm)
- Alnyphyllum fortunei (bà ®O xanh)
- Styrax tonkinensis (bà ®O tr¾ng)

Other types of wood trees and multi-utilizing trees, which are available in Yen Bai, include:

- Talauma gioi (gìæi)
- Talauma sp (gìæi tîng)
- Paraschorea stellata (chß chØ)
- Dipterocarpus tonkinensis (chß nÕu)
- Terminalia myriocarpa (chß xanh)
- Hexaneurocarpom brilletii (®inh thèi)
- Radermachera brilletii (®inh xanh)
- Vatica tonkinensis (l.u mÈt)
- Shorea vulgaris (chai)
- Peltophorum forrumgineum (lim xÑt)
- Michelia baviensis (gìæi bµ)
- Vatica sp (l.u muèi)

- Indigofera trifoliata (chµm ba l,

- Keng
- Rang rang mit
In addition to wood trees, there are many types of bamboo trees such as: luong, nua, vau, dien, tre mo, tre gai, hop, buong, etc..., which can be used for building houses or making paper. These trees are growing everywhere in the province.

Local people say that every household in the mountainous area has a few bamboo bushes for bamboo shoots or for making furniture. The hot and humid weather of Yen Bai is good for the plantation of bamboo. The good soil for this kind of tree is clay and sandy clay land area or the valley of limestone mountain or of soil mountain.

Planting bamboo trees in sloppy land may help to prevent erosion in rainy season. People said that the bamboo trees could be allocated as follows:

- Bamboo tree include: housing bamboo, thorny bamboo, lo o bamboo, loc ngoc bamboo, flower bamboo, hop sao, hop nuoc, chicken’s leg ivory bamboo, budda stomach ivory bamboo, and yellow stick bamboo.
- Luong tree have buong, may hoc, may can, met.
- Giang often grows in the forests. It has strong thread and is soft, solid. It can be used as string for tiring things and materials for making high quality paper.
- Canebrake (sÆt): similar to sweet and bitter reed. It can be used as material for making paper and as bamboo shoot for eating. There are big or small leave thorny-cane-brake, mang lang and may tre
- Mai grows by clump with 15 – 17 cm high. Its body has thick and firm wattle, which can be used for building houses, or for making water pipes of Mong, Dao, Thai, Tay, and Nung ethnic minority peoples. Its bamboo shoot is tasty (fresh or dry one). The similar types of this bamboo are: dien trung, fatty bamboo, dien da, and trinh bamboo, etc....
- Le has small body with condensed entrails. It often grows in dry area. It can be used as fence or bamboo shoot for eating
- Dung grows by clump along the mountain in a cool area of Dao and Tay ethnic minority peoples’ villages. It has long internode. There are three types as follows: dung nha, may tan and Lung
- Ivory bamboo (truc): there are not as many ivory bamboo trees in Yen Bai as in Cao Bang but they are...
growing spreadly there. Local people can distinguish the star ivory bamboo (up to 20m high) to rod ivory bamboo (only 10m high). There also has a dragon ivory bamboo – a beautiful decorative plant.

The edible forest trees

Among the above-mentioned trees, in addition to their usage as wood, paper materials, Yen Bai local people also use them as sources of food. Most bamboo shoots of all bamboo types: *nuá, vau, mai, truc, hop, etc...* is edible. Among the wood trees, including forest wood trees and garden wood trees, there are many edible fruit trees. They are the followings:

