



Assessing opportunity and implementation cost of forest certification for ecosystem services

Under project

Forest Certification for Ecosystem Services - ForCES, SNV REDD+ Program

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The project aims to pilot and enhance global and national environmental standards as an initial step in upgrading the successful models of FSC® certification and establishing them as a market tool for a wide range of Ecosystem Services (ES), which are currently inadequately covered for sustainable forest management. This report will provide a basis for selecting suitable ForCES benefit and certification models to implement in the pilot sites across Vietnam.

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Abbreviations

BCA	Benefit and Costs Analysis
BCR	Benefit and Cost Ratio
c.m	Cubic Meter
CW/CoC	Controlled Wood/Chain of Customary
ES	Ecosystem Services
FM	Forest Management
FMU	Forest Management Unit
ForCES	Forest Certification for Ecosystem Services
FSC	Forest Stewardship Council
FV	Future Value
IRR	Internal Rate of Return
LEV	Land Expectation Values
MA	Millennium Ecosystem Assessment
NPV	Net Present Value
NTFPs	Non-Timber Forest Products
OP	Opportunity Cost
RIL	Reduced Impact Logging
SFE	State Forest Enterprise
SFM	Sustainable Forest Management
SNV	Netherlands Development Organization
VND	Vietnam Dong

1. Introduction

1.1. Background

The Forest Stewardship Council (FSC) certification has typically focused on the certification of timber products sourced from sustainably managed forests as determined by a set of principles and criteria. Under the Forest Certification for Ecosystem Services (ForCES) project, the idea of expanding FSC to include additional ecosystem services (ES), such as carbon, water, biodiversity and others, will be tested across 4 countries; Vietnam, Chile, Indonesia and Nepal. Essential to this is the development of suitable measurable compliance indicators which will be incorporated in FSC national standards in the pilot countries as well as with international standards. SNV Vietnam will implement activities under the ForCES project in Quang Tri province and Ha Tinh province.

In order to provide baseline data for proposing and setting up the payment mechanism for selected Ecosystem Services, it is necessary to conduct an analysis on the opportunity cost of FSC sustainable forest management, compared to other land use options. This report is the result of consultations on “assessing opportunity and implementation cost of forest certification for ecosystem services”, which were conducted in two ForCES project test sites: Huong Son State Forest Enterprise (Huong Son SFE) in Ha Tinh province and Vinh Tu commune in Quang Tri province.

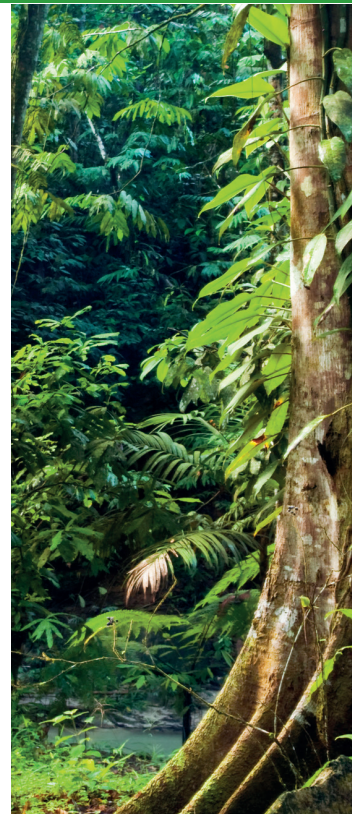
1.2. Forest ecosystem services, certification for ES, and opportunity cost

Forest ecosystem services

Forests, particularly tropical forests, are ranked as the most important ecosystems on the earth because they are crucial to the survival of human beings (Pearce & Pearce, 2001). Forest ecosystem services are the outcome of forests ecosystem functions that benefit human well-being. In principle, these could include both forest products (timber and non-timber) and environmental services. The United Nations 2005 Millennium Ecosystem Assessment (MA) categorized ecosystem services into four types: *Provisioning, supporting, regulating, and cultural*, depending on the nature of the services and benefits derived by society. Of these categories:

- *Provisioning services* are goods and services obtained from the production functions of the ecosystem, such as timber, non-timber forest products (NTFPs), freshwater, etc.
- *Regulating services* are environmental benefits obtained from regulation of the ecosystem process, such as climate regulation, flood regulation, soil erosion prevention, water purification, etc.
- *Cultural services* are non-material benefits obtained from the ecosystem, such as spiritual and religious, recreational, etc.
- *Supporting services* are services necessary for all the production of other ES, such as soil information, nutrient recycling, primary production, etc.

Although forest ES are rather diverse and play a vital role for human beings, the value of forest ES has been predominantly calculated in terms of its marketable



forest products, such as timber, only. Many important ecosystem services have been systematically under-valued. Their importance is not revealed by existing price calculators and they are therefore unlikely to be considered fully, if at all, in decision making processes regarding land use and management. It remains difficult to estimate the true value of these services.

Certification for ES

Forest certification is a system for identifying well-managed forests, requiring the maintenance of ecological, economic, and social components, as well as associated ecosystem services. FSC has pioneered forest certification as an innovative and market-oriented instrument to support responsible management of the world's forests, with a primary focus on management of natural and planted forests for the production of timber and fiber. The FSC Principles and Criteria (P&C), however, have relevance for the certification of ES too. For example, FSC has pioneered the concept of protecting through certification with its 'High Conservation Value Forest-Principle #9' and 'Environment Impact- Principle #6'. Therefore, the FSC considers it increasingly pressing to expand and adapt its certification system for well-managed forest ES other than timber production. Under the scope of the ForCES project, FSC and partner organizations will research, analyze, and field-test innovative ways of evaluating and rewarding the provision of critical ES, such as watershed protection, carbon sequestration, and biodiversity conservation. As mentioned above, due to externality and difficulty in estimation of ES, the major challenge in certification of ES is how to quantify and set up payment mechanisms for ES (CIFOR, 2011).

Opportunity cost

Deforestation or forested land conversion into agricultural land, despite all of its negative impacts on environmental and social development, might bring economic benefits through timber selling, crop cultivation and raising animals. Reducing deforestation and preventing land use change means forgoing these economic benefits. The costs of the forgone benefits (the net benefits that conserving a forest ecosystem generates) are known as "opportunity cost", and this can be the most important factor influencing policy makers, forest land managers and owners in decision making regarding the land use and management of these areas.

The sustainable forest management for certification of ES, however, generates costs which can be grouped in to three categories:

- (i) *Opportunity costs*, which may include the profit differences between conserving forest and converting forest for other land uses, and profits generated from forest ES maintenance or enhancing both on-site and off-site (like carbon storage, NTFPs, and positive externalities in terms of economical, social and culture values for the livelihoods of surrounding and downstream communities);
- (ii) *Implementation costs*, the costs involved in implementing the FSC sustainable forest management, e.g. costs for sustainable forest management planning, forest protection and improvement, practices of low impact logging, job training, etc; and
- (iii) *Transaction costs*, the costs incurred through the process, such as FSC certification, measuring, reporting, verification, etc...

In terms of human rational behavior, it only makes sense for decision makers to pursue forest certification and implementation if the benefits are greater than all the costs. In this study, the

consultation group just focuses on assessing the opportunity and implementation costs of forest certification for ecosystem services for scenarios of FSC certification forest management. The study may cover some other costs (e.g. auditing costs), but certainly not all the possible associated transaction costs.

1.3. Objectives

The objectives of this consultancy work are to:

- i) Identify potential ecosystem services of the major forest ecosystems in the project sites;
- ii) Conduct an opportunity cost analysis from the financial study of different land use options; analyze the land expectation values (LEV) of bare land in perpetual forest production; integrate opportunity cost analysis into expanded FSC certification forest management models;
- iii) Give a suggestion of the best land use option, which has highest net benefit, to be used as scientific evidence in support of provincial policy makers in their decision making on issues of land-use and land management in the future;
- iv) Identify opportunities to set up a payment scheme for ES.

2. Settings of the study areas

2.1. General overview

Huong Son SFE in Ha Tinh province and Vinh Tu commune in Quang Tri province are the two pilot sites of the ForCES project in Vietnam. Each site is characterized by its typical forest ecosystems and functions.

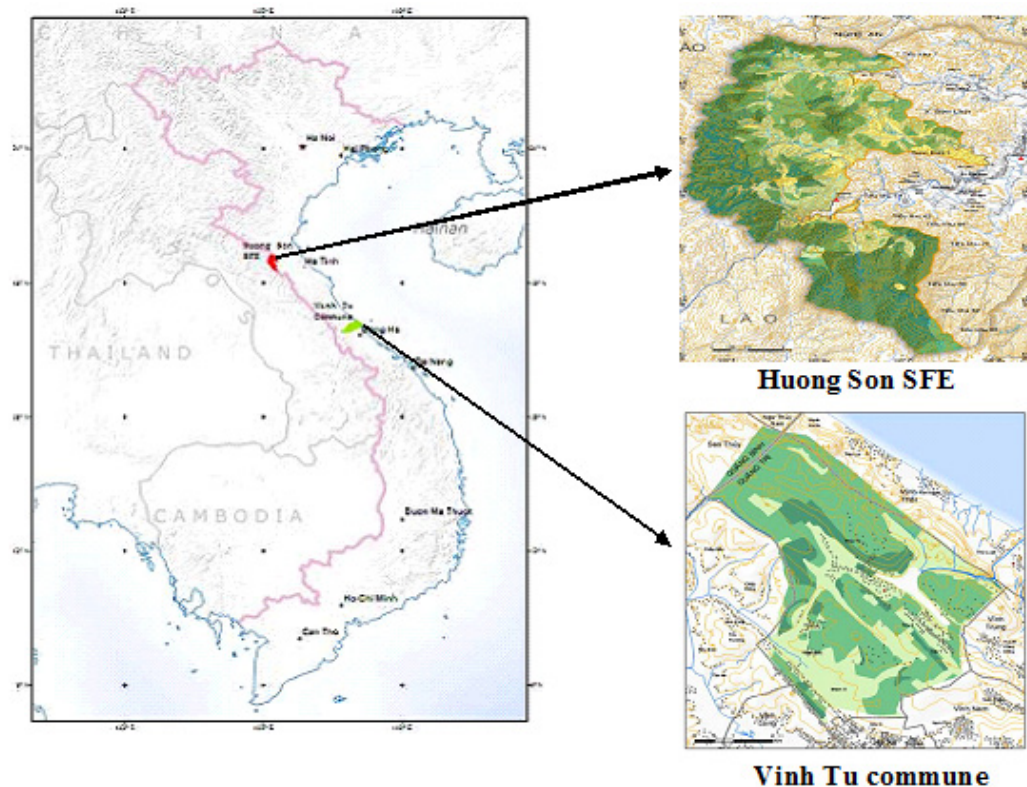


Figure 01: Map of study sites

Huong Son SFE is located in the low and medium high mountainous region, and manages a total area of 38,500 ha, much of it containing production areas of evergreen tropical forest and rich biodiversity. About 400 species of flora and 87 species of fauna, many of which are high conservation value species listed in the IUCN red book, have been identified in the forest management unit (FMU). The FMU shares a border with the Ngan Pho river watershed forest protection area to the north, and has a large area of primary forest in Laos PDR to west. Vu Quang National Park, where the endangered Sao La species was first identified, lies to the south. Therefore, the forest ecosystems of Huong Son SFE play an important role in biodiversity conservation and environment protection in the region, which has been ranked as a biodiversity hotspot in the Indochinese Peninsula.

In the low land adjoining the FMU lives approximately 6,000 habitants (including local people and staff of the SFE) in 4 communes and one district town. Understanding the importance of the forests and responding to the threats from deforestation, degradation, and illegal wildlife poaching, Huong Son SFE has

initiated some activities towards sustainable forest management in an effort to achieve FSC/FM certification. The sustainable forest management plan of Huong Son SFE was approved in 2011. GFA certification carried out a scoping FSC FM audit and FSC CW/CoC audit in November 2013 for the FMU, and the SFE has received FSC CW certification.

Vinh Tu Commune is located in the coastal sandy area of Vinh Linh district, Quang Tri province, adjacent to National Highway #1. The commune has 10 villages with a total population in 2013 of approximately 3,450 people living in 990 households. The total natural area of the commune is 3,454 hectares; of which there are 450 hectares of natural forests used majorly for to prevent sand movement and to provide water reserves that enable the local people to live and pursue agriculture production. Another 1,527 ha of forest plantation areas is uses for the purposes of timber production. The natural forests, together with plantations, have formed patches of shelterbelts protecting settlements and the agriculture land areas of the commune.

Some initial studies have shown that Vinh Tu's sand forests are typical ecosystems for Vietnam's coastal zone, with rich and diverse flora and fauna species. All the natural forests in the commune have been claimed as communal property forests and put under the management of Vinh Tu Commune People's Committee (CPC) through protection conducted by village forest protection teams. All the plantations (mainly Acacia plantations), on the other hand, are owned by private households, and these have gathered into small groups to apply for smallholder forest certification. By 2013, 298.78 ha of hybrid Acacia plantation owned by 145 FSC small group groups had been formed with the support of WWF Vietnam.

2.2 Forests and land use systems of the study sites

In the project sites, the forest lands are being used as different land types with different purposes. In Huong Son SFE, the total area of natural forests accounts for 95.4% of the FMU area (38,448 ha); the total plantation area is 275 ha (just 0.7%), the non-forested area is 1,012.3 ha (2.6%), and 1.2% of the total area is classified as other land types (see Table 01). In this FMU, there are 4 major land use types:

- (i) For the management of natural rich and medium forests for timber production purposes, with the protection and sustainable harvesting of timber ensured by applying selective cutting methods with a designed production rotation of 35 years (2011-2045).
- (ii) For the management of mixed forest to produce bamboo and timber by applying selective cutting (just designed as a potential land use option).
- (iii) For the protection of poor and regenerated forests.
- (iv) For the establishment of timber plantations (mainly hybrid Acacia species) on bare land for production purpose, with a designed rotation of 7 years.

In short, the Huong Son SFE is a production-oriented company, and it has applied for FSC/FM for natural production forests with the major aim of pursuing the sustainable harvesting of valuable timber forests, the creation of plantations on bare land, and the protection and enrichment of poor forests.

In Vinh Tu commune, the total natural area is 3,454.0 ha, just equal to 10% of the total area of Huong Son FMU, and local people are practicing 6 different land use systems:

- (i) The largest area is 1,527 ha (44.2%) of hybrid Acacia plantations for production purposes, with rotation from 7 to 10 years (mainly the former). All the plantations are being managed by households, and many households have been organized into smallholder certification groups to achieve FSC CW/CoC certification of their timber products.
- (ii) The area of the natural forests on sandy soil accounts for 12.9% of the total communal land, and is considered as a very important forest ecosystem for environmental protection, to ensure the livelihoods and agriculture production of local villagers. Local people are organized in small patrolling groups to protect their forests; no timber harvesting is allowed, except some NTFPs.
- (iii) The total area for annual crops production (e.g. corn, cassava, and peanuts) is about 990 ha (nearly 29%). This area is allocated to private households to introduce crops for subsidy demand and cash earning.
- (iv) The area suitable for paddy rice growing is rather small, at just 105.5 ha (3%), but is vital to the food security of local people. With the protection of forests, this area is now being cultivated 2 seasons each year.
- (v) The area of rubber plantations is quite small (just 40.5 ha) and established by just some households, due to the very high cost of forming a rubber plantation. Normally, it takes at least an initial 7 year investment (in a 30 year rotation period) to see the first rubber resin products.
- (vi) In home gardens, some local people are cultivating pepper for commercial purposes.

From the brief description above, it can be seen that the land use systems of Huong Son SFE are mainly natural-based systems, depending on the use of natural forest for production purposes. On the other hand, the land use systems of Vinh Tu commune are rather diverse, including agriculture production systems which often require high inputs and environmental protection-oriented forest use systems.

Table 01: Land use types of the study sites

Site	Current land use types	Brief description	Area (ha)	Percentage (%)	Major use purpose	Management model
Huong Son SFE	1. Forested land		36,961.90	96.1		
	1.1. Natural forest		36,686.90	95.4		
	- Rich forest	- Evergreen broad-leaf forest	18,258.40	47.5	Production	
	- Medium forest		11,038.20	28.7		
	- Poor forest		5,542.70	14.4		
	- Regenerated forest	Shrubs & saplings	1,227.00	3.2	Protection & enrichment	Being applied towards FSC forest management (35 year rotation), received FSC CW/CoC
	- Mixed forest	Mixed bamboo	620.6	1.6	Production	
	1.2. Plantation	Acacia species, 7 year rotation	275	0.7	Production	
	2. Non-forested land		1,012.3	2.6	To be planted, production	
	2.1. Bare land with some young saplings		357.7	0.9		
	2.2. Bare land	Mainly grass & climbers	654.6	1.7		
	3. Other lands	Water bodies, roads & homestead areas	473.8	1.2		
	Total			38,448.0	100	
Vinh Tu commune	1. Forested land		1,973.0	57.1		
	1.1. Natural forest	Forests on sandy soil	446.0	12.9	Env. protection	Sus. mgt towards FSC
	1.2. Plantation	Hybrid Acacia, 7 year rotation	1,527.0	44.2	Production	FSC CW/CoC
	2. Rubber plantation	30 year rotation	40.5	1.2	Production	
	3. Agriculture lands		1,097.2	31.8		
	3.1. Rice paddies	02 season cultivation	105.3	3.0	Production	
	3.2. Other agri. crops	Corn, cassava, peanut, yearly	991.9	28.7		
	4. Home garden & settlement	Some pepper home garden (about 6.0 ha), area of water bodies	343.3	9.9	Production	
	Total		3,454.0	100		

Sources: Huong Son SFE sustainable forest management plan period 2012-2040, Vinh Tu CPC report 2013

3. Methodology and assumptions

Estimating opportunity and implementing cost of forest certification for ecosystem services requires the identification and evaluation of products and services of forest ecosystems, a calculation of associated costs and benefits of the forest ecosystem management models, and then an estimation of opportunity costs on the basis of comparing net profits of the forest management schemes to other land use options in a same time frame and interest rate. In theory, estimating the opportunity cost is simple, but it can be difficult in practice to generate reliable estimates, especially for natural forest ecosystems. Practically, it is very difficult to quantify and evaluate many forest products and services (e.g. most environmental services) because many forest environment services have externality attributes and non-market value (Bishop, 1999). To meet the requirements of the objectives, this study applies the following approach with multiple estimation methods to collect and analyze data (see Figure 02).

