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**Faculty of Tropical
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Bachelor thesis

Non-timber forest products collection and use by rural
households living near Phong Dien Nature Reserve,
central Vietnam

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Declaration

I hereby declare that I have written my bachelor thesis entitled “Non-timber forest products collection and use by rural households living near Phong Dien Nature Reserve, central Vietnam” by myself and have used all the resources mentioned in the references.

April 25, 2014

.....
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Abstract

Non-timber forest products represent important source of subsistence for households living in rural areas, particularly near the forests. These products have many possibilities of use, such as food, construction material, medicine, or, as a source of additional income. Bachelor thesis documents results of research focused on collection and utilization of non-timber forest products in four villages in Phong My commune, Thua Thien Hue province, central Vietnam. The aim of the thesis was to (i) document what kind of forest products are collected and for what purpose, (ii) to estimate and understand driving forces for commercialization of those products, (iii) to identify main socioeconomic and demographic indicators as well as livelihood strategies of households, and (iv) to obtain future expectation of local households on forest resources capacity and use. Data used in this thesis were collected during the Czech ODA project “Sustainable development in Phong My commune” implemented by CULS FTA in the period 2006-2009. Data were collected via semi-structured interview. Survey included 48 households, 26 from buffer-zone area and 22 from central area of the commune (representing 26.3%, respectively 21.4% of total number of households in target area). In total, 39 plant-based and 22 animal-based NTFPs that were regularly collected in local forest was identified. Results show that households collect NTFPs mainly for subsistence. From 62 most frequently documented NTFPs ethnospecies, only six were collected solely for commercial purposes. Households from buffer-zone villages collected 53 NTFPs ethnospecies, while half of them solely for subsistence purpose and the income from old forest represented 4.1% of total cash income comparing to 22.3% in central villages. Household in central villages collected 28 NTFPs ethnospecies, especially rattan and leaves for making traditional Vietnamese hats, both for commercial purposes. The most collected animal in both research sites were snails/shellfish and frogs. Farmers perceive decreasing biodiversity on average in case of 68% ethnospecies and also realize the necessity of forest protection. It can be concluded that government support plays a big part in commercial collection of NTFPs in research areas and therefore local authorities could support rural farmers by developing alternative systems, e.g. home gardens to reduce extraction of NTFPs from local forest and keep it at a suitable level ensuring local households their food security and cultural habits.

Key words: forest, livelihood, biodiversity, household economy, protected areas, ethnic minority, Vietnam

Abstrakt

Nedřevní lesní produkty představují důležitý zdroj obživy pro domácnosti žijící ve venkovských oblastech, hlavně pak v blízkosti lesů. Tyto produkty mají mnoho možností využití, jako je zajištění potravin, konstrukčních materiálů, léčiv nebo jako další zdroj příjmu. Bakalářská práce dokumentuje výsledky výzkumu zaměřeného na sběr a využití nedřevních lesních produktů ve čtyřech vesnicích v komuně Phong My, v provincii Thua Thien Hue, ve středním Vietnamu. Cílem této práce bylo (i) zdokumentovat, jaké druhy lesních produktů jsou sbírány a za jakým účelem, (ii) odhadnout hlavní faktory ovlivňující komercializaci těchto produktů, (iii), zjistit hlavní socioekonomické, demografické ukazatele a způsoby obživy domácností, a (iv) zjistit budoucí očekávání místních domácností týkající se kapacity přírodních zdrojů a jejich využití. Data použitá v této práci, byla nashromážděna v průběhu projektu zahraniční rozvojové spolupráce s názvem „Udržitelný rozvoj v komuně Phong My“ který byl realizován ČZU FTZ v období 2006-2009. Data byla sesbírána pomocí polo-strukturovaných rozhovorů. Výzkum zahrnoval 48 domácností, 26 z nárazníkové zóny a 22 z centrální části komuny (představujících 26,3 %, resp. 21,4 % z celkového počtu domácností v cílové oblasti). Celkem bylo identifikováno 39 rostlinných a 22 živočišných nedřevních lesních produktů, které byly sbírány v tamním lese. Z výsledků vyplývá, že nedřevní lesní produkty byly sbírány především pro vlastní obživu. Z 62 druhů, bylo pouze šest sbíráno čistě pro komerční účely. Domácnosti žijící v nárazníkové zóně přírodní rezervace sbíraly 53 druhů, z toho polovinu čistě pro obživu. Příjem z prodeje lesních produktů představoval 4,1 % celkových příjmů, zatím co ve vesnicích obývajících centrální část komuny 22,3 %. Domácnosti v centrálních vesnicích sbíraly 28 druhů, zejména ratan a listy pro výrobu tradičních klobouků, téměř výhradně pro komerční účely. Nejvíce sbíranými zvířaty v obou oblastech byli hlemýždi, měkkýši a žáby. Farmáři vnímají pokles biologické diversity v průměru u 68 % sbíraných druhů a uvědomují si nutnost ochrany lesa. Podpora vlády hraje velkou roli ve sběru nedřevních lesních produktů a kroky místních autorit směrem k podpoře rozvoje alternativních systémů, jako jsou např. různé formy agrolesnických postupů či plantáží, vedou ke snížení extrakce lesních produktů z místních lesů a k udržení vhodných podmínek zajišťující potravinovou bezpečnost a kulturní zvyky domácností do budoucna.

Klíčová slova: les, živobytí, biodiverzita, ekonomika domácností, chráněná území, etnické minority, Vietnam

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List of Abbreviations

CIFOR	Center for International Forestry Research
CULS (ČZU)	Czech University of Life Sciences Prague
FAO	Food and Agriculture Organization of the United Nations
FTA (FTZ)	Faculty of Tropical AgriSciences
GDP	Gross Domestic Product
GSO	General Statistic Office of Vietnam
HDI	Human Development Index
MFPs	Minor Forest Products
NTFPs	Non-Timber Forest Products
NTRV	Non-Timber Resources and Values
NWFPs	Non-Wood Forest Products
NWGS	Non-Wood Goods and Services
ODA	Official Development Assistance
PDNR	Phong Dien Nature Reserve
UNDP	United Nations Development Programme
USD	United States Dollar
VND	Vietnamese Dong
WB	World Bank

1. Introduction

Nowadays, in whole world, particularly in developing countries, rural households practise a wide range of livelihood strategies. Some households rely on few main activities, while others diversify their livelihood strategies. Forest products provide subsistence to many rural households. However, the level of their utilization is influenced by many factors, and varies across households. Households depend on a wide diversity of plant and animal-based forest products for their use as well as for commercial value and income generation (Sundriyal and Sundriyal, 2004). NTFPs extraction helps to prevent further poverty and support current livelihoods of rural households, but might not help to lift people out of poverty (Belcher, 2003).

In Vietnam, forests are rich in biodiversity and there are substantial amount of non-timber forest products species. Forest products traditionally represent a subsistence which significantly participates to household income generation. This share differs in each villages and households, and generally forest income is higher in areas with better forest access. In areas where households as an opportunity for different income than from forest or have suitable condition for home gardens and planting own crops, income from NTFPs collections seems to be lower. In many developing countries and principally among population of rural areas, NTFPs offer increasing possibilities of utilization, e.g. they are source of food for own consumption, medical or construction material, but also are a possible source of additional income.

During last decades NTFPs has become a suitable as a livelihood option for rural household which is able to meet their basic needs and serve as a component of sustainable forest management and conservation strategies. Therefore there is growing evidence of researches which are focused on advantages, utilization and overall situation of forest products. On the other hand, NTFPs collecting for commercial purposes may lead to harvesting and uncontrolled collection of various species, including rare ones, and subsequently to biodiversity decline and unsustainable situation for next generations. Take growing population into consideration, NTFPs will not meet basic need of all needy for long time. Forest products are still very significant for many households over the world so

further researches are necessary to handling situation with both household forest dependency and biodiversity decline.

2. Literature review

2.1. Role of non-timber forest products for rural households

Non-timber forest products (NTFPs) play crucial role in maintaining of livelihoods particularly in rural areas of developing countries (Cavendish, 2000; Campbell and Luckert, 2002; Shackleton and Shackleton 2004; Quang and Anh, 2006; Cocks et al., 2008). NTFPs are important because of their risk management role, especially given that agriculture crops encounter many types of shocks, including seasonal flooding, crop diseases or price shocks (Mujawamariya and Karimov, 2014). The limited recognition of NTFPs is often due to insufficient knowledge regarding their importance and total value (Croitoru, 2007). This is because NTFPs can fulfil a lot of different functions in household economy. Economically speaking, they represent a significant source for improving household's subsistence system or to cover consumption needs when households have no or just low cash security or purchasing the food, medical or building material.

Thus, households generate additional income through selling NTFPs either in unexpected events like time of crises, e.g. crop yield failure, occurrence of natural hazard, higher sickness rate of household members, political instability (see e.g. Vantomme et al., 2002; Shackleton and Shackleton, 2004; Paumgarten, 2005), or, continuously when selling NTFPs provide regular cash income (Shackleton et al., 2007). Generally, rural households use majority of NTFPs for consumption purposes however the commercialization of NTFPs has being increasingly recognized by recent studies see (e.g. Larsen et al., 2000; Saha and Sundriyal, 2012; Heubach, 2011). Collection of NTFPs for commercial purposes could also bring negative aspects for the rural areas. It is expected that the role of NTFPs as a resource contributing to cash security will increase further, which could affect their importance in the future. As a result, rural households will face lack of NTFPs supply which would hinder their livelihoods (Saha and Sundriyal, 2012). Increasing population and market demand bring negative effects of overharvesting of NTFPs including stock depletion (Arnold and Ruiz-Pérez, 2001; Belcher et al., 2005). For example, the collection of bamboo has been reduced from 44,364 to 4,050 culms within a decade in northeast Asia (Saha and Sundriyal, 2012). Households were forced to collect bamboo far away from their villages due to reduction of bamboo's resources. These examples show the importance to

link rural development and NTFPs security strategies with forest management. It is notable that the NTFPs commercialization included some vulnerable species, such as *Amalocalyx yunnanensis*, a rare species, which are sold to earn income in China (Fu et al., 2009). The collection and sale of NTFPs by Asian communities is often illegal, although collection of low value products is often tolerated (Fisher, 2000).