- **Artocarpus heterophyllus** (*cố y mỳ*). The young jackfruit can be used as vegetable or peeled in salt. The unripe jackfruit segments is boiled for eating and the ripe ones is edible.
- **Walnut trees** (*Castanea mollissima* - *cố y dĩ*). Though Yen Bai does not plant as many walnut trees as Cao Bang, they still grow in the forests, which are in the height of 1000 - 2000 m. The nuts are very tasty and the leaves can be used as food for pigs and silkworm.
- **Canarium nigrum** (*tr. m *ố*én*) is also called as tasty canarium. The fruit becomes ripe from October to December. The fruit is edible, the nut is pressed for oil or used as cake’s stuffing.
- **Canarium album** (*tr. m trí*ăng) is called solid canarium. The fruit becomes ripe from June to July. It can be boiled, preserved in salt or fresh eaten or used as medicine. The canarium resin can be used as attar in the techniques of painting and printing. Its leave is used for raising animals. Local people said that they were planting more types of canarium trees and the canarium was the first tree fruit. For thousands of years, people had known how to plant canarium trees for fruits. People used to eat cassava with canarium fruits.
- **Black tree** (*Cleidiocarpon cavaleriei* - *cố y *ố*én*). It is also called black-eye or butterfly fruit. Its body’s skin and leaves are used for dying (that’s why it is called black tree). Its nut has fat oil, which is edible; the dry oil can be used in husbandry.
- **Dracontomelus, dupstreamum** (*cố y sEu*). Its nut is used for cooking sour soup, making jam and carambola. Its skin and root are used as a herb medicine.
- **Tamarind tree** (*Caesalpinia* - *cố y me*). Its fruit is sour-tasting and it is edible or used for making jam and carambola.
- **Artocarpus Sampor** (*cố y chay*). Its fruit is big and it tastes sour and sweet. Its skin is for betel chewing.
- **Baccaurea ramiflora** (*dốU da *ố*ét*). It is fruitful. Its fruit tastes sour and sweet.
- **Garcinia multilinea** (*dâc*). Its ripe fruit has yellow skin, which is used for cooking sour soup. Its nut is oily, which is used for lighting.
- **Ficus glomerata** (*cố y sung*). It has false fruit and the ripe fruit has brown-red skin. The tender leave can be eaten or used for rolling meat roll. Its fruit can also be eaten or used as food for fish. It is often planted in the embankment of fish pond.
- **Livistona Saribus** (*cố y cù*). It is also called as *tro*, *ke*, *la goi* and *la non*. Its fruit is small and edible. The ripe fruit is preserved in salt or boiled for eating. Its leaf is used for roofing house or making hat, raincoat and wall. Its old tree can be used for making water pipe and the leave’s stem is used for making screen or match.
- **Ficus noxburghii** (*cố y vff*). It is a perennial fruit tree. The unripe fruit can be eaten as vegetable and the ripe one can be eaten prematurely.
- **Hodgsonia macrocarpa** (*dốy mi lín*). It is also called *Dai hai*, *fat nut*, and *forest loofah* or *mac khinh*. It is a kind of liana trees, with oval seedily fruit. The seed stuffing can be eaten because it is fat. People have plant this kind of tree in their garden.
- **Oleaster tree** (*Elaeagnuts latifolia* - *cố y nhât*). The ripe fruit has red-yellow skin. It is edible or used for cooking sour soup.

The edible mushrooms: include rubbish-feather Jew’s ear, *ngan nhi*, *kim nhi*, short-legged perfumed mushroom (violet mushroom), white mushroom, perfumed mushroom (it grows in the body of walnut tree, *san san*, *com and mau cho*). It is a precious kind of mushrooms, which has been planted for a long time), fat mushroom, king mushroom, termite mushroom and straw mushroom.

The attar forest trees:

- **Cinnamomon cassia** (*quÔ*): is the most famous attar tree of Yen Bai. The tree is big and green, from 15 - 17m high, with grey-brown body skin. Its leave is 20 - 25cm long. It is planted in the height of over 500m, in the old hill-rice field or in the old forest area. It can be harvested after 10 - 15 years and the more perennial tree, the better skin and the more attar they have.

A 15 - 20 years old cinnamon tree in Yen Bai can provide 5 - 7 kg of skin, each ha can have 20 - 25 tons of skin. Its leave can provide attar. A 10 - 12 years old tree can only give 10 - 12 tons of skin/ a ha. The skin can be peeled easily from May to August, in the rainy season when the humidity is high and the resin inside the
tree runs up and down strongly (the experience of Dao people in Nam Lanh commune, Van Chan). The cinnamon skin can be used as spice, herbal medicine or attar in foodstuff, cosmetics, medicine and pharmacies industry.