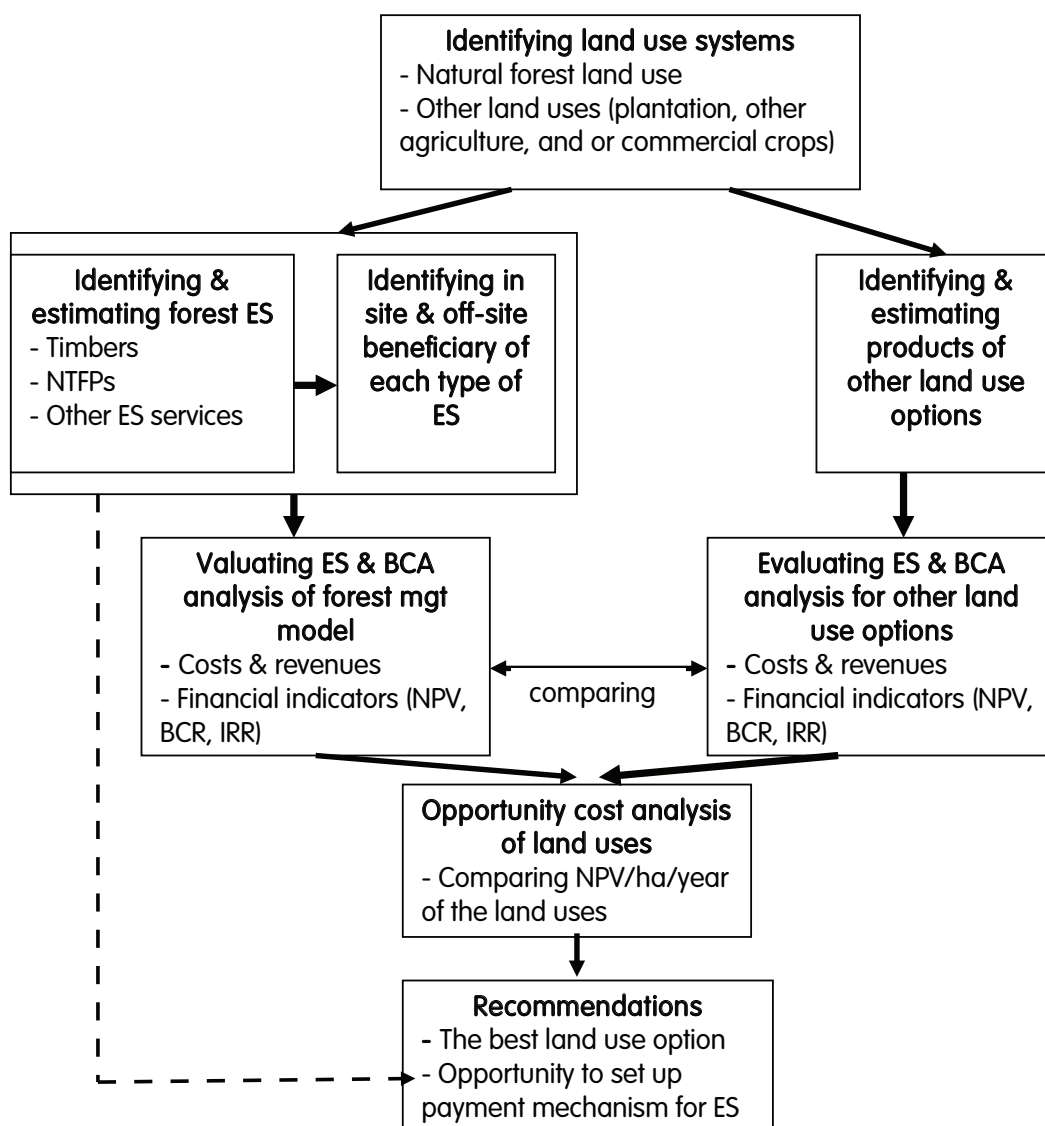


Figure 02: Research follow chart i) Limitations and assumptions

i) Limitations and assumptions

In the study sites, there are two major forest ecosystems, the tropical evergreen broad-leaf rain forest of Huong Son SFE and the natural forest on sandy soil of Vinh Tu commune. The other land uses are plantations (mainly Acacia, in both communes), rubber plantation and agriculture crops (only in Vinh Tu). In this study, opportunity cost analysis and Land Expectation Value (LEV) were conducted with the following assumptions:

- Only some major plantations and crops with significant cultivated areas (e.g. Acacia and rubber, rice, corn, cassava, and peanut) are subject to this study, other very small areas (e.g. pepper in home gardens) are not considered.
- The production rotations of Acacia and rubber plantations are fixed as 7 years and 30 year respectively,
- Timber stock per ha of both FSC Acacia plantations and Non-FSC Acacia plantations are considered the same, and there is an assumption that there will be no reduction in the timber stock of Acacia plantations in the next rotation,
- For LEV estimation, bare land is assumed to be grassland without trees or any crops, and the value of biodiversity and NTFPs on such land is assumed to be zero,

For forest ES estimation - the most difficult task in this research - there is an available consultation report on mapping some ecosystem services in the sites for SNV Vietnam, including the estimation of carbon storage and soil loss potential (estimated in range value), and a description of biodiversity. This research used some data of the report as secondary data (such as carbon storage), but many other important ES (e.g. NTFPs and water reservation, sand moving prevention) were directly determined in the field by conducting interviews and exploring other research (see Table 02 for details). Of course, it is impossible for this research study to estimate all possible forest ES. Some ES, such as disease regulation and cultural services are not included in our estimation because local people/interviewees did not value them significantly at the study sites.

ii) Identifying, estimating and valuating forest ecosystem services

The identification and classification of forest ecosystem services was conducted through interviewing forest managers (as services providers) and local people (as beneficiaries) about types of forest products and services of the different forest ecosystems, using open-ended questionnaires and secondary data from the training workshop on monitoring ES conducted by Sini Savilaako¹. The key question for this is '*what are the environmental services of the forest ecosystem and for whom do they benefit?*' Estimation of forest ES is one of the most difficult missions for the research team because many services (e.g. biodiversity, water purity) have been not yet quantified so far. To overcome this difficulty, a combined method of reviewing secondary data and interviewing was applied (see Table 02).

For timber products, which have available inventory data and market price, the estimation and valuation are mainly based on secondary data, and then cross-checked by interview. For NTFPs which have market prices (such as bamboo, rattan, medicinal herbs) or substitute goods (like fuel wood, green manure), the data and prices of products are collected from interviewing key informants (see App. #2).

¹ Sini Savilaako, 2013. Report from training workshop on monitoring environmental services with an introduction to impact valuation.

For forest environmental services, the estimated carbon storage in Huong Son SFE and Vinh Tu of the SNV report were used for this study, and the price for a tCO₂ is fixed at 5 US\$.

For soil erosion protection services, the previous report only estimated ranges of potential soil loss in the areas based on Universal Soil Loss Equation (USLE). For the case of Huong Son SFE, the secondary data of the previous SNV report on potential soil loss of forested area, and the value of soil loss prevention for hydro power plan from Vuong Van Quynh's study, have been used here. In the case of Vinh Tu commune, the area's relatively flat land means that there will be no soil erosion by water as found in the Huong Son area. However, there is a high potential for land loss due to sand movement, but there is no available secondary data covering this. To estimate this important ES of the forests in Vinh Tu commune, an avoided cost method is applied to identify the role and value benefits of the forest shelterbelt on preventing loss of agricultural and crop land from sand moving in Vinh Tu commune by applying the following equation:

$$Esp = Aagri. * P * NPV$$

Where:

Esp is total value of soil loss prevention service per year in the commune

Aagri. is estimated total area of potential agriculture and crop land loss due to sand moving (in scenario of having no the shelterbelt),

P is the productivity per area unit (ha)

NPV is profit per area unit (ha) of cultivated agriculture or crops.

For water preservation service, because of a lack of available data, for Huong Son SFE the data from Quynh's study was used. For the Vinh Tu commune, the avoided cost method was applied to value this service on the basis of the forest's impacts on water for rice productivity and living essentials of local people. Amenity service was estimated by the hedonic method according to the willingness to pay (WTP) of local people for a better environment condition to benefit their lives.

Table 02: Selected methods to estimate and value forest ES

FMU	Forest ES	Estimation		Valuation	
		Methods	Data sources	Methods	Data sources
Huong Son SFE	1. Timber	Forest inventory	SFE reports, interview	Market price (MP)	SFE reports, interview
	2. Fuel wood	Interviewing	Field interview	MP/substitute goods(SG)	Field interview
	3. NTFPs				
	- Bamboo	Interviewing	Field interview	MP or SG	Field interview
	- Rattan	Interviewing	Field interview	MP or SG	Field interview
	- Medicinal herbs	Interviewing	Field interview	MP or SG	Field interview
	- Other NTFPs	Interviewing	Field interview	MP or SG	Field interview
	4. En. Services				
	4.1. Carbon storage	UN IPCC 2003	SNV report ¹	MP (5US\$/tCO ₂)	Matthew ²
	4.2. Soil loss protection	Soil loss (USLE)	SNV report ² , Quynh ⁴	Avoided cost	Quynh (2009) ³
Vinh Tu commune	4.3. Water preservation	N/A	Quynh (2009) ⁴	Avoided cost	Quynh (2009) ⁴
	4.5. Biodiversity	Qualitative only	-	-	-
	4.6. Other ES				
	1. Timber	Forest inventory	Reports, interview	Market price (MP)	Reports, interview
	2. Fuel wood	Interviewing	Field interview	MP/SG	Field interview
	3. NTFPs				
	- Foods	Interviewing	Field interview	MP or SG	Field interview
	- Medicinal herbs	Interviewing	Field interview	MP or SG	Field interview
	- Green manure	Interviewing	Field interview	MP or SG	Field interview
	- Others	Interviewing	Field interview	MP or SG	Field interview
	4. En. Services				
	4.1. Carbon storage	IPCC 2003	SNV report ²	MP (5US\$/ton/ CO ₂)	Mathew ³
	4.2. Soil loss prevention	USLE) + interview	SNV report ² , interview	Avoided cost	Field interview
	4.3. Water reserve	Interview, qualitative	Field interview	Avoided cost	Field interview
	4.3. Amenities for people health	Interview, qualitative	Field interview	Hedonic price	Field interview
	4.3. Improved agri. crop productivity	Interview, qualitative	Field interview	Avoided cost	Field interview
	4.4. Biodiversity	Qualitative only	-	-	-
	4.5. Other ES				

2 SNV, 2012. Mapping of ecosystem services, Quang Tri and Ha Tinh provinces, consultation report.

3 Mathew, O. 2012. Opportunity cost analysis of REDD+ in Lam Dong province, Vietnam, report submitted to SNV Vietnam

4 Vuong Van Quynh, 2009. Valuating soil loss protection and water reserve of forest in watershed area of Suoi Dap hydro power, Son La province (in Vietnamese)

iii) BCA of key land use options

In the study sites, forest lands are being used for many different land use options as the description in Table 01 shows. Cost and revenues of the key land use options were collected from available data (e.g. financial statement of Huong Son SFE) and field interviews (see App #2) and were calculated in the benchmark year price of 2013. The fluctuation of the inputs and output prices in the timeframe of land use rotation (e.g. 7 years for plantation) is proposed to be crossed out (as is common in BCA). The FSC natural forest management scheme (namely *FSC forest management*) is given as the baseline model to compare with other land use alternatives, including:

- a) Conventional natural forest management, named as *conventional forest management* with the assumption of timber production only.
- b) Acacia plantation certification group with FSC for the rotation of 7 years (named *FSC plantation*).
- c) Acacia plantation in the same rotation (7 years) but without FSC, named *non-FSC plantation*.
- d) Rubber plantation with 30 year rotation, named *Rubber plantation*.
- e) Other crop cultivations are named by crop species, such as *Cassava, Rice...*
- f) *Bare land*.

Net Present Value (NPV), Benefit and Cost Ratio (BCR), Internal Rate of Return (IRR) are the key financial indicators selected for analyzing and comparing financial feasibility of the different land use options with the given interest rate of 10 %/year by applying the following formulas:

$$- NPV = \sum_{i=0}^n \frac{(Bi - Ci)}{(1+r)^i}$$

$$- BCR = \frac{\sum \frac{Bi}{(1+r)^i}}{\sum \frac{Ci}{(1+r)^i}}$$

- IRR is the interest rate that makes the NPV equal to zero

Where: r = discount rate (10%); Bi = benefit at year i^{th} , Ci = cost at year i^{th} , n= period of time (in years).

iv) Opportunity cost analysis of the land uses

The calculated NPVs of the different land uses are used to analyze opportunity costs by comparing indicator of NPV per ha per year of FSC forest management with other land use options.

v) Land Expectation Value (LEV)

This considers the value of bare land at the start of an even-aged plantation rotation. It is the present value (PV), per unit area, of the projected costs and revenues from an infinite series of identical even-aged rotations, starting initially from bare land. LEV can be used to estimate the opportunity costs of various management regimes. In this study, LEV is applied for estimating value of bare land with an assumption of use for a *Non-FSC Acacia plantation* with a 7 year rotation. A simple three-step process is used for this calculation:

- i) Determine all of the costs (C) and revenues (B) associated with the first rotation. These values include initial costs of planting, site preparation, and so on, as well as all subsequent costs and revenues.

- ii) Place the costs and revenues on a timeline and compound all of them to the end of the rotation, and calculate future value (FVR) of the first rotation of the land use by applying the following equation:

$$FV_R = -E(1+r)^R + \sum_{t=1}^{R-1} I_t(1+r)^{(R-t)} + \frac{A[(1+r)^R - 1]}{r} + \sum_{p=1}^n P_p Y_{p,R} - C_h$$

Where:

R = the length of the rotation (here $R=7$ years)

r = interest rate expressed as a decimal (here $r = 0.1$, equal to 10%)

E = plantation establishment cost per unit area (here = 01 ha)

I_t = an intermediate cost or revenue per unit area at a time t larger 0 but less than R

A = the net cost or revenue per unit area from all annual cost and benefits

P_p = price of product p

$Y_{p,R}$ = expected yield per unit area of product p at age R

C_h = cost of harvesting the timber

- iii) Then, apply the infinitive periodic payment formula to get LEV:

$$LEV = \frac{FV_R}{(1+r)^R - 1}$$

4. Results



4.1. Estimation of goods and services of different land use options

4.1.1. Types of goods and ES of different land use options

Different land use options provide different goods and services for different beneficiaries. Table 03 summarizes the management purposes of the different land uses in the 2 pilot sites with associated types of goods and services for different target groups.

In Huong Son SFE, there are two major types of land uses: management of production natural forest, and establishment of plantations (mainly Acacia species). The natural forest can be managed in one of two following schemes:

- (i) Conventional forest management for timber production.
- (ii) The alternatives - FSC forest management for sustainable provision of timber, NTFPs, and other environmental services. The conventional management, as usual in almost all SFEs in Vietnam, is mainly planned for a 5 year period with the main purpose to gain the benefit of timber logging. In terms of sustainable management, the planned period of 5 years is too short in comparison with a normal rotation for tropical natural management (at least 30 years). Furthermore, timber and some NTFPs are just some direct use values, a part of total value of a forest ecosystem. In short, this management scheme just focuses on earning direct economic values from the forest in a narrow and short term vision.

On the other hand, the sustainable natural forest management towards obtaining FSC certification has long-term and multi-use purposes to provide a broader the forest goods and environmental services for both the SFE, local people and downstream communities. In this management scheme, the SFE could preserve and benefit both direct use values (such as timber and some NTFPs) and indirect use values (from provision of some environmental services (e.g. carbon storage, soil erosion, water preservation) in the long-term. In addition, off-site beneficiaries (e.g. local and downstream communities and companies) could also gain benefits from some NTFPs and some forest environmental services. It can be seen that many ES (except carbon storage) from the forest are positive externalities, not allocating to the SFE but to off-site beneficiaries. It means Huong Son SFE, the ES provider, likely has low incentive to provide the services unless there is sound Payment for Environment Services (PES) mechanism agreed by all stakeholders in the ES provision.

In Vinh Tu commune, there are four categories of land uses: management of natural forest on sandy soil, timber plantations, commercial rubber plantation and cash crop cultivation with wide range of land use options. The key purpose of the natural forest is for environmental protection against the negative effects of the sand moving in the coastal region, in order to protect the living conditions and agriculture production of the local community. Beside the direct benefits (e.g. fuel wood and NTFPs), the most significant and important benefits which the local community are reaping from the forest are the indirect values of the forest environmental services, e.g. land loss prevention, improvement of cash crop

productivity, air purification, and the conservation of a typical coastal forest ecosystem. Therefore, the natural forest in Vinh Tu plays a vital role on environment protection for the livelihoods of local people, with many on site ES for the local communities.

Acacia plantations and Rubber plantation are mainly established in Vinh Tu for commercial purposes; some areas of Acacia plantations have been managed by small household groups for achieving FSC certification for the purpose of gaining the premium price of timber and environment protection. The other land use options are annual cash crops cultivations, like peanut, cassava and corn for subsistent and cash earning purposes.

4.1.2. Estimation of goods and services of land use options

Table 04 presents the result of estimating the quantity of the goods and services of the land use options in the pilot sites from the results of the field study and the secondary data review. In Huong Son SFE, the total area of the FMU is of 38,448 ha with the estimated average timber productivity per ha of 160.70 cubic meter (c.m). By applying the FSC management scheme, Huong Son SFE might benefit a numbers of the forest values, from timber logging (estimated annual amount of 6,372.29 c.m), fuel wood, bamboo, and at least 11 other species of NTFPs, and some environmental services. Among the NTFPs species, bamboo, rattan, and Mau cho (a medicinal species) are the most abundant. For environmental services, the forest could store about 6.9 million tons of C (SNV, 2012), prevent a potential soil loss amount of over 1.6 million tons per year in comparison to bare land (Phuong 2009, Quynh 2010), provide water for 2 hydro-power plants with the total electric generating capacity of 360 MW per year and about 200,000 c.m of water for the consumption of people in Huong Son town. In short, the tropical forest in Huong Son FMU provides a wide range of goods and services, especially some high value NTFPs and a high capacity of carbon storage. On the other hand, under the conventional management scheme the major benefits come from timber logging in an unsustainable way. In the long term, the forest would be degraded to a poor forest due to unsustainable use. Therefore, the capacity of C storage and soil loss prevention would be decreased; and the quantity of almost NTFPs (except bamboo) would be also reduced.