2.2 NTFPs and agriculture in Vietnam

There are several scientific studies published on NTFPs in Vietnam. They are focused particularly on human and environmental influences on plant diversity and composition (Hoang et al., 2011), household socioeconomic factors influencing forest use (McElwee, 2008) or collection NTFPs as a secondary option during collection of war residues in central Vietnam (Boissiere et al., 2011). Interestingly, only a few scientific publications dealt with commercialization of NTFPs and forest income in Vietnam (Quang and Anh, 2006; McElwee, 2010). Sunderlin and Ba (2005) published study which summarize knowledge on poverty alleviation in Vietnam including NTFP collection. Nguyen (2006) focused on NTFP from the point of view of forest devolution and harvesting from devolved forest in Vietnam.

Vietnam itself is a very unique country with socioeconomic evolution for the past decades. Since 2000 the Vietnamese population and GDP have rose regularly (see Figure 1). On the other hand economic growth has been causing inequality, particularly widening rural-urban income gap (FAO, 2009). HDI in Vietnam has achieved slightly growth since 2000 with value of 0.617 in 2012 (UNDP, 2012). With this value, Vietnam is on 127th place from 186 monitoring countries. Most of population lives in rural areas (68.3%) in spite of constantly increasing annually urbanization (World DataBank, 2012). Agriculture land comprises 35% and forest land 45% of total area of the country (WB, 2012). Agriculture is important sector of Vietnamese economy, with a value added in agriculture accounting for 20% of GDP and about 48% of the population depend on agriculture for their livelihoods (FAO, 2009; WB, 2012). But in the long-term, the share of Vietnamese agricultural sector on GDP generation is decreasing despite it agriculture plays an important role in household's livelihoods, particularly for the poor households (World DataBank, 2012).

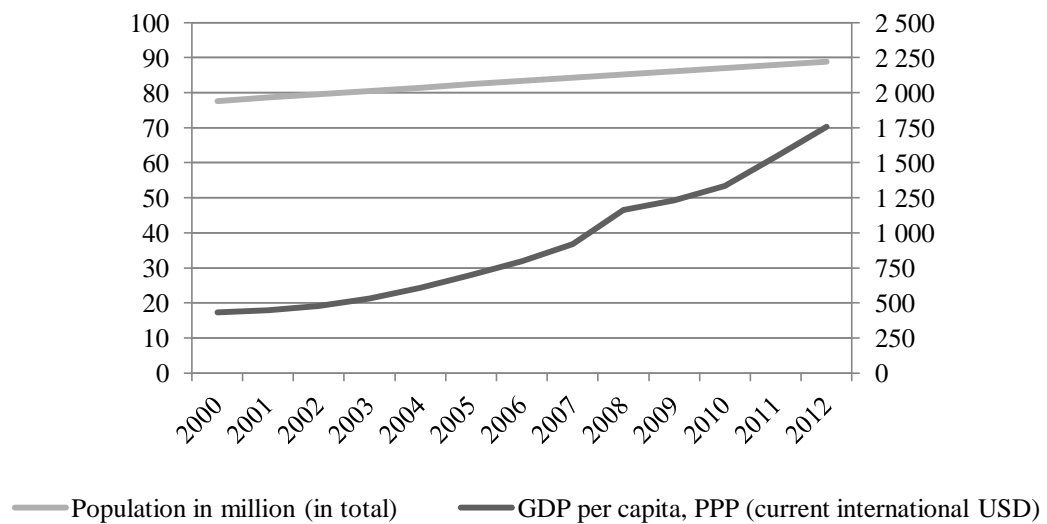


Figure 1
Trend of Vietnamese total population and GDP, 2000-2012
Source: [World DataBank \(2012\)](#)

2.3 Theoretical concepts

Definition of non-timber forest products is debated since the term was firstly used by [de Beer and Mc Dermott \(1989\)](#), but clear terminology and definition of the term NTFPs is still lacking. It is often discussed what should be and what should not be in the definition ([Belcher, 2003](#)). There are differences in the understanding of what a NTFPs is and how NTFPs are important. Individuals and organisations use this term, but with little differences of meaning and modify the definition in different ways according they needs. Many different synonymous expressions for NTFPs exist, e.g. non-wood forest products (NWFPs), minor forest products (MFPs), non-timber resources and values (NTRV), non-wood goods and services (NWGS), wild products, secondary forest product etc. ([Belcher, 2003](#)). Definition of NTFPs according [de Beer and Mc Dermott \(1989\)](#) is: “*Non Timber Forest Products (NTFPs) encompasses all biological materials other than timber, which are extracted from forests for human use*”. They also mentioned that timber and non-timber materials are outstanding by the level of their industrial extraction which means that non-timber wooden materials can be easily harvested by rural households without high skills and technology requirements. According the Center for International Forestry

Research (CIFOR) NTFPs are defined as *“any product or service other than timber that is produced in forest. They include fruits and nuts, vegetables, fish and game, medicinal plants, resins, essences and a range of barks and fibres such as bamboo, rattans, and a host of other palms and grasses”*(CIFOR, 2011). There is definition of NWFPs the FAO operates on which was established by organisation in 1995 and update in 2014: *“Non-wood forest products are goods of biological origin other than wood, derived from forests, other wooded land and trees outside the forest. NWFPs and similar terms such as “minor”, “secondary” and “non-timber” forest products have emerged as umbrella expressions for the vast array of both animal and plant products other than wood derived from forests or forest tree species”* (FAO, 2014).

3. Objectives

The objective of our research was (i) document what kind of forest products are collected in the natural forest and for what purpose, (ii) to estimate and understand driving forces for commercialization of those products, (iii) to identify main socioeconomic and demographic indicators as well as livelihood strategies of involved households, and (iv) to obtain future expectation of local households on forest resources capacity and use.

4. Methods

4.1 Study site description

The research was performed in Phong My commune (Figure 2), which is located in the rural area of Thua Thien Hue province, about 40 km north-west of its administrative centre Hue city and 50 km south-east of Dong Ha town, administrative centre of Quang Tri province, central Vietnam (Vlkova et al., 2011). Western part of the commune extends into the buffer-zone of Phong Dien Nature Reserve (PDNR). This protected area spreads over two districts, Phong Dien and A Luoi, with total area exceeding 41.5 thousands hectares and it is a part of the system of biodiversity conservation programme in central Vietnam called “green corridor”. Phong My commune is administratively part of Phong Dien district, situated in the western direction at about a half hour motorbike ride from its centre, Phong Dien town.

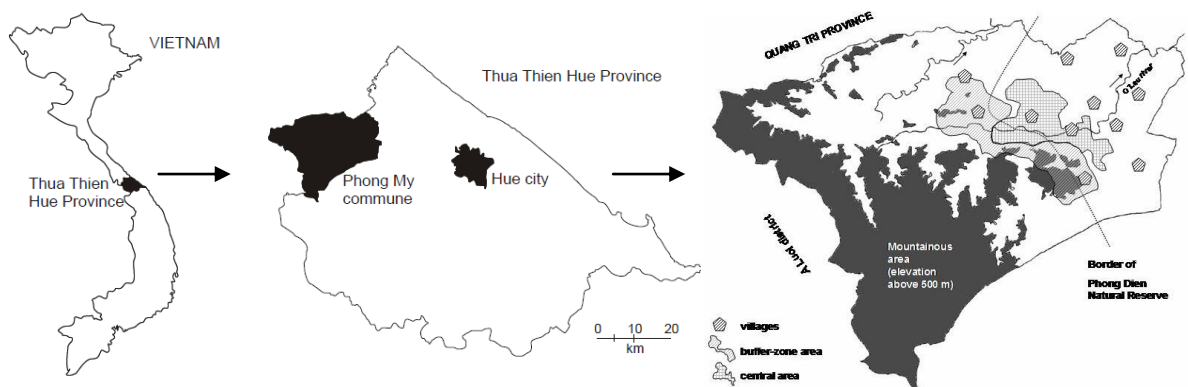


Figure 2

Map of our study sites

(based on Vlkova et al., 2011)

Study area could be characterized by the flat terrain with very low altitude usually not exceeding 50 meters above the sea level. At the east-west gradient, elevation is sharply increasing towards the Annamite Mountains exceeding 1,600 metres (Boissiere et al,

2006). Local climate is characterized by tropical monsoon climate with cold, humid winter and high-humidity rainy season (from late August till late January) (Vlkova et al., 2011). Summer bear continental wind and hot a dry weather. The average rainfall is about 3,000 mm per year (Tuan et al. 2003). Next figure (Figure 3) shows composition of average rainfalls and temperature during the year.