- In addition to cinnamon tree, there are some other attar trees as: mint, thia sansaqua, pierre, ricinus communis, etc....

Forest garden in Luc Yen

Luc Yen district is about 100 km away from Yen Bai Town on the North. We had visited 5 communes of this district twice: in May and in June, 2000. They are: Dong Quan, Phuc Loi, Lam Thuong (visited in May) and Tan Linh and Vinh Lac (visited in June) communes. In all visited communes, we observed and discussed with people about their forest garden. It is quite amazed that the forest gardens in Luc Yen are well kept. Many natural forest areas are well protected and cared. Many trees have grown bushy in many hill areas such as: styrax, acacia, cinnamon, etc.... and they are well cared and managed, after 7 - 10 years their haloes have covered all over the hills.

Nung, Tay and Dao households are paid mush attention to caring and planting more local trees in the secondary forest or to doing intensive cultivation in the miscellaneous forest. The phrase "forest garden" was firstly said by farmers.

Mr. Duong Dinh Lieu, a 46 years old Tay Farmer in Dong Quan commune, Luc Yen district, has a total forest garden of 15 ha. His gardens are in different hills. The biggest garden is 6 ha in large, which is next to his house. The furthest garden is 1 ha in large and is 3 km away from his house. In the 6 ha garden, Mr. Lieu and our team had found over 50 spices of botanical plants with many kinds of wood trees, fruit trees and perennial industry trees such as: mango, longan, litchi, coffee, attar and herbal trees (cinnamon, amomum costatum and morinda officinalis, etc....). Mr. Lieu said that his forest garden gave his family about 15 to 20 million VND/a year and the biggest source was from selling bamboo.... and fruits. In the next 5 years, he will have higher income from cinnamon.

6.10. Indigenous knowledge on husbandry and Veterinary services

Up till now, raising animal by traditional method is a main form of Mong, Dao, Thai, Tay, Nung and Kin people in two surveyed districts. The local experience and knowledge on husbandry that we learnt through interviews and household visits were not as much as those on plantation and forestry. Farmers thought that husbandry was supplement to plantation. The overall worry of peoples in 2 districts is the risky animal raising. The epidemic diseases come frequently every year, which causes big losses and the vaccination to animals is not as good as expected. In a very poor living condition, people have tried to raise up many excellent initiatives on animal rearing.

- Thai people in Tu Le commune (Van Chan district) have an initiative in raising duck by covering a corner of 10 m² (2 x 5m) with a fence. 10 - 15 ducks are raised in this corner next to the field. Each corner has water runs through from the field so the ducks can eat food in the water. Thai women said that this way of raising duck appeared a long time ago and the ducks there would become bigger and fatter than the ducks raising in the garden.

- Tu Le duck is a big one, which can be weight up to 2.5 - 3 kg. Its meat is delicious and it has good price in the market. This kind of duck is rarely ill - as Thai women said.

- The local pig is the most popular one in both 2 surveyed districts. Local farmers, including Thai, Nung and Tay ethnic people, have an experience of putting a triangle bamboo frame into pig's neck when it is small (less than 20 kg) so that the pig cannot go through the fence. Farmers say that this simple bamboo frame is quite effective for protecting the trees in the garden.

- On Vet. Mong and Nung ethnic minority people have an experience of killing the maggots in the cattle’s wound by herbal medicine but they used different herbal trees. Mong people also use herbal medicine to cure the small pigs from "white dung" disease. Local women said that the herbal trees were available in the forest or were brought to plant in their home garden.

6.11. Indigenous knowledge of ethnic people in Yen Bai on Garden - Fish pond - Sty (VAC) and Garden - Fish pond - Sty - Forest (VACR) models

*VAC model
In two surveyed districts, Thai, Tay, Nung, Dzao, and Mong ethnic minority groups have an abundant experience in implementing VAC model at household level. Even Mong ethnic group in Suoi Giang, a high mountainous area has tried to carry out VAC. In this area, the garden and the sty are closed to one's house, the fish pond must be in the valley where enough water for raising fish.