In Vinh Tu commune, NTFPs and ES are the major benefits which local people can derive from the natural forest. It is estimated that every year local people collect about 3,000 c.m of fuel wood, about 1,000 tons of tree leaves for making green manure, and a number of medicinal and food products from the natural forest. However, the most important benefits of the forest for the local community are the environmental services. According to the results from interviewing local people on the role of the forest, all the interviewees agreed that compared to the past (about 20 year ago when there was a lack of natural forest), the existing natural forest has been a very effective shelterbelt preventing a large area of soil loss and improving crop productivity significantly. It is estimated that with the existing shelterbelt local people have more cultivatable areas for agriculture production (about 40 ha for paddies, 70 ha for peanuts, and 50 ha for cassava), and the crop productivity has been increased about 20-30%. The natural forest is also a carbon sink of 35,520 tons per year (Ty, 2012).

The estimated productivity of other land uses in Vinh Tu are about 3 tons per ha of peanuts, 30 tons per ha of cassava, 5 tons per ha of corn, 32.15 tons per ha of rubber resin (for 30 year rotation). The estimated timber productivity of Acacia plantations for 7 year rotation is just around 75 c.m per ha, smaller than the per ha productivity of Acacia plantations in Huong Son (119.18 c.m).

Table 03: Key land use options, associated products & services, and beneficiaries

Site	Key land use option	Management models	Major purposes	Identified goods, services and beneficiaries	
				On site	Off- site
Huong Son SFE	Natural forest management	Conventional mgt (5 year plan)	Production	Timber for the SFE	Some NTFPs for surrounding villages
		FSC mgt (35 year plan)	Sustainable timber production & provision of NTFPs and ES	Timber, carbon storage, and partly NTFPs for the SFE	Some timber & NTFPs for surrounding villages
				Biodiversity conservation (for region and national)	Soil erosion & sedimentation prevention & water preservation and flood prevention for surrounding and downstream villages (on agricultural production & living) & for hydro power plans and water plan
				Potential ecotourism	Soil erosion, sedimentation prevention & water preservation for surrounding and downstream villages and hydro power plans (but much less significant than natural forest)
Vinh Tu commune	Plantation (Acacia)	Non-FSC plantation	Timber production	Timber for HS SFE	
				Fuel wood & NTFPs (foods, medicinal herbs, green manure) for local people	
				Land loss prevention (soil protection from moving sand & water conservation for living & agriculture cultivation)	Preventing sand moving to National Road #1
				Agriculture protection (as improvement of productivity)	
	Natural forest on sandy soil	Sustainable mgt	Environment protection	Air purification/temperature regulation for health of local people	
				Biodiversity conservation of representative sandy forest (for region)	

Table 03: Key land use options, associated products & services, and beneficiaries (cont.)

Site	Key land use option	Management models	Major purposes	Identified goods, services and beneficiaries	
				On site	Off- site
	Plantation (Acacia)	Non- FSC plantation	Production	Timber & fuel wood for local households	
				Along with natural forest, set up shelterbelt	
		FSC plantation	Production with care of environment protection	Timber & fuel wood for households with environmental friendly operations	
				Along with natural forest, set up shelterbelt	
	Rubber plantation (35 year rotation)	Pure plantation	Commercial production	Resin and timber for households	
	Paddy rice cultivation	Annual	Food security	Rice	
	Crops (peanut,	Annual	Food provision & cash earning	Crop products for households	

Table 04: Estimated products and environmental services of major land use options

Indicators	Land uses in Huong Son SFE			Land use in Vinh Tu commune						
	FSC N. forest mgt option	Conventional N. forest Mgt option	Acacia plantation	N. forest on sandy soil	Non_FSC_Ac acia plantation	FSC_ Acacia plantation	Peanut	Cassava	Corn	Rubber
Rotation (year)	35	5	7	L. term	7	7	annual	annual	annual	30
Total area (ha)	38448	38448	275	446	1228.22	298.78	300.0	500.0	380.0	40.5
Average productivity per ha for rotation (m³ or ton (t))	160.70 m3	160.70 m3	119.18 m3		75.0 m3	75.0 m3	3.0 t	30.0 t	5.0 t	32.15 t resin
Total productivity for rotation	6178602 m³	6178602 m³	32774.5 m³		92116.5 m³	22408.5 m³	900 t	15000 t	1900 t	1302.08 t resin
Average harvested area/ year (ha)	233.26	233.26					105.3	300.0	500.0	
Average harvested amount / ha/year	26.73 m³	25.46 m³					3.0 t	30.0 t	5.0 t	1.01 t resin
Average harvested products/ year	6372.29 m³	6068.85 m³					900 t	15000 t	1900 t	43.4 t resin
Total harvested amount for rotation	223030.15 m³	212409.94 m³	32774.5 m³		92116.5 m³	22408.5m³	900t	15000 t	1900 t	1302.08 t resin
Harvested amount of NTFPs / year										
Fuel wood (1000 m3)	10-15			3.0						
Green manure (ton/year)				1000						
Bamboo (1000 stems)	15,520	15,520								
Medicinal herbs										
Chrysobaphus roxburghii (mau chol) (1000 kg)	250-300	100-150								
Knema globularia (lan Kim tuyen) (1000 kg)	3-5	1.5-2.5								
Drynaria sp (bo cot toai) (1000 kg)	1-2	0.5-1.0								
Ganoderma lucidum (linh chi) (kg)	50-70	25-35								
Lindera strychnifolia (ô dước) (1000 kg)				2-3						
Tongkat ali (sâm dăng) (1000 kg)				1-2						
Sp (lầu ầu) (1000 kg)				1-1.2						
Rattan (1000 kg)	200-250	100-125								

Table 04: Estimated products and environmental services of major land use options (cont.)

Indicators	Land uses in Huong Son SFE			Land use in Vinh Tu commune						
	FSC N. forest mgt option	Conventional N. forest Mgt option	Acacia plantation	N. forest on sandy soil	Non_FSC_Acacia plantation	FSC_Acacia plantation	Peanut	Cassava	Corn	Rubber
Orchidacea (1000VND) Honey (1000 l) Phynium placentarium (la Dong) (1000 leaves) Licuala Fatoua Becc (la Nón) (1000 leaves) Canarium (quả Trám) (kg) Quescus nut (1000 kg) Others (mil. VND) <i>Benefit from ES per year</i>	350.000	150								
	2.5-3.5	1.25-1.75		0.2-0.3						
	500-1000	5000-1000								
	500-800	500-800								
	2000-3000	1000-1500								
				4-5						
	500-700	250-350		40-50						
Carbon storage (tC) ton of C Soil loss prevention compared to bare land (ton/ha/year)** Total soil loss prevention (ton/year) Prevention of losable area of paddy cultivation (ha) due to sand follow Prevention of losable area of peanut cultivation (ha) due to sand follow Prevention of losable area of cassava cultivation (ha) due to sand follow Increasing productivity of crops due to the ES of improving land condition	6,870,281	4190871*		35,520	155188.5	456237.1				
	44.04	43.64								
	1615691.1	1601016.3								
				40 ha						
				70 ha						
				50 ha						
				added productivity 20-30%						

* Referenced to rate of forest cover loss average 13% per 10 years, Mathew (2012);

** Referenced to Phuong 2009 & Quynh 2009 (applied for medium forest in case of FSC management and poor forest in case of non-FSC management for 36.686,9 ha of N. forest of Huong Son)

4.2. Benefit and Cost analysis (BCA) of the key land use options

4.2.1. BCA for the options of land use options of Huong Son SFE

4.2.1.1. BCA for conventional natural forest management for timber products

The unit cost and revenue of the conventional forest management for timber production is presented in Table 05. On average, the total cost per harvested c.m is estimated at 2,576,864.2 VND, accounting up to 91.12% of the revenue per c.m (2,827,886.2 VND). Of this, the total operation costs (for harvesting design and approval, harvesting operations, road maintenance and post harvesting activities) accounts for 73.4% of the total cost. On average, the net income (after income tax) from a harvested c.m is rather small, just 188,266.5 VND, equal to 4,722,052.3 VND per harvested ha, or 3409.4 VND per managed ha.

Table 05: Unit cost and revenue structure of conventional forest management

Unit: VND

		Per harvested c.m	Per harvested ha (for 233.26 ha)	Per mgt ha (for 38448 ha)
I	Costs	2,576,864.2	64,632,250.1	416,223.1
1.1	Harvesting design	63,308.8	1587895.2	10225.8
1.2	Approval of the design	7,577.7	190061.9	1224.0
1.3	Harvesting operations	1,001,461.7	25118406.7	161759.2
1.3.1	Preparations before harvesting	89,285.4	2239433.6	14421.7
1.3.2	Skidding trails	248,493.9	6232660.6	40137.5
1.3.3	Felling & logging	1,171.4	29380.8	189.2
1.3.4	Transportation to landing area	240,636.0	6035570.7	38868.3
1.3.5	Transportation log yard	407,777.3	10227766.2	65865.5
1.3.6	Grading, protection & others	14,097.7	353594.9	2277.1
1.4	Road maintenance	189,078.3	4742413.7	30540.5
1.5	Post harvesting operations	629,647.1	15792647.8	101702.5
1.6	management expenses	206,495.0	5179254.9	33353.7
1.7	Taxes	332,828.7	8347924.5	53759.5
1.7.1	Natural resource tax	310,814.4	7795767.4	50203.7
1.7.2	Land use tax	21,394.8	536618.9	3455.8
1.7.3	Business tax	619.5	15538.1	100.1
1.8	Depreciation	146,466.9	3673645.4	23657.8
II	Revenue per m3 of logs	2,827,886.20	70,928,319.8	456,768.9
III	Income before tax (= II-I)	251,022.0	6296069.7	40545.9
IV	Income tax (25% of III)	62755.5	1574017.4	10136.5
V	Net income (=III-IV)	188,266.5	4,722,052.3	3,409.4

(Source: Huong Son SFE, calculated by the authors)

Under the conventional scheme, Huong Son SFE has two income sources; the major one from timber selling and the small from the government fund for forest protection activities (mainly used for natural forest logging and protection of the forest). With the given interest rate of 10% a year, the total NPV for the 5 year plan was estimated at 6,302,717,607.4 VND, and BCR is equal to 1.105 times. On average, the NPV per year is just 1,260,543,521.5 VND. (see Table 06).

Table 06: BCA for conventional forest management of Huong Son SFE (5 year plan)

No	Costs & Revenues Key forest management activities	Year					Total
		2011	2012	2013	2014	2015	
I	Harvesting natural forest						
1	Harvesting area (ha)	247.6	231.7	223	234	230	1166.3
	Harvesting volume of logs (m3)	6210.24	6252.18	6000.12	6072.66	6164.4	30699.6
2	Protection of forest (ha)	38448	38448	38448	38448	38448	38448
II	Total cost (VND) (C)	16002945129.4	16111018814.0	15461494423.7	15648420152.8	15884821674.5	79108700194.3
III	Total revenues (VND) (B)	17681851994.7	17800453541.9	17087656546.3	17292791411.3	17552221691.3	87414975185.5
1	Revenue from timber harvesting	17561851995	17680453542	16967656546	17172791411	17432221691	86814975185.5
2	Total government fund for forest protection & regeneration	1200000000.0	1200000000.0	1200000000.0	1200000000.0	1200000000.0	6000000000.0
IV	B – C	1678906865.3	1689434728.0	1626162122.6	1644371258.5	1667400016.8	8306274991.2

Interest rate (r) = 10%/year

NPV = 6,302,717,607.4 VND ; **NPV/year** = 1,260,543,521.5 VND;

NPV/harvester ha/year = 5,404,027.8 VND **NPV/managed ha/year** = 32785.7 VND

BCR = 1.105

4.2.1.2. BCA for FSC compliance natural forest management of Huong Son SFE

a) Estimation of costs and benefits for FSC certification and implementation

Costs of FSC certification and implementation

The total cost related to FSC certification over the 35 year period is significant at the FMU level (Table 07). It consists of the direct costs of the FSC certification process and indirect costs (in compliance with FSC standard requirement). The **direct costs** are associated with the certification process, including (i) internal and (ii) external elements. *Direct internal costs* relate to internal expenditure for the preparation of certification, including SFM planning, training staff on FSC, hiring consultants for guiding and training, consulting stakeholders and other logistical costs. The indirect internal costs were at one time allocated and invested in the first years of rotation and were estimated at 129,500,000 VND, accounting for just 0.2% of the total costs of FSC certification and implementation.

The *direct external costs* are the contracted payments to the auditing body, with the total estimated expenditure about 5189100000 VND (7.5%). Of this, about 7,600 USD is related to the scoping audit, 12,000 USD to the main audit, and about 6,600 USD every year for the annual surveillance audits.

Indirect (compliance) costs consist of two cost categories (i) *costs of compliance with management system criteria* (or costs of management system) and (ii) *cost of compliance with performance criteria* (or forest management costs). The total indirect costs were estimated at 64084677023 VND for the whole rotation (about over 92% of the total FSC cost), including 14.6% allocated to costs of the management system and 77.8% allocated to forest management costs. The costs of the management system are necessary costs of adjusting the forest management system in accordance with FSC standards, covering costs of resource assessment and inventory, HVCF surveys and mapping, and SFM re-planning for every 5 year period. The cost of Reduced Impact Logging (RIL) design and annual recording is also necessary. Forest management costs can be further classified into 2 sub types: (i) costs for forestry operations & ecological aspects and (ii) costs related to social aspects. Costs for forest operations & ecological aspects are the expenditures for the adjustment of the SFE technical procedures to comply with legal requirements and the certification criteria (which includes investment for required equipment, running RIL operations, road maintenance, waste management, biodiversity measures, etc). This type of cost takes up to nearly 74 % of the total FSC allocation due to high costs for equipment and the high cost requirement of forestry operation annually. The costs related to social aspects are the expenditures to ensure the health and safety system of workers (e.g. training and monitoring), to reduce conflicts with local communities and encourage the participation of local people. In Huong Son SFE, this cost is significant, accounting for nearly 4% of the total.

Compared with the conventional scheme, which mainly focuses on the economic aspect of timber logging without insufficient investment for ecological and social aspects, the costs of preparing and implementing sustainable forest management towards FSC certification were significantly higher. On average, FSC compliance costs about 2 billion VND per year, or nearly 327,000 VND per harvested c.m, equal to nearly 13% higher than the total cost per c.m in the conventional management approach.

Table 07: Cost of FSC certification and implementation for 35 year rotation of natural forest management of Huong Son SFE

No	Costs	Brief description	Year of cost location (1)	Cost (VND) (2)	Number of years of cost allocation (3)	Total cost (VND) 4 = 2*3	(%)	Source of reference
A	<i>Direct costs of FSC certification process</i>					5318600000	7.7%	
<i>A.1</i>	<i>Internal costs</i>					<i>129500000</i>	<i>0.2%</i>	
1	SFM planning		1st year	50000000	1	50000000		Interviewed
2	Internal training of staff on the certification	1000 USD/year*2 years	2 st year	21000000	2	42000000		Dak To SFE
3	Hiring of consultants	1 month expert *1500 USD	1st year	31500000	1	31500000		Interviewed
4	Consulting stakeholders		1st year	5000000	1	5000000		Interviewed
5	Other costs		1st year	1000000	1	1000000		Interviewed
<i>A.2</i>	<i>External costs</i>					<i>5189100000</i>	<i>7.5%</i>	
6	Scoping & FM CW/CoC		1st year	159600000	1	159600000		GFA audit free
7	Mail audit		2nd year	252000000	1	252000000		Dak To SFE
8	Annual surveillance audit		yearly	140514706	34	4777500000		
B	<i>Indirect costs (compliance with FSC standard requirements)</i>					64084677023	92.3%	
<i>B.1</i>	<i>Costs of compliance with management system criteria</i>					<i>1010148908</i>	<i>14.6%</i>	
9	Resources assessment and forest inventory, HCVF, re-planning	432540000 VND for 5 years	1 times for every 5 years	432540000	7	3027780000		Cost-norm # 690/2013/QD-BNN-TCCB
10	Additional cost for RIL designs (compared to conventional)	about 50% higher than conventional	yearly	192105974	35	6723709078		Malaysia, Dak To SFE
13	Recording	documentation	yearly	10000000	35	350000000		Interviewed

Table 07: Cost of FSC certification and implementation for 35 year rotation of natural forest management of Huong Son SFE (cont.)

No	Costs	Brief description	Year of cost location (1)	Cost (VND) (2)	Number of years of cost allocation (3)	Total cost (VND) 4 = 2*3	(%)	Source of reference
B.2	<i>Costs of compliance with performance criteria</i>					53983187945	77.8%	
	<i>Forestry operations & ecological aspects</i>					51315089280	73.9%	
14	Reduced impact logging equipment	safety equipments for worker	every 5 years	120000000	7	840000000		Dak To SFE
15	Additional cost of RIL operations, including change of roads, waste management, protection of biodiversity, and monitoring to meet FSC standards	Increasing 41% compared to conventional logging	yearly	1442145408	35	50475089280		Malaysia, Dak To SFE.
	<i>Social aspects</i>					2668098665	3.8%	
16	Measures to improve safety and health of workers	training staff & monitoring on RIL	yearly	9103283	35	318614904		
17	Provision of social services for local communities	5% of total income after tax	yearly	57128108	35	1999483761		referenced to Dak To SFE
18	Measures & actions to resolve potential conflicts		yearly	10000000	35	350000000		Interviewed
	Total cost for 35 year rotation					69403277022.8	100	
	Average cost per year					1982950772.1		
	Average cost per ha/year					51574.9		
	Average cost per harvested c.m					326742.1		

* Exchange rate: 1 USD = 21,000 VND

Benefits from FSC implementation

The benefits derived from the certification are more difficult to estimate than the cost estimation. First, they come forward with a time lag; second, many of them cannot be quantified directly in monetary terms. Because Huong Son SFE has just started its SFM plan, the result of the estimation of FSC certification costs and benefits is mainly derived from reviewing the experiences of other case studies in Vietnam (e.g. Dak To SFE). It shows that the implementation of forest certification could bring both direct and indirect benefits to Huong Son SFE and other stakeholders on economical, environmental and social aspects.