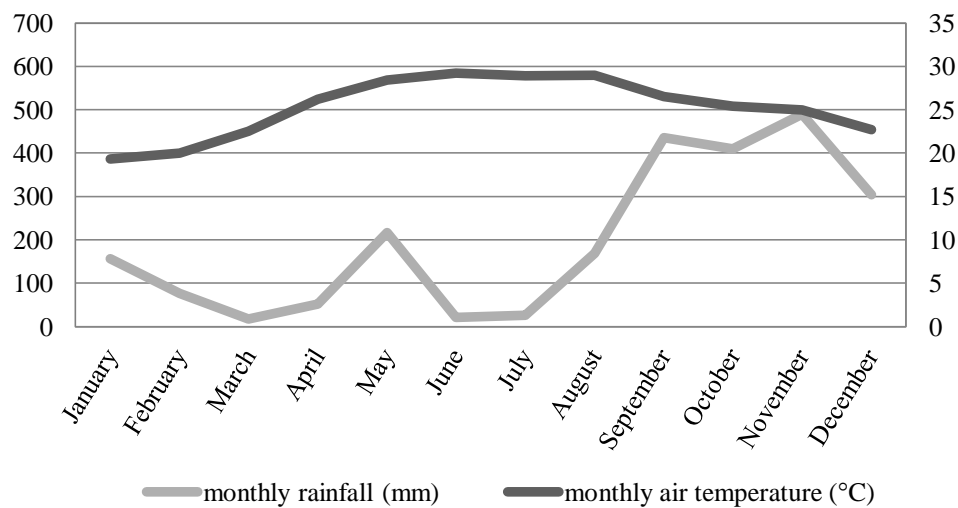


Figure 3
Average rainfall and temperature

Source: GSO (2012)

The highest rainfall months are October and November, while from February to July the rainfalls are rather low (Vlkova et al., 2011; Salek and Sloup, 2012). The average annual temperature fluctuates around 25°C (Tuan et al. 2003) and average annual relative humidity reaches 85-88% (Trai et al. 2001; Vlkova et al., 2011). According to People’s Committee of Phong My Commune (2009), total population of the study area reached 6,279 at the beginning of our study, spread into 1,208 households and eleven villages. Main activities of the households were agriculture and/or running small businesses.

4.2 Data collection

In order to cover different vegetation periods, data were collected over a period of three years, i.e. November 2008, March 2009 and July 2010 among 48 households in Phong My commune¹. Based on interviews with local village heads and commune administrative staff about collection of forest products for maintaining the livelihood, four out of total number of eleven villages were identified as suitable for our survey. Taking into consideration the distance to forest and ethnical composition, we divided chosen villages into two groups: buffer-zone villages and central villages (see Table 1).

Table 1: Study sampling

Study site	Total number of households in 2009	Number of focused households	Total area of the study area (ha)	Total area of buffer-zone forest (ha)	Total area of primary forest (ha)	Names of focused villages	Main ethnic group in focused villages
I.	99	26 (26.3%)	1,014	185	374	Khe Tran, Ha Long	Pa-Hi
II.	103	22 (21.4%)	388	0	0	Hoa Bac, Tan My	Kinh

Source: [People Committee Phong My Commune \(2009\)](#)

Buffer-zone villages are based very close to or directly in the natural forest. Population consists of ethnic minorities, particularly from Pa-Hi language group or related ones, such as Ka-Tu, Van-Kieu, Pa-Co or Ta-Oi ([Dao et al., 2002](#)). They practice traditional livelihood strategies, which are strongly connected to forest resources. Most important products were rubber, timber and forest products. One reason for this strategy is the fact that due to higher altitude as well as lack of favourable terrain and water management, they do not plant rice. On the other hand, central villages are populated by Kinh people who represents major ethnic group in Vietnam. Livelihood strategies of local households are focused primarily on annual crops, such as rice and peanuts or livestock production.

Using list of households from local People's Committee Office, we approach each household in both study areas. Main criteria for conducting an interview with particular

¹ Data were collected by CULS/HUAF research team. Author of this thesis used those data for further analysis which were not done in previously published studies.

household were willingness to participate in our research and confirmation of regular collection of forest products, i.e. at least one product during the last five years. Data were collected through a semi-structured interview with the head of the household and her wife. No female-headed households were suitable for our survey. We tested and adjusted our questionnaire prior to the survey among three randomly selected households.

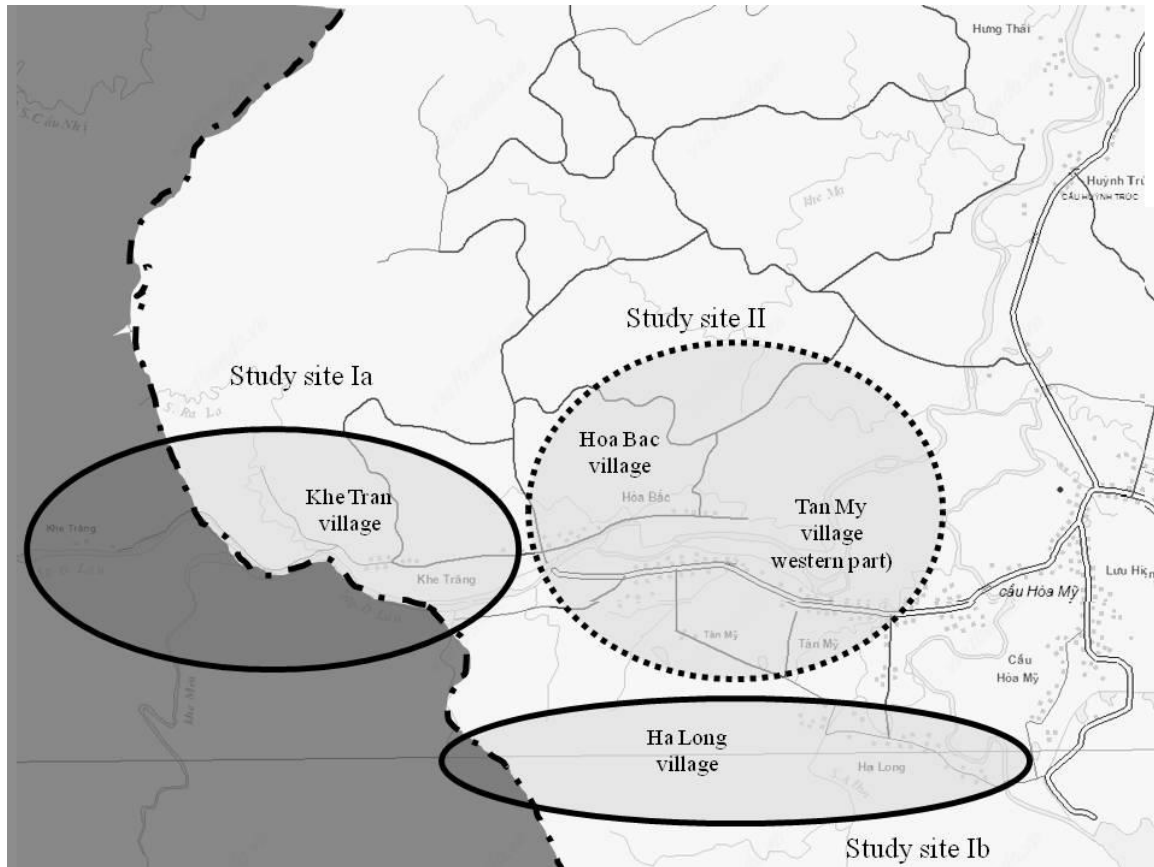


Figure 4

Detailed map of study sites I and II

Note: Study sites I stratified according to particular villages into Ia) and Ib),

PDNR highlighted in dark

Source: based on [Socialist Republic of Vietnam, Government Portal \(2009\)](#)

Our questionnaires were developed in English and then translated into Vietnamese. All interviews were carried out in local languages, i.e. Vietnamese or ethnic dialect. Taking into consideration that the issue is of certain sensitivity for local people, the discussion was

terminated at any time the respondent expressed reservation. This happened in only three cases of households from Central villages. Our questionnaires were developed according to published studies on similar issue (Quang and Anh, 2006; Reyes-García et al., 2006; Davidar et al., 2008; Heubach et al., 2011). Particular variables used in our study are shown in Table 2, reason for choosing them are available and, if possible, supported by already published studies.

Firstly, we ask for household demographic composition, land-use system, income composition and perceiving imbalance in supply household demands. Secondly, we ask farmer to identify what kind of forest products he/she usually collects from the natural forest during the last five years. The list of the products was initially made upon the interviews with local key-informants, i.e. household heads of focused villages and two farmers of higher age with long-term experience on the role of forest for local households as well as with great respects among other farmers from the study areas. Farmers were asked to fill the collection place, time of collection, collected amount per one visit, mode of use and gender involvement into the collection. Specific attention was put to commercialization of forest products. Farmers were asked to identify which products are consumed within their households and which of them are intended to be sold on local market or via middleman. Finally, farmers were asked about their future expectations and opinions on forest products collection and on the role of forest for the community development in general. The questions were oriented serious problems in farming as well as problems during the collection of forest products. Farmers were also asked about their fears connected to collection of forest products and attitudes on protection and future use of forest.

4.3 Data analysis

Data were entered into MS Office Excel and analysed through suitable statistical tools. Descriptive analysis was applied in order to compare study sites in the terms of household economy and resource management and main agricultural practices. Furthermore, in order to uncover significant differences among two study sites, t-test was used (Quang and Anh, 2006).