- **Home garden:** plant many different kinds of perennial fruit trees as: apricot, plum, longan, litchi, orange, lemon, mandarin, persimmon, papaya, banana, the spices vegetables as: marjoram, balm-mont and the herbal trees as *ma de, dia dien* and mugwort.
- **Fishpond:** raise local types of fish as: carp, tench mud carp and amur. Around the pond, people often plant ficus glomerata and ficus noxburghii trees, which fruits are good food for fish. In Luc Yen, over the fish pond there often has a trellis of melon or ground and pumpkin. And in the middle of pond, it may have soil raft for growing onion.
- **Sty:** raise cattle as cows, buffaloes and pigs or poultry as: chickens, ducks, swans and geese. Raising geese for meat or house keeping. When a stranger comes to one’s house’s yard, the geese will shout loudly to inform the house owner. Manure fertilizer or urine are ran to the closed ponds by a special way or if the fish pond is far from one’s house, the women will carry them there for feeding the fish.

This VAC model has an advantage of making full uses of the space, water light, labor force, and fertilizer sources. It also a good annually income source for people.

* **VACR model**

Being a mountainous province, household in Yen Bai tend to change from home garden to forest garden by planting both perennial fruit trees with some types of local forest trees as: cinnamon, canarium, fig tree, Hodgsonia macrocarpa, bamboo, dracontomelum and livistona saribus, etc ... with the aim to increase income and take full use of land and the bamboo trees which can be used for building houses. These models were set up by people themselves a long time ago, without the support of the government so they are only appropriate with the self-sufficient economy. And in fact the produced products are not much. Therefore, it is necessary to have the assistance of government and development organizations to help farmers improve their capacity. In the VACR model, forest has been more and more interested by ethnic minority communities. Putting forest into VAC model for creating a more completed ecological system is appropriate with the present orientation of developing forest gardens and farms.

**6.12. Indigenous knowledge useful to daily life mountainous communities**

**6.12.1 Water-based mortar**

In many communes of VanChan and Luc Yen district of Yen Bai province, Tay Dzao, Nung, Thai, Mong ethnic minority people are still using some kinds of water-based mortar, a traditional production methodology, which has been existed for hundreds of years.

With a small water and a small dam for stopping and raising up the water level, which made water run down from the height of 1-2 m with the output of 3-4 litre a second, a wood rice mortar could be installed and operated all the time. A rice mortar can provide 5-7 kg of clean rice after 1-10 hours. The place for putting rice is covered by a roof. People often arrange mortars in different height level in order to make full use of water force. This is a meaningful initiative, which helps to save time and energy for women and children and to make a beautiful scene of mountainous area. The place, where has the water-based mortar, is also a meeting area of people in the community. People come there to exchange information with each other and it is a useful activity of people living in an isolated area.

**6.12.2. The bamboo water pipe**

For bringing water to watering the fields, gardens or to supplying for daily use of households, Mong, Dzao, Thai, Tay and Nung ethnic minority groups of Yen Bai have the initiatives of installing the bamboo pipe systems (the bamboo knots have been carved out so the water can run through). A system may be 200m – 1000 m long, running through the hills, fields, gardens and roads to bring water to kitchens and water-needed fields. Every 2 – 3 households can share 1 main system and the supplement pipe system will take to each household. Or 1 household has its water pipe system. For watering the field, each system can provide enough water for the area of 1 – 4 sao. The water pipe system has saved works for women and children. They do not have to bring water from the far low stream to the high hill. It is also help to prevent erosion, increase land’s humidity and food productivity.
7. VIEWS OF PEOPLE OF YEN BAI MOUNTAINOUS MINORITY ABOUT THE PRESERVATION AND DEVELOPMENT OF INDIGENOUS AGRICULTURAL KNOWLEDGE.

By small group discussions, household interviews and small workshops at village level, the views of farmers of ethnic minority peoples in the upland area of Yen Bai on the conditions of preserving and improving the local agricultural knowledge and techniques can be summarized as follows:

7.1. Requirements on economic efficiency

In order to preserve and develop the local agricultural knowledge and techniques, it is necessary to meet the followings requirements on economic efficiency:

- Improve the agriculture capacity and productivity. E.g.: Yen Bai cinnamon, non-pip persimmon and thick-skinned orange in Luc Yen can have high productivity and good quality.