(i) Economic benefits: There are two main sources of possible additional revenue as a result of the certification. First, the certified timber can be sold at price premium which is 15 % higher than normal price (Dak To SFE, 2013). Second, practicing RIL with good monitoring can avoid the loss of usable timber (from the lower height of stumps and a reduced percentage of damaged timber). It was estimated in Dak To that RIL practice can increase the total usable timber amount by 5% without cutting down more trees. Table 08 shows the estimated direct additional economic revenue from the forest certification per year for Huong Son SFE. Compared to the conventional logging option, the additional usable timber per year is estimated at 303.4 c.m, and the total annual timber output is estimated at 6372.3 c.m, which can be sold at premium price of 3252069.1 VND/c.m (or added revenue of 424182.9 VND per c.m). So, the total direct economic benefit for Huong Son SFE is estimated at 3561121680.1 VND per year, equal to 179.6% of the total FSC cost per year (1982950772.1 VND). It means that the forest certification could bring the significant economic profit for Huong Son SFE.

Table 08: Average added revenue per year from FSC management scheme compared to conventional scheme*

Management scheme	Average amount of harvested timber per year (m ³)	Price per m ³ (VND)	Total revenue (VND)
Conventional (1)	6068.9	2827886.2	17162032193.1
FSC scheme (2)	6372.3**	3252069.1***	20723153873.1
Additional revenue from FSC (= (2)-(1))	303.4	424182.9	3561121680.1
Average additional revenue per managed ha			92621.8
Average additional revenue per harvested ha			15266748.2

* Only account for timber production

** Added amount of timber saved by applying RIL (about 5% higher than conventional logging), referenced source from Dak To SFE

*** Price premium about 15% higher than normal price of a m³ in case of conventional scheme, referenced source from Dak To SFE

In addition, several possible indirect economic benefits from the certification can be gained. For example, a reduction of damage on remaining trees and saplings during logging would have significant indirect benefits. The study results on the impact of RIL in Dak To SFE and Truong Son SFE

shows that good practices of RIL reduced logging damage percentage from 13 % (in conventional logging) down to 4.5 % (in RIL practice). In addition, you can shorten the rotation from 35 years (as is normally fixed in Vietnam) to only 25 years (Tuan and Hung, 2013). It means that the FMU can save costs for post harvesting silvicultural treatments and can gain more profit from shortened rotation. In the near future, Vietnam is going to sign two important timber trade agreements, FLECT and LACEY, and the Vietnamese government also has a proposal to close natural forest logging (except any FSC certified FMU). Therefore, the forest certification will create competitive advantages on timber market access and price premiums for any FSC certified FMU. It is a really important indirect economic benefit.

(ii) Environmental benefits are derived from improved mitigation of environmental impacts on forest operations and enhanced measures of biodiversity conservation, and biological functions of the forest. Most of the benefits generated by the forest certification are accrued by society. However, some of them, either directly or indirectly, contribute to the FMU in the long run. For example, the flow of timber and NTFPs can be not be sustained without environmental sustainability.

(iii) Social benefits are derived in a similar way as environmental benefits. They can include a broad range of contributions, from clarification of land rights and conflict resolution, and direct and indirect employment of local people as FMU workers to direct cash or kind (e.g. seedlings) support for local communities. These could bring benefits for both the local communities and the FMU (e.g. reduced costs of forest protection and conflict management).

b) Unit cost and revenue analysis of FSC forest management scheme

Table 09 presents the cost and revenue structures for both the conventional and FSC management schemes for a harvested c.m of timber in Huong Son SFE. It can be seen that total cost of a c.m harvested by FSC scheme is estimated at 2917998.9 VND, about 341134.7 VND (or 13.2%) higher than the cost of a c.m harvested by the conventional scheme. As described above, the additional cost is caused by more investments required to meet FSC principles and criteria.

Table 09: Structure of cost and revenue per c.m in two forest management schemes

Unit: VND

	Costs & Revenues	Conventional logging scheme (1)	FSC compliance scheme (2)	Difference (= 2-1)
3	Costs per m3 of harvested logs (VND)	2,576,864.2	2,917,998.9	341,134.7
3.1	Harvesting design	63,308.8	94,963.2	31,654.4
3.2	Approval of the design	7,577.7	7,577.7	
3.3	Harvesting operations	579,586.7	817217.247	237,630.5
	Pre-felling activities	89,285.4		
	Skidding trails	248,493.9		
	Felling, de-branching, and de-bucking	1,171.4		
	Log skidding to landing area	240,636.0		
3.4	Log hauling and transporting to log ward (for selling)	407,777.3	407,777.3	

	Costs & Revenues	Conventional logging scheme (1)	FSC compliance scheme (2)	Difference (= 2-1)
3.5	Scaling, grading, marking, protection	14,097.7	14,097.7	
3.6	Maintenance of transportation road	189,078.3	189,078.3	
3.7	Costs of post harvesting operations (silvicultural treatments)	629,647.1	629,647.1	
3.8	Management expenses (overhead costs)	206,495.0	206,495.0	
3.9	Other costs of FSC certification and implementation		57,457.2	57,457.2
	SFM planning		235.4	235.4
	Internal training of staff on the certification		197.7	197.7
	Hiring of consultants		148.3	148.3
	Stakeholders consultation		23.5	23.5
	Other costs of preparation		4.7	4.7
	Scoping & FSC FM		751.4	751.4
	Mail audit		1,186.4	1,186.4
	Annual surveillance audit		22,491.9	22,491.9
	Resources assessment, forest inventory, HCVF		14,254.4	14,254.4
	Recording		1,647.8	1,647.8
	Reduced impact logging equipments		3,954.6	3,954.6
	Measures to improve safety and health of workers		1,500.0	1,500.0
	Provision of social services for local communities		9,413.3	9,413.3
	Measures & actions to resolve potential conflicts related to land rights		1,647.8	1,647.8
3.10	Taxes	332,828.7	347,221.2	14,392.5
	Natural resource tax	310,814.4	325,206.9	14,392.5
	Land use tax	21,394.8	21,394.8	
	Business tax	619.5	619.5	
3.11	Depreciation	146,466.9	146,466.9	
4	Revenue per m3 of logs	2,827,886.20	3,252,069.13	424,182.9
5	Income before tax (= 4-3)	251,022.0	334,070.3	83,048.3
6	Income tax (25% of (5))	62,755.5	83,517.6	20,762.1
7	Net income per m3 of logs	188,266.5	250,552.7	62,286.2

c) BCA of FSC forest management scenarios

This subsection presents the results on estimating the average Total Economic Value (TEV) of the natural forest of Huong Son SFE, and the BCA of the different scenarios of the natural forest management.

i) TEV

From the Table 10, it can be seen that the natural forest is the high value ecosystem producing a wide range of products and environmental services. On average, each year, the SFE can derive up to 71 billion VND, of which 29.2% is from timber logging, 13% from NTFPs harvesting and 57.5% from environmental services. Fuel wood, bamboo, rattan, and some medicinal herbs are rather abundant NTFPs in the FMU. Meanwhile, carbon storage and soil loss prevention are the highly valued services of the forest ecosystems. But the value of the other environmental services, like water reservation for a hydropower plan and living consumption, are rather small (just less than 1%). This estimation is likely undervalued because of the relative difficulty in determining other potential downstream beneficiaries of these services (e.g. for flood prevention value) while the nearby and direct beneficiaries are quite limited and small (only two small hydropower plans and a small water plan in a small town).

The estimated TEV of Huong Son forest clearly shows that the revenue from the conventional natural forest logging just accounts for one third of the TEV. In other words, conventional forest management has not managed and used the forest resources in optimal ways, because many valuable products (e.g. NTFPs) and all the ES have been not considered adequately.

Table 10: Estimated total economic value of forest ecosystem of Huong Son SFE

Unit: VND

	Products and services	Average forest benefits per year			Revenue	%
		Unit	Amount	Price		
1	FSC Timber value	m³	6372.3	3252069.1	20723153873.1	29.2
2	NTFPs value				9251000000.0	13.0
	Fuel wood	m ³	15000	200000	3000000000	4.2
	Bamboo	stem	152000	6000	912000000	1.3
	Chrysobaphus roxburghii (mau cho)	kg	300000	3200	960000000	1.4
	Knema globularia species (lan Kim tuyen)	kg	5000	250000	1250000000	1.8
	Drynaria sp (bo cot toai)	kg	2000	30000	60000000	0.1
	Ganoderma lucidum (nam linh chi)	kg	70	1200000	84000000	0.1
	Rattan	kg	250000	2500	625000000	0.9
	Orchidacea (VND)				350000000	0.5
	Honey	liter	3500	200000	700000000	1.0
	Phrynium placentalium (la Dong)	leaves	1000000	500	500000000	0.7

	Products and services	Average forest benefits per year			Revenue	%
		Unit	Amount	Price		
	Licuala Fatoua Becc (la Nón)	leaves	800000	25	20000000	0.03
	Canarium (quả Trám)	kg	3000	30000	90000000	0.1
	Others (VND)				700000000	1.0
3	Potential environment services values				41059272802	57.8
3.1	Carbon storage per years (= 6870281/35)	ton of C (tC)	196293.7	105000	20610843000	29.0
3.2	Soil loss prevention compared to bare land	ton/year	1100607.0	18500	20361229802	28.7
3.3	Water reservation for hydro power plan	kWh/year	360000	20	7200000	0.01
3.4	Water for living consumption from water plan	m ³	2000000	40	80000000	0.1
3.5	Biodiversity		NA	NA	NA	
	Total estimated economic value				71033426675.6	100.0
	Average value can be derived from one ha of forest per year				1,847,519.4	

ii) BCA of FSC natural forest management of Huong Son SFE in different scenarios

Table 11 presents the estimation result of some financial indicators for the different scenarios of FSC natural forest management in the 5 year phased approach:

(i) Scenario 1: FSC management for timber production only, (ii) Scenario 2: FSC management for timber and NTFPs, and (iii) Scenario 3: FSC management for timber, NTFPs and ES. Table 12 shows the result of BCA for FSC forest management for both timber, NTFPs and ES in the 35 year plan.

For the scenario of FSC management for timber production, the total NPV for 5 years is estimated at 11,570,540,350.2 VND for the whole FMU, with the given tax of 10% per year. Therefore, NPV per ha per year is quite low, just 60,188 VND. The BCR is 1.17. Meanwhile, for the other scenarios, the figures of NPV are much higher, 15,950,225,181.3 VND in case of FSC management for timber & NTFPs production, and 131,834.670,6011 VND in case of FSC management for both timber & NTFPs products and environmental services provision. On average, Huong Son SFE can earn a monetary benefit of 82,970.4 VND per ha per year if practicing Scenario 2 or 685,781.7 VND per ha per year if following Scenario 3. The BCR values of Scenario 2 and Scenario 3 are estimated at 1.23 and 2.09 respectively. In case of the 35 FSC year plan, the estimated NPV is 450,324,482,830 VND (or NPV per ha per year at 334,645), and the BCR is estimated at 2.92 (see Table 12). The above BCA results clearly show how much profit the SFE can derive from the forest, depending on the management strategy. A wide range of forest products and environmental services can be lucrative.

Table 11: BCA for different scenarios of FSC forest management of Huong Son SFE in 5 year phased approach

Scenario	B & C	2011	2012	2013	2014	2015	Total
Scenario 1: Only for FSC timber production	Cost of timber production	18121473196.2	18243854068.1	17508343277.2	17720014914.0	17987712128.8	89581397584.2
	Revenue from timber production	21205936283.6	21349147651.9	20488445279.7	20736145629.1	21049407692.2	104829082536.5
	B-C	3084463087.4	3105293583.8	2980102002.5	3016130715.1	3061695563.5	15247684952.3
	NPV	2804057352.2	2566358333.7	2238994742.7	2060057861.6	1901072060.1	11570540350.2
	<i>Total NPV = 11570540350.2</i>		<i>NPV/year = 2314108070.04</i>		<i>NPV/ha/year = 60188.0</i>		<i>BCR = 1.17</i>
Scenario 2 FSC FM (timber & NTFPs	Total cost	22727946856.0	22856446771.5	22084160441.1	22306415659.7	22587497735.2	122827285664.0
	Costs of timber production	19027546856.0	19156046771.5	18383760441.1	18606015659.7	18887097735.2	94060467463.4
	Cost of NTFPs production (of 40% of the NTFPs revenues	3700400000.0	3700400000.0	3700400000.0	3700400000.0	3700400000.0	18502000000.0
	Total revenue	30456936283.6	30600147651.9	29739445279.7	29987145629.1	30300407692.2	151084082536.5
	Revenue from timber production	21205936283.6	21349147651.9	20488445279.7	20736145629.1	21049407692.2	104829082536.5
Scenario 3 FSC FM (timber, NTFPs & ES)	Revenue from NTFPs	9251000000.0	9251000000.0	9251000000.0	9251000000.0	9251000000.0	46255000000.0
	B-C	7728989427.6	7743700880.4	7655284838.6	7680729969.4	7712909957.0	28256796872.5
	NPV	7026354025.1	6399752793.7	5751528804.4	5246041916.2	4789110255.1	15950225181.3
	<i>Total NPV = 15950225181.3</i>		<i>NPV/year = 3190045036.3</i>		<i>NPV/ha/year = 82970.4</i>		<i>BCR = 1.23</i>
	Total cost	24780910496.1	24909410411.6	24137124081.2	24359379299.8	24640461375.3	122827285664.0
	Costs of timber production	19027546856.0	19156046771.5	18383760441.1	18606015659.7	18887097735.2	94060467463.4
	Cost of NTFPs production	3700400000.0	3700400000.0	3700400000.0	3700400000.0	3700400000.0	18502000000.0
	Transaction cost for ES (estimated of 5% of the ES)	2052963640.1	2052963640.1	2052963640.1	2052963640.1	2052963640.1	10264818200.6
	Total revenue	71516209086.0	71659420454.3	70798718082.2	71046418431.6	71359680494.7	356380446548.8
	Revenue from timber production	21205936283.6	21349147651.9	20488445279.7	20736145629.1	21049407692.2	104829082536.5
	Revenue from NTFPs	9251000000.0	9251000000.0	9251000000.0	9251000000.0	9251000000.0	46255000000.0
	Revenue from ES	41059272802.5	41059272802.5	41059272802.5	41059272802.5	41059272802.5	205296364012.3
	B-C	46735298589.9	46750010042.7	46661594001.0	46687039131.8	46719219119.3	233553160884.7
	NPV	42486635081.8	38636371936.1	35057546206.6	31887875918.2	29008959347.9	131834670601.1
	<i>Total NPV = 131834670601.1</i>		<i>NPV/year = 26366934120</i>		<i>NPV/ha/year = 685781.7</i>		<i>BCR = 2.90</i>

Given R = 10%/year

Table 12: BCA for 35 year rotation of FSC forest management in Huong Son SFE

year	Total cost (C)	Revenue (B)	B-C	$(1+r)^i$	NPV
2011	24780910496	71516209086	46735298590	1.10	42486635082
2012	24909410412	71659420454	46750010043	1.21	38636371936
2013	24137124081	70798718082	46661594001	1.33	35057546207
2014	24359379300	71046418432	46687039132	1.46	31887875918
2015	24640461375	71359680495	46719219119	1.61	29008959348
2016	24156353110	70820148567	46663795457	1.77	26340496013
2017	24380005467	71069406007	46689400541	1.95	23959044923
2018	24290220976	70969342442	46679121466	2.14	21776154665
2019	24357357127	71044164748	46686807621	2.36	19799763922
2020	24369857834	71058096612	46688238778	2.59	18000337156
2021	24276470198	70954017391	46677547193	2.85	16360195534
2022	24434199708	71129804736	46695605028	3.14	14878658813
2023	24405337782	71097638520	46692300739	3.45	13525096332
2024	24357357127	71044164748	46686807621	3.80	12294095610
2025	24195583270	70863870035	46668286765	4.18	11172016809
2026	24438244055	71134312104	46696068049	4.59	10162424934
2027	24316913663	70999091070	46682177407	5.05	9235819933
2028	24187494577	70854855299	46667360722	5.56	8393535028
2029	24458465787	71156848943	46698383156	6.12	7635558805
2030	24175361538	70841333196	46665971658	6.73	6936599332
2031	24195583270	70863870035	46668286765	7.40	6306312235
2032	24422066669	71116282633	46694215964	8.14	5736196420
2033	24296691930	70976554230	46679862300	8.95	5213121028
2034	24147051113	70809781621	46662730508	9.85	4737461619
2035	24377578859	71066701587	46689122728	10.83	4309219186
2036	24579796179	71292069977	46712273798	11.92	3919414488
2037	24385667551	71075716322	46690048771	13.11	3561408807
2038	24179405885	70845840564	46666434679	14.42	3236006890
2039	24316913663	70999091070	46682177407	15.86	2942816857
2040	24195583270	70863870035	46668286765	17.45	2674492000
2041	24394123912	71085140819	46691016907	19.19	2432540574
2042	24173523199	70839284392	46665761194	21.11	2210204349
2043	24359195466	71046213551	46687018085	23.23	2010191934
2044	24244115427	70917958449	46673843022	25.55	1826931508
2045	24276470198	70954017391	46677547193	28.10	1660978635
Total	852170274474.6	2486169933645.3	1633999659170.7		450324482830.2

NPV= 450324482830

NPV/year = 12866413795

NPV/year/ha = 334645

BCR = 2.92

* given $r = 10\%$ /year

4.2.1.3. BCA for Acacia plantation & Land Expectation Value (LEV) in Huong Son SFE

i) BCA for Acacia plantation

The establishment of an Acacia plantation in some low land areas of the SFE is one of the designed tasks of Huong Son SFE. In the next 5 years, Huong Son SFE has planned to set up about 500 ha of Acacia plantations on shrub and bare land areas. Table 13 shows the result of BCA for one ha of Acacia plantation with a rotation of 7 years. This analysis is based on the assumption that the plantation is only for timber production, and other products and services of the plantation are assumed to be insignificant.