Table 2: Variables used in our questionnaires

Variable	Description	Relevance of indicator for the survey	References
Household member	All people living regularly in the household together with household head	<ul style="list-style-type: none"> • More people represent higher requirements for food security • More people represent larger labour input • More people mean more resources required and more labour accessed, and, potentially, higher forest revenues or income • More people is able to withdraw large amount of forest products, particularly in the time of food and/or cash insecurity and/or during the time of lack of farm or household activities • More member of households can gather more NTFPs 	Almeida (1992), Dove (1985), Godoy et al. (1997), Babulo et al. (2008), Fu et al. (2009), Kamanga et al. (2009), Paumgarten and Shackleton (2009), McElwee (2010), Heubach (2011), Kar and Jacobson (2012), Melaku et al. (2014)
Household head age	Age of the household head	<ul style="list-style-type: none"> • Higher age of rural dwellers is assumed to be linked to greater knowledge of usable NTFPs and appropriate skills related to their extraction • Young households may need forest income but may lack necessary skills and competence • Elder people are often limited in their physical performance • Greater age of household to augment NTFP dependency 	Piland (1991), Fisher (2004), Fisher and Shively (2005), Babulo et al. (2008), Kamanga et al. (2009), Kar and Jacobson (2012), Hogarth et al. (2013), Melaku et al. (2014)
Gender of the household head	Whether household is headed by man or woman	<ul style="list-style-type: none"> • Female-headed households often have less access to labour and lower forest income • NTFPs used in culinary and/or for ensuring food security could be more important for female-headed households • Collection of war crap is also connected to NTFPs collection, predominantly by men 	Vedeld et al. (2007), Babulo et al. (2008), Kamanga et al. (2009), Kar and Jacobson (2012), Melaku et al. (2014)

Table 2: Variables used in our questionnaires (cont'd)

Variable	Description	Relevance of indicator for the survey	References
Years of schooling of household head	Total length of school attendance of household head	<ul style="list-style-type: none"> • Education is a focal point in order to create access to a greater diversity of income opportunities • Higher formal education, the lower NTFP dependency • Better-educated households have more access to a wider range of income opportunities, thus forest income could be lower 	Godoy and Contreras (2001) , Adhikari et al. (2004) , Fisher (2004) , Kamanga et al. (2009) , Heubach et al. (2011) , Kar and Jacobson (2012) , Hogarth et al. (2013)
Years of schooling	Total length of school attendance of household members older than 15 years	<ul style="list-style-type: none"> • Higher formal education of household members, more access to a wider range of income opportunities • Wider range of income opportunities, the lower NTFP dependency 	Babulo et al. (2008) , Heubach (2011) , Melaku et al. (2014) , Morsello et al. (2014)
Dependency ratio	Number of people living in the household younger than 15 and older than 60 divided by the number of labour force	<ul style="list-style-type: none"> • More dependant household members, the higher NTFP dependency • Higher NTFP dependency, higher collected amount of NTFP 	Quang and Anh (2006) , Heubach (2011)
Male labour	Number of men between 15 and 60 in the household	<ul style="list-style-type: none"> • More men in households, more animal-based NTFPs collected • Higher capacity of male labour force, more opportunities for income diversification 	Quang and Anh (2006) , Fu et al. (2009)
Female labour	Number of women between 15 and 60 in the household	<ul style="list-style-type: none"> • The higher proportion of female labour, the higher NTFP dependency 	Quang and Anh (2006) , Illukpitiya and Yanagida (2008) , Fu et al. (2009) , Heubach et al. (2011)

Table 2: Variables used in our questionnaires (cont'd)

Variable	Description	Relevance of indicator for the survey	References
Off-farm activities	Number of household members involved in off-farm activities	<ul style="list-style-type: none"> • More number of households involved in off-farm activities, more off-farm income • When occupies with profitable off-farm income activities, NTFP extraction will be lower 	Adhikari et al. (2004) , Fisher (2004) , Quang and Anh (2006) , Heubach (2011) , Melaku et al. (2014)
Farm size	Total area of the farm in hectares	<ul style="list-style-type: none"> • If land size and, thus, crop production is rising, NTFP extraction is likely to decrease • Households with less land use forests more 	Babulo et al. (2008) , Vedeld et al. (2007) , Heubach (2011) , Kamanga et al. (2009) , Melaku et al. (2014)
Living in the village	Number of years for which farmer lives the village	<ul style="list-style-type: none"> • Longer experience with forest-linked livelihood strategies, more intensive involvement in NTFPs collection • Longer experience with forest-linked livelihood strategies, higher sensitivity regarding to forest conservation 	Quang and Anh (2006) , Heubach (2011)
Ethnicity	Whether household's head is of Kinh origin or he/she belongs to ethnic minority group	<ul style="list-style-type: none"> • Livelihood strategies of ethnic minorities are more involved in NTFPs collection and, assumingly, commercialization • Ethnic communities are more sensitive to any environmental changes in forest 	Heubach (2011)
Income generation	All cash income from particular activities	<ul style="list-style-type: none"> • Higher total income, higher total forest income 	Quang and Anh (2006) , Kamanga et al. (2008) , Fu et al. (2009) , McElwee (2010) , Kar and Jacobson (2012) , Melaku et al. (2014)

4.4 Ethical considerations

The objectives of the research were explained to each head of the selected villages. The interviewees were also informed about the purpose of the research that participation was voluntary and informed consent was obtained. Anonymity was guaranteed.

5. Results

5.1 Characteristics of focused households

5.1.1 Household resources capacity and use

In general, significant differences between buffer-zone and central villages were documented, particularly in the terms of total farm size, dependency ratio and the amount of time devoted to household activities (Table 3). Additionally, other high differences (>80% significance) were observed in the total number of household members and education status. In a certain manner, number of years living in the area can be also considered as important indicator pointing at different socioeconomic background of both study sites.

Table 3: Household characteristics: human and land resources

Indicators	Unit of measure	Buffer-zone villages (N = 26)		Central villages (N = 22)		T-test (p=0.05)
		Mean	SD	Mean	SD	$P(T \leq t)$, paired- samples
Household members		6.08	2.10	6.95	2.36	0.179†
Dependent members (0-14, 60+)		1.58	1.27	2.36	1.43	0.050**
Labour force (15-59)		4.50	2.25	4.59	2.91	0.903
Male labour		2.23	1.50	2.23	1.66	0.994
Female labour		2.31	1.41	2.36	1.99	0.910
Off-farm activities		1.19	1.96	0.82	1.05	0.427
Household-related activities		2.96	1.51	2.18	1.14	0.053*
Farm size	ha	3.12	2.47	0.83	0.74	0.000***
Household head age	years	49.77	18.56	46.59	12.76	0.501
Living in the village	years	19.88	11.90	24.32	12.64	0.218
Years of schooling (15+)	years	3.85	2.62	4.86	2.19	0.155†

Note(s): *, **, and *** are significance at 90%, 95% and 99% respectively, † other significant difference.

Central villages exceed those that are situated in the buffer-zone of nature reserve by the total number of household members. This leads, taking into consideration similar levels of labour force among both study sites, to higher number of dependent members in villages situated in central parts of the commune. Farm size is another important indicator showing the difference among study sites.

5.1.2 Income diversification

Our results show that there is not statistically significant difference in per capita between two focused study sites (Table 4). Nevertheless, certain differences were observed in income generating from annual crops, home gardens, government support and old forest. Based on this finding we can describe central villages as more focused on annual crops and selling products from old forest. Compare to this, buffer-zone villages derive their cash security from home gardens and they also rely more on money transfers from the government.

Table 4: Per capita cash income (in thousand VND)

Indicator	Buffer-zone villages (N = 26)		Central villages (N = 22)		T-test (p=0.05)
	Mean	SD	Mean	SD	$P(T \leq t)$, paired- samples
Total	3,106	1,898	2,563	1,990	0.391
Annual crops	78	158	438	390	0.000***
Plantation	904	1,424	763	1,514	0.742
Home garden	416	408	230	327	0.093*
Livestock	167	412	141	305	0.810
Fishing from local rivers	41	166	8	36	0.358
Small business	126	447	167	542	0.778
Salaries	291	635	213	327	0.605
Government	955	1,333	22	53	0.002***
Old forest	125	231	573	814	0.010**
Other	4	14	9	15	0.266

Note(s): *, **, and *** are significance at 90%, 95% and 99% respectively, † other significant difference.

1 USD = 17,500 VND as of July 2009

As there is no significant difference in total amount of income between our two study sites, the income structure is more important for understating local livelihood strategies (Figure 5) Plantations play crucial role in livelihood generation in both buffer-zone villages and central villages, contributing to household income generation by 29.62 and 29.77% respectively. Buffer-zone villages have less income from annual crops (2.55%, 17.08% respectively) and from old forest (4.09%, 22.34% respectively), but higher income from government support (31.29%, 0.87% respectively), home garden (11.82%, 8.98% respectively) and fishing (1.35%, 0.30% respectively).

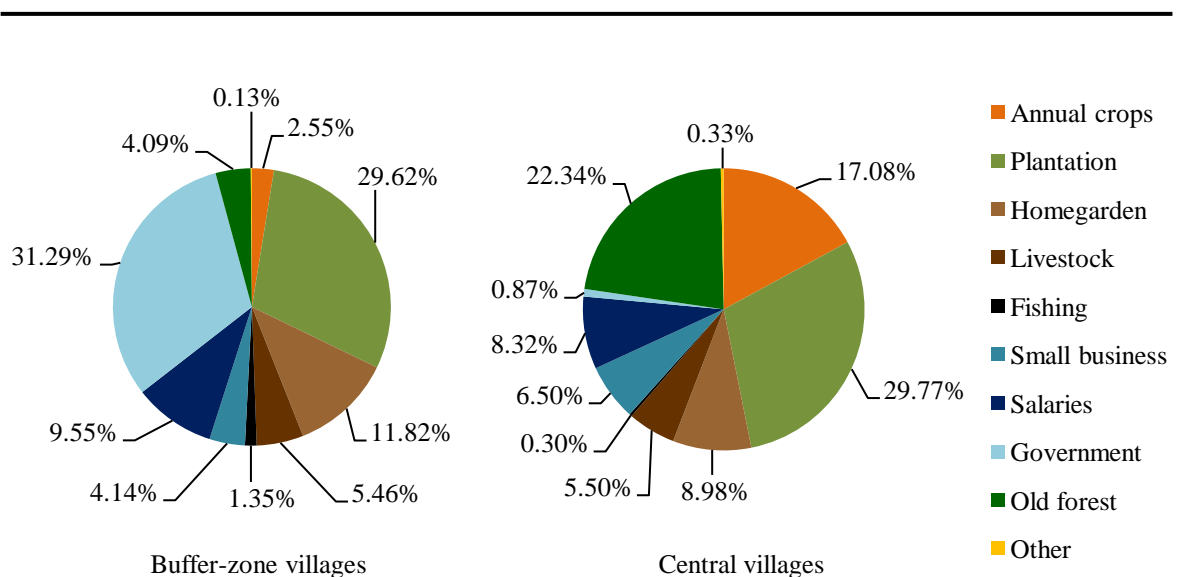


Figure 5
Household's income diversification in Phong My commune

5.1.3 Self-perception of local threats and opportunities from external environment

Instead of income, we try to understand how local household perceive possible threats or to see potential opportunities that could affect their livelihood strategies (Table 5). No difference was observed in perceiving food security between buffer-zone and central villages (4.96, 4.36 months respectively), natural hazards, such as floods (2.27, 2.64 months respectively) or involvement of household labour force in farm activities (2.92,