- Improve the economic values of agricultural products. E.g.: the price of Shan tea in Suoi Giang is 1.5 – 2 times higher than its of tea in Phu Tho or Central area (4,000 VND/ a kg in comparison with 2,000 – 2,500 VND/ a kg).

- Improve household income. Planting Shan tea, Tu Le sticky rice, non-pip persimmon and Luc Yen thick-skinned orange can increase household income to 20 – 50%.

- Improve foodstuff productivity and create markets for products: Tu Le sticky rice is not enough to provide for the markets.

- Improve the in-cash income source: the products have high productivity and are easy to sell so people will receive more money.

- Quick retrieval of invested capital: in order to have money for growing perennial trees and implementing VAC program, it should follows the saying “doing short-term things for keeping the long-term things” by raising capon, planting the short-term trees to meet the forthcoming needs while waiting for the perennial trees.

- Assure the markets for the outputs of perennial trees.

- Have other income sources all the year round.

- Increase the food sources for animal and fuel for use for family.

- Production has low price and requires not much money to invest in.

- The trees should be in line with the land and difficult weather conditions and the situations of poor households.

- Use the techniques harmoniously.

- Prevent land erosion. Grow local perennial trees or Shan tea, which has high and large lampshade; do not hoe up grasses but clear them by knife.

- Plants and animals have rarely got epidemic diseases.

7.2. On ecological aspect

The local agricultural techniques should meet the following ecological requirements so that farmer can maintain and develop them:

- Improve the agricultural ecological system. For example: fit the sloppy cultivated land condition, prevent erosion, increase the fertility and humidity of land and increase the plants productivity.

- Meet the local specific conditions with poor technical and material basis.

- Meet the unsustainable ecological conditions of the high mountainous area.
7.3. On social aspect

- The local techniques should be in accordance with the cultural characteristics of high ethnic minority peoples
- Do not create misunderstanding and conflict within the community
- Do not require too many laborers
- Assure food security and improve the social role of people
- Reduce work load for women
- Help people to be self-confident

7.4. On technical aspect

- The techniques should be simple
- Effectiveness
- Have enough good local seedlings (e.g. the seeds of Suoi Giang tea and Tu Le sticky rice)
- Assist people to choose good seedlings by themselves and provide for other areas
- Reduce labor force in production as local techniques
- Inputs and needed materials for local techniques are available.

8. CONCLUSIONS

8.1. Indigenous knowledge on agriculture (including forestry) has acted an important role in agricultural production activates of ethnic minority communities in Yen Bai province. In any area and any specific activity of agricultural production as: planting, forestry, animal husbandry, natural resourced protection, etc. we can find out that people have their local traditional knowledge. They have used them effectively in production and in their daily life. The knowledge has helped them to have significantly improvement in production, to assure the food self-sufficiency and to improve household income

8.2. Many local agricultural knowledge and techniques have not been neglected and forgotten by time. They are still existed or largely developed. In future, many agricultural techniques as Shan Suoi Giang tea, Van Yen cinnamon, Tu Le perfumed sticky rice, thick-skinned orange, Luc Yen non-pip persimmon and Luc Yen capon, etc.... will be kept and developed.

8.3. Up till now, Yen Bai leaders and people have paid attention to make a specific plan for the development of some indigenous knowledge and techniques which have good and sustainable economic effects such as enlarge the area and implement intensive cultivation in planting Yen Bai cinnamon, Shan Suoi Giang tea, Tu Le perfumed sticky rice, persimmon, Luc Yen thick-skinned orange. It is the firmly base for the development of sustainable ecological agriculture to come step by step to industrialization and modernization

8.4. The local traditional agricultural knowledge shows the creative and intelligent of ethnic minority communities living and developing sustainability in Yen Bai province

At present, facing with the challenges on environment degradation, natural disasters, epidemic diseases, ecological imbalance and unsustainable development, etc. the attention of the provincial leaders to create favorable conditions for farmers to select, maintain and improve the good local agricultural techniques has met the community's willingness and the economic, social and cultural conditions of all ethnic groups in the whole province. That's why the policy of developing the local agricultural techniques of provincial leaders has been highly appreciated by ethnic minority communities.