Table 13: Cost and revenue structure of Acacia plantation per ha (7 year rotation)

Unit: 1000 VND; given $r = 10\%$ per year

No	Items	Year							total
		1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	
I	Costs (C)	6416.0	2960.0	840.0	840.0	480.0	480.0	28194.1	40210.1
A	Production costs	6416.0	2960.0	840.0	840.0	480.0	480.0	24238.8	36254.8
1.1	Design	240.0							
1.2	Vegetation removal	480.0							
1.3	Hole digging (manual)	960.0							
1.4	Seedlings	1056.0							
1.5	Fertilizers (NPK)	1760.0	1760.0						
1.5	Planting	720.0							
1.6	Tending	720.0	720.0	360.0					
1.7	Protection & fire prevention	480.0	480.0	480.0	480.0	480.0	480.0	480.0	
1.8	Brunching				360.0				
1.9	Harvesting							23758.8	
B	Other costs							3955.3	3955.3
1.10	Maintaining road							298.5	
1.11	Management expenses(10%) production cost							3625.5	
1.12	Business tax							10.0	
1.13	Land use tax							21.4	
II	Revenues (B)							109111.5	109111.5
2.1	Timber							71533.0	
2.2	Chip wood							37578.5	

NPV/ha = 31,470,572 VND

NPV/ha/year = 4,495,796 VND

BCR = 2.71

IRR = 43.2%

It can be seen from Table 13 that the total estimated cost of one ha of Acacia plantation in a 7 year rotation is 40,210,100 VND, and the total estimated revenue from selling timber and chip wood is of 109,111,500 VND per ha. So, the NPV is estimated at 31470572 VND per ha in 7 years. On average, each year the forest owner can earn a profit of about 4.5 million VND per ha from an Acacia plantation. BCR is rather high (2.71), and the IRR value (43.2%) is much higher than the interest rate (10%). It means that the management of Acacia plantations may produce high profits for the land owner.

ii) LEV in Huong Son SFE

The expected value of bare land in Huong Son SFE in this study is estimated using an even-aged Acacia plantation with a single rotation of 7 years for timber production by using the future value (FV) method. The result shows that the LEV using an Acacia plantation at the age of 7 years is 63,444,200 VND per ha with a 10% interest rate (or 9,063,457.1 VND per ha per year). This LEV presents the maximum amount that could be paid for a tract of land and still earn the required interest rate. Here, a potential buyer could invest a maximum amount of 63,444,200 VND per ha for the tract and earn 10 % on the investment, assuming that the land is used to grow timber according to the management scheme (for timber production only). This figure shows that the LEV in Huong Son SFE is rather higher than the revenues from other land use options in Huong Son FMU.

Table 14: LEV of bare land in Huong Son SFE

Unit: VND

Year	Cash follow	Present value (PV)	Future value (FV)
1	-6416.0	-6416.0	-12503.0
2	-2960.0	-2446.3	-4767.1
3	-840.0	-631.1	-1229.8
4	-840.0	-573.7	-1118.0
5	-480.0	-298.0	-580.8
6	-480.0	-270.9	-528.0
7	80917.4	41523.4	80917.4
Total	68901.4	30887.3	60190.6

Given $r = 10\%$

$$PV = 30887300 \text{ VND}$$

$$FV = PV * (1+r)^7 = 60,190,600 \text{ VND for 7 years of land use}$$

$$LEV = \frac{60190600}{(1 + 0.1)^7 - 1} = 63,444,200 \text{ VND for 7 years of land use}$$

$$LEV \text{ per ha per year is equal to } 9,063,457.1 \text{ VND.}$$

4.2.1.4. Comparison of key financial indicators of the different forest management options of Huong Son SFE

Table 15 presents some financial indicators (NPV, BCR, IRR) of 6 different land use options in Huong Son SFE, including 5 natural forest management schemes and a land use solution for the Acacia plantation.

Among the natural forest management schemes, it can be seen clearly that the conventional timber production scheme has the lowest NPV value, earning just a small profit at 163,928.4 VND per ha, or equal to 32,786 VND per ha per year. The BCR of this scheme is just above 1.1. It implies that although the conventional scheme is still profitable, the management mainly based on conventional timber logging could only generate a very small profit per unit of forested area. Meanwhile, all the 4 other forest management schemes in accordance with FSC standards were more profitable. The indicators of NPV/ha, NPV/ha/year, and the BCRs of these management schemes were significantly higher than those of the conventional logging scheme. However, there is a noteworthy difference in these indicators between the FSC management schemes, depending on the management strategy for producing a single-type product (timber) or multi-forest products and services. It is clearly seen that the more types of forest products and services that the SFE provides, the higher profit the SFE can earn. It increases from an old FSC timber production scheme to become a combined FSC timber, NTFPs and ES production plan.

For the FSC timber production scheme, with the advantages of the timber price premium and timber saving by applying RIL, the value of NPV/ha/year is estimated at 60,188 VND with the BCR of 1.17. This value is almost double the figure of the conventional logging scheme, but it is still a small amount. While the FSC scheme in which the SFE focuses on sustainable management of forest products (both timber and NTFPs), the value of NPV/ha/year is approximately 1.4 times higher than the figure of the FSC timber scheme. This is because the SFE can get a significant revenue from extracting NTFPs, which are rather abundant in the site.

The Huong Son SFE can get the highest profit if it practices FSC natural forest management with a provision for both forest products and environmental services. The value of NPV/ha/year of this management scheme sharply increases up to 685,782 VND. This figure is over 10 times higher than the value of the FSC timber scheme, and over 20 times higher than the figure of the conventional logging scheme. The BCR reaches a value of 2.9, almost 3 times higher than the BCR of the conventional one. In the scenario of the 35 year plan, the management scheme has the highest BCR value (2.92), and also high NPV/ha/year (334,645 VND), although the NPV figure is smaller than that of the 5 year plan scheme due to highly discounted value in long rotation.

The man-made forest-Acacia plantation, on the other hand, is the most profitable land use. A ha of the plantation can provide a net present value of 4,495,796.0 VND per year on average. In terms of economic factors alone, this land use management is likely to be the most financially attractive land use option. Obviously, compared to the Acacia plantation land use, the profits from the natural forest options are too small and less attractive. The main reason explaining the relatively low value of NPV/ha/year in the natural forest management schemes is that the area where cuts are allowable (ACC) is too small. On average, every year the ACC of Huong Son FMU is just 233.26 ha out of the total 38,448 ha (less than 1%). Meanwhile the SFE has to bare all costs for managing the 38,448 ha. That lessens the per ha profit of the management schemes.

However, if estimating for only the logged area, the profit of the scheme of FSC timber, NTFPs & ES production (5 year phased approach) is valued at 6,029,621.5 VND per ha per year, of which 5,404,027.8 VND is a profit from timber logging and 625,593.7 VND is a profit from NTFPs and ES. This figure is the highest among all land use options in Huong Son FMU, even compared to the Acacia plantation.

Table 15: Financial indicators of the land use options in Huong Son SFE

Unit: VND

Indicators	Conventional timber production (5 year plan)	FSC natural forest management schemes				Acacia plantation (7 year rotation)
		FSC timber production (5 year plan)	FSC timber & NTFP production (5 year plan)	FSC timber, NTFP & ES production (5 year plan)*	FSC timber, NTFP & ES production (35 year plan)	
1. Total management area (ha)	38448	38448	38448	38448	38448	
2. Annual average logging area (ha)	233.26	233.26	233.26	233.26	233.26	
3. Total NPV	6302717607	11570540350	15950225181	131834670601	450324482830	
4. NPV/ha (= (3)/(1))	163,928.4	300,940.0	414,851.9	3,428,908.4	11,712,559.4	31,470,572.0
5. NPV/year (= (3)/ rotation)	1260543521	2314108070	3190045036	26366934120	12866413795	
6. NPV/ha/year	32,786	60,188	82,970	685,782	334,645	4,495,796.0
BCR	1.105	1.17	1.23	2.90	2.92	2.71
IRR						43.2%

Given r = 10%

4.2.2. Cost and benefit analysis of land use options in Vinh Tu commune

4.2.2.1. BCA of natural forest on sandy soil

a) Total economic value (TEV) of the natural forest on sandy soil

Table 16 presents the estimated costs and revenues from the management of the natural forest on sandy soil in Vinh Tu commune. At present, the total 446 ha of the forest is being managed by several village forest protection teams for environment protection purposes. Patrolling the forest is the key forest management activity. Therefore, providing a labor force for patrolling is the main cost for the management. It is estimated that every year the local community has to spend about 900 man-days to protect the forests, equal to about 420,000 VND per ha per year. In addition, the local community has to pay some small management costs (called 'other costs'), for example for team meetings. In cases where the local community can receive revenue from selling the carbon credits of the forest, about 5% of the revenue would be paid as a transaction cost to receive the revenue. On average, the estimated total cost per ha per year for the forest management is rather small, just less than 280,000 VND.

In contrast to the natural forest in Huong Son, Vinh Tu's natural forest on sandy soil is being managed to ensure environmental protection for the local community, not for timber production. However, the local people can derive a great and wide range of benefits from the forest, mainly from environment services and NTFPs. It is estimated that on average local people can benefit as much as around 45 million VND from one ha of the forest every year. The total forest environmental benefits accounts for nearly 87.4% of the total TEV of the forest, mainly from the benefits of preventing agricultural soil loss (53%), and improving crop productivity (31%). Green mature and fuel wood are two major annual NTFPs sources which local people benefit from the forest (see Figure 03).

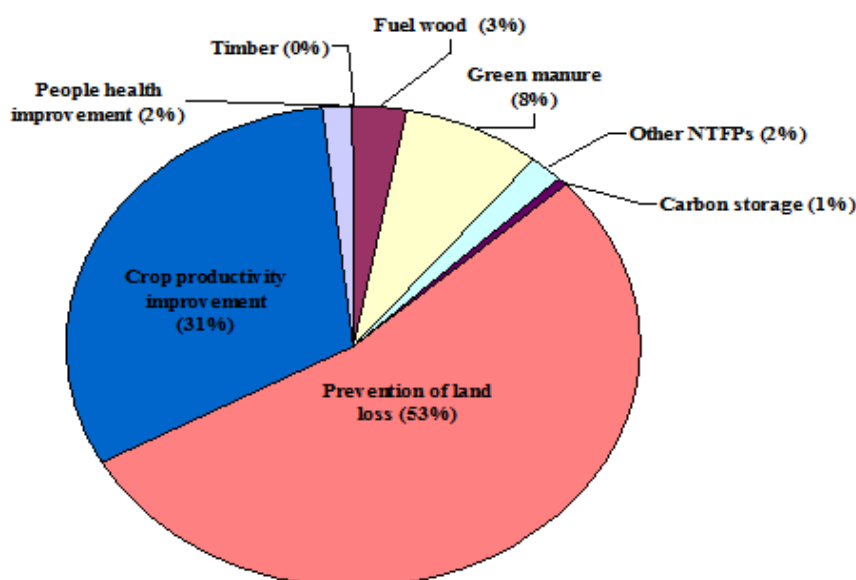


Figure 03: Benefits from natural forest on sandy soil in Vinh Tu commune

Table 16: Average costs and benefits per year of management of natural forest in sandy soil in Vinh Tu commune

	Costs & benefits	Unit	Amount	Price (VND)	Total (for 446 ha) (VND)	Average per ha (VND)
I	Costs				123090000	275986.5
1.1	Protection cost (labor) (2 man-day/ha/year*446 ha)	man-day	902	120000	108240000	242690.6
1.2	Transaction cost for C (estimated of 5% of the C storage average revenue per year)				12432000	27874.4
1.3	Other costs				14850000	33296.0
II	Benefits				19871570000.0	44555089.7
2.1	Timber	No harvesting			0.0	0.0
2.2	NTFPs				2513000000.0	5634529.1
2.2.1	<i>Fuel wood</i>	m ³	3000	210000	630000000	1412556.1
2.2.2	<i>Green manure</i>	ton	1000	1500000	1500000000	3363228.7
2.2.3	<i>Other NTFPs</i>					<i>858744.3</i>
	<i>Lindera strychnifolia</i> (ô dước)	kg	2000	12000	24000000	53811.7
	Tongkat ali (sâm đắng)	kg	2000	60000	120000000	269058.3
	Sp (lầu ầu)	kg	1200	70000	84000000	188340.8
	Honey	liter	300	150000	45000000	100896.9
	Queues nut	kg	5000	12000	60000000	134529.1
	Others				50000000	112107.6
2.3	Environmental services				17358570000.0	38920560.5
	Carbon storage (tC) ton of C for about 30 years	tC	35,520	105000	3729600000	8362331.8
2.3.1	<i>Carbon storage (tC) ton of C per year</i>	<i>tC</i>	<i>1184</i>	<i>105000</i>	<i>124320000</i>	<i>278744.4</i>

Table 16: Average costs and benefits per year of management of natural forest in sandy soil in Vinh Tu commune (cont.)

	Costs & benefits	Unit	Amount	Price (VND)	Total (for 446 ha) (VND)	Average per ha (VND)
2.3.2	<i>Prevention of agriculture land loss</i>					23878923.7
	Prevention of losable area of paddy cultivation (ha) due to sand moving	ha of paddy	40	60000000	2400000000	5381165.9
	Prevention of losable area of peanut cultivation (ha) due to sand moving	ha of peanut	70	75000000	5250000000	11771300.4
	Prevention of losable area of cassava cultivation (ha) due to sand moving	ha of cassava	50	60000000	3000000000	6726457.4
	<i>Increasing productivity of crops from improving land condition 10% of the productivity accounts for remaining area, about 830 ha of paddy, corn, peanut and cassava, with the assumption that 10% of peanut productivity = 7,500,000 VND/ha</i>	ha	831.9	7500000	6239250000	13989349.8
2.3.3	<i>People's health improvement (reduce risk of eye problems and respiratory diseases caused by sand drifts & reduction of medicine needed</i>					
2.3.4		People	3450	100000	345000000	773542.6

From the above estimation, it can be said that the natural forest in Vinh Tu commune has very high value, especially the ES values for livelihoods and agriculture production of the local community. The value of TEV, which local people can derive from one ha of the forest per year, is quite high (near 45 million VND). In Vinh Tu, the major income sources of the local community come from agricultural production. The natural forest, as a very effective shelterbelt for agricultural field protection, plays a vital role and has a great positive impact on the prevention of soil loss and on crop productivity improvement. Therefore, the forest is very highly valued; and the local community has a strong incentive to protect the forest for their livelihood.

b) BCA of the natural forest management in different scenarios

Table 17 shows the results of calculated indicators NPV, BCR for three different options of the natural forest management in Vinh Tu commune; (i) management for providing NTFPs only, (ii) management for providing NTFPs and ES (except Carbon storage), and (iii) management for NTFPs and ES (include Carbon storage). For the first option, the NPV/ha/year is estimated at nearly 536,000 VND. This indicator increases quickly up to about 44 million VND for option ii, and nearly 44.6 million VND for option iii. Similarly, the BCR increases from 20.4 for option i to 160.4 for option ii. These figures clearly indicate that management of the natural forest on sandy soil in Vinh Tu might generate high profit for local people. All the financial indicators of the natural forest management in Vinh Tu are much better than those of the forest management in Huong Son SFE.

Table 17: Financial analysis of different options of natural forest management for 01 ha per year in Vinh Tu commune

Indicators	NR for forest products (NTFPs) (option i)	NR for forest products & ES (exclude C storage) (option ii)	NR for forest products & ES (include C storage) (option iii)
1. Total cost	275986.5	275986.5	303861.0
Protection cost	242690.6	242690.6	242690.6
Transaction cost for C (estimated of 5% of average revenue from C storage)			27874.4
Other costs	33296.0	33295.96413	33296.0
2. Total revenues	5634529.1	44276345.3	44555089.7
Timber	0.0	0	0
NTFPs	5634529.1	5634529.1	5634529.1
ES (without C storage)		38641816.1	
ES (with C storage)			38920560.5
3. NPV (= (2)-(1))	5358542.6	44000358.7	44251228.7
4. BCR	20.4	160.4	146.6

4.2.2.2. BCA for other land use options at Vinh Tu commune

a) Cost and revenue structures of Acacia plantation in cases of non-FSC and FSC

Acacia plantation is one of the major land use types in Vinh Tu. In this commune, the local people practice two different types of Acacia plantation management for production purposes, one for normal

timber production without FSC and one with FSC by small groups of households. The result of financial analysis in Table 18 shows that all the two land use schemes are profitable. All the indicators NPV, BCA and IRR are positive and rather high. However, the establishment of FSC Acacia plantation brings more profit for the land owners. All the indicators NPV, BCR and IRR of the FSC scheme are significantly better than those of the non-FSC scheme. For example, the NPV/ha/year of the FSC scheme is up to 6244371.1 VND, almost 1.8 times higher than the figure of the Non-FSC scheme.

In comparison to the non-FSC Acacia plantation in Huong Son, the financial indicators (NPV and IRR) of the non-FSC Acacia plantation in Vinh Tu are slightly smaller (3502965.1 VND/ha/year in Vinh Tu vs 4495796 VND/ha/year in Huong Son SFE). Local people explain that the timber productivity of the Acacia plantation in Vinh Tu is rather low because the site quality of sandy soil is poor due to semi-dry climate conditions.

Table 18: Financial analysis of Acacia plantation in different management schemes in Vinh Tu commune

Year	FSC Acacia plantation (7 year rotation)				Non- FSC Acacia plantation (7 year rotation)		
	Operation costs (1000 VND)	FSC costs (1000 VND)	Total cost (1000 VND)	B-C (1000 VND)	Operation costs (1000 VND)	Revenue (1000 VND)	B-C (1000 VND)
1	5512	50	5562	0	5512	0	-5512
2	2720	50	2770	0	2720	0	-2720
3	600	50	650	0	600	0	-600
4	960	50	1010	0	960	0	-960
5	240	260	500	0	240	0	-240
6	240	327.5	567.5	0	240	0	-240
7	14129.4	327.5	14456.9	117476.3	14860	79500	64640
Total	24401.4	1115	25516.4	117476.3	25132	79500	54368
	NPV=	43710598 VND			NPV=	24520721 VND	
	NPV/year	6244371.1 VND			NPV/year	3502965.1 VND	
	BCR=	4.604			BCR=	3.16	
	IRR =	53%			IRR =	41%	

Given interest rate (r) =10%

b) BCA for cash crops and rubber plantation

Peanut, cassava and corn are annual cash crops commonly cultivated in Vinh Tu commune. These products are mainly used for subsidy purposes, and the profits gained from cultivating these crops are not high, from 21- 29 million VND per ha. Among these crops, cultivating cassava is likely the most profitable land use, with the NPV of 28670000 VND per ha and the BCR of 1.92. However, many

local people said that this calculation only fits for the first rotation of cassava; they have experienced that the productivity of cassava cultivation dramatically reduces in the subsequent years due to soil loss quality and erosion when continuously cultivating on the same site. Therefore, the revenue may decrease sharply in the next years. It means that cassava cultivation can only create high profit in the first rotation, but it bears high risk of significant profit reduction and unsustainable land use in the sequence rotations.