3.55 months respectively). On the other hand, buffer-zone in comparison with central villages feels to be less cash secured (5.35, 3.32 months respectively, $p=0.067$) and their households also sees shorter period for rubber collection (0.38, 1.45 months respectively, $p=0.084$) as an alternative income generating activity. Nevertheless, buffer-zone villages are little bit more optimistic regarding to potential to use local water bodies, especially river, for fishing activities (3.19, 1.09 months respectively).

Table 5: Farmer's risks and opportunities perception (in months)

Indicator	Buffer-zone villages ($N = 26$)		Central villages ($N = 22$)		T -test ($p=0.05$)
	Mean	SD	Mean	SD	$P(T \leq t)$, paired- samples
Food insecurity	4.96	4.08	4.36	1.89	0.531
Cash insecurity	5.35	4.76	3.32	1.86	0.067*
Involved in farm activities	2.92	1.76	3.55	2.34	0.300
Rubber collection	0.38	1.27	1.45	2.77	0.084*
Fishing	3.19	4.97	1.09	3.53	0.104†
Natural hazards (e.g. floods)	2.77	0.9	2.64	1.22	0.667

Note(s): *, **, and *** are significance at 90%, 95% and 99% respectively, † other significant difference.

5.2 Collection and use of NTFPs

The forest in both research sites provides the basis for the livelihood of interviewed households through provision of various products serving as subsistence or commercial goods. Based on our survey, 61 NTFPs regularly collected by local households were identified. Out of this number, 39 were plant-based ethnospecies and 22 animal-based. Generally, majority of those products were collected mainly for subsistence purposes. However, taking into consideration income diversification of target families (see figure 5 in the text above), the level of commercialization is definitely important factor as well.

5.2.1 Plant-based NTFPs

Table 6 shows the composition of collected plant-based NTFPs in Phong My commune. In general, farmers stated the collection of 33 ethnosppecies in buffer-zone villages compare to 20 ethnosppecies in central villages. Typical representatives of collected plant-based NTFPs in our study sites were rattan, leaves for making traditional Vietnamese hats, bamboo, mushrooms, rau rón (*Diplazium esculentum*), taro leaves and wild pineapple. More than half of collected NTFPs (53.85%) were collected in old forest, one fifth in plantations (17.99%) and the rest in both production systems. More than half of identified NTFPs (22 out of 39) were collected by farmers during the whole year, i.e. from January to December, while the rest were collected seasonally. Among ethnosppecies collected for commercial purposes, only mushrooms and thuốc lá were not collected during whole year. Typical farmer had to overcome the distance to collection place, which ranged from one-half to ten kilometres. Based on the terrain and collection technique, the time spent on collecting varied from ten minutes to ten hours. Additionally, two households stated that in the case of two NTFPs, rattan and wild pineapple, two days were necessary to spent on their collection. In general, farmers' wives were more involved in collection of plant-based NTFPs compare to farmers (see figure 6). Regarding to gender involved in collection of NTFPs, our results show that farmer's wives are involved in collection of 27 ethnosppecies, farmers in 24 and other household members in 17 respectively. From the gender perspective, nine ethnosppecies were collected by farmer's wives only, i.e. cay dong dinh, crab-apple, jackfruit or quýt rừng, and the same number only by farmers, cay mung, gỗ làm nhà, trầm hương or hoang dang.

According to our results, 20 of 39 NTFPs have only one mode of use, 15 has two and the rest has three. In the case of chua me (a flower to belonging to order Oxalidales, most probably *Oxalis corniculata*), our respondents did not specify any mode of use. Typical examples of multi-useful ethnosppecies were bamboo, lá bùm bạc (*Argyreia acuta*) and mon thuc. Generally, the most NTFPs is used for food (41.94%), out of which 23.07% were indented for both subsistence and commercialization and the rest for household consumption only. Second the most important mode of use after contribution to food security and culinary is medicine, construction material, tools and firewood (14.52%, 12.90%, 4.84% and 1.61 respectively). Quite high proportion of collected ethnosppecies

(24.19%) was used also for other, not further specified, purposes. However, those purposes are believed to be ornamentals, offerings and worships etc.

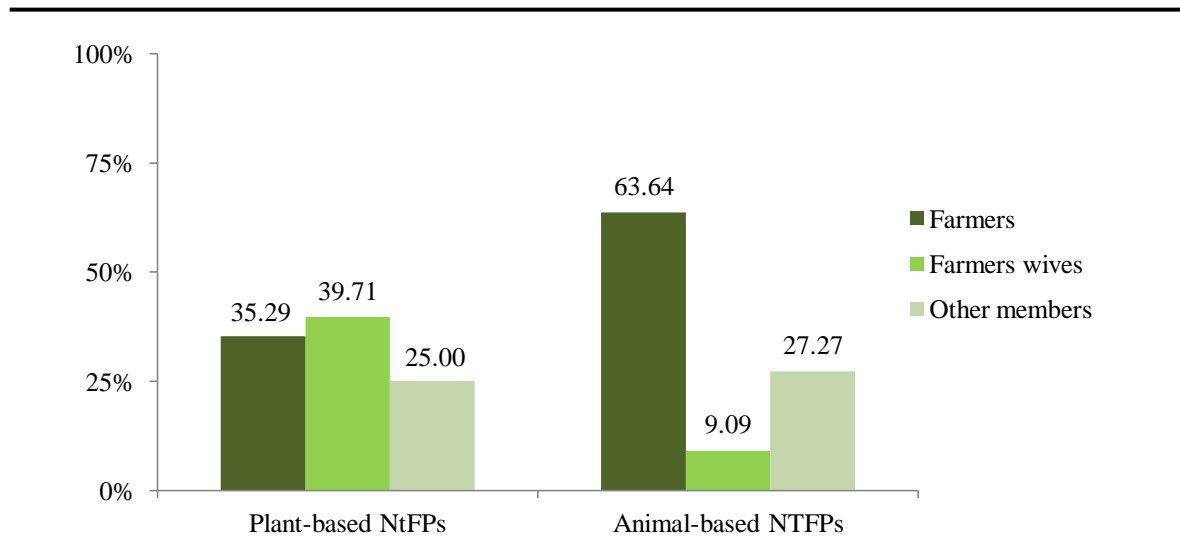


Figure 6

Gender involvements in collection of NTFPs

Average amount of NTFPs gathered per one visit differ according to particular ethnospecies. In general, it ranged from half a kilo in the cases of mushrooms or one piece, taking into consideration wild pineapple, to more than 300 kg in the case of rattan, which was identified as the product collected particularly for commercial purposes. Out of total number of 39 plant-based NTFPs, only three of them were collected by more than 50 percent of focused households. Those products were rattan, leaves for hats and rau rón for the purposes of traditional Vietnamese culinary, while the involvement of target households were 75%, 73%, and, 52% respectively.

Table 6: Collection of plant-based NTFPs in Phong My commune

NTFPs	Place of collection	Month of collection	Distance from home		Part of use	Mode of use	Average amount gathered per one visit	Market orientation	Commercial utilization	Gender involved in collection	Percentage of households involved in collection		Status of occurrence 5 years ago	Present status of occurrence
			km	hour							%			
1	Bac bang	P	4, 5	1 h	leaves	food	5 kg		S	X	2	+	++	
2	Bamboo	O, P	1 – 12	1 – 7 km 1 – 9 h	stem shoots trunks	food const. mat. other	1 – 15 kg	LM, MM	C, S	M, F, X	30	+	+++	
3	Cay dong dinh	O, P	1 – 12	1 – 5 km	stem	const. mat. other	50 – 100 kg		S	F	2	++	++	
4	Cay mung	O	4	5 – 6 km	stem	const. mat. other	35 – 55 kg		S	M	2	+	++++	
5	Chua me	P	1 – 12	1 km	leaves	other	1kg		S	F	2	+	+	
6	Co	O, P	1 – 12	1 – 7 h	leaves	food const. mat.	not stated ("many")		S	F	2	+	++	
7	Crab-apple	O	6 – 8	1 h	fruit	food	5 – 10 kg		S	F	2	++	+++	
8	Cu bach bo	O	1 – 12	5 – 6 km	tuber	food medicine	2 – 3 kg		S	F	2	+	++++	
9	Firewood	O, P	1 – 12	5 min – 3 h	stem branch	firewood	10 – 25 kg	LM, MM	C, S	M, F, X	13	+++	+++	
10	Ganoderma	O	8	3 h	pieces	food	1 basket (2 – 4 kg)		S	X	2	+++	+++	
11	Ginseng	O	1 – 12	5 – 6 km	tuber	food medicine	1kg		S	M, F	4	++	++++	
12	Gỗ làm nhà	O	3, 4	3 h	stem	const. mat.	5 pieces		S	M	2	+++	++++	

Note(s): Following symbols should be understood as follows, O – old forest, P – plantation, 1 – January, 12 – December, MM – middleman, LM – local market, C – consumption, S – subsistence, M – male (farmer), F – female (farmer's wife), X – other member, + very abundant, ++ abundant, +++ common, ++++ rare.