8.5. It is necessary to do the survey on local agricultural knowledge systematically with the participation of people. The survey should concentrate on the best and most appropriate indigenous knowledge and technique in order to have suitable orientation for development.

9. RECOMMENDATIONS

9.1. Continue doing survey on local agricultural knowledge in a larger area of Yen Bai by a systematically way to have further understanding on the effective economic knowledge and techniques which are suitable to the natural, economic and social conditions of Yen Bai is an urgent need
9.2. In present situation of market economy structure and in the process of industrialization and modernization, many indigenous knowledge on agriculture and other sectors - especially in the field of plant and animal genetic resources in upland area and the sustainable cultivation in sloping land of ethnic minority peoples are going to be forgotten. Many varieties of plants (forest trees and herbal trees) and animals are gradually disappeared or degraded or being rare because of lacking of protecting, developing and managing activities of some people in the community and other relating offices. Therefore, the government should have a specific plan for preserving those valuable natural resources before being disappeared. It is the responsibility of the community to do the survey to collect, protect and develop the plant and animal genetic resources and the local agricultural techniques, with the participation of all related agencies, organizations and local people in the support of the government and other internal and external development organizations.

9.3. It is needed to study and implement a full and long program on using experience of local traditional agricultural techniques not only in the upland area but also in the deltas and coastal areas. The overall view is to use the ones which need less input but they have high productivity, good quality, sustainability; and those which had been created and developed by farmer for many centuries, are appropriate with the natural, social economic and cultural conditions of Vietnamese people.

9.4. Firstly, the Ecological Economy Institute with the support from AFAP planned to cooperate with Yen Bai Agricultural Extension Center and Women’s Union to implement some activities of establishing the small models on preserving the indigenous agricultural knowledge in 2 districts: Van Chan and Luc Yen. Some poorest households, especially the women, in Suoi Bu commune will be provided the seeds and fertilizers for planting more Shan Suoi Giang tea trees in 2000. Some other poor households in Tan Linh and Vinh Lac communes of Luc Yen district will be supported the layers or roots of orange and persimmon trees for planting.

9.5. At present, there are some Vietnamese offices and organizations, which have paid attention to study the indigenous agricultural knowledge. However, these researches are very simple and unsystematically. It is necessary to set up a model in Vietnam as a club or a center for studying, protecting and developing the indigenous knowledge in general, including agricultural and forest knowledge. Such organization will cover all agencies and individuals interested in researching and developing the indigenous knowledge. Such club or center will coordinate the implementation of the studying and developing activities on indigenous knowledge in all mountainous, central highland and delta areas of Vietnam, including agriculture, forestry and other related sectors. These activities may help the communities to preserve and develop selectively the most effective indigenous knowledge.

9.6. Nowadays, a network of many agencies and national, regional and international organizations in the world has concerned on studying and developing the indigenous knowledge such as: LEAD, CIRAN in Holland; CIKARD in America; CARIKS and CIKIB in India; BARCIK in Bangladesh; IBRIK in Indonesia; REPPIKA and PHIRCSDIK in the Philippines, etc.... Vietnam should participate in this network at regional or global level to share information and experiences.

9.7. For implementing all these conditions, it is important to recommend to the government to have the specific guidelines on the protection and improvement of the national cultural characteristics, including indigenous knowledge and techniques – an important natural resource of the country in the process of "building up and keeping our country".

9.8. Recommend AFAP and other international organizations to collaborate and support a bigger project on exploring, protecting and developing the indigenous knowledge and techniques in general in Vietnam, including agriculture and forestry. The project can be implemented in many areas in the whole countries as: mountainous area, central highland, and delta area with more interest on the more promising indigenous knowledge system.

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