Table 19: Financial analysis of some cash crops and rubber plantation per ha in Vinh Tu commune

Unit: 1000 VND

Year	Peanut		Cassava		Corn		Rubber	
	(1 year rotation)		(1 year rotation)		(1 year rotation)		(30 year rotation)	
	cost	revenue	cost	revenue	cost	revenue	cost	revenue
1	54300	75000	31300	60000	28050	50000	20380.0	0.0
2							5208.4	0.0
3							5208.4	0.0
4							5208.4	0.0
5							5208.4	0.0
6							5208.4	0.0
7							5908.4	17600.0
8							6108.4	24200.0
9							6808.4	30800.0
10							6808.4	31900.0
11							6808.4	33000.0
12							6808.4	33000.0
13							6808.4	33000.0
14							6808.4	35200.0
15							6808.4	35200.0
16							6808.4	36300.0
17							6808.4	36300.0
18							6808.4	36300.0
19							6808.4	36300.0
20							6808.4	34100.0
21							6808.4	34100.0
22							6808.4	31900.0
23							6680.0	31900.0
24							6680.0	30800.0
25							6390.0	29700.0
26							6390.0	29700.0
27							6390.0	29700.0
28							5640.0	28600.0
29							5640.0	26400.0
30							2200.0	76400.0
Total	54300	75000	31300	60000	28050	50000	199766.4	802400.0
NPV	20700		28670		21950		88707.4	
BCR	1.38		1.92		1.78		4.0	
IRR							22.74	

(Interest rate of 10%)

Rubber is one of the key industrial trees being planted in the commune. Rubber plantation rotation is rather long, normally around 30 years. Furthermore, the establishment and management of such kind of plantation usually require a big investment and it takes at least a 6 year initial investment before getting the first resin harvest. Table 19 is the summary of the costs and revenues of one ha of rubber plantation for a rotation of 30 years from the household interview data in 2013. The total cost for one ha of rubber plantation in 30 years is estimated at approximately 200 million VND, mainly for the plantation establishment activities like site preparation, annual fertilizers, and labor cost for harvesting. In the period of the first 6 years (the period of first investment without any income), the cost counts for appropriately 25% of the total cost. The expenditure for the first year is an especially large amount (up to 20.3 million VND per ha).

Local farmers can derive their first income from selling the first rubber resin product from the 7th year (around 18 mill.VND/ha), and then the income gradually increases until the 11th year (85 mill.VND/ha). From the 11th year until the 27th year, this annual income amount is rather stable. In the last 3 years of the rotation, the income reduces quickly, and all the rubber trees will be clear cut at the end of the rotation. The total revenue from one ha of rubber plantation is estimated at approximately 802.4 million VND for 30 years. Although the total gross income is quite high, the net present value (NPV) from one ha of rubber plantation is just of 88.7 million VND due to the high cost of establishment and management and the high discounted rate of long rotation. The BCA value for this case is calculated at rate of 2.45, and the IRR value is of 22.7% .

4.2.2.3. Land Expectation Value (LEV) at Vinh Tu commune

Similar to the case of Huong Son SFE, the expected value of bare land in Vinh Tu commune is estimated for even-aged Acacia plantation with a single rotation of 7 years for timber production. The estimated LEV of the bare land in Vinh Tu for one ha of Acacia plantation is 54,403,600 VND (or 7,771,942.9 VND per ha per year) at an interest rate of 10%. This LEV presents the maximum amount that could be paid for a tract of land and still earn the required interest rate of 10% on the investment with assumption of timber production only. This LEV is higher than the profit of rubber plantation land use, but smaller than other profit from agricultural land use, and it is too small to compare to the profits from the natural forest management.

Table 20: LEV of bare land in Vinh Tu commune

Unit: VND

Year	Cash follow	Present value (PV)	Future value (FV)
1	-5512.0	-5512.0	-10741.3
2	-2720.0	-2472.7	-4818.6
3	-600.0	-495.9	-966.3
4	-960.0	-721.3	-1405.5
5	-240.0	-163.9	-319.4
6	-240.0	-149.0	-290.4
7	64640.0	36487.6	71104.0
Total		26972.8	52562.3

$$PV = 26972800 \text{ VND}$$

$$FV = PV * (1+r)^7 = 52562300 \text{ VND for 7 years}$$

$$LEV = \frac{52562300}{(1+0.1)^7 - 1} = 54403600 \text{ VND for 7 years}$$

4.2.2.4. Comparing financial indicators of land use options in Vinh Tu commune

Table 21 summarizes the some financial indicators of the land uses in Vinh Tu commune. In terms of average net profit (NPV/ha/year), the most beneficial land use option is the management of the natural forest on sandy soil for NTFPs and ES, followed by cash crop land uses options, FSC Acacia plantation, non-FSC Acacia plantation, rubber plantation, and finally the natural forest management scheme for NTFPs only

Table 21: Financial indicators of the major land use options in Vinh Tu commune

Unit: 1000VND

Land use options	NPV/ha	NPV/ha/year	BCR	IRR
Natural forest for NTFPs		535.85	20.4	
Natural forest for NTFPs & ES (without C)		44000.36	160.4	
Natural forest for NTFPs & ES (with C)		44251.23	146.6	
Non-FSC Acacia plantation	24520.7	3502.9	3.16	41.0
FSC Acacia plantation	43710.6	6244.4	4.60	53.0
Peanut	20700.0	20700.0	1.38	
Cassava	28670.0	28670.0	1.92	
Corn	21950.0	21950.0	1.78	
Rubber	88707.4	2956.9	4.0	22.74

Given $r = 10\%$

Although the total NPV of rubber plantation is reasonable, the value of NPV/ha/year is rather low due to long rotation. Furthermore, the establishment of a rubber plantation requires a high level of investment in the first years. Local people have to bare the risk of potential damage caused by tropical cyclones in the region⁵. For cassava cultivation, it can make a high profit for farmers (compared to other cash crop land uses) in the short-term, but it faces some risk and uncertainty in the long-term due to the high level of price fluctuations and significantly sharp reduction of productivity. Therefore, recently rubber plantations and cassava have not been considered as priority land uses in the community. In reality, management of natural forest for NTFPs and ES and establishment of FSC Acacia plantations are the best land use options in Vinh Tu. The first is mainly for livelihood protection and agriculture production improvement; and the second is mainly for cash earning. In short, the sustainable management schemes of natural forest on sandy soil can be considered as the most valuable land use/resources in Vinh Tu commune.

⁵ In 2013, many areas of Rubber plantations in the regions had been destroyed by a very strong tropical cyclone.

4.3. Opportunity cost analysis for land uses

4.3.1. Opportunity cost for land uses of Huong Son SFE

4.3.1.1. Opportunity cost of FSC forest certification and implementation

Figure 04 presents the tradeoff between the net cost and benefit of FSC certification and implementation per ha per year of the natural forest management in Huong Son SFE. From the figure, it can be seen that changing management scheme from conventional logging to FSC forest management requires a significant investment for FSC certification and costs for implementation to achieve compliance with the FSC standards. On average, the total FSC costs per ha in a year was estimated at 51574.9 VND. The estimated profit from the conventional logging is 32785.7 VND/ha/year, while the profit of the FSC forest management scheme is up to 685781.7 VND/ha/year.

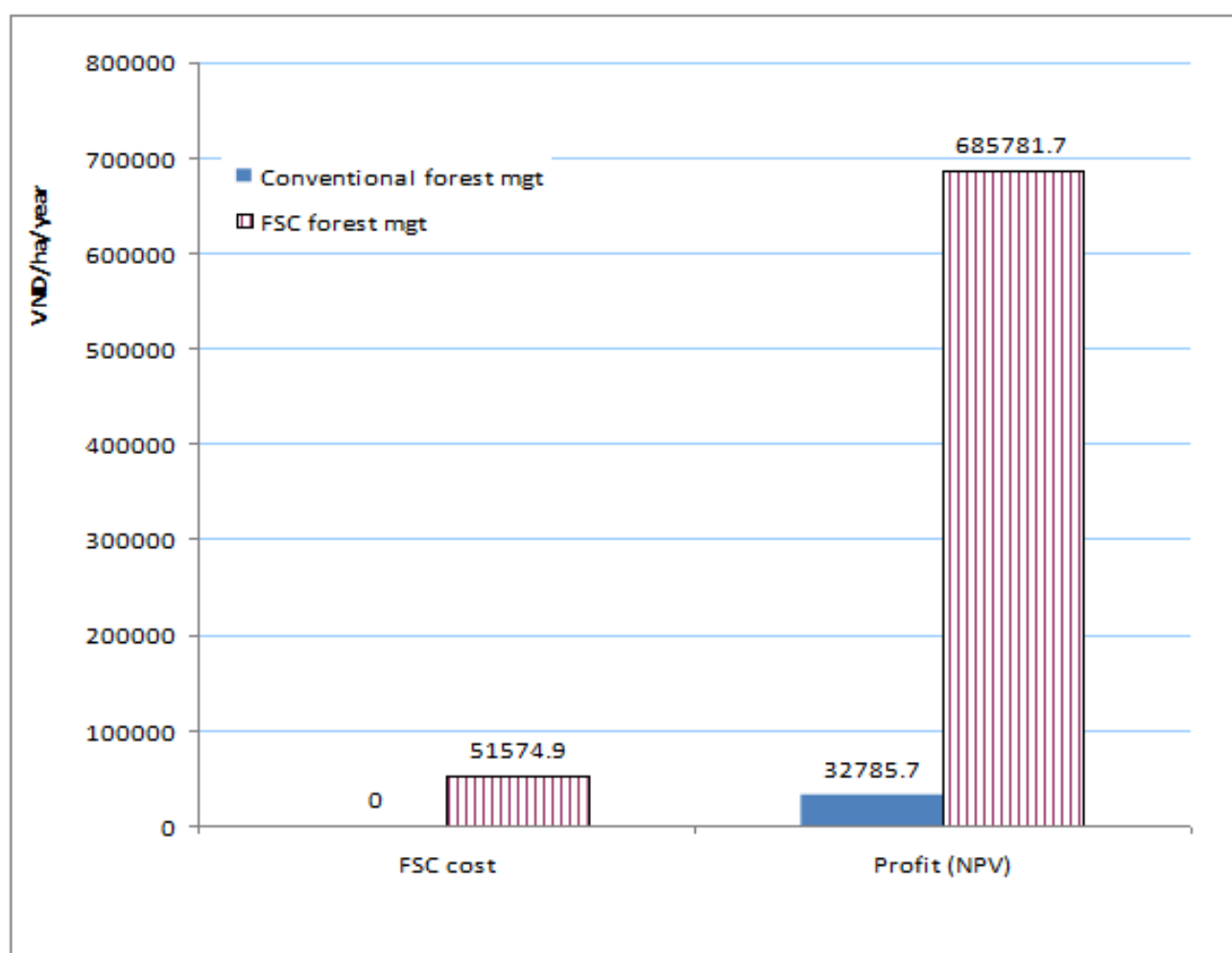


Figure 04: FSC cost and profit gain from changing conventional logging to FSC natural forest management in Huong Son SFE (estimated for whole managed forest area of 38448 ha)

It means that the FSC forest management needs more investment on FSC certification and implementation, but gains much more profit. Shifting conventional logging into FSC forest management might increase the profit by 652,996 VND/ha/year while costing a further 51,574.9 VND/ha/year. Therefore, the opportunity cost of not changing the management scheme from conventional

logging to FSC forest management is equal to the difference between the gained profit and the FSC cost (652996 VND/ha/year - 51574.9 VND/ha/year = 601421.1 VND/ha/year). In other words, the per unit land area estimated opportunity cost is 601421.1 VND/ha/year, or Huong Son SFE will forgoe 601421.1 VND/ha/year if it does not apply the FSC management scheme.

4.3.1.2. Opportunity cost of land use change

This subsection analyzes per ha profit of timber-ES trade-off when converting natural forest to plantation with two different application conditions: (i) for a management ha (applied for whole the management area of 38448 ha per year (see Figure 05)), and (ii) for a harvesting ha (applied for a harvested forest area of 233.26 ha per year (see Figure 06)).

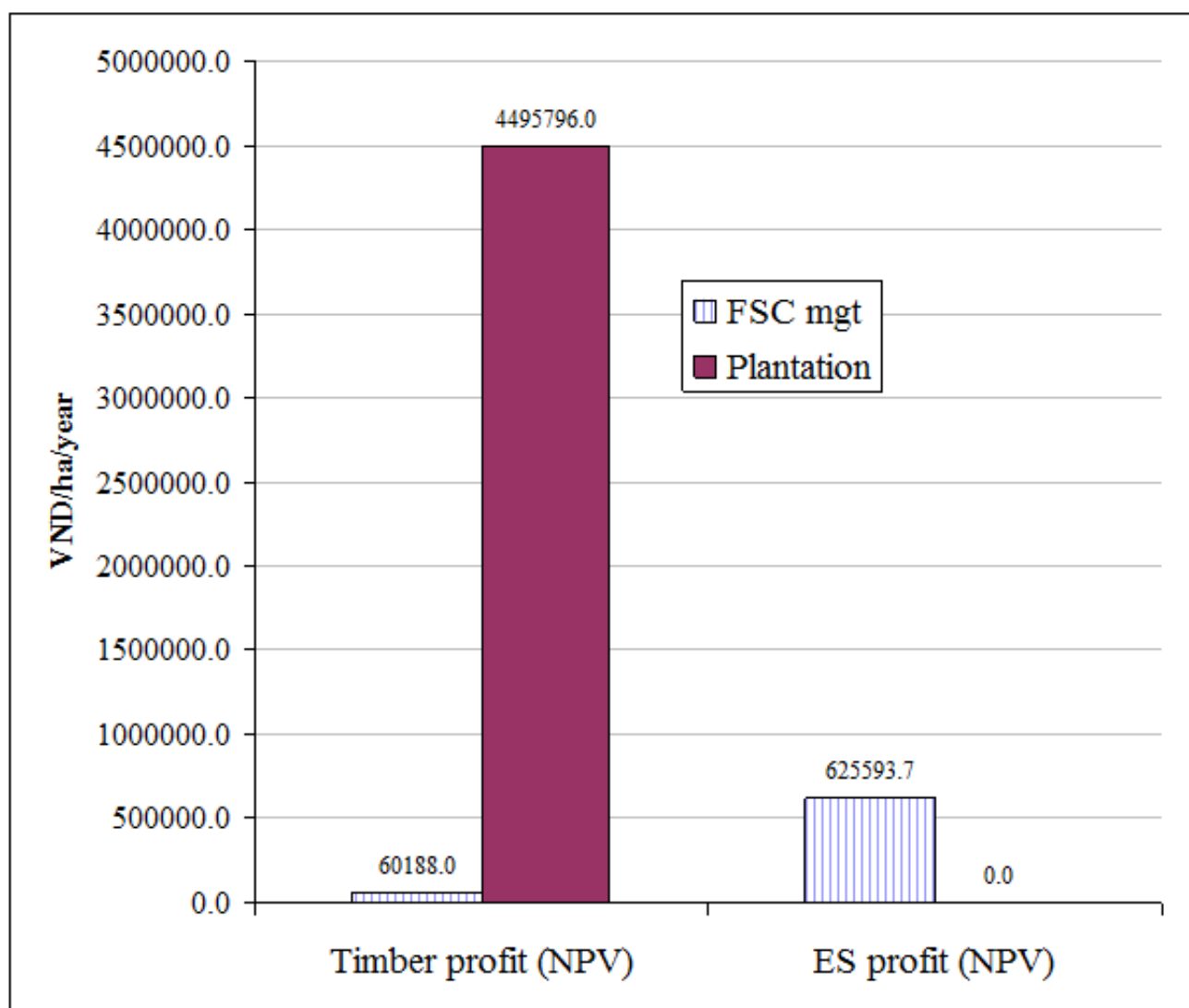


Figure 05: Per ha timber profit gain and ES profit loss from conversion FSC forest management to plantation (scenario for a management ha)

For the calculation for a management ha in the Huong Son SFE, let's compare a ha of managed natural forest to a ha of Acacia plantation. The FSC forest management has the total NPV profit of 685781.7 VND/ha/year (of which, 625593.7 VND from ES and 60188 VND from timber), while the total NPV profit

of Acacia plantation is of 4495796 VND/ha/year (just from timber). Therefore, the opportunity cost of not changing the natural forest to Acacia plantation is equal to 3810014.3 VND/ha/year. This is a high opportunity cost; it is much higher than the NPV of the natural forest management. This may be the key reason why many SFEs would like to convert their natural forest in to plantation. In theory, it is likely that the SFE would gain more profit of converting the natural forest to plantation. However, in reality most of the forest area of the FMU is steep and at a high elevation, and so is not suitable for Acacia plantation. Furthermore, the Vietnamese government does not allow any conversion of natural forest into plantation, except in some special cases, e.g. very poor and degraded forest. So, the area which could be used for plantation establishment is rather limited in Huong Son SFE, about 1000 ha totally.

For harvesting area (of 233.26 ha per year), for each ha of logged forest under the FSC forest management, there is a profit of 5,404,027.8 VND/ha/year from timber logging and 625,593.7 VND from ES, while the total NPV profit of Acacia plantation is 4,495,796 VND/ha/year from timber. The total NPV per harvested ha under the FSC management forest is of 6,029,621.5 VND/year. It means that in this case, if converting on ha of natural forest to plantation, the SFE will lose 1,533,825.5 VND/year in NPV profits ($4495796 \text{ VND} - 6029621.5 = -1533825.5 \text{ VND}$).