Table 6: Collection of plant-based NTFPs in Phong My commune (cont'd)

NTFPs	Place of collection	Month of collection	Distance from home <hr/> km or hours	Part of use	Mode of use	Average amount gathered per one visit	Market orientation	Commercial utilization	Gender involved in collection	Percentage of households involved in collection	Status of occurrence 5 years ago	Present status of occurrence
										%		
13 Hà thù ô	P	1 – 4	1 h	tuber	food other	not stated (“many”)		S	F	2	+	++++
14 Hoang dang	O	1 – 12	8 h	stem	medicine	1 kg		S	M	2	+	+
15 Jackfruit	O	6 – 8	1 h	fruit	food	5 – 10 kg		S	F	2	++	+++
16 Lá bùm bạc	O, P	1 – 12	5 – 6 km 1 h	leaves	food medicine other	1 – 5 kg		S	F, X	13	+	+
17 La kè	O	1 – 12	7 km 8 – 9 h	leaves stem	const. mat.	not stated (“many”)		S	M, F, X	6	+	+
18 Lá Ngấy	P	3 – 5	1 h	leaves	food other	1 kg		S	M, F, X	8	+	++
19 Leaves for hats	O	1 – 12	4 – 10 km 0.5 – 9 h	leaves	tools other	25 – 40 kg	LM, MM	C	M, F, X	73	++	+++
20 Mon thuc	O, P	1 – 12	1 km 8 h	stem	food medicine other	1 kg		S	M, F	4	+	++
21 Mushrooms	O, P	7 – 12	1 – 7 km 10 min – 9 h	stem	food other	0.5 – 4 kg	MM	C, S	M, F, X	46	++	+++
22 Nua	O	1 – 2	8 h	stem	const. mat.	not stated (“many”)		S	M	2	+	+
23 Quả bipbip	P	10 – 12	5 – 6 km	fruit	food	1 basket		S	M	2	+	+

Note(s): Following symbols should be understood as follows, O – old forest, P – plantation, 1 – January, 12 – December, MM – middleman, LM – local market, C – consumption, S – subsistence, M – male (farmer), F – female (farmer’s wife), X – other member, + very abundant, ++ abundant, +++ common, ++++ rare.

Table 6: Collection of plant-based NTFPs in Phong My commune (cont'd)

NTFPs	Place of collection	Month of collection	Distance from home	Part of use	Mode of use	Average amount gathered per one visit	Market orientation	Commercial utilization	Gender involved in collection	Percentage of households involved in collection	Status of occurrence 5 years ago	Present status of occurrence	
										km or hours			%
24	Quả búa	O	10 – 12	5 – 6 km	fruit	food	1 basket		S	M	2	++	++
25	Quả rừng	O	10 – 12	3 h	fruit	food	5 kg		S	M	2	++++	++++
26	Quýt rừng	O	10 – 12	2 h	fruit	food	5 kg		S	F	2	+++	+
27	Rambutan	O	10 – 12	2 h	fruit	food	3 bunches		S	M	2	+++	+
28	Rattan	O	1 – 12	0.5 – 10 h 4 – 10 km 2 days	stem	tools	50 – 300 kg 1 bundle 30 – 40	LM, MM	C	M, F, X	75	++	+++
29	Rau éo	O	1 – 12	1 km	leaves	food	1 basket		S	M, F	2	+	++
30	Rau má	P	1 – 12	1.5 km	whole plant	food	1 basket		S	X	2	++	++
31	Rau ráo	O, P	1 – 12	5 – 7 km 1 – 8 h	leaves stem	food medicine	1 – 5 kg		S	M, F, X	17	++	+++
32	Rau rón	O, P	1 – 12	0.5 – 6 km 7 h	leaves stem	food other	1 – 2 kg	MM	C, S	F, X	52	++	++
33	Riềng ráng	P	1 – 12	1 h	leaves	food	1 kg		S	F	2	+	++++
34	Taro leaves	O, P	1 – 12	1 – 6 km 7 h	leaves stem	food other	1 – 15 kg	LM, MM	C, S	M, F, X	40	++	++
35	Thuốc lá	O	4 – 8	5 – 6 km 2 h	leaves roots tops stem	food medicine	1 basket	MM	C, S	M, F	4	+++	++++

Note(s): Following symbols should be understood as follows, O – old forest, P – plantation, 1 – January, 12 – December, MM – middleman, LM – local market, C – consumption, S – subsistence, M – male (farmer), F – female (farmer's wife), X – other member, + very abundant, ++ abundant, +++ common, ++++ rare.

Table 6: Collection of plant-based NTFPs in Phong My commune (cont'd)

NTFPs	Place of collection	Month of collection	Distance from home		Part of use	Mode of use	Average amount gathered per one visit	Market orientation	Commercial utilization	Gender involved in collection	Percentage of households involved in collection	Status of occurrence 5 years ago	Present status of occurrence
			km	hours							%		
36 Trâm hương	O	1 – 12	5 km	9 h	stem oil	medicine other	1 kg		S	M	4	+++	++++
37 Tranh	O, P	1 – 12	7 km	1 – 7 h	leaves	const. mat.	not stated (“many”)		S	F, X	4	+	++
38 Trees for making brooms	O	1 – 10	7 km	1.5 – 6 h	leaves	tools other	15 – 50 kg	MM	C, S	M, F, X	8	++	+++
39 Wild pineapple	O	1 – 12	1 – 9 h	5 – 7 km 2 days	fruit	food medicine other	1 – 10 pieces	MM	C, S	M, F, X	29	++	++++

Note(s): Following symbols should be understood as follows, O – old forest, P – plantation, 1 – January, 12 – December, MM – middleman, LM – local market, C – consumption, S – subsistence, M – male (farmer), F – female (farmer’s wife), X – other member, + very abundant, ++ abundant, +++ common, ++++ rare.

5.2.2 *Animal-based NTFPs*

Our survey identified 20 ethnospecies collected by farmers from buffer-zone villages, while those who lived in central villages were collecting only eight. One fifth of interviewed households (20.8%) did not collect animal-based NTFPs at all and were fully focused on plant-based NTFPs collection only. Furthermore, total number 22 animal-based NTFPs regularly collected in Phong My commune were identified (see Table 7). Animal-based NTFPs are hunted/collected more in old forest (63.6%), in smaller scale in both old forest and plantations. Generally, frogs, snails and shellfish were the most collected ethnospecies in both research sites, as more than 50 percent of households involved into their collection. In buffer-zone villages, there is common hunting of civet cats, wild boar and porcupine or honey collection, predominantly for household consumption as well as to be commercialized at local market or via middleman. The distance to collection and/or hunting place, ranged from one to seven kilometres or, expressed in time perspective, from ten minutes to eight hours. Farmers are particularly involved in animal-based NTFPs extraction (63.6% of identified ethnospecies), while farmer's wives were involved in collection of only three of them, such as honey, snails, shellfish or water turtles. Dependent and other household members participated in collection of 27.3% animal-based NTFPs, mainly frogs and snails or shellfish.

Table 7: Collection of animal-based NTFPs in Phong My commune

NTFPs	Place of collection	Month of collection	Distance	Hunted amount per trip	Market orientation	Commercial utilization	Gender involved in collecting	Percentage of households involved in collection	Status of occurrence 5 years ago	Present status of occurrence
			km or hour					%		
1 Bamboo rat	O, P	1 – 12	0.25 – 8 h	1 – 10 pieces	MM	C, S	M, X	6	++	+++
2 Bee hive	O	1 – 12 particularly 4, 5, 6	1 – 5 km 1 – 3 h	6 – 7 pieces	MM	C, S	M	8	+++	+++
3 Civet cat	O, P	1 – 12	1 – 7 km 1 – 7 h	1 – 5 pieces	MM	C, S	M	17	+	+++
4 Cobra (krait/bonga)	O	4 – 6	6 km	3 pieces	MM	C	M	2	+	++
5 Chuot	O, P	1 – 12	1 – 8 h	4 – 15 pieces	MM	C, S	M	4	+	+++
6 Eel (big)	O	1 – 4	1 – 6 km 0.2 – 7 h	0.5 – 10 kg	MM	C, S	M, X	10	+	+++
7 Frog	O, P	1 – 12	1 – 6 km 0.2 h – 8 h	0.5 – 2 kg 3 – 30 pieces	LM	C, S	M, X	50	++	+++
8 Gecko	O	1 – 12	5 km 8 h	2 – 5 pieces	LM	C, S	M	4	++	++++
9 Honey	O	3 – 6	1 – 6 km 1 – 8 h	1 – 6 litre	LM, MM	C, S	M, F, X	23	++	+++
10 Java mouse-deer	O	1 – 12	6 km 1 h	1 – 4 pieces	MM	C	M, X	4	++	++++

Note(s): Following symbols should be understood as follows, O – old forest, P – plantation, 1 – January, 12 – December, MM – middleman, LM – local market, C – consumption, S – subsistence, M – male (farmer), F – female (farmer's wife), X – other member, + very abundant, ++ abundant, +++ common, ++++ rare.