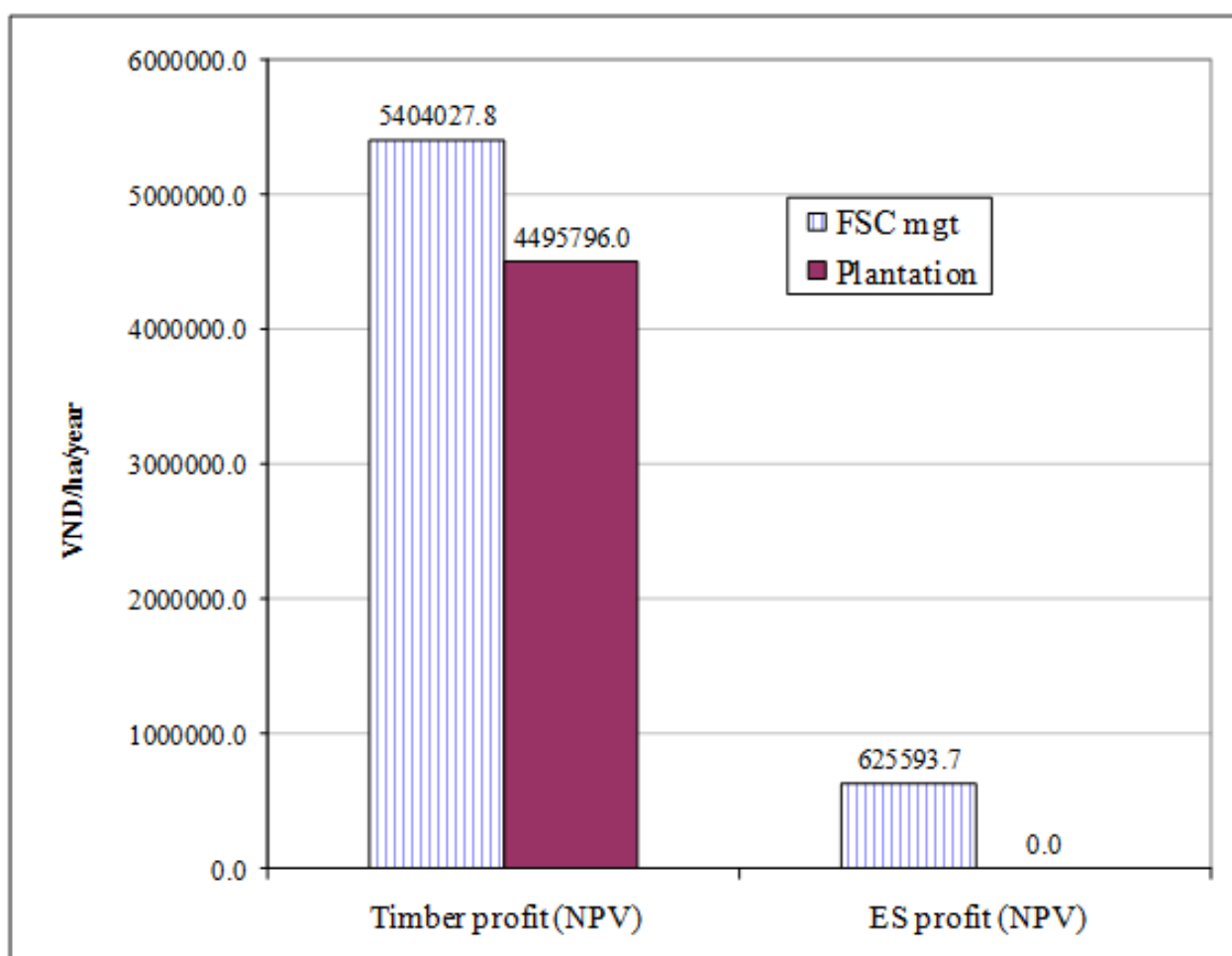


Figure 06: Timber profit and ES profit loss from conversion FSC forest management to plantation (for a natural forest ha)

4.3.2. Opportunity cost for land uses of Vinh Tu commune

Figure 07 and Figure 08 present the profits of different land uses and the opportunity costs of 6 different types of land use changes (from natural forest to 6 other land uses). From Figure 07, it can be seen that the natural forest management for ES and NTFPs is the most profitable land use option with the NPV/ha/year of over 44 million VND, followed by three cash crops (cassava, corn, and peanut), then by Acacia plantation land use, and then rubber plantations.

If the natural forest is converted to the other land uses, each has a different opportunity cost and all the opportunity costs are negative. These denote that local people will lose significant profit when converting the natural forest on sandy soil into any type of other land use in the community. The highest profit loss will happen if converting the natural forest to rubber plantation, then non-FSC Acacia plantation. So in terms of profit making, local people should avoid conversion of the natural forest to any other land uses.

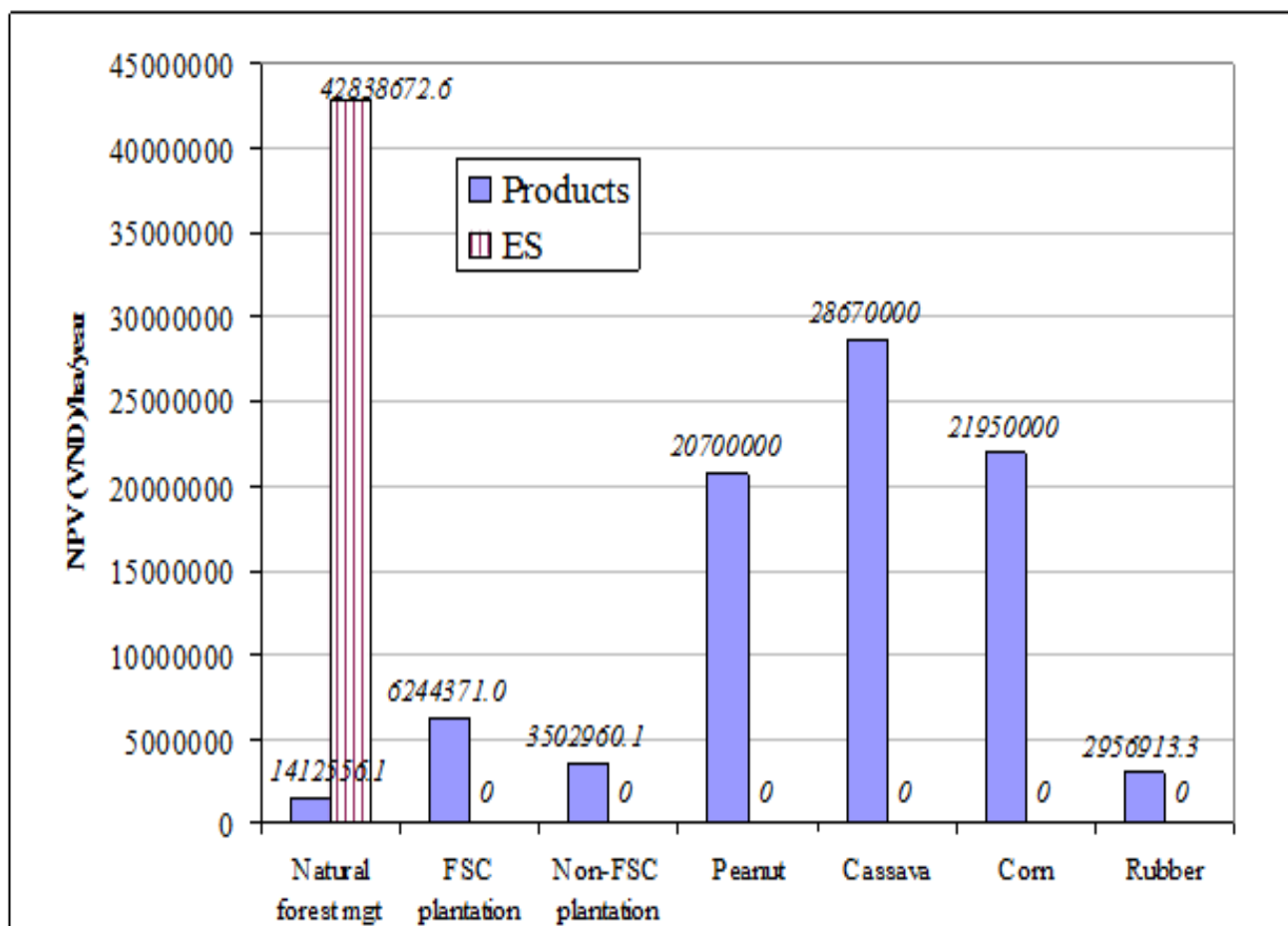


Figure 07: Product profits and ES profits of different land use options in Vinh Tu

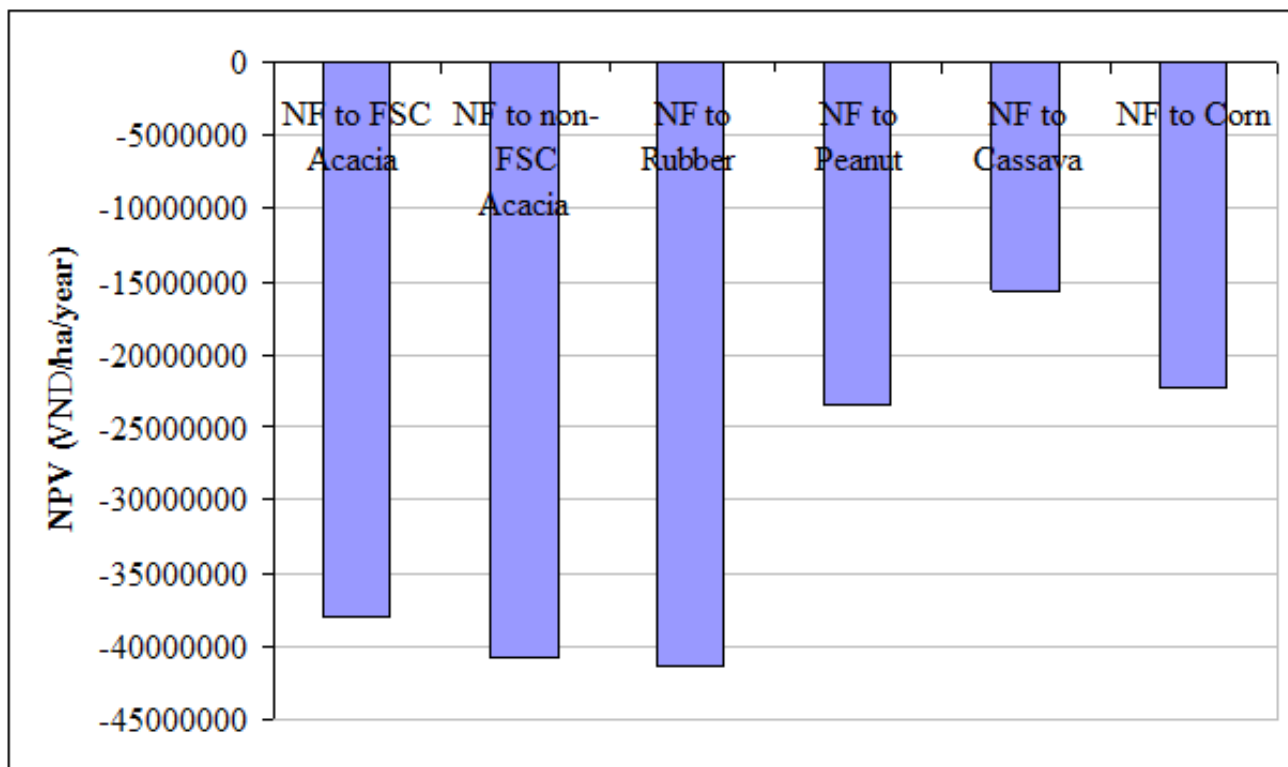


Figure 08: Opportunity costs of 6 different land use changes in Vinh Tu

5. The best land use options & opportunity to set up a payment scheme for ES



5.1. The best land use options in the project sites

Based on the result of benefit- cost analysis and opportunity cost analysis of the different land use options, in terms of high net benefits the following land uses are the best land use options in the study sites:

i) For Huong Son SFE

Huong Son SFE is managing a total area of 38448 ha, of which 96.1% is forested area and 2.6% is bare land.

For the forested area, implementation of FSC forest management for sustainable provision of timber, NTFPs and ES is the best choice of land use because:

- + The FSC natural forest management can generate significantly higher profits from timber production than with the conventional logging schemes (by gaining high price premiums and an added volume of timber from RIL practice),
- + Potential benefits from the provision of forest NTFPs and ES which has been significantly valued, which could produce important added values for the SFE.

For the bare land and very poor and degraded forest areas (about 1000 ha) on the hills and low mountain areas, the establishment of plantation (e.g. Acacia species) would be the best choice to produce timber for commercial purposes, because this is the highest NPV land use option in the region. However, the land owner should seriously consider that although the plantation land use is likely the best option in terms of profit making, the SFE should not expand the area for plantation more than 1000 ha, because:

- + It is illegal to convert natural forests to plantations by the legal regulation on forest land management,
- + The productivity of plantation could not reach the LEV and maintain its productivity if establishing on unsuitable site conditions, especially on high and steep areas
- + There is a high risk of possible negative environmental impacts (e.g. soil erosion) on both on-site and off-site of the FMU.

ii) In Vinh Tu commune

In Vinh Tu commune, the sustainable management of the natural forest on sandy soil for NTFPs and ES provision is the best land use option. This has the highest NPV land use, producing a wide range of products and services, especially the environmental services (e.g. soil loss prevention and crop productivity improvement), the vital services for the livelihood of the commune. Therefore, protection and regeneration promotion of the remaining natural forest are key activities in the management.

For some bare land (except areas for cash crops cultivation), the establishment of FSC certified smallholder groups on Acacia plantation is the good land use option; this land use has rather higher profit than other plantation land uses (e.g. non-FSC Acacia plantation, rubber plantation).

5.2. Opportunity to set up a payment scheme for ES

Payments for ecosystem services (PES) are, as the name implies, payments made to compensate and incentivize individuals or groups engaged in activities that support the provision of ecosystem services. A PES schemes relies on incentives to induce behavioral change through one of two types of ES market: voluntary or regulation (public payment scheme), and it and can be considered part of the broader class of incentive- or market-based mechanisms for environmental policy. In the world, the ecosystem services that are most commonly delivered through PES schemes are carbon sequestration and storage, biodiversity conservation, watersheds and landscape beauty. In Vietnam, there is a key legal framework (Decree 99/2010) regulating level and mechanisms on the payment schemes for three types of forest environmental services (water provision for living consumption, water for hydropower plan, and landscape for ecotourism), and the ES providers can receive the revenues through a government fund namely "Forest Protection and Development Fund - FPDF). In addition, the Vietnamese government is implementing a pilot REDD+ program for carbon storage services of forest. These could be considered as the important institutional settings for local PES schemes for the study sites. Table 22 presents a summary of a recommended payment scheme for different kinds of ES of the study sites from the results of literature study and field surveys.

From Table 22, two key points can be seen. The first is the difference on types of forest ES, the beneficiaries and providers of forest ES between Huong Son SFE and Vinh Tu commune. In Huong Son SFE, the forest ecosystem is rich in biodiversity and has its major environmental services related to carbon storage for Huong Son SFE and water reservation and soil erosion prevention for off-site beneficiaries (e.g. nearly and/or downstream communities, hydropower plans, etc.). In Vinh Tu commune, on other hand, the most important environmental services of the natural forest on sandy soil are agricultural soil loss prevention and crop productivity improvement for the local community itself. In other words, most ES users in Huong Son are different from the providers, while in Vinh Tu commune the local people are both the ES providers and users. Therefore, the difference of the actors in Huong Son may cause more difficulty and high transaction cost for PES implementation than case of Vinh Tu commune.

The second point is that most of the existing PES schemes in Vietnam are public payments based on the regulations of Decree 99/2010. But this legal document just mentions a very limited range of ES and has been not widely implemented so far. The REDD+ mechanism is still at pilot period at small scale. On the other hand, the voluntary market for ES payment is lacking in Vietnam due to many constraints, e.g. lack of reliable measuring and monitoring systems. So expanding certification to include forest ES in the FSC FM standard would be one way to open ES voluntary markets in general, and in Vietnam in particular.

From the analysis, we could recommend 3 payment schemes for the ES in the sites:

- (i) For some services (e.g. water for water plan, water for hydropower plans) which are subject to Decree 99/2010, the service provider(s) can apply through the procedure of Vietnam FPDF.
- (ii) For the service of carbon storage, the piloting REDD+ scheme would be a possibility.
- (iii) For the other services, the voluntary market would be one option.

For timber, NTFPs, and some ES (e.g. water for paddies and living, soil loss prevention) local communities can benefit from the forests of Huong Son. Labor contribution of local people for the forest protection is possible through setting a co-management mechanism, but they are too poor to pay cash for the SFE to enjoy the benefits.

Table 22: Ecosystem services and identified potential payment schemes for ES in Huong Son and Vinh Tu

Site	Natural forest products & Services	Provider(s)	User(s)/beneficiaries	Potential funder/purchaser	Potential payment scheme	Legal framework/reference
Huong Son SFE	Timber	Huong Son SFE	Huong Son SFE itself	Any wood processing com.	Free timber market	
	Fuel wood & NTFPs		(i) Huong Son SFE itself & (ii) local communities	Local people	Local people pay fees of NTFPs collection or contribution labor for joint forest protection	On basis of negotiation between local communities & the SFE
	Water for living consumption		Residents in Huong Son Town and local communities	Water plan in Huong Son town	Public payment through provincial FPDP	Decree 99/2010
	Water for hydropower plan		Two small hydropower plans	Two small hydropower plans	Public payment through provincial FPDP	Decree 99/2010
	Carbon storage		Regional, national and global	Government, business, industries required to reduce emission or purchasing carbon offset voluntary	- REDD+ program	Piloting policy
	Biodiversity services		-	Conservation agencies Potential inter. buyers	Voluntary	Access to voluntary market via FSC +ES
	Landscape beauty services		- Local & regional	Ecotourism	Public payment through provincial FPDP	Decree 99/2010
	Other ES (e.g. soil conservation)			Potential inter. buyers	Voluntary	Access to voluntary market via FSC +ES

Table 22: Ecosystem services and identified potential payment schemes for ES in Huong Son and Vinh Tu (cont.)