Table 7: Collection of animal-based NTFPs in Phong My commune (cont'd)

NTFPs	Place of collection	Month of collection	Distance from house	Hunted amount per trip	Market orientation	Commercial utilization	Gender involved in collecting	Percentage of households involved in collection	Status of occurrence 5 yrs ago	Present status of occurrence
			km or hour					%		
11 Jungle fowl	O, P	1 – 12	1 – 6 km 1 – 7 h	1 – 8 pieces	LM,MM	C, S	M, X	17	++	+++
12 Pheasant	O	1 – 12	2 – 4 km	1 – 3 pieces		S	M	4	+++	++
13 Porcupine	O	4 – 12	6 km 1 – 7 h	1 – 4 pieces	MM	C, S	M, X	13	+	++++
14 Python	O	not stated	5 km 1 h	1 piece	MM	C	M	4	++	+++
15 Rattle snake	O	4 – 5	6 km	5 pieces		S	M	2	+	++++
16 Snail/Shellfish	O, P	1 – 12	1 – 5 km 10 min – 8 h	0.5 – 15 kg	LM, MM	C, S	F, M, X	58	++	++
17 Stag (deer)	O	not stated	1 h	2 pieces	MM	C	X	2	++	++++
18 To ong	P	not stated	0.5 h	not stated		S	M, X	2	+++	+++
19 Turtle	O	1 – 12	5 – 6 km 1 h	1 – 3 pieces	LM, MM	C	M	6	++	++++
20 Turtle (water)	O	1 – 8	2 – 5 h	3 – 5 pieces	MM	C	M, F	4	++	+++
21 Wild boar	O, P	1 – 12	1 – 6 km 1 h	1 piece	MM	C, S	M	10	++	++++
22 Wolf	O	3 – 4	0.5 h	1 piece	MM	S	M	2	++++	++

Note(s): Following symbols should be understood as follows, O – old forest, P – plantation, 1 – January, 12 – December, MM – middleman, LM – local market, C – consumption, S – subsistence, M – male (farmer), F – female (farmer's wife), X – other member, + very abundant, ++ abundant, +++ common, ++++ rare.

5.3 Commercialization of collected NTFPs

With respect to level of NTFPs commercialization, our study shows that it varies among particular ethnosppecies. In general, NTFPs contributed to both subsistence purposes as well as to cash income generation to households in both research sites (see Table 8). Solely for subsistence purposes served 50.9% of all collected ethnosppecies in buffer-zone villages and 64.3% in central villages.

Table 8: Commercialization of NTFPs in study sites

NTFPs	Buffer-zone villages				Central villages			
	Total	S	C	C+S	Total	S	C	C+S
Total	53	27	8	18	28	18	6	4
Plant	33	24	2	7	20	15	3	2
Animal	20	3	6	11	8	3	3	2

Note(s): Following symbols should be understood as follows, S – subsistence purposes, C – commercialization, S+C indicates the combination of both.

However, certain differences were observed if plant-based and animal-based ethnosppecies are compared. In the case of plant-based NTFPs, 72.7% in buffer-zone villages and 75.0% in central villages were used for subsistence purposes. However, in the case of animal-based NTFPs the situation was completely different as the share of ethnosppecies used for households represented 15% and 37.5% respectively. Majority of animal-based products was sold via middlemen and only a very few of them were intended for direct sales on local markets. However, majority of ethnosppecies sold and/or consumed remain rather low in terms of total amount withdrawn from the local ecosystems. For example, ten plant-based NTFPs were used for commercial purposes, but only two of them, rattan and leave for hats, were solely collected for commercial purposes. Nevertheless, farmers were able to collect huge amount of rattan per one visit (commonly up to 300 kg) in order to ensure a higher income as expected price is quite low and fluctuates around 300 VND per one fibre. Similarly, leaves for hats are collected in amount ranged from 25 to 40 kg per one visit for expected price from 80 to 150 thousand VND per 30 kg. Those values are equal to daily salary in rural areas. Based on our survey, 54.2% of households from buffer-zone villages were less involved in collection of rattan,

comparing to 100% from central villages. On the contrary, similar percentage of households involved in collecting of leafs for hats were documented in our study sites, 66.7% and 68.2% respectively. Generally, central villages are believed to earn more money from selling NTFPs compare to buffer-zone villages. This assumption is also supported by documented income diversity among targeted households (see figure 5). Considering animal-based NTFPs, households from buffer-zone villages were involved more in both collection and selling activities, however only a little of animal-based NTFPs were collected and in low value, particularly honey, shells, fish and small rodents. Nevertheless, as demand for such products increases, the situation could change in the future. Particularly central villages would focus more on small animals collection sell it in local restaurants as additional income to rattan or leaves for hats.

5.4 Farmer's attitudes towards NTFPs collection and perception of biodiversity dynamics in target area

Majority of farmers in study sites (62.8%) considered price fluctuation as the most serious problem on their farms. The second most serious problem was erosion (50.0%), followed by low yield of planted crops at (18.8%). Only few respondents stated that their most serious problems are natural disasters, such as regular floods occurring every autumn and from time to time also during spring. About using the forest in the future, almost one half of farmers (46.0%) answered that they are planning use forest less than today mainly because of various health hazards, heavy work load and continuous shift of income generation activities to plantation, home gardens or off-farm activities. Other reasons were decreasing availability of forest products (47.4%) and rising awareness about forest depletion (43.2%). Some farmers, however, stated that they always will use some forest resources in the future, particularly for food (Vietnamese traditional cuisine), ornamental purposes or for making offerings. Among most serious problems with collection belong long distance to collecting/hunting place and decreasing of NTFPs, of which some products are becoming rare and related forest depletion. Majority of interviewed farmers is afraid of dangerous or venomous animals (e.g. snake, tiger), accidents happened during collection including falling trees or stones and related

injuries. When farmers were asked if they go to the forest with their children to teach them about the nature, practically all respondents answered negatively. Only two respondents go to the forest with their children. Majority of farmers (90%) perceived the necessity of forest protection in their surroundings in order to both preserve the same values of forest for next generations as well as for the role of forest for their own livelihood. Main reasons for protection of the forest were mainly prevention of erosion and floods, dependence some households on forest in term of cash and/or food security, and, protection of rare and valuable animals from extinction that could have a negative effect on potential development of agro-tourism in their villages.

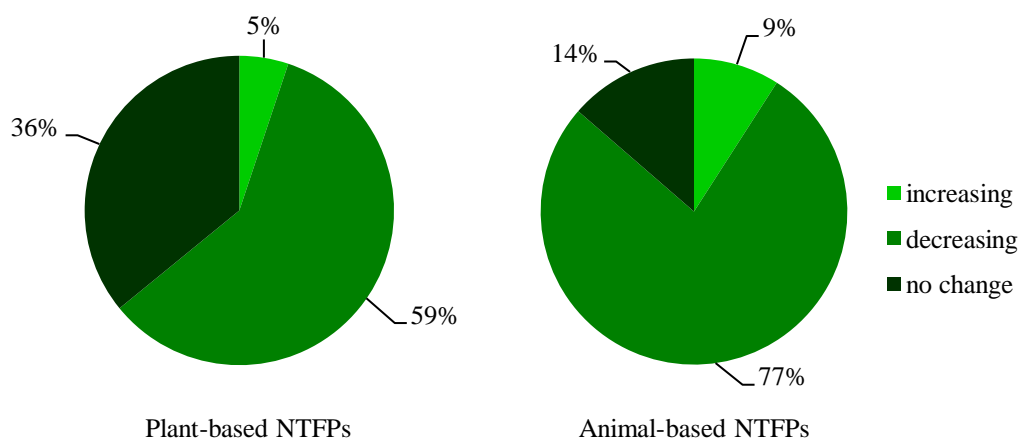


Figure 7

Farmer's perception of biodiversity dynamics in target area

Figure 7 shows farmer's perception of biodiversity dynamics in both research sites. Generally, farmers perceived occurrence decline among 23, no change in occurrence among 14 and increase in occurrence among two out of 39 plant-based NTFPs. In the case of 22 identified animal-based NTFPs, 17, three and two respectively. Regarding to perception of decreasing of number of forest products, 18 out of 62 products have become rarer according to farmers. The largest occurrence decline was at cu bach bo, cay mung, hà thủ ô and riêng rang among plant-based, which were of various modes of uses documented, and, in the case of porcupine and rattle snake among animal-based NTFPs.

6. Discussion

Based on our results, we documented 61 NTFPs ethnospecies regularly collected among local households, which is comparably higher than in other studies from Vietnam ([Quang and Anh, 2006](#)) or other tropical countries ([Saha and Sundriyal, 2012](#)). Nevertheless, studies on NTFPs commercialization are not directly focused on detailed inventory of collected species. Out of total number 61 ethnospecies, less than half (28, 46%) was intended for market, which is in correspondence to other studies ([Mahapatra and Tewari, 2005](#); [Kar and Jacobson, 2012](#)).

Our study revealed following important patterns. First deals with the understanding of driving forces of local households that influence forest products collection. Correspondingly to [Babulo et al. \(2008\)](#), we can say that the lack of cash or poor access to credit is not the main driving force for local households to collect NTFPs to decide whether to collect them or not. As a result, commercialization of non-timber forest products is focused on few species only, particularly those with prevailing constant demand such as rattan or leaves from making hats. This corresponds with the findings that those products are collected particularly by poor households from central part of the commune who can be described as those with larger families, higher percentage of dependent members, small farm sizes and less opportunities for off-farm income. Interestingly, this is in contrast to other published studies worldwide ([Cavendish, 2000](#); [Angelsen and Wunder, 2003](#); [Babulo et al., 2008](#)), where particular better-off households were more involved in NTFPs collection for commercial purposes. In central villages of Phong My commune, the NTFPs commercialization was more important compare to buffer-zone villages as contribution of selling of forest products to household income represented 22.3%. This value is however lower if we compare it with 39% reported from Benin ([Heubach et al., 2011](#)), 27% from Ethiopia ([Babulo et al., 2009](#)), 19-32% from India ([Saha and Sundriyal, 2012](#)), 31.5% from China ([Hogarth et al., 2013](#)) or more than 50% in Sudan ([Adam et al., 2013](#)) On other hand, it is still more than 15% observed in Malawi ([Kamanga et al., 2009](#)). Our estimations of monetary value of extracted NTFPs are based on assumption that other commercialized NTFPs were sold at very low amounts, such as small animals, where any attempts of calculation of economic value would be less reliable

(Mahapatra and Tewari, 2005). In this regards, we can compare the situation in central Vietnam with other published studies (Sullivan, 2002; Quang and Anh, 2006; Kar and Jacobson, 2012). Majority of commercialized NTFPs in both research areas were sold via middleman and only few products on local market (e.g. frogs, gecko, rattan, taro leaves). This correspond to finding of Fedele et al. (2011), where women from Madagascar were involved into collection of important NTFPs, such as *Pandanus guillaumetii*, and sold it mainly to traders coming directly into the village and only few women walked far distance to sell their products on markets. This is the contrast to other published studies where most of commercialized products were sold on local markets (Saha and Sundriyal, 2012). Generally, majority of identified products have been rather used for household consumption and similarly to other countries, the main modes of use documented were food security (see e.g. Quang and Anh, 2006; Davidar et al., 2008; Heubach et al., 2011), traditional medicine (Ndangalasi et al., 2007; Saha and Sundriyal, 2012), culinary purposes, practicing traditional offerings and worships or other cultural events.

Second deals with socioeconomic and demographical factors connected to NTFPs collection and use. Correspondingly to Wickramasinghe et al. (1996), we observed that commercial gathering is often dominated by men, whereas subsistence gathering represents regular task for all household members. Thus, farmers from our study sites have to walk up to eight kilometres deep into the forest to collection places, which are about half way in comparison to other studies (Saha and Sundriyal, 2012). Also we can agree with other authors (Quang and Anh, 2006; Kamanga et al., 2009) that location of particular household is a crucial indicator pointing at specific natural conditions, but mainly socioeconomic norms. Interestingly, opposite of other studies (Davidar et al., 2008; Saha and Sundriyal, 2012), economically better-off households from our target area were less involved in NTFPs collection, particularly for economic purposes. Resource-poor households from central part of the commune were the main collectors of rattan or leaves for hats despite of lack of income diversification opportunities. Households from buffer-zone area can also be considered as poor ones at the district level, however, their land resources and government support enabled them to diversified their livelihood also to agroforestry plots or plantations. Correspondingly to Heubach et al. (2011) we agree that the age of household head is significant factor in NTFPs

studies. Households headed by young men or women was involved very rarely in forest product collection because of limited knowledge on forest and due to government support of alternative farming systems for young families.

Last pattern underlines sustainable-oriented government forest policy regarding to NTFPs collection, mentioned by [Quang and Anh \(2006\)](#), as well as successful adoption of alternative farming systems by local households. Even farmers themselves perceived decreasing occurrence among both plant-based and animal-based NTFPs, which corresponds with research of NTFP in Guyana ([Sullivan, 2002](#)). Also [Saha and Sundriyal \(2012\)](#) noticed reduced availability over the years due to unsustainable harvesting, most importantly of cane and bark of *Litsea* and *Oroxylum*. Declining abundance of NTFPs in consequence of deforestation caused by rubber plantation has resulted in insufficient forest products to meet even subsistence needs in China ([Fu et al., 2009](#)). Despite of newly developed products, rattan has been widely recognized as one of the most important NTFPs in South and South-East Asia during the last decades ([de Beer and McDermott, 1996](#); [Peters et al., 2007](#)). Previous practice of local households towards forest products collection has become a subject for local government development plans. Systematic and governmentally supported shifts of livelihood strategies from ineffective planting of annual crops and forest product collection to alternative farming systems have positive impact on conservation efforts in buffer-zone forest and in the whole reserve as well. Particularly strengthening the role of home gardens or multi-cropping agro forestry systems ([Vlkova et al., 2011](#)), are suitable strategies that could reduce the amount of extracted products from the local forests.

Our study should be also understood in the light of certain limitations. As mentioned in other studies ([Mahapatra and Tewari, 2005](#)), NTFPs collection is of higher sensitivity for targeted households. For example to estimate financial value of hunted game or certain species of medicinal plants from the forest is quite difficult, particularly due to relatively low amounts per household, purchasing price fluctuation or lower willingness to share traditional knowledge of farmers on collecting and utilization of such species.

7. Conclusion

Our survey identified 61 non-timber forest product species regularly collected by local households living near or in Phong Dien Nature Reserve. Out of the total number of ethnosppecies, 39 were plants and 22 animals. According to our results, buffer-zone villages collected more ethnosppecies compare to central villages. On the other hand, central villages were focused more on collection of a few species with higher commercial potential. Majority of ethnosppecies were used as a food, and in the case of plant-based NTFPs also as a medicine or constructing material. With respected to commercialization of identified NTFPs, our study shows that nine plant-based and 18 animal-based species were regularly sold on local market or mainly via middleman. It is necessary to add that only five species were collected by more than half of target households in the study area in bulk amounts, i.e. rattan, leaves for hats, rau rón, frogs and snails/shellfish. Majority of farmers have perceived decreasing biodiversity both among plants and animals in comparison with situation before five years. Half of interviewed farmers were planning use forest less than today, partly due to decreasing availability of forest products and rising awareness about forest depletion. They also perceived the necessity of forest protection in their surroundings in order to both preserve the same values of forest for next generations as well as for the role of forest for their own livelihood. Study proved that alternative farming systems, such as home gardens or plantation, together with well-planned government policy have a potential to reduce extraction of NTFPs from local forest and keep it at a suitable level ensuring local households to maintain their food security, traditional culinary or cultural habits.

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Annex

Annex 1. Semi-structured questionnaire

Province: Thua Thien Hue
District: Phong Dien
Commune: Phong My
Village: Khe Tran ♦ Ha Long ♦ Hoa Bac ♦ Tan My

Name of interviewer	
Name of family head	
His/her family live in the village since	
War veteran	

Family

	Parents, children, other relatives, friends etc.	Male Female	Ethnic group	Age years	Live in house Yes=1	Working on farm Yes=1	Working for household Yes=1	Having off-farm job Yes=1	Years of schooling Years	Receiving pension from government Yes=1
1										
2										
3										
4										
5										
6										
7										
8										
9										

Farm

Total area of the farm		3 most time-spending activities according to time spend	
3 most important products according to their importance			

Cash income (thousands VND) per year

Annual crops (e.g. rice, peanuts, corn)	Plantation (e.g. rubber, acacia, bamboo, sugar cane)	Home-garden (e.g. cassava, pomelo, jackfruit, pineapple pepper)	Livestock (e.g. meat, animals, services, eggs)	Fishing from O Lau river	Small business (shop)	Wages (hired by other farmer, in town)	Government support (e.g. pension)	Planted forest products (e.g. firewood, war wreckage)	Old forest (e.g. plants, honey, ratan, leaves, herbs, animals)	Other (e.g. gifts, money from relatives)
Sao: R: P: C:	Sao: R: A: B: SG:	Total area in sao:	Pieces: Bo: Buff: Pig: Poul:			Hired for days:		FW (kg): WW (kg):		
% for market	% for market	% for market	% for market	% for market				% for market	% for market	

Cash expenditures (thousands VND) per year

Farm (fertiliser, seed, fuel, fodder, equipment)	Household (electricity, food, water, land, house)	Health care	Education	Paying back for credit	Government taxes	Other

Time schedule

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Food insecurity												
Cash insecurity												
Farm activities (H-harv., L-prepar.)												
Rubber collection												
Fishing in O Lau river												
Natural hazards (floods)												

Plant forest products collection

Name	Collector (1-12)	where collected A – old forest B – re-planted C – plantation	Distance from house	Month (1-12)	Part of use (fruit, root, leaves, tuber, stem, berry, capsule...)	Modes of use (A-L)	Gathered amount per one visit (kg, l, pcs...) and spent time	Price per unit (expected)	Market	Middle-man	Exchange (for what)	Status of occurrence *	
												000 VND	(%)
			km & hours										

- A) food
- D) drug
- G) wicker
- J) fuel

- B) beverages (leaching, tea, brandy- define..)
- E) dye
- H) building materials
- K) incense

- C) cure and medicine production
- F) fibre
- I) decoration, cultural, worship
- L) others

* +++++ very abundant +++ abundant ++ common + rare

Animal-based forest products collection

Name	Collector	where hunted and collected A – old forest B – re-planted C – plantation	Distance from house	Month (1-12)	Methods of hunting		Purpose	Hunted amount per trip	Price per unit paid to hunters (expected)	Market	Middle-man	Exchange (for what)	Status of occurrence* + Last sighting-year if possible	
					T-trap S-shoot H-by hands	live or dead							5 yrs ago	now
			km & hours					000 VND	(%)	(%)	(%) e.g. 10kg of rice			

* +++++ very abundant +++ abundant ++ common + rare

Future expectations and opinions on forest

1) **Do you have credit or loan?**

Amount:

Interest rate:

Payback period:

2) **Most serious problems on your farm?**

yields

price fluctuation

erosion

....

3) **Will you use the forest in the future less, more or at the same level as today?**

4) **The most serious problems with collecting of forest products?**

5) **What is dangerous and what are you afraid of in forest?**

6) **Do you go sometimes to the forest with your children to teach them about the nature?**

7) **Do you think that protection of forest in your surroundings is necessary? /To preserve the same values of forest for next generations/Why?**

Yes

No

I don't know