Site	Natural forest products & Services	Provider(s)	User(s)/beneficiaries	Potential funder/purchaser	Potential payment scheme	Legal framework/reference
Vinh Tu	Fuel wood	Local community through their protection teams	Being used as common property resources (CPR) by local people themselves	Local people would contribute cash or labor or in kind for cost protection	Village/communal regulations	Self-governance by local people
	NTFPs					
	Prevention of land loss					
	Improving crop productivity					
	Improving people health		Regional, national and global	Government, business, industries required to reduce emission or purchasing carbon offset voluntary	- REDD+ program	Piloting policy
	Carbon storage					
	Biodiversity or typical ecosystem					
				i) Conservation agencies -Potential inter. buyers ii) Government forest protection program	i) Voluntary ii) regulations	i) Access to voluntary market via FSC +ES ii) Government fund on forest protection & management

6. Conclusions and recommendations

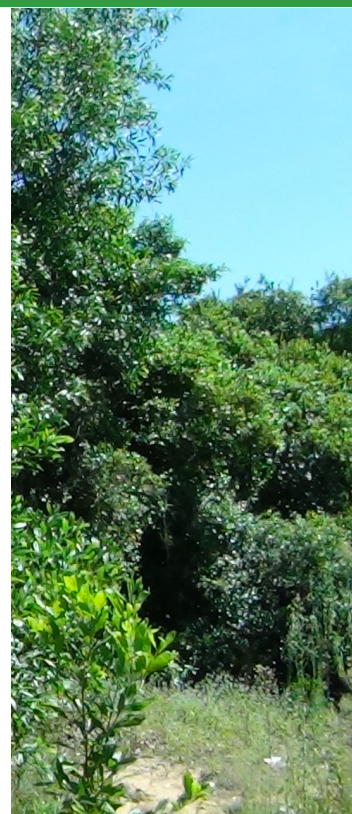
This report aims to identify the best land use options from BCA and opportunity cost analysis of the land use options, and identifying payment mechanisms for ES in two SNV ForCES project sites in the provinces of Ha Tinh and Quang Tri. From the study, some key following findings can be drawn:

(i) Land use options & estimation of products and services of the forest ecosystems

- The forest resources and land use types in Huong Son SFE and Vinh Tu commune are different in terms of bio-characteristics, site condition and forest land use purpose. Huong Son SFE has about 38500 ha in the medium and high mountain region along the Vietnam and Lao border, mostly covered by evergreen tropical forests. The natural forest in Huong Son is classified as production forest and is primary used for timber production. Vinh Tu commune is located in a coastal area of 3450 ha with 5 major land uses (natural forest on sandy soil, Acacia plantations, agricultural cash crops (corn, peanut, and cassava), paddy rice, and rubber plantation). The natural forest in Vinh Tu commune is about 450 ha, claimed as the communal property resource and mainly used as natural shelterbelt for environment protection for livelihood of the community.
- Both the forest in Huong Son SFE and Vinh Tu commune are high value ecosystems, providing a wide range of products and environment services. The total economic values (TEVs) of the forests are far more than direct use value of timber as commonly understood in Vietnam, mainly from environmental service and NTFPs, especially the natural forest on sandy soil in Vinh Tu commune. On average, the total TEV which can be derived from one ha of forested land in Huong Son per year is estimated at nearly 1.95 million VND, of which about 29% from timber, 13% from NTFPs, and the remainder (nearly 58%) from environmental services (mainly of high carbon storage capacity, high soil erosion prevention). In Vinh Tu commune, although the natural forest has not been managed for timber production, the forest ecosystem has been very highly valued by local people because of the forest's vital role in provision of environmental protection services. The estimated TEV/ha/year of the natural forest in Vinh Tu is very high (approximately 44.6 million VND), of which 87.4 % from the environment services (mainly agriculture land loss prevention against sand moving and agricultural cash crop productivity improvement) and the remainder from NTFPs (mainly green manure and fuel wood).

(ii) BCA and opportunity cost of land uses

- In Huong Son SFE, the financial efficiency of the natural forest management is significantly affected by management scheme. The conventional management with focus on timber logging only has the very low NPV profit, just 60118 VND per ha per year. The implementation



of the FSC management scheme for sustainable provision of timber, NTFPs and ES is the most profitable option with significant higher gain profit; the NPV/ha/year is estimated at 685,781.7 VND, much higher than the figure for the conventional scheme.

- The sustainable forest management scheme in Huong Son requires high additional investment for FSC certification and implementation, about 327000 VND per harvested c.m or 51574.9 VND per ha per year (nearly 13% higher than unit cost of the conventional scheme). However, the total benefit from the FSC implementation is significantly higher than the FSC costs because of added profits from timber price premiums (about 15% higher), increased percentage of usable timber (5%), and other social and environmental benefits. On average, the profit gain from FSC scheme is estimated at 652,996 VND per ha per year. It means that the per unit land area estimated opportunity cost is 601421.1 VND/ha/year, or Huong Son SFE may forgo 601421.1 VND/ha/year by not applying FSC management scheme.
- Establishment of Acacia plantation on bare land is likely the most profit making land use in Huong Son with the NPV of 4,495,796.0 VND per ha per year. It is considered as the most attractive land use options in terms of financial analysis. However, the area (bare land and much degraded forest) suitable for Acacia plantation establishment is small, just less than 1000 ha. Therefore, any conversion of forested land on steep and high hills and mountains into Acacia plantation should not be allowed.
- The expected value of bare land (LEV) in the study sites (both Huong Son SFE and Vinh Tu commune) is estimated for even-aged Acacia plantations with a single rotation of 7 years for timber production by using future value (FV) method. The result shows that the LEV is estimated at 63,444,200 VND per ha in case of Huong Son and at 54403600 VND per in case of Vinh Tu at a 10% interest rate. This LEVs presents the maximum amount that could be paid for one ha of land while still earning the 10 % on the investment.
- In Vinh Tu, the management of the communal forest on sandy soil for provision of ES and NTFPs is the most financially effective land use option, followed by cash crop land uses options, FSC Acacia plantation, non-FSC Acacia plantation, rubber plantation, and finally the natural forest management scheme for NTFPs only. Therefore, change of the natural forest into any other land use in Vinh Tu would all create negative opportunity cost. In other words, local people would loss significant profit when converting the natural forest on sandy soil into any types of land uses. The highest loss will happen if converting the forest to rubber plantation.

(iii) Identifying the best land use options

- In Huong Son SFE, implementation of FSC forest management for sustainable provision of timber, NTFPs and ES is the best land use option for management of the natural forests in terms of financial efficiency; chance to enter PES market, and long term production perspective. For the area of bare land and very degraded and poor forest on low land, establishment of Acacia plantations is reasonable land use in terms of profit maximization, but only suitable low land area (not more than 1000 ha).
- In Vinh Tu commune, the protection and regeneration promotion of the remaining natural forest on sandy soil is the best land use option because the forest ecosystem is vital for the livelihood of local people and has high NPV profit. For some bare land (except areas for cash crops cultivation), establishment of FSC certified Acacia plantation is the good land use option for cash earning.

(iv) Opportunity to set up a payment scheme for ES

- In Vietnam, currently there is just a public payment market for PES on the basis of Decree 99/2010 via Vietnam Forest Protection and Development Fund (VNFPDF), indicating very limited types of ES which are subject to this legal framework. REDD+ scheme is still in a period of piloting. meanwhile, the identified ESs in the study sites are very diversified. So, it needs an institutional setting at national level for establishing a voluntary market for some ES (e.g. biodiversity). Incorporating forest ES in FSC certification would provide an opportunity to bring forest ES into voluntary PES market and/or public payment markets.
- Payments for water services for water and hydropower plans is possible via the public payment mechanism of Decree 99/2010. However, payment for carbon storage is still in need of a national mechanism, e.g. the Vietnam National Carbon Fund.
- In Vinh Tu commune, the local community is the both forest ES provider and user, while in Huong Son FMU most the ES beneficiaries are external. Local people in Vinh Tu have experienced the vital roles of the natural forest and they have high incentive to self-govern the resources for their own benefit. In Huong Son, on the other hand the motivation of the Huong SFE to provide some off-site forest ES (e.g. water reserve, biodiversity conservation, etc) is likely to be rather low because the opportunity to receive cash from these services is not significant. However, local people living nearby the forests of the SFE are willing to contribute in kind (e.g. labor for joining patrols). Therefore, there is high potential for setting up a working mechanism between the SFE and local communities on sustainable management of the forests for both the SFE and the local communities.

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Indexes

Index 1: List of interviewees

List of interviewees in Ha Tinh

No	Name	Address	Position
1	Lê Hồng Đạm	Bo Let protection check point	
2	Nguyễn Huy Đan	Village 11, Sơn Hồng commune	Village head
3	Nguyễn Tiến Dũng	Village 11	
4	Cao Xuân Hợp	Village 11	
5	Lê Vũ Quang	Village 11	
6	Nguyễn Đình Cầm	Village 11	
7	Phạm Quyết Thắng	Village 11	
8	Trần Xuân Lý	Village 11	
9	Phạm Ngọc Tú	Village 11	
10	Trần Văn Hùng	Village 11	
11	Trần Xuân Khôi	Village 11	
12	Nguyễn Huy Nhân	Village 11	
13	Trần Bá Quốc	Village 11	
14	Trần Xuân Khôi	Village 11	
15	Nguyễn Sỹ Nhu	Village 11	
16	Nguyễn Hồng Cầu	Village 3, Sơn Hồng commune	Village head
17	Nguyễn Thị Hòa	Village 3	
18	Phạm Xuân Hòa	Village 3	
19	Nguyễn Thị Thu	Village 3	
20	Trần Xuân Hòa	Village 3	
21	Đoàn Văn Hùng	Village 3	
22	Lê Nhân	Village 3	
23	Pham Nguyen Binh	Huong Son SFE	Vice-director
24	Nguyen Trung Anh	Huong Son SFE	Head of technical department

List of interviewees in Quang Tri

No	Name	Address	Position
1	Nguyễn Quang Hải	Vĩnh Tú commune	Vice chairman of CPC
2	Lê Hồng Hiều	Thủy Tú II village, Vinh Tu	Village head
3	Lê Hữu Diệp	Thủy Tú II village	
4	Trần Thị Hải	Thủy Tú II village	
5	Lê Đại Hành	Thủy Tú II village	
6	Lê Văn Quân	Thủy Tú II village	
7	Lê Quang Trung	Thủy Tú II village	
8	Lê Đức Đăng	Thủy Tú II village	
9	Nguyễn Quang Hải	Thủy Tú II village	
10	Võ Văn Phong	Thủy Tú Phương village, Vinh Tu	Village head
11	Võ Trường Năm	Thủy Tú Phương village, Vinh Tu	
12	Võ Đức Thắng	Thủy Tú Phương village, Vinh Tu	
13	Lê Vĩnh Trình	Thủy Tú Phương village, Vinh Tu	
14	Lê Đức Cẩn	Thủy Tú Phương village, Vinh Tu	
15	Trần Thị Phương	Thủy Tú Phương village, Vinh Tu	
16	Võ Văn Minh	Thủy Tú Phương village, Vinh Tu	
17	Nguyễn Thị Loan	Thủy Tú Phương village, Vinh Tu	
18	Lê Quang Phong	Thủy Tú 1 village, Vinh Tu	Village head
19	Lê Thị Đúng	Thủy Tú 1 village, Vinh Tu	
20	Lê Đình Sồ	Thủy Tú 1 village, Vinh Tu	
21	Trần Đức Tường	Huỳnh Công Tây village, Vinh Tu	Village head
22	Trần Mai Hưng	Huỳnh Công Tây village, Vinh Tu	
23	Trần Hữu Thông	Huỳnh Công Tây village, Vinh Tu	
24	Trần Đức Vần	Mỹ Duyệt village, Vinh Tu	Village head
25	Trần Thị Tính	Mỹ Duyệt village, Vinh Tu	
26	Võ Thị Bích Liên	Mỹ Duyệt village, Vinh Tu	
27	Hoang Duc Doan	Quang Tri department of forestry	Vice director
28	Doan Viet Cong	Quang Tri department of forestry	

Annex 2: Tools for data collection

Tool # 1: Identify and classify current land use options on forest land uses

1. Basic information of forest management unit (FMU)

- Name:.....
- Address:.....
- Total area (ha):
- Type of FMU: Private.....group.....SFE.....other:.....
- Year of formation:
- Type of Land use ownership:.....
- Type of Land use right:.....
- Total number of staff or members.....
- Name of leader:.....
- Key mission or task/ or field of business:.....
.....
.....
.....

2. Identify and classify land use options on forestry land

- What are the major land use options on forest land of your FMU ?
 - ☐ Natural forest ☐ Plantation ☐ Water body ☐ Unused bare land
 - ☐ Land for agriculture production ☐ Other (name)
- What are the categories of the FMU natural forest land?
 - ☐ Special-use forest ☐ Protection ☐ Production
- What are the categories of the FMU plantation land?
 - ☐ Special-use forest ☐ Protection ☐ Production

Please list the types of species for plantation:

- +
- +
- +
- +

- What are the type of land use for agriculture production on forestry land?
 - + Pasture
 - + Crop production, of which crop species grown are:
 - i) Cassava:.....
 - ii) Rubber:.....
 - iii).....
 - iv).....
- Please provide information on each type of land use (e.g. area, location, purpose, current characteristics of each land use (species composition, density, DBH, H, standing volume) and management activities (such as protection, enrichment and harvesting)). Harvesting information includes clear cutting, selection cutting, HCVF area, NTFP production, timber production.

Table : Land use types and characteristics

No	Land use types/ ecosystems	Area (ha)	Status (Ic,....V, & forest types (evergreen broad leaf..))	Key site condition	Key management objectives (special use, protection, production...)	Key mgt practices	Key attributes (density, DHB, H, volume/productivity, rotation)	In case of FSC certification Key mgt practices	Key attributes
1	Forested land								
1.1	Natural forests								
1.1.1	Rich forest								
1.1.2	Medium								
1.1.3	Poor forest								
1.2	Plantations								
1.2.1									
1.2.2									
1.2.3									
2.	Non-forested land								
2.1.	Crop land								
2.1.1									
2.1.2									
2.1.3									
2.2	Bare land								
3	Other lands								
3.1	Water body								
3.2	Road								
3.3	Other								
Total									

In cases where there is no available data on the above land use options (e.g. crop land inside the FMU,) information will be gathered by asking people on the above variables.

.....

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Tool # 2: Identify available and potential goods and services of each land use options/ecosystem

(the following key information will be collected from group discussion and from review the secondary data)

No	Land use types/ ecosystems	Area (ha)	Status (Ic,.....V, & forest types (evergreen broad leaf..)	Rotation (years)	Kinds & amounts of goods from the land use (per ha/year or rotation)				Environmental services				Notes
					Timber (m3) ¹	Fuel-wood *	NTFPs (by types)	Carbon storage (ton of C) ^{**}	Soil protection ***	Water reserve ****	Other *****		
1	Forested land												
1.1	Natural forests												
1.1.1	Rich forest												
1.1.2	Medium												
1.1.3	Poor forest												
1.2	Plantations												
1.2.1													
2.	Non-forested land												
2.1.	Crop land												
2.1.1													
2.2	Bare land												
3	Other lands												
3.1	Water body												
3.2	Road												
3.3	Other												
Total													

Notes: 1 Timber volume is based on the results of the SFE inventory and referenced to available data from other research.

* Fuel wood is estimated by asking how much a local household collects from the land use per year in terms of cubic meters. Data will be checked by household interview.

NTFPs data is collected in the same way for fuel wood.

** , *** , **** , ***** are estimated by two methods: (i) quantitative methods reviewing available data from SNV projects, other research projects from VN and international research, if available, and (ii) qualitative with a scale ranging from +++ (high/high positive), ++ (medium/positive), + (low/low positive) , 0/N.a (don't know), to - (light negative), - - (medium negative), to - - - High negative (from group discussions) based on the participants experiences.

- In case more information is needed, open-end questionnaires for some important ecosystems should be used:

e.g. How does the water storage change if the forest cover is cleared out?

How is the productivity of your paddy rice? Will be affected (and by what percentage)?

And why?

Tool # 3: Estimation of costs and benefits of each land use option

This tool is applied for each type of ecosystem for its use purpose, such as production natural forest with harvesting, natural forest regeneration promotion, plantation...

3.1. Estimation costs and benefits of natural forested land use option *(for each type of land use options identified in Tool #1)*

(Reviewing secondary data of the FMU)

- Type of forest:.....
- Area (ha):.....
- Status:
- Key mgt objectives and practices:
.....
- Key questions about what activities are conducted and their cost, and what benefits are created in two cases (with and without FSC).

Activities	Types and amount of costs and benefits each year per ha (or total area)									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
A. Costs of the ecosystem management										
A.1. costs of the ecosystem management in case of non-FSC										
A.1.1. Direct costs										
1. Protection										
2. Tending										
3. Harvesting										
3.1. Pre-harvesting										
- Road maintenance										
- forest inventory										
- Harvesting design										
-										
-										
3.2. Harvesting										
- Cutting/felling										
- log skidding										
-log grading										
- log hauling to landing II										
- Transportation										
-										

Activities	Types and amount of costs and benefits each year per ha (or total area)									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
3.3. Post harvesting										
- Sanitation										
2.4. Other costs										
- Equipments depreciation/rent										
- Tools										
A.1.2. Indirect cost										
Mgt & monitoring										
Taxes										
- Land use tax										
- VAT										
- Income tax										
- Natural resource tax										
Sub-total										
A.2. In case of FSC										
Cost of main audit										

Notes: ask for bank interest (%/year)

**Key technical characteristics & cost and revenues of different land use options for one rotation
(case of plantation and non-forested land use)**

Items	Land use options			
	A	B	C	D
I. Some key technical characteristics				
Species				
Business rotation (years)				
Planting density (trees/ha)				
II. Types of direct costs & revenues				
1st year				
- Vegetation removal				
- Soil preparation				
- Seedlings				
- Fertilizer				
- Weed control				
- Labor costs				
- Protection costs				
- Designing cost				
- Harvesting cost				
+ Revenues				
2nd year				
- Weed control				
- Fertilizer				
- Protection cost				
+ Revenues				
3rd year				
- Weed control				
- Fertilizer				
- Protection cost				
+ Revenues				
4th year				
- Weed control				
- Fertilizer				
- Protection cost				
+ Revenues:				
5th year				
- Weed control				
- Fertilizer				

Items	Land use options			
	A	B	C	D
- Protection cost				
+ Revenues:				
6th year				
- Weed control				
- Fertilizer				
- Protection cost				
+ Revenues:				
7th year				
- Weed control				
- Fertilizer				
- Protection cost				
- Harvesting cost				
+ Revenues:				
8th year				
- Weed control				
- Fertilizer				
- Protection cost				
- Harvesting cost				
+ Revenues:				
Years 9-31				
The last year				
- Weed control				
- Fertilizer				
- Protection cost				
- Harvesting cost				
+ Revenues				
II. Types of indirect costs				
- Evaluation and FSC certification				
- Cost of refining & adjustment to meet FSC requirement				
- Annual cost of monitoring				

Example of Table of: cost and revenue structure of plantation										Unit: 1000 VND/ha		
Year	Costs							Revenues				
	Total	Site preparation	Seedlings	Fertilizer	Planting	Weed control/ tending	Protection	Harvesting materials	Harvesting Rubber resin: (8 mths* 1500)	Total	Resin	Timber selling
1												
2												
3												
4												
The last year												
Total												